A Geographical Analysis of Environmental and Human Potentials and Their Impact on the Diversity of Agricultural Patterns in Al-Muthanna Governorate (2024)

Anmar Sami Al-Rikabi

College of Education for Humanities, Al-Muthanna University, Iraq

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ABSTRACT

The agricultural system, which one of the basic pillars affects food production for the population and fodder for animals and the main engine of industrial. The model associated with commercial farming pays attention to selected crops as per the various relevant conditions of the natural and human environment. This process helps increase the area under cultivation and the volume of production. The used study descriptive and analytical that used quantitative data to enrich scientific knowledgde and widen the horizons. The study aims to follow the development and organization of methods that help enable agricultural development. Research shows that climate factors such as temperature, evaporation and low rainfall constraint agricultural expansion. Agricultural patterns and productivity will be increasingly influenced by human factors (e.g., the choice of irrigation method, and land ownership). The climate data was of 2024 as it had the complete climate record & recent climatic record and also prevailed climatic reality. The research results proved that most of the research in brief is mainly directed towards local consumption, with a lack of diversity, for large areas of interest in agriculture within administrative units. It also showed that agriculture generally suffers from dry climatic conditions, which can lead to aridity, resulting in weak production and exploitation of agricultural crops. Geographical limitation of the study is Muthanna Governorate in southern Iraq. The governorate is situated between latitudes .29.5° and .31.75° N and longitudes 43.81° and 46.75° E. The total area of the samawa province is 51,402 kilometers squared or about 11% of Iraq. According to Map 1, Al-Muthanna Governorate shares an international border with the Kingdom of Saudi Arabia.

Keywords: Agricultural patterns, Climate, Irrigation, Soil, Al-Muthanna Governorate.

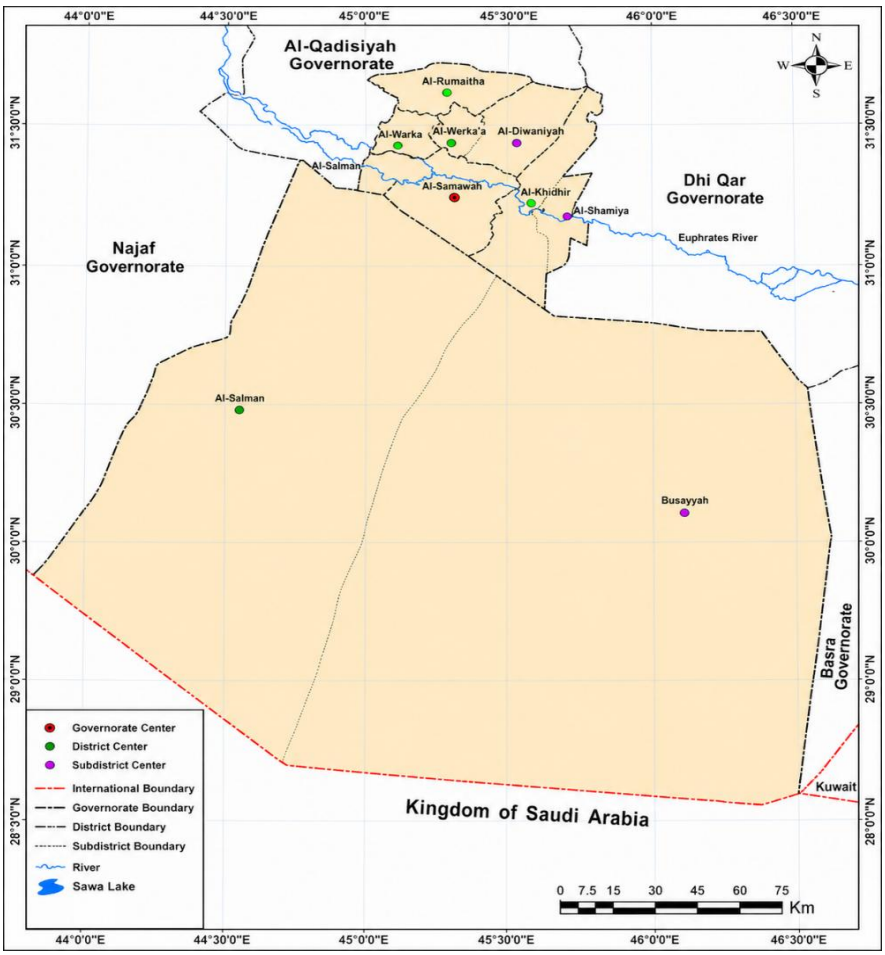
INTRODUCTION

Specialization in agriculture helps spread agricultural patterns and contributes to their prosperity, especially certain agricultural crops in some areas with a suitable environment, due to their connection with natural and human conditions. This has contributed to increasing exports compared to importing some other crops that cannot be produced in the local environment, which has led to the emergence of trade exchange between countries and an increase in supply and demand through import and export. The agricultural reality in Al-Muthanna Governorate indicates a gap, despite the availability of some environmental resources and the actual level of utilization of these resources. This raises questions about the direction of agricultural patterns and their compatibility with prevailing environmental and human characteristics. Hence, this study aims to analyze agricultural patterns in Al-Muthanna Governorate and identify the factors and conditions influencing them. Furthermore, Al-Muthanna Governorate was chosen as the subject of this research due to its agricultural potential, which qualifies it to expand the cultivated area and diversify agricultural patterns, particularly in the production of crops suited to the natural and environmental conditions within the study area

METHODOLOGY

To investigate the participants in the emergence within Al-Muthanna Governorate, quantitative analysis was used, focusing on natural, human, and distribution factors to arrive at accurate results. External data from (2024) was selected due to its recency, completeness of external records, and representation of the current external reality that influences participation in the area currently under study.

Map 1. Geographical location of Al-Muthanna Governorate and its administrative units



Republic of Iraq, General Survey Authority, Navigation Department, Administrative Map of Iraq at a scale of 1:1500000, Baghdad, 2011.

First topic Environmental Conditions and Their Impact on the Diversity of Agricultural Systems. Natural factors play a key role in shaping agricultural production, as they directly influence crop selection and farming methods. These factors can also affect livestock. Among the most important of these factors, as shown in Map 2.1.1, are geographic location and topography. The topography of Muthanna Governorate is characterized by flatness and a lack of relief, rising gradually from the northeast toward the southwest due to the governorate's vast area, giving the region a relatively flat appearance. (Ibrahim & Shalash 2002). As shown in Map 2, the governorate's area is divided into two main sections:

alluvial plain:

o It is characterized by a flat surface and a gentle slope toward the south.

O It covers an area of approximately 1,412 km², or about 0.3% of the total area of the province (21,211 km²).

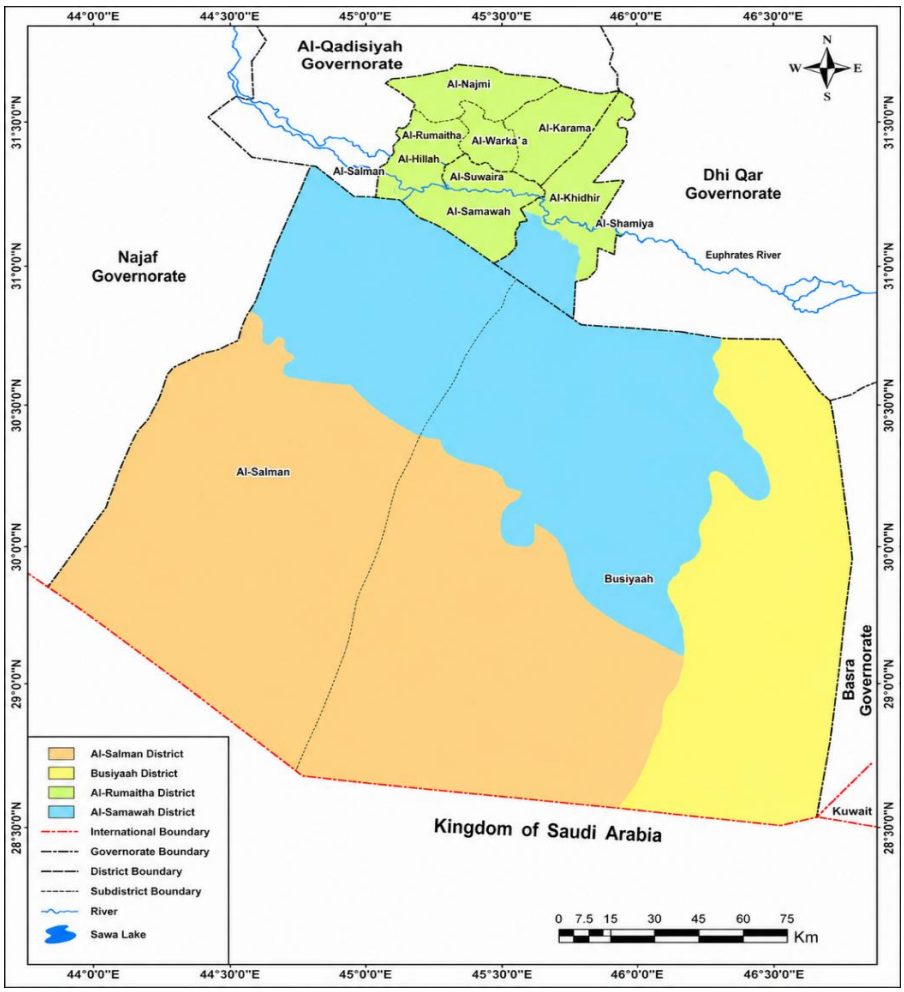
This slope affects the course of rivers and streams, with a gradient of 1.17 meters per kilometer toward the Euphrates

River. Western Plateau:

It occupies the largest portion of the governorate's area, covering approximately 13,032 km², or about 61.2% of the total area.

Its topography varies from one region to another, and it has been divided into three natural sections, the most important of which is the Al-Hajara region, which occupies the central part (Al-Mashhadani, 2002).

Map 2. Sections of the Earth's surface in Al-Muthanna Governorate



P. Buringh.Ngh. Soils and soil conditions in Iraq. H Veen man and Zonen, NV Netherlands, 1960, pp. (122,192).

The second section of the plateau comprises the lower valleys stretching between the western banks of the Euphrates River and Shat al-Atashan, and the Hajara region to the south, while the third section lies in the far southeast of the desert plateau and includes the Dabdaba region, whose waters flow through northeastern valleys, foremost among which is Wadi al-Batin (Al-Husseini, 2011).

Despite the varied topography of Muthanna Governorate, its terrain does not pose an obstacle to agricultural activity, as it is characterized by gentle slopes, The alluvial plain is considered the most suitable area for agriculture due to its flatness and the ease of operating agricultural equipment there; however, its low slope leads to poor natural drainage, which contributes to the problem of soil salinization (Al-Dhalimi, 2013).

Climate: The climate is one of the most influential natural factors affecting agricultural patterns in Muthanna Governorate. Its arid, desert-like nature results in significantly high temperatures and solar radiation, imposing clear limitations on the types and patterns of crops that can be grown during their growing season (Al-Saigh, 2012).

Hours of sunshine:

According to the data in Table 1, the average theoretical sunshine hours at the Samawah station are **12.1 hours/day** While the actual hours are recorded **6.9 hours/day** Seasonally, this is a clear difference between the theoretical and actual values of sunshine hours, as a result of Al-Muthanna Governorate being affected by weather factors, especially the dust particles and dust storms prevalent in the study area.

The monthly distribution of the number of hours of brightness also shows a clear variation during the seasons of the year, especially in the summer, where the highest average was recorded in June with an average of 11.3 and

11.0-11.2. Hours/day during July and August, and this is due to the clear weather and long daylight hours. In contrast, in winter, the hours of sunshine decrease and reach the lowest level of radiation in February at an average of 2.3 hours/day due to the study area being affected by dust storms, increased clouds, and short daylight hours.

This variation in hours of sunshine directly affects agricultural activities, as it accelerates the growth of certain crops due to increased solar radiation in the summer. This leads to a significant rise in temperatures, which in turn increases evaporation rates, exacerbates water losses, and limits the use of irrigation water, which in turn leads to variations in agricultural patterns within the study area.

Table 1. Monthly and Annual Averages of Theoretical and Actual Sunshine Hours (hours/day), Samawah Station (2003–2024).

Months Average Brightness	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**	**Average Annual**
Theoretical	**10.6**	**10**	**11.3**	**12.4**	**13**	**14**	**14.3**	**13.5**	**12**	**11.3**	**11.1**	**10.3**	**12.1**
Actual	3	2.3	4.1	5.2	8.2	11.3	11.0	11.2	10.0	7.4	5.3	4.3	6.9

Source: compiled by the researcher based on official data (2024)

Temperature:

As for temperatures, Table 2 shows the minimum and maximum temperatures in the study area, indicating that high temperatures prevail throughout the year. The annual average minimum temperature was 20.7°C, while the average maximum temperature is 33.5°C, reflecting the hot nature of Muthanna Governorate's climate. The values below show a clear seasonal variation in temperatures. Spring marks the beginning of a gradual rise in temperature, reaching its peak in summer, with the highest temperatures recorded during June, July, and August, exceeding 45°C. This illustrates the intensity of the heat during this period (Al-Janabi & Ghalib, 2007), In winter, temperatures drop to their lowest values in the study area during December and January due to the apparent motion of the sun in the Capricorn tropic, with the annual temperature range reaching approximately 12.8°C This indicates a significant temperature variation between the seasons, which directly affects agricultural activity, leading to higher evaporation/transpiration rates and increased water requirements for crops, This limits agricultural expansion during the summer and increases dependence on irrigation water. Conversely, the moderate thermal conditions in winter are a contributing factor to the success of winter crops and thus contribute to the orientation and diversity of agricultural patterns in the study area (Abdul-Baqi, 2001).

It can be said that the influence of solar radiation (heat—actual and theoretical irradiance) on evaporation rates and the thermal regime is one of the most important climatic determinants contributing to the distribution of agricultural patterns and their productive efficiency in the study area.

International reports also confirm that arid and semi-arid regions are among the areas most affected by rising temperatures and increased evaporation rates, which negatively impacts agricultural production and the efficient use of water (IPCC. 2024).

Table 2. Monthly and Annual Average Minimum and Maximum Temperatures for Samawah Station (2003–2024).

Average Annual	**December**	**November**	**October**	**September**	**August**	**July**	**June**	**May**	**April**	**March**	**February**	**January**	**Months**
20.7	8.7	20	26.1	30.3	32.2	35.1	30	22.1	16.5	12	8.9	6.4	**Minimum (°C)**
33.5	20	30	38	45	48.3	47.6	45.5	37.6	32.6	22.9	18.9	14.3	**Maximum (°C)**

Source: compiled by the researcher based on official data (2024)

Rainfall:

As for rainfall, the total rainfall for the period between 2003 and 2024 in the study area was approximately 2,289.042 mm. This figure does not represent an annual average but rather the total for the aforementioned period; it is fluctuating, variable, and trending downward, reflecting the arid nature of Muthanna Governorate. It is also characterized by irregularity from one year to the next, with some years being wet and others relatively dry. This represents the most prominent feature of the desert climate in Muthanna Governorate. Rainfall begins in October, which marks the start of the rainy season. November then sees a clear increase in rainfall, with December recording the highest rainfall values. The peak of rainfall occurs in January, precipitation continues into February, and rainfall begins to gradually decrease in March. April also sees a clear decrease in rainfall, and precipitation nearly ceases in May, becoming very rare in June and absent during the summer. This indicates that Muthanna Governorate falls within the desert climate BWh according to the Köppen classification. Rainfall directly affects agricultural activity due to the limited reliance on rain-fed agriculture and the dependence on irrigation sources, which helps determine the types of crops grown, their seasons, and the distribution of agricultural patterns in the study area.

Reports by the Food and Agriculture Organization have shown that the scarcity of water resources combined with significantly high temperatures are among the determining factors in the selection of agricultural patterns in desert and semi-arid regions (FAO, 2024).

Table 3. Annual Rainfall Totals for Samawah Station (2009–2024).

Years Months	Avg Monthly (mm)	2024	2023	2022	2021	2020	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009
October	71.2	0.001	0.1	-	0.2	-	-	9.8	0.2	0.1	-	27.1	-	6.1	0.3	-	17.3
November	113.5	10.9	-	-	3.7	1.6	0.1	1.4	21.6	15.2	0.1	2.6	-	19.3	2.6	6.1	28.3
December	254.8	0.7	6.8	3.6	9.4	8.2	9.2	14.4	18.7	12.8	5.2	-	14.3	98.7	9.9	21.6	21.3
January	268.2	14.7	22.4	13.1	17.5	12.5	0.30	0.001	24.2	7.8	3.9	27.1	4.9	14.9	26.6	9.0	69.3
February	152.7	15.8	11.0	5.1	11.8	7.5	3.2	3.8	30.7	2.7	16.5	2.7	1.0	23.9	1.9	3.9	11.2
March	155.9	7.3	4.6	12.2	9.7	12.6	6.7	9.4	13.9	4.3	2.4	0.8	19.8	10.7	19.9	20.7	0.9
April	97.8	3.5	1.0	0.3	6.4	3.1	19.0	8.0	6.2	0.1	2.6	0.2	13.0	0.3	24.2	9.0	0.9
May	29.3	0.8	0.2	1.0	0.3	0.1	10.3	3.0	3.1	0.2	1.1	2.7	0.6	2.0	0.001	3.0	0.9
June	1.12	0	0.01	0	0	0	0	0	0.1	0	0.01	0	0	0	0	0	0
July	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
August	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
September	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**2289.042**	**53.7**	**46.1**	**35.3**	**59**	**45.6**	**48.8**	**49.8**	**118.7**	**43.2**	**31.8**	**63.2**	**53.6**	**175.9**	**86.4**	**73.3**	**150.1**

Source: compiled by the researcher based on official data (2024)

Wind speed:

As for wind, the annual average wind speed in the study area is 3.2 m/s, indicating low to moderate wind activity with clear monthly and seasonal variations. Table 4 shows that the highest wind speeds were recorded in July and August, at 4.6 m/s and 4.4 m/s, respectively. This is due to rising temperatures and seasonal temperature differences, while lower rates were recorded in November at an average of 1.7 m/s During the winter season, the impact of these winds on agricultural activity is almost entirely limited to moisture loss and increased soil evaporation rates, as well as causing dust storms, dust transport, and an increased need for water resources, and determining the type of crops and the duration of cultivation (Hammadi, 2013). and thus wind speed is one of

the climatic factors that fundamentally influences the distribution of agricultural patterns within the study area, particularly in the regions most exposed to dry and hotter summer winds.

Table 4. Monthly and Annual Averages of Wind Speed (m/s) at Samawah Station (2003–2024).

Months	January	February	March	April	May	June	July	August	September	October	November	December	Average Annual
Wind Speed (m/s)	2.9	3	3.3	3.2	3.5	3.7	4.6	4.4	3.1	2.8	1.7	2.7	**3.2**

Source: compiled by the researcher based on official data (2024)

As for storms and dust, winds have a negative impact on agricultural production, as they spread plant pathogens and affect the physiological aspects of plants, such as leaf desiccation and branch breakage during strong winds, leading to the loss of flowers and fruits, especially during the flowering season, and consequently affect agricultural patterns in the governorate as a whole (World Bank. 2024).

The climate varies between winter and summer, and this directly affects agricultural production in both seasons due to the marked differences between them. Humidity also affects livestock production. Iraq is among the countries most vulnerable to the risks of climate change; the noticeable rise in temperatures and the increase in droughts directly impact the sustainability of agricultural activity (Mar'i, & Al-Qassab, 2003).

Soil: Soils vary depending on the factors influencing their formation and the regions where they are found, resulting in two main types of soil:

1- Sedimentary soil:

- It covers the northern part of the governorate.
- They are characterized by fertility and suitability for agriculture.
- Their characteristics include being deep, uniform, and generally composed of fine particles, with coarse sand particles. They are divided into:

 River terrace soils: Located on both sides of the Euphrates River and its tributaries.

 Sand dune soils: Generally unsuitable for agriculture unless fertilizers are added; they pose a risk to crops.

 River basin soils: Cover a large area of the province; suitable for agriculture despite high levels of lime and salts.

Desert soil:

- Found in the southern and southwestern parts of the study area, west of the Euphrates River.
- Characterized by low vegetation cover due to low rainfall and high evaporation rates; it includes gypsum and stony soils, as well as soils formed by floods and mostly deposited in valley bottoms (Al-Rikabi, 2021).

It is clear from the above that the soils of riverbanks and basins are of significant importance for agricultural production, as they are characterized by high productivity and suitability for growing various crops. Furthermore, the arid climate and scarcity of rainfall in the study area constitute a constraining factor affecting agricultural activity; However, they have not been a direct cause of limiting agricultural patterns. This shows us that productivity has never been limited to climatic conditions alone; rather, human and planning capabilities play an important role in increasing production and investment, which explains the variation in production levels between Muthanna Governorate and other governorates with similar climates.

Human potential and its impact on the diversity of agricultural patterns

Labor Force

Most agricultural production patterns rely heavily on the labor force, as labor intensity per unit area determines the dominant agricultural pattern and the type of crops produced in a given region. The importance of the labor force is evident in its role in agricultural production, as it influences the size and distribution of the rural population at the administrative unit level (Abu Ayana 2004).

In Muthanna Governorate, as shown in Table 5, the rural population is concentrated primarily in the district of Rumaytha, where it numbers 213,370 people, constituting about 56% of the total rural population in the governorate. The Samawa district ranks second, with a population of 109,350, representing about 29% of the total rural population in the governorate, while the Al-Khader district ranks third with 58,830 people, or about 15% of the total rural population in Muthanna Governorate (Muthanna Statistics Directorate 2024).

Table 5. Distribution of Rural Population by Administrative Units, Al-Muthanna Governorate (2024).

Administrative Unit	Rural Population	%
Al-Rumaytha District	213,370	56%
Samawah District	109,350	29%
Al-Khidr District	58,830	15%
Governorate Total	**381,550**	**100%**

Source: compiled by the researcher based on official data (2024)

Agricultural Holdings: Agricultural holdings are characterized by two main factors:

Size of agricultural holdings:

The data show that small holdings (less than 12 dunams) account for about 11% of all holdings, and this percentage decreases as the size of the holding increases in Muthanna Governorate, reaching 73% for holdings ranging in size from 12.1 to 31 dunams, while holdings larger than 31.1 dunams account for about 11%. As for holdings ranging from 12.1 to 22 dunams and larger, accounted for a combined 73% of all holdings in 2024. These differences in the size of agricultural holdings reflect the nature of the relationships between farmers and their level of attachment to the land, leading to variations in the crops grown and the prevailing agricultural practices.

Agricultural Land Tenure System:

The pattern of agricultural land ownership varies among the administrative units in the governorate, with private ownership accounting for approximately 10.21% of all land holdings in the Rumaitha district, dropping to 23.33% in the Samawa district, while reaching 44.1% in the Al-Khader district; leased land predominates, accounting for 10.1% of all land holdings in the governorate (Muthanna Governorate Statistics Directorate. 2024).

Irrigation Methods:

The Rumaitha District is the primary user of the flood irrigation system. This high usage is due to the fact that the majority of Rumaitha's population lives in rural areas, and the Rumaitha District is one of the most important agricultural regions in Muthanna Governorate, particularly in the areas covered by the Rumaitha Project during the winter and summer seasons. where the percentage of land irrigated by this system reached 11% in the winter season and 41% in the summer season. This land covers an area of 32,211 dunams in the project's high-density

agricultural zones, indicating a correlation between rural population density and high agricultural activity in the region. In the Majd subdistrict, where the proportion of land irrigated by flood irrigation reached 71%, while in the Najmi and Al-Warka districts, the proportions were 1% and 7%, respectively (Directorate of Wells in Al-Muthanna Governorate. 2021). As for sprinkler irrigation, it was used in the Al-Ramitha project on an area of 4,121 dunams during the winter and summer seasons, at rates of 41% and 71%, respectively (Al-Muthanna Governorate Irrigation Directorate, Planning Department 2024).

Agricultural Policy:

Agricultural policy in the study area focuses on supporting farmers and encouraging them to grow crops that meet local demand for grains and vegetables, as well as providing all the necessary resources to ensure the success and development of agricultural operations, including livestock farming across all types of agricultural systems (Muthanna Agriculture Directorate, Fisheries Department. 2024). The government's role in providing support and assistance to farmers is defined by pricing and marketing policies; the state purchases certain crops, such as wheat, barley, and rice, and provides marketing centers for them, while other crops, such as sesame and millet, lack such marketing centers (Cloke, & Goodwin, 2014).

Spatial Distribution and Variation in Agricultural Patterns in Muthanna Governorate

Agricultural production patterns vary spatially, depending on the degree of stability of agricultural activity or its link to mobility, as well as differences in the availability of cultivated or arable land (El-Baz, 2012). Therefore, there is a need for a comprehensive analytical geographical study of agricultural patterns and their distribution in the study area, and to identify the predominant agricultural pattern in the use of agricultural land within administrative units, as follows:

Farming Pattern

Table 6 illustrates the variation in cultivated

Barley

Barley is one of the most widespread winter crops in Muthanna Governorate, and the largest agricultural areas are dedicated to it due to the suitability of the agricultural conditions. Barley cultivation generally thrives in soils with a low salinity level, and Muthanna Governorate is among the southern governorates where barley cultivation yields good results, despite the dry climate and desert terrain. However, barley is the crop most tolerant of these conditions compared to other crops. Barley is a versatile crop and ranks first in terms of cultivated area in Muthanna Governorate, with a cultivated area of 67,500 dunams in 2024, accounting for 30.2% of the total crops cultivated in the governorate.

The areas planted with barley vary across administrative units. The district of Al-Warka ranked first with an area of 25,000 dunams, followed by the district of Al-Ramitha and the sub-district of Al-Najmi with an area of 19,000 dunams, and then the central district of Al-Khader with an area of 7,000 dunams. This indicates that barley cultivation in these areas is primarily aimed at providing animal feed, as sheep and camel herding predominates and the population relies on these animals to meet their needs.

Table 6. Variation of Cultivated Areas (Dunams) and Production between Summer and Winter Crops for the Year 2024.

Administrative Unit	Barley (Dunams)	Wheat (Dunams)	Rice (Dunams)	White Corn (Dunams)	Mung Beans (Dunams)	Others
Al-Warka Sub-district	25,000	15,800	2,300	-	200	-
Al-Rumaytha District Center	10,000	2,800	8,248	-	-	-
Al-Najmi Sub-district	9,000	13,000	980	-	-	-

Al-Khidr District Center	7,000	11,000	-	6,000	-	-
Al-Majd Sub-district	6,000	7,000	2,680	100	90	-
Al-Hilal Sub-district	3,000	4,100	98	600	10	-
Al-Samawah District Center	4,480	10,800	-	998	-	-
Al-Suwayr Sub-district	-	-	12	-	10	-
Al-Darji Sub-district	-	-	10	-	6	-
Total	**67,500**	**64,500**	**14,328**	**7,698**	**316**	**small**

Source: compiled by the researcher based on official data (2024)

Wheat:

Wheat is a major crop in Muthanna Governorate. The total area under cultivation across the administrative units reached approximately 64,500 dunams in 2024. The districts of Al-Warka, Al-Najmi, and the Al-Khader sub-district accounted for the largest areas, at 15,800, 13,000, and 11,000 dunams, respectively, while the Hilal subdistrict recorded the smallest area at 4,100 dunams.

Rice:

Rice ranks third after barley and wheat in terms of cultivated area, covering 14,328 dunams. Its cultivation is concentrated primarily in the center of the Rumaitha district, covering 8,248 dunams, followed by the Majd district with an area of 2,680 dunams, while the areas in other administrative units are smaller due to its need for abundant water and a large workforce.

White corn:

White corn is successfully grown in rotation with other crops, and yields the best results when planted after legumes. The area planted with white corn in the governorate reached 7,698 dunams in 2024, This varies across administrative units: 6,000 dunams in the Al-Khader District, 998 dunams in the Samawa District, and 600 dunams in the Al-Hilal.

Mung beans:

The areas planted with masha appear relatively small, with the largest area recorded in the Al-Warka District at 200 dunams, while the total planted area in the governorate reached 316 dunams in 2024 (Directorate of Agriculture Al-Muthanna. 2024).

Horticultural Farming Practices

Fruits and Dates:

1. Fruits are grown on a small scale in small plots and consist of a few varieties that can tolerate high summer temperatures. Citrus cultivation, however, is limited and uneconomical because these crops cannot withstand high temperatures and the dry desert climate.

2- Dates are widely cultivated due to their suitability for hot climatic conditions; the plant grows best at temperatures ranging between 34–37°C, and the trees tolerate drought, making their cultivation suitable for desert regions. Date palm cultivation is mainly concentrated in the northern areas adjacent to the Euphrates River, due to the availability of fertile soil and water resources, and is less common in areas far from water sources where sandy, gypsum, and arid soils prevail (Aboud, H., & 2021).

According to Table 7, the total area of palm groves in the study area was 26.39 dunams, comprising approximately 6,408 groves. Most of these are concentrated in the Samawa district (37.1%), followed by the Al-Warka subdistrict (22.1%). The remaining percentage was distributed across the other districts and sub-districts in varying proportions. This disparity reflects the influence of proximity to water resources, particularly the Euphrates River, confirming that water sources are the decisive factor in the distribution of palm cultivation patterns within Muthanna Governorate (Directorate of Agriculture Al-Muthanna. 2024).

Table 7. Geographical Distribution of Palm Groves in Al-Muthanna Governorate, 2024.

Administrative Unit	Number of Orchards	Ratio%
Samawa District Center	2,379	37.1%
Warka District	1,418	22.1%
Al-Khader District Center	600	9.4%
Al-Sawyer District	600	9.4%
Al-Majd Sub-district	381	5.9%
Al-Hilal District	300	4.7%
Rumaitha District Centre	280	4.4%
Al-Najmi Sub-district	245	3.8%
Al-Daraji District	205	3.2%
Total	**6,408**	**100%**

Source: compiled by the researcher based on official data (2024)

RESULTS AND DISCUSSION

The diversity of agricultural crops is significantly affected by climatic factors. The growth of crops is influenced greatly by temperature and precipitation conditions. The geographic growing of any crop is influenced by the type of soil and its fertility. On the other hand, this contribution decreases due to inefficient use of water. The diversity of land tenure and concentration of labor shows the clear impact of human factors on agricultural production..

CONCLUSION

- Since the climate factor is one of the most controlling factors in the type of agricultural pattern, especially when the hours of sunshine increase significantly, this leads to the proliferation of palm cultivation activity in summer.
- As a result of the different natural and human environmental conditions and the differences from one region to another in the different administrative units, there is a diversity of agriculture in Al-Muthanna Governorate.
- The study concluded that palm grove cultivation is concentrated in specific locations where water sources and manpower are available and where environmental conditions are suitable.
- Human factors require the labor force for private agricultural exploitation, which requires continuity to concentrate in the rural areas due to the impact of the population.
- There is a difference in eliminating the great diversity in Al-Muthanna province, as there are still some areas and agricultural lands that are not exploited due to a lack of identification.
- It reflects the clear overlap between natural environmental factors (climate, atmospheric humidity, water) and human factors (planning, labor, discrimination in irrigation).

Second: Proposals

1. Expanding the area of land not used for agriculture, except for areas that require it, for agricultural production.

2. Providing guidance programs for farmers with the aim of achieving appropriate agricultural productivity targets for natural farmers instead.

3. Encouraging farmers to engage in agriculture, in particular, by supporting farmers, increasing agricultural employment opportunities, and expanding rural migration.

4. A variety of agricultural products that are suitable for the climatic conditions, especially the freedom, freedom, and aridity of Al-Muthanna Governorate.

5. An agricultural vision for cultivating the appropriate agricultural profit for each administrative unit in Al-Muthanna Governorate.

6. Supporting the cultivation of palm groves and expanding the allocation of space for horticulture, due to its great economic importance and the suitability of the environmental conditions in Al-Muthanna Governorate.

LIST OF SOURCES AND REFERENCES:

1. Ibrahim, S., & Shalash, A. H. (2002). Soil Geography. Baghdad University Press.
2. Al-Mashhadani, I. A. (2002). Principles of Agricultural Geography. Dar Al-Salam Press, Baghdad.
3. Al-Husseini, S. H. J. (2011). White Corn Crop Between Past and Present. Iraqi Journal of Agriculture, (3).
4. Al-Dhalimi, H. A. H. (2013). Spatial Analysis of Field Crop Production in Al-Muthanna Governorate for the Period 2001–2011. Unpublished Master's Thesis, College of Arts, Al-Qadisiya University.
5. Al-Saigh, R. A. N. (2012). Climatic Characteristics and Their Relationship to Palm Diseases in Najaf Governorate. Unpublished Master's Thesis, College of Arts, University of Kufa.
6. Al-Janabi, S. H., & Ghalib, S. A. (2007). Regional Geography of Iraq. Mosul Press, Mosul.
7. Abdul-Baqi, F. K. (2001). The Low Discharges of the Euphrates River and Their Impact on Agricultural Production in Iraq. Unpublished Master's Thesis, Ibn Rushd College of Education, University of Baghdad.
8. IPCC. (2024). Climate Change 2021: The Physical Science Basis. Cambridge University Press.
9. FAO. (2024). The State of Food and Agriculture. Food and Agriculture Organization of the United Nations.
10. Hammadi, M. I. (2013). Irrigation and Drainage Projects on the Al-Sayl and Al-Atshan Rivers in Al-Muthanna Governorate. Unpublished Master's Thesis, College of Arts, University of Baghdad.
11. World Bank. (2024). Climate Risk Country Profile: Iraq. World Bank.
12. Mar, M. S., & Al-Qassab, I. H. (2003). Geography of Agriculture. Mosul University Press, Mosul.
13. Al-Rikabi, A. S. (2021). Climate Variation Between Barren and Vegetated Areas of Selected Regions in Al-Muthanna Governorate. Unpublished Master's Thesis, College of Education for Human Sciences, Al-Muthanna University.
14. Abu Ayana, F. M. (2004). Agricultural Geography. University Knowledge House, Egypt.
15. Muthanna Statistics Directorate. (2024). Population Statistics Department. Unpublished data.
16. Muthanna Governorate Statistics Directorate. (2024). Agricultural Statistics Records. Unpublished data.
17. Directorate of Wells in Al-Muthanna Governorate. (2024). Report of the Committee Formed to Inspect Wells. Unpublished data.
18. Al-Muthanna Governorate Irrigation Directorate, Planning Department. (2024). Unpublished data.
19. Muthanna Agriculture Directorate, Fisheries Department. (2021). Unpublished data.
20. Cloke, P., Crang, P., & Goodwin, M. (2014). Introducing Human Geographies (3rd ed.). Routledge.
21. El-Baz, F. (2012). Remote Sensing and Geographic Information Systems for Environmental Studies: Applications in the Middle East and North Africa. Springer.

22. Directorate of Agriculture Al-Muthanna. (2024). Agricultural Plan – Winter and Summer Seasons. Unpublished data.
23. Aboud, H., & Aswad, M. G. (2021). The Geographical Distribution of Palm Groves in Al-Muthanna Governorate. Al-Qadisiyah Journal of Humanities, 24(2).
24. Directorate of Agriculture Al-Muthanna. (2024). Agricultural Plan – Winter and Summer Seasons: Planning Follow-up Division. Unpublished data.