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ROLE OF IRRIGATION IN WATER NEEDS IN EXPLOITING FARMLANDS IN QARADAGH DISTRICT, IRAQ

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Abstract

Qara Dag district is located in the northeast of Iraq and southeast of the Sulaymaniyah Governorate, at an altitude of (607 m) above sea level. The area of the study area is 728,43 km^2, which constitutes about 4.3% of the Sulaymaniyah Governorate. The area of agricultural land in Qaradagh district is estimated at (82028 dunums), and the population of the judiciary is estimated at (12,330 people) and the per capita share of agricultural land is estimated at (6,65 dunums). The results of the study indicated that the investment of agricultural lands was very low by (6,2%) of the total agricultural lands prevailing in the region and riverside lands (37,4%). Several scenarios were conducted to invest agricultural land in the judiciary in the event that all advanced agricultural requirements are available, including the use of irrigation and mechanization systems and other services. In the case of cultivating all agricultural lands (82028 dunums) in the summer season with different agricultural crops with a water requirement of (700 mm), the amount of water will be Necessary up to 143,549,000 (million m3). As the maximum potential for investment of all agricultural lands in the winter season under conditions, salvage irrigations are four irrigations and an amount of 50 (mm) for each irrigation, the water requirement during the winter season is about 41.014.000 (million m3). And as the maximum possibility of the loss that may occur for any reason was (20%), the water requirement becomes (265.200,000 million m^3).

Keywords: water needs, irrigation, Qaradagh, touristic agriculture, ruminant agriculture.

Introduction

The continuous population increase in any region equals the increase in demand for food. Which calls for expansion of the agricultural lands horizontally. In addition to expanding the productivity of the survey unit, through relying on sound scientific planning and optimal use of the land. Generally, agriculture is the largest consumer of water resources, so it must invest water according to a well-studied plan so that the economy can be supplied with water supplied to irrigate lands in the correct way. One of the things that should be emphasized knowledge of in the agricultural planning process is not knowing the area of irrigated land currently in the study area. Rather, it is to know what the expansion of the area of irrigated agricultural lands may have in the future, according to the available water, to ensure the success of the production of winter and summer crops. Research problem: Given the heavy reliance of agriculture in the study area on dermatological cultivation is itself a problem. Therefore, the reality of the state of investment and exploitation of agricultural land in the Qaradagh district bears the following questions: 1 - To what extent the amount of agricultural production varies according to the amount of rainfall in the district?. 2 - Is there no water balance between the amount of water available and the requirements for growing summer and winter crops in the Kara Dag district?. 3 - There are no indications that the use of agricultural land in summer crops in the district has decreased. 4 - What is the degree of correlation between the available agricultural land area in the study area, and which are utilized for summer and winter crops?

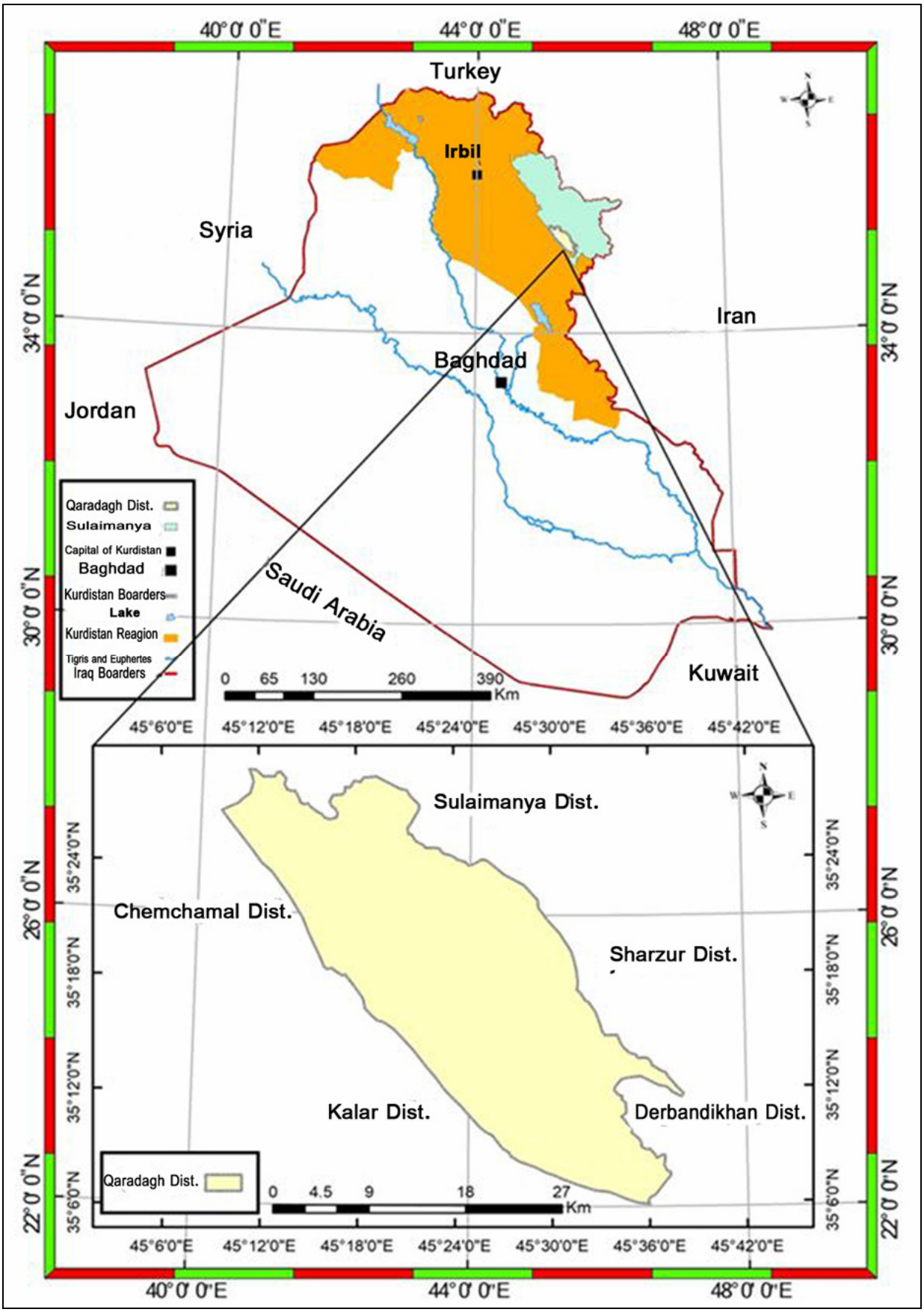
Research Hypothesis

- There is a great variation in the quantity and quality of agricultural production, according to the amount of rain that falls annually beginning the fall season and the length of its duration in the district.
- Qaradagh district is characterized by a water surplus during the winter half of the year, which is much more than the needs of agricultural crops. And a significant water shortage in the summer crop season.
- Most indicators indicate eliminating the decline in the investment of agricultural land in summer crops and their low productivity.
- There is no correlation between the area of arable agricultural land in the district and what is used by farmers with the quantity and quality of summer crops.

Research objective

The research aims to reveal the water requirements for agricultural land investment in the Qaradagh District. And the extent of the possibility of its investment in expanding the agricultural area horizontally and vertically, by calculating the amount of water crops needed by agricultural crops in addition to the water stored in the soil. By determining the time, location, and quantification of irrigation. In addition to disclosing the balance between the individual annual requirements of agricultural crops according to the estimates of the United Nations World Food Program (W.F.P) and the amount of annual production in the district. It could be an essential first step in the direction of drawing the attention of the concerned authorities and departments towards the scale of the problems, in a way that can accelerate their solution through proper planning, and in this way the geographer has provided what benefits the community. Search limits: In terms of spatial dimension, the study area includes the administrative borders of Qaradagh District, which has an area of (728,43 km^2), which constitutes (4.3%) of the total area of the Sulaymaniyah Governorate. Which is located in the eastern part of the Kurdistan Region of Iraq. In the southwestern part of the city of Sulaymaniyah (45 km), it is bordered to the north and northeast by the Sulaymaniyah district, to the southeast by Darbandikhan district, and to the

west and northwest by the Jam Jamal district. Astronomically, it is located between the latitude (11˝ 7¯35˚ - 2˝ 28¯ 35˚) north and longitude (15˝9¯45˚ - 21˝37¯45˚) east. Map (1).



As for the temporal dimension of the study, it was limited to the observed climate data in the Darbandikhan Climatic Observatory for the period (2000-2018) as well as the population and the area of agricultural land in the district for the year 2018.

Material and Methods

The importance of the study lies in building a geographic database for the agricultural sector in terms of the detection of the area of arable land suitable for cultivation, and the suitability of the amount of rainfall in all water years for winter cultivation and its absence in rearing agriculture. The quantity of agricultural production and production varied in quantity and quality due to the lack of rain in time. And then determine the current water requirements in the judiciary in light of the emergence of the characteristics of climate changes and the water pollution of the sources of water resources in the judiciary. And how to expand the area of agricultural land and the amount of its production by providing the necessary irrigation for the growth of agricultural crops in a manner that is appropriate to the various stages of growth.

Results and Discussion

The climate has a reflection and impact on agricultural production and the quality of the crop in the study area, and thus determining the amount of land support for the population. Moreover, the climate has an impact on the functions of human settlements through its influence on soil and agricultural production. And due to the absence of a climate station in the Qaradagh district, which recorded the climatic elements for a long time, therefore, meteorological data for the Darbandikhan Meteorological Station were depended for the period (2000-2018) due to the proximity of the Darbandikhan Station to the district and the similarity of the climate elements in both regions. In order to fully cover the study area in terms of spatial space and in terms of time required in discussion and analysis. The rain in the study area starts from October and continues until the end of May. As for the dry season, which extends from June to September, note Table (1). Because the rain in the study area is related to the passage of atmospheric depressions from the Atlantic Ocean through the Mediterranean (Narrator, 1990). As for the annual total of rain, it amounted to (568.4 mm) for the period above. Most of the precipitation was concentrated in winter and spring. Therefore, winter crops are grown in the study area, such as wheat and barley, depending on the winter rains. It is not necessary that the increase in the amount of rainfall falls is evidence of the success of agricultural production. Rather, it is important and necessary that the amount of rain required for plant growth fall in time during the three stages of growth for all agricultural crops in the study area. In addition, the amount of rain falling annually must not be less than the level required for the success of the agricultural process in the study area in general, and stage.

Table 1 : Monthly and yearly averages of climate elements in Darbandikhan Climatic Weather Station for the period (2000-2018).

Ingredient / Months	Temperature (°m)	Rain (mm)	Wind (m/s)	Relative humidity	Evaporation mm
January	9,4	143,4	1,8	72,1	59,43
February	9,8	121,2	2,3	66,1	73,90
March	13,9	80,5	2,6	63,7	98,87
April	17,2	62,3	2,4	54,6	145,53
Mace	24,6	27,3	2,1	41,9	257,28
June	30,7	0,3	1,5	25,9	413,81
July	33,9	0	1,3	22,1	486,45
Father	32,3	0	1,6	23,8	450,34
September	29,6	1,4	1,5	29,6	377,77
October	24,1	9,7	1,4	39	264,71
November	16	51,9	2,1	52,1	144,94
December	9,7	70,4	1,7	70	65,02
Average	20,9	568,4	1,8	46,7	2838,05

reference / From the work of the researcher relying on Iraqi Kurdistan Region, Ministry of Transport and Communications, Sulaimaniyah Weather Service, Climate Department, unpublished data.

Initial growth in particular. Perhaps this is due to the increase in the plant's need for water at this stage of growth compared to other stages represented by the flowering and ripening stage. This is what has been observed in recent years due to the decrease in the amount of rainfall annually. So that it is not among the secured areas in terms of the amount of rain. The amount of rain falling annually must not be less than (500 mm). As an indication, the amount of annual rainfall in the Darbandikhan meteorological station in the years (2000, 2001, 2007, 2008, 2009) reached about (291,3 mm, 310,1 mm, 224,8 mm, 355,5 mm and 353 mm), respectively. (Weather Service, 2018), on the one hand, and on the other hand, the amount of rainfall may exceed the water requirements of agricultural crops, especially in the flowering and ripening stage of the plant growth stages in the study area. Then, the agricultural crops are subject to deterioration in terms of quantity and quality, and this is what actually happened in the study area in the year 2019, due to the rain in the last months of the growth stages of the wheat and barley crops, which exposed the two crops to echo disease and their poor production. It is also worth noting that the lower annual quantities of precipitation falling annually have an impact on the quality and quantity of winter agricultural production. In addition to its effect on natural pastures and summer cultivation, due to the low rate of wells and springs prevailing in the study area. This means that agricultural activity cannot be entirely dependent on rain in the judiciary. Therefore, farmers must compensate for the

shortage or deficit of sufficient water requirements for the success of the agricultural process in the study area by irrigation by means. Without relying entirely on endemic agriculture, in all water years, in order to reach the principle of sustainable agricultural development. This result is, in fact, a clear indication of what the study area is subjected to repeated droughts after 2000 due to the characteristics of the climate changes that affect the world climate and are likely to increase in the coming years. As for the temperatures in the study area, they have a great effect on the soil. It works to increase the soil loss of water through evaporation, and thus leads to an increase in the percentage of salts in the soil due to the capillary characteristic. Therefore, for the appropriate temperature, its importance for the plant is no less than the importance and necessity of water and other elements needed by the plant during all phases of its growth, and each stage of plant life has specific thermal limits so that these limits control the life of the plant. Generally speaking, temperatures begin to rise during the end of winter. The annual average rate is (20.9 ˚m). It is worth noting that the reports of scientific studies indicate that the temperatures accumulated in the district are suitable for the production of agricultural crops, both winter and summer, in all stages of plant growth. As for the effect of humidity on agricultural production in the study area. High humidity and high temperatures create an ideal environment for pest and insect reproduction and disease spread. Consequently, the agricultural process in that place failed (Al-Hassani and Al-Sahaf, 1990). Where the highest humidity rate was recorded in the winter months, specifically in January at (72.1%) and the lowest in the summer months, specifically in July at (22.1%). Perhaps this is due to the inverse relationship between air temperature and relative humidity in an area studying. As for the element of wind and its impact on agricultural production in the study area, it appears through its speed, its blowing season and its characteristics. The higher the wind speed, the more it evaporates. Conversely, the wind affects the growth of plants, which helps to match the heat and pressure in the plant body and decrease the percentage of moisture (fecal and al-Mashhadani, 2000).

Generally, the area is affected by the different directional winds, where the northeast and south eastern winds prevail mainly in the winter. In the summer, the northwest and southwestern winds prevail. As the annual average wind speed (1.8 m/s). Accordingly, the winds are characterized by a slow speed of the study area, which leads to a decrease in soil temperatures, especially if they are synchronized with snowfall. Which has negative effects on the agricultural process in the crop growth season. Meanwhile, the slow speed winds help pollinate and regulate the concentration of CO_2 in nearby air layers. In addition, it helps to establish plant roots in the soil.

2. Drought and water deficit:

Climate drought means less precipitation falls than the annual rate. So that it creates a water deficit in the soil moisture so that the rain does not provide the needs of water crops. In 1926, Dimarton proposed a mathematical method for calculating the drought coefficient as follows (Narrator and Samurai, 1990).

Annual drought index = (mm for annual rainfall, amount) / (10+ (˚m) temperature for adjusted annual degrees)

When analyzing the numerical data and the result obtained from the Dimarton equation, the characteristics of the climate in the study area are shown from the characteristic of the semi-humid climate with a drought index equal to (18.4). At the same time, when applying the equation to climatic data for the years (2000, 2001, 2007, 2008, 2009), we find that the values of the Dimarton equation have fallen from its natural limits. As the results were the above water years in a row (7,1 - 10 - 7,3 - 6,9 - 7,5), i.e. the study area occurred in those years within the semi-arid context, and the characteristic of vegetation is characterized by dry cultivation in those years. To show the water balance in the study area, it is necessary to calculate the amount of water losses represented by the amount of evaporation-transpiration, as it was calculated according to the following Ivanov formula (Darwish and Talib, 2008). X = 0.0018 (h + 25) 2 (100 - Ren), whereas, X = amount of evaporation (mm). H= average monthly temperature (˚m). Rang = relative humidity.

When analyzing the numerical data and the results obtained in the Ivanov equation, it was found that the climate water balance in the study area is in the case of an annual water deficit that is estimated by comparing what falls into the region in a falling water and the loss of evaporation and transpiration from plants. As the amount of precipitation falling annually in the study area for the period (2000-2018) (568.4 mm), while the amount of evaporation - true transpiration in the district for the same period was about (2838.05 mm). Therefore, the difference between the inputs and outputs of water in the study area is negative by (2269.65 mm) annually. This last difference means the amount of water that must be prepared by the irrigation process or prepared through other water resources, which may be surface or groundwater. In other words, for the success of the agricultural process in the study area, the agricultural fields must be prepared with the amounts that were negative in nine months of the year and compensated for in another way.

3. Water resources

Agricultural production in the judiciary is unstable due to the prevailing climate factors. Therefore, water resources of various shapes play a major role in agricultural expansion in the study area, despite their limitations. Among the most important types of water resources prevailing in the region, with the exception of the rain water that has been explained, they are as follows:

A. Surface water

No source of surface water will prevail in the study area except the tributary of its diwan, which stems from the heights of the Karagh Heights and continues to run inside a concave fold confined between the Sartarma and Karagh Dag mountain range from the west and southwest and the Barranan mountain range from the east and northeast until it flows into the Sirwan River in the south The Darbandikhan Dam, specifically in the south of the village of Dhalanau, as it reaches lengths (62,8 km) and is the first river to flow into the Sirwan River after its departure from the Darbandikhan Dam and the tree drainage pattern prevails in it. The drainage of this river in the winter at the height of the flood is more than (200 m^3/D) This amount of water is not insignificant if it is invested in the proper way Fake. And then it gradually decreases until it reaches its lowest in the summer due to its dependence on underground feeding and sewage wastes (Al-

Tamimi, 2007). It is worth noting that the water of its Diwanah River, as a case, is used in a limited way for irrigation purposes. Perhaps this is due to the narrow course of the river, the steep slope and the rise of agricultural land on the banks of the river. Therefore, its water is difficult to use easily, and it can only be done through electric pumps. Moreover, it is due to the lack of serious consideration by the government and farmers of the agricultural sector in the study area and leaving them to a lot of arable areas.

B Groundwater

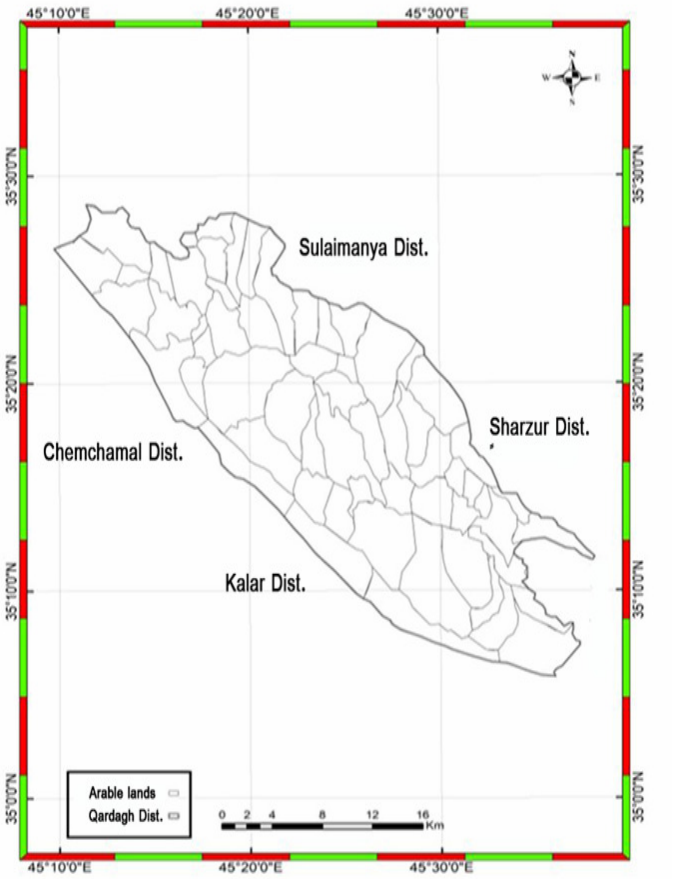
The groundwater is in Qara Dag district, with water from El-Ayoun, springs and kharis, as well as well water. Which is one of the most important causes of human stability and distribution of the population of the judiciary. It is the main source of irrigated farmland in the summer. Where the number of springs in the district (58 springs) and the rate of discharge (18.1 l / s). Where it contributes (78%) of the total irrigation of summer crops. While the number of karez (193 karez) and the number of automatic and manual wells is estimated (114 wells) and the rate of discharge (125 liters / second). From the foregoing, we can say that the study area is characterized by high capabilities of groundwater, if properly managed, to help achieve the principle of agricultural expansion in the district, both winter and summer. We can also estimate the amount of filtered water annually. According to the following mathematical equation (Hussein, 2001).

Underground storage = amount of precipitation falling annually x area x 1000

And then the amount of the annual underground storage equals 0.1126.669 billion cubic meters. It is a high percentage, but it is subject to change due to the annual variation of the amount of rainfall, with a high rate of evaporation and the percentage of water consumption in various fields. In addition, a large number of springs and kharis were subjected to demolition and drought during military operations and Anfal campaigns in the study area by the defunct Baath regime against our people.

Agricultural land uses

Before studying and analyzing the changes in the area of agricultural lands and their productivity by providing the necessary water requirements through irrigation, with other geographical factors proven. It would be useful to give general indicators on the spatial distribution of the area of agricultural land, its quality and investment in the judiciary for the year 2018. Map (2).



Map (2)

Table 2 : Percentage of the area of agricultural land uses in the Qaradagh district.

Type of use	Area (acres)	%
Tourist lands	16276	5,58
rainfed	65752	22,57
Orchards	2784	0,96
Forests	69272	23,77
Natural pastures	92724	31,83
Marginal lands	43304	14,86
Human settlements	1260	0,43
total summation	291372	100

As the total area of agricultural land uses in the district is about (2910372 dunums). It shows us the prevalence of agricultural land uses on natural pastures over the rest of the uses, at a rate of (31,83%) from that group. Then came the uses of agricultural lands invested in forests, at a rate of (23.77%) of the total agricultural lands prevailing in the judiciary. Whereas, the area of lands invested in tourist and ritual agriculture amounted to (16,276 dunums) and (65,752 dunums), respectively. As for the uncultivated marginal lands, they amounted to (43,304 dunums), at a rate of (14,86%) of the total area of agricultural lands in the district. Table No. (2). Perhaps the reason for this is due to the prevailing constituents of the natural geography prevailing in the region and its variability from one place to another.

From Table (3), it appears to us that the area of land planted with winter crops has reached (48,600 dunums) of the total cultivated lands. Whereas the area of the lands cultivated with spring crops reached about (420 dunums) of the total agricultural lands. This indicates that the proportion of the areas invested in the riverside lands (74,55 dunums). As for the area of agricultural lands planted with different summer vegetables, within the limits of (1017 dunums) of the

total number of Christian lands in the district of (16,276 dunums), This means that the percentage of investment in the tourist lands was (6,25%) only. In spite of the investment of the agricultural lands, it is a significant area. However, the productivity of one dunum is very low. Where it does not exceed at best (400 kg/dunum) in humid years in which the amount of rain falls is more than (700 mm).

Table 3 : Investment of agricultural lands and their area with different crops in the district for the year 2018.

Type of winter crop	**Area (acres)**	**%**
Wheat	21000	43,21
barley	26000	53,49
Lentils	600	1,23
Chickpeas	1000	2,05
Total	48600	100
Spring crop type	**Area (acres)**	٪
Tarouzi	200	47,62
Watermelon	220	52,38
Total	420	100
Type of summer crop	Area (acres)	**%**
Various crops	1017	
Total	1017	100

Reference / From the work of the researcher relying on1- The Ministry of Agriculture and Irrigation at the General Directorate of Agriculture of the Sulaymaniyah Governorate, Department of Agriculture, Qara Dag District, Department of Planning and Follow-up 2018.

On average, the productivity of one dunum in the study area ranges between (200-300 kg/dunum), i.e. an average that does not exceed (250 kg / dunum), which is a low value compared to the productivity of one dunum in developed countries that exceed (1000 kg / dunum) (Ali and Jalal, 2008). Accordingly, we can analyze the role of irrigation in meeting the water needs of agricultural land investment in summer and winter crops and their impact on increasing production in the study area as follows:

A. Water needs to invest in winter crops

The general distribution of the increase or decrease in the amount of rain over the amount of evaporation / transpiration that can occur during the season of growing winter crops for the period between November and April in the study area (Darwish, 2012). We find that the observed climatic data at the Darbandikhan meteorological station recorded a noticeable water surplus and a clear increase in the amount of precipitation falling from the amount of evapotranspiration possible in the three winter months (December, January and February). Where the amount of water surplus (198.35 mm). So it can be said that the amount of water surplus for the three months is so small that the amount of water shortage for November, March and April exceeded the amount of water surplus in the winter months. It recorded a water shortage during the winter agricultural crops (190.99 mm). That is why the study area is one of the areas that are highly exposed to the fluctuation of rain. Time and place. By evidence, the amount of rain fell in the years (2000, 2001, 2007, 2008, 2009) to less than (400 mm), which is much less than the general average. Therefore, the general climate characteristic in the district according to these data has shifted from the humid or semi-humid climate to that of the semi-arid climate. For this reason, agriculture in the study area is at risk of drought. In addition, the rain is characterized by its failure during the one season. When the rains fall early and abundantly, the pastures are green and the amount of winter crop production represented by wheat and barley crops increases, while the opposite occurs when the amount of falling rains decreases, as well as their delay when they fall, attracting lands, drying pastures and reducing the production of winter crops. To say that winter planting in the study area cannot be entirely dependent on the amount of precipitation that falls annually in general in its winter planting. There has always been a shortage of water in excess of winter crops in dry years. Although the growing season for winter crops in the study area actually corresponds to the duration of the rains. However, the need for agricultural crops for irrigation water is much greater than the amount of water falling, especially in dry years. Therefore, the process of investing all available agricultural lands in the study area requires after providing all the advanced agricultural requirements, including the use of irrigation and mechanization systems and the rest of the services. In the case of cultivation of all agricultural lands in the Qara Dag district (82028 dunums) in the winter season with winter crops, including wheat, by producing one ton per dunum, the production of the district will be up to (82028 tons) and that the required water will be in the amount of two to four irrigations and in a quantity (50 mm) per Raya (Amin, 2003). The amount of water requirements for the growth of winter crops in the district will be in the amount of production (tons / dunums) up to (102,535,000 m^3). Note that this amount of production is sufficient to provide the wheat needed for growth (683,566 people) on the basis of the amount estimated by the (WFP) per capita, up to (120 kg / year), knowing that the population of Qaradagh in 2018 was (12,230 people) Statistics in Sulaymaniyah, 2018). Then it needs approximately (122,300,000 tons) of wheat annually to secure the necessary quantity for its population. Thus, with regard to the water requirements for cultivating the barley crop in the district, according to climatic data, the reality of production and the quantity. However, in the case of investing all available agricultural lands (82028 dunums) in the winter season by growing the lentil crop with a yield of (500 kg/dunum), then the production of the region of lentils becomes around (41,014,000 tons), and with a water requirement of water for the success of the agricultural process, the amount of water needed is (20,507,000 m^3).

B. Water needs to invest in summer crops

Summer crops are cultivated in the summer half of the year. It runs from the month of May to October. Where high temperature and dehydration prevail which ultimately leads to an increase in the amount of evaporation / transpiration possible. This means the necessity of providing the largest possible amount of irrigation water in varying quantities from one month to another during that period in order to ensure the success of crop production of all kinds. This means that the Qaragh district suffers from a severe water shortage or deficiency in every month of the most famous summer crop season. Upon analyzing and extrapolating Table (1), we see the great water shortage in the Darbandikhan meteorological station and in every month of the most famous summer crop season. This large deficit of the amount of water required for irrigation from the study area reaches (2211,66 mm). Drought damage to summer agricultural crops in the study area can be prevented by choosing agricultural crops with

few water requirements or by providing what agricultural crops need from irrigation water . It can be provided according to the natural capabilities available in the study area. Irrigation is the only means by which you can resist drought and address its problems, and the ideal way to produce summer and winter agricultural crops in the study area. Now it remains for us to know the amount of water that must be provided for the purpose of using it to irrigate agricultural crops in the Karadagh district. Therefore, the investment of all available agricultural lands in the judiciary (82028 dunums) in the summer season, with different summer agricultural crops, with a water requirement of (700 mm) on the basis of approximately 14 irrigation by (50 mm) per irrigation (Ali and Jalal, 2016). The need for the amount of water in the summer is equal to (143,549).

Conclusions and Recommendations

It appears from the study and analysis that irrigation is the only way by which to resist the years of drought in the study area. As well as addressing his problems through it. So it is the ideal way to produce summer and winter agricultural crops. Therefore, we firmly say that the hydro-climatic efficiency coefficients in the Qaradagh district are not sufficient to completely rely on endemic agriculture. Perhaps this is due to the compatibility between the pattern of high and low water shortage and the pattern of high and low temperatures on the one hand and the fall of rain in the winter and interruptions in the summer on the other hand. In addition to the decrease in the amount of rainfall during the dry years to less (350 mm) and delaying the onset of precipitation in the water year itself. Which ultimately affects the decline in the ability of the land to produce in quantity and quality in the judiciary. The study showed that the ability of the land to produce does not exceed its average rate (250 kg / dunum) in the best climatic conditions, that is, in the case if the water year is a wet year. It is a small amount compared to the prevailing data in the study area and compared to the amount of production in developed countries. The reason for this is due to poor planning, and the failure to protect the local crop on the market from imported goods. Therefore, the area of agricultural lands must be expanded horizontally and vertically and increase production in the judiciary by adopting the method of irrigation according to a programmed scientific plan through which water can be used wisely. Through which we can raise productivity to a reality (1000 kg / dunum). By providing two irrigations to four irrigations (50 mm) per irrigation for the growth of wheat and barley crops in the event that all the agricultural and sacred agricultural lands amounting to (82028 dunums) are used, then we need a quantity of water in the amount of (102,535,000 million m^3). While we need (20,507,000 million m^3) to grow the lentil crop and produce (500 kg / dunum). The need for water increases to expand agricultural areas with summer crops. The different summer crops, in case all lands are invested in the district, require the number of irrigations approaching (14 irrigation) by (50 mm) for each irrigation as well. And when it is necessary to provide an amount of water through irrigation by (143,549,000 million m^3) without the possibility of losing any percentage of the estimated water. Otherwise, you need more than that. In order to achieve the goal, we recommend constructing small, standing or submerged dams at the top and centre of the Diwana basin to store and use water in the years when the area is subject to drought. In addition, all requirements for agricultural production, including fertilizers, machines and equipment, must be provided. And the establishment of a body to produce seed multiplication certified to provide production for farmers for all summer and winter crops. In addition to replacing the winter crops with water through irrigation in the years in which the rain is late. Because crops are in the stage of primitive growth, it requires large amounts of water for the success of the agricultural process in the remaining stages.

References

Alberazi, N.K. and Almashhadani, I.A. (2000) Agricultural Geography, Books Publishing and Printing Corp., Mosul University, 57.

Alhusseini, F. and Alsahaf, M. (1990). Fundamentals of Applied Climatology, Alhikma Publishing Corp., Baghdad University, 141.

Ali, M. and Jalal, J. (2008). Investing natural resources in agricultural development in the Sulaymaniyah governorate, Ph.D. thesis, University of Sulaymaniyah, P 98-106.

Ali, M. and Jalal, J. (2016). The impact of natural resources on water resources and their future development in the Darbandikhan region of Sulaymaniyah, Iraq, Raprin Magazine, (8): 130-136.

Alrawi, A.S. and Alsamer'ai, Q.A. (1990). Applied Climatology, Baghdad, P. 116.

Alrawi, S.M.A. (1990) Agricultural Climate in the North of Iraq. Appendix of Karawan Journal for Human Sciences no. 1 Irbil, 147.

Altemimi, O. S. (2007). Assessing Water Resources in Diyala River, Master Thesis, College of Sciences, Baghdad University, 48.

Amin, A.A.N. (2003). Fundamentals of Agricultural Crops in the Cultivated Areas, College of Agriculture, University of Sulaimanya. 78.

Derwish, I.J. (2012). Water Balance of Soil and its Relation to Agricultural Crops (Sulaimanya Governorate as a sample for the study) Journal of Arts, Baghdad University, 15.

Derwish, I.J. and Talib, J.T. (2008). Water-cliamte Balance of Sulaimanya Governorate (a climate quantitative study) Journal of Arts no. (82) Dijla Corp. for Media and Journalism, College of Arts, Baghdad University, 251.

Hussein, I.O. (2001). Natural evaluation and distribution of tributary waters of Ziwa in the Kurdistan region, fraternity center, special number (18), Ministry of Education Press, Erbil, 58.

Iraqi, K.R. (2018). Ministry of Planning, General Statistic Diretorate in Sulaimanya Governorate. Sulaimanya Services and Infrastructure in 2018. Table 1 (Unpublished).

Iraqi, K.R., Ministry of Transportation, Meteorological Directorate in Sulaimanya, Department of Climatology, Unpublished data.