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The effect of climate on agricultural products in Roshtkhar-Razavi Khorasan province-Iran

Hassan Rahmanpour*[1], Zahra Tavakoli[2]

[1]*Young Researchers and Elite Club, Torbat-e Heydarieh Branch, Islamic Azad University, Torbat-e Heydarieh, Iran*

[2]*M A Geography & Secretary of Education Roshtkhar city, Iran*

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Abstract

Climatic elements including precipitation, temperature, humidity and are among parameters that have important effects on agricultural activities. There for investigation of climatic elements in different geographical areas is very important .The main objective of this study is the investigation of the Impact of climate parameters on yield of wheat in roshtkhar. The spss software has been used to analyze date. The results obtained showed reduced yield in recent years the city has Roshtkhar. correlation coefficients showed a significant relationship between climate factors and yields of wheat. Wheat moisture performance wosmone significant.

***Corresponding Author:** Hassan Rahmanpour ✉ rhmanpor@yahoo.com

Introduction

Agricultural production is highly correlated with annual precipitations and good climatic conditions. However, the climate is the only source that a man can use to any amount with paying no fees. In our country, due to very limited rainfalls, the overwhelming heat in summer and extremely cold temperatures in winter, the climate plays a special role in agricultural productions (Khayatzade Mahani, 2006).

Among the great achievements in the field of breed, technology, irrigation, pest and weed control, and biotechnology, the climate has still remained as a major and determinant factor in agricultural geography (Koochaki and Khazanedari, 1997). Generally, agricultural planning associated with planting, growing and harvesting, controlling the pests and diseases, etc. will have little success without understanding the impact of and controlling the climate nature (Kaviani and Alijani, 2001). Awareness of the right time of planting, growing and harvesting of garden and agricultural crops and identifying the climatic indicators make it possible for planners to think about the appropriate allocation of resources to different crops. Study of climate and environmental factors in determining the agricultural and gardening crop species of each region has become an essential matter.

Today, agricultural management and increased production per unit area require optimal utilization of natural resources and further knowledge about these resources (Noori, 2004). Defining a good research design will enable researchers to spend the least money for solving the concerned problems, objectively and accurately .The overall goal of this research is to understand the existing opportunities and potentials of the region, so that with the knowledge about these features and proper planning and by raising the awareness among farmers toward agricultural development and finally the sustainable development of the region, the appropriate context is provided for the wheat cultivation in the suitable conditions of the region. Therefore, in addition to increasing economic productivity, employment, providing income and improving the social situation, it can prevent the migration of villagers. The overall objective of this research was providing an appropriate design and solution that can play a more effective role in the agricultural development of the region. The aim of this study is definition effect of climate on agricultural products in Roshtkhar-Razavi Khorasan Province-Iran.

Material and methods

Research question

1-Do climate parameters have made changes in the rate of irrigated wheat yield of the town?

Research hypotheses

1- It seems that in the last few years, major changes have occurred in the rate of irrigated wheat yield.

Data Analysis

Data analysis means sorting, arranging, processing and summarizing the data, instead of answering the research questions.

The purpose of the analysis is determining the data in such a way that it can be changed and understand-dable, thereby the relations between different variables that are relevant to the problem of research, can be studied (Khaki, 2005). The required climatic factors were extracted from the climatic variables table as follows:

1- Average Temperatures
2- Average maximum and minimum temperatures
3- Precipitation
4 - Relative Humidity

The mentioned parameters are among those variables that have an impact on the yield of agricultural products and the results are in presented in Table (4-5).

Result and discussion

Research objectives

Defining a good research design will enable researchers to spend the least money for solving the concerned problems, objectively and accurately (Nabavi, 1995). The overall goal of this research is to understand the existing opportunities and potentials

of the region, so that with the knowledge about these features and proper planning and by raising the awareness among farmers toward agricultural development and finally the sustainable development of the region, the appropriate context is provided for the wheat cultivation in the suitable conditions of the region. Therefore, in addition to increasing economic productivity, employment, providing income and improving the social situation, it can prevent the migration of villagers. The overall objective of this research was providing an appropriate design and solution that can play a more effective role in the agricultural development of the region.

Research Background

In order to achieve the purpose of research, awareness and understanding of the background of the problem seems essential and necessary; because it makes the research and its contents clearer. Literature review by researchers could be important in several ways. Because, the authors carry out the research to assess the feasibility of its scientific application (Moulazadeh, 1998).

Using Zicardian method, Vaseghi and Ismaili (2008) examined the economic effect of climate change on agricultural sector of Iran (Case study: Wheat). The results showed that an increase in temperature and decrease in rainfall will cause 41 percent reduction in the yield of wheat in the country up to next 100 years.

Zarrin and Farajzadeh (2002) modeled the wheat yield with regard to climatic and agricultural parameters in Western Azerbaijan and obtained the analytic functions of wheat yield for the area.

Using stochastic production function, Karbasi and Nodehi (2003) examined the effect of using inputs on production risk of wheat growers of Neishaboor. Results showed that fertilizer, the value of consumed seeds and the cost of machineries had a positive and significant effect on wheat production. Lamason (1974) studied the effects of rainfall fluctuations on agriculture success in eastern Montana. The results showed that the possibility to obtain a high yield in this area is once every 23 years while the complete destruction of the yield resulting from drought can be expected once every seven years.

Different climates of irrigated wheat and their recommended cultivars

There are different planting dates for different climates of the country. But wheat planting period in dry and hot climatic conditions of Roshtkhar region is from November 11th to December 21st and the best time is first half of December. The number of seeds used is 350-400 seeds per square meters and commonly early spring wheat is used for this purpose. Currently, land and bedding preparation for dry and hot areas is the same as land preparation for temperate climates. (Rahmanpour, 2014).

Table 1. The relationship between performance and pre-season rainfall (mm). (Koochaki, 1985).

More than 199 mm	150-199 mm	100-149 mm	Less than 100 mm	Amount of rainfall
945	670	520	240	The average yield (kg/ ha)
4/4	9/17	8/20	0/9	the years with a yield of 650 kg per hectare to the total number of years

Location and extent of the study area

The province of Khorasan Razavi with an approximate area of 127,600 square kilometers covers 7.7 percent of the total area of Iran. The Province is located between 34° to 38° northern latitudes and 57° to 61° eastern longitudes. Roshtkhar is a town of Khorasan Razavi Province located at a distance of 190 kilometers from the Capital of the Province (Mashhad). Roshtkhar has an approximate area of 3598 square kilometers and located between 34° 30' to 35° 13' northern latitudes and 59° 30' to 59° 55' eastern longitudes and its height from sea level is 1141 meters (Rahmanpour, 2013).

Fig. (3-1) shows that the neighboring cities of this town are Dolat Abad Zaveh and Torbat Heidarieh to the north and northeast, Mah Velat to the west, central part of Gonabab to the south and southwest and Salami, Zuzan plain and central regions of Khaf to the south and southeast (Roshtkhar Statistical Yearbook, 2009).

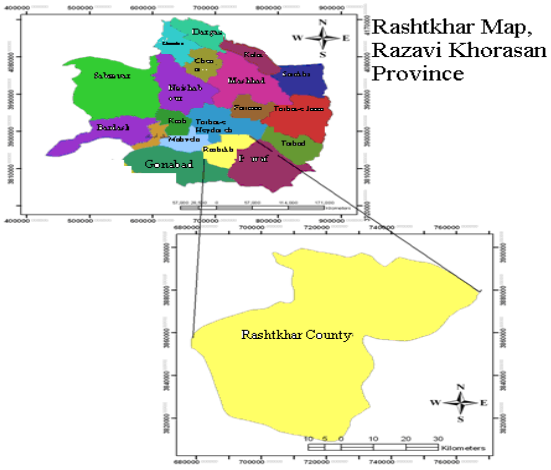

Fig. 1. Location Map of Roshtkhar in Khorasan Razavi province.

Roshtkhar climatic parameters

Given that the climatic data were essential for the study and the necessity of using various and multiple parameters affecting the growth and yield of wheat required the use of synoptic stations, due to lack of such stations, the data of three stations of Torbat Heidarieh, Malek Abad and Khaf were inevitably used. The specifications of studied meteorological stations are presented in Table 3-2.

Table 2. Specifications of meteorological stations.

Malek Abad	Khaf	Torbat Heidarieh	Station specifications
Measurement of evaporation	Synoptic	Synoptic	Type of station
35-80	34-35	35-16	Latitude
59-23	60-90	59-13	Longitude
1196	998	1450	Height from sea level

First, according to data gaps of Khaf station, Torbat Heidarieh synoptic station was considered as the reference station and using differences and ratios, statistical gaps of Khaf were filled. To correct the suspicious data or filling the blanks in the statistical data set, the differences method was used for temperature, and the ratio method was used for precipitation and relative humidity. For data analysis, we evaluated the position and extension of agricultural lands of the study area and identified the yield of agricultural crops, including cereals (irrigated wheat). Then the cultivars were recognized. Given that in the past, there was much raining in the region and the weather was suitable for growing crops, the farmers had no problem with the cultivars and the land was ready and suitable for cultivation of any type. But in recent years, due to the changes in the type of precipitation and climate of the region, the authorities have decided to conduct research about the current changes and conditions. Therefore, among the adaptable cultivars for the climate of the region (used since 2010-11) that had high protein content, we can mention to Zare, Pishgam and Orum cultivars.

Then, the cultivated acreages of agricultural crops were compared for the town among which the most cultivated area is devoted to irrigated wheat and the dominant cultivation in the region occurs in winter. Also, changes in cultivated area and irrigated wheat yield of the town was determined for the statistical period (2002-2011) and provided as some curves. And finally, we investigated the relationship between the mean humidity, rainfall and temperature with yield of irrigated wheat. This means that the 10-year data of irrigated wheat yield and the restored data of the climate were fed into Excel for analysis. Then, Spss was used to assess the impact of climatic parameters on the yield to determine which parameters have the greatest impact on the yield. Based onrestored statistics for Roshtkhar in Tables of Appendices (3-2-1) and agricultural statistics provided by Agricultural Jihad of Khorasan Razavi province in Table of Appendix (7) and using Spss, some diagrams were plotted and in these diagrams, the coefficient of determination (R2) and their correlation values were also specified.

Table 3. Cultivated area, production and yield of wheat in Roshtkhar during the 2009-10 agricultural year.

Yield (ha/km)			production (ton)			cultivated area (Ha)			Agricultural crop	
Rain fed	Irrigated	Total	Rain fed	irrigated	Total	Rain fed	Irrigated		Name of the crop	Type of crop
400	3200	44680	1480	43200	17200	3700	13500		wheat	Cereals

Reference: Simaye Keshavarzi of Roshtkhar, 2009.

The most important areas of the town in terms of growing irrigated wheat are the villages of Astaneh, Roshtkhar, Shobe and Jangal. Rainfed wheat is also cultivated in certain lowland and mountainous areas with good rainfalls.

October is mostly the season for wheat cultivation in the town and the harvest begins in late June and early July. There is also a spring cultivation of wheat which usually happens in late March and according to the yearly rainfalls. Wheat production is mostly of the irrigated kind. If the rains are good, rainfed cultivation is also carried out and given the low cost of production, it is economical. It should be mentioned that the quality of rainfed wheat is much more than the irrigated wheat for baking breads.

Table 4. The cultivated area and agricultural production rate of the town separated into two categories of irrigated and rainfed crops for 2009-10 farming year.

Yeald (Kg/ha)	Production (ton)	Cultivated land (Ha)	The type of crop	Row
3200	43200	13500	Irrigated wheat	1
3700	10360	3950	Irrigated barley	2
2603	18578	10100	Cotton	3
31000	66030	2130	Sugar beet	4
30000	9000	300	Onion	5
10	-	4500	Saffron	6
8	3200	4000	Rainfed wheat	7
850	2125	2000	Rainfed barley	8

Table 5. Descriptive statistics for study variables in the period (2002-2011).

Average of minimum temperatures	Average of maximum temperatures	Average rainfall	Average humid	Average temperature	yield	
2 /61	17/05	17/79	51/37	11/18	3072/5	Average
3/52	17/07	18/92	51/44	11/20	3153/27	Standard deviation
12/38	291/52	357/87	2646/53	125/53	9943142/5	Variance
-0/34	15/63	7/13	48 /30	10/39	1180	Minimum
6 /02	18 /66	25/66	55 /94	12/87	3700	Maximum

Evaluation of wheat yield and climatic variables using Pearson method

Since the subjective estimates cannot always be trusted for showing the extent of the relationship between two variables, a quantitative index should be used.

Pearson method is used to calculate the correlation coefficient for two statistical populations, the individuals of which are measurable or in other words, they are quantitative, (Jabbari, 2006).

According to Table (4-6), it is observed that the relationship between the average irrigated wheat yields and climatic variations is specified with its value for the significance level of 0.05. There is a negative correlation between the wheat yield and all the studied climatic parameters which means that if one variable increases, the other variable decreases. In this table, the highest correlation coefficient is associated with the humidity and the lowest correlation coefficient is associated with the average temperature.

Table 6. Pearson correlation between variables.

Average maximum temperature	Average precipitation	Average humidity	Average temperature	Variable Index	
0/57-	0/40-	0/43-	0/19-	Pearson's value	
Smaller than the error level of 0.05	Smaller than the error level of 0.05	Smaller than the error level of 0.05	Smaller than the error level of 0.05	Sig	Average yield
10	10	10	10	Numbers	
Average and adverse	Average and adverse	Average and adverse	Very small and negligible	interpretation	

Conclusions

During the past 10 statistical years, the wheat yield of Roshtkhar has been fluctuating constantly. So that, due to favorable weather conditions, it had an ascending trend since the 2001-2002 crop year up to the end of the 2006-2007 crop year. During the 2007-2008 crop years, due to lower rainfall, it suffered a downward trend. The grain yield increased again in 2008-2009 crop year and since 2009-2010 crop year up to 2010-2011, the yield decreased again. Based on statistical analysis performed using Pearson method for the climatic parameters of temperature, humidity, rainfall and frost, it became clear that based on the coefficient of determination, the parameters of humidity, rainfall and temperature had the first, second and third priorities in determining the yield, respectively.

In addition to climatic parameters, the most important factors affecting wheat yield loss are as follows: A) Low level of scientific and applied knowledge of farmers. B) Failure in timely supply and distribution of agricultural inputs (seeds, fertilizers, pesticides, etc.). C) High level of wastes in various stages of production. D) Damages caused by pests, plant diseases, weeds and the lack of proper management in controlling them.

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