Agroclimatic Modeling of Wheat to Agricultural Meteorological Data The studied Ardabil Province

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Abstract
One of the problems of agriculture, especially in arid regions of the world are faced with fluctuating rates, yields from rain-fed several years. Climate parameters affecting the level of product knowledge is very important because it provided a model to predict the necessary programs to meet the needs of the product can be stored in case of deficiency and excess recommended. To check Agroclimatic dryland wheat cultivation methods, deviation from optimal conditions, the thermal gradient is applied. The results indicate that wheat climatic zonation map of cultivated wheat lands in Ardabil province is divided into four areas Agroclimatic approximately 20% very good, 10% good, 40% moderate and 30% is unsuitable for cultivation of wheat. The most suitable area for the cultivation of this crop, meshkinshahr and parts of the city of Ardabil, because it depends on the distribution of annual rainfall and Namsadtryn region and parts of the West anklet Ardabil province is included. The results show the optimal place for planting rainfed areas of the Northeast and the small territory in the center of the studies is that the potential is high; in fact, the meshkinshahr a deviation from optimal conditions, resulting in less favorable conditions for wheat than any other station in the world. Best cropping calendar based on the analysis of this study was to Agroclimatic wheat for selected stations in the wiki, Pars abad and meshkinshahr in late October, and anklets station is at the end of September. The wheat harvest calendar for station Ardabil, Meshkin Pars abad and June respectively, and anklets station is the end of July.
Keywords: Agroclimatic, dryland wheat, phenology stages, thermal gradient, Ardabil

INTRODUCTION

Wheat (Triticum aestivum L.) is counted among the “big three” cereal crops, with over 600 million tons annual harvest. The total world harvest in 2007 was about 607 million tons compared with 652 million tons of rice and 785 million tons of maize (Shewry, 2009). Currently, about 95% of the wheat grown worldwide is bread wheat, and most of the remaining 5% being durum wheat (FAO statistics, 2008). Climate change highly impacts agricultural production quantity and quality (Samadi et al., 2011). Climate change and global warming process will probably have direct impact on tropical and temperate regions and any other areas where high temperature or inadequate rain often limits crop productivity (Morison, Morecroft, 2006). Predictions of human induced global climate change are derived from increases in atmospheric level of carbon dioxide. One of its adverse effects is warmer temperatures and increasing episodes of very hot weather. Temperature is the primary factor driving wheat development (Wilhelm and McMaster, 1995), and consequently influence yiel (McMaster, 1997). Numbers of tillers are usually decreased when wheat plants were exposed to high temperature. In addition, temperature is the major variable controlling spikelet initiation and development rates (McMaster, 1997). Furthermore, high temperature during anthesis causes pollen sterility (Saini and Aspinall, 1982) and reduces number of kernels per head, if it prevailed during early spike development (Kolderup, 1979). At higher temperature, the duration of grain filling period was reduced (Sofield et al., 1977) as well as growth rates with a net effect of lower final kernel weight (Bagga and Rawson 1977; McMaster, 1997). Therefore, it is expected that climate change will have implications for possible fluctuation on wheat yield (Wrigley, 2006). Presently, many proposed prediction models of crop yield have

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been divided into two categories of mechanistic and empirical approaches (Poluektov and Topaj, 2001). Hosseini et al. (2007) adopted ANN and multi-variable regression models for dryland wheat yield in a moderate climate in Ghorve of Kordestan Province, Iran. They showed that ANN model can estimate the crop yield with acceptable accuracy. Maximum and minimum air temperature, daily mean relative humidity,net radiation, precipitation, dew point temperature, and wind velocity were included as input data in their ANN models.

Methodology

Geographically position region

The Ardabil province is located in the west of Iran and is over than 17953 km and form about 1.1 percent of the total area of the country. It is limited from the north to republic of Azerbaijan and from the west to the Eastern Azerbaijan province and from south to Zanjan province and from the east to Gilan province and republic of Azerbaijan.

Considering the ripples situation water ways network and climate variability, four major agriculture are in Ardabil province were identified as follows:

1- The Moghan agriculture area : This area includes the cities of Pars Abad, Bile Savar and parts of Garmy. This area is approximately 45000 hectors (25.7 percent of area) and its main source of agricultural water supplies are rivers of Aras, Pahla, Dare rud, Baezand Chay and Azadue.

Its main crops are wheat, barely, cottten, hay, suger, beet, oil, seeds, horticultural products, grain and corn.

2- Region of Ardabil agriculture : this area includes cities of Ardabil, Nir and Namin is about 511270 hectares, equivalent to 28.45 percent of the province area. The main water resources include the rivers of Qare sue, Baliklochay, Namin chay and deep and semi-deep wells.

3- Meshgin sgahr, Garmy agricultural region : This area includes the cities of Meshgin shahr and some parts of Garmy. It is about 434160 hectares equivalent to 24.18 percent of the hold area of province. The main water supply resources include the rivers of Meshgin shahr, Chay springs and wells. The main crops of this region are wheat, barely, hey, grain, Jat and other garden products.

4- Khalkhal - Kosar agricultural region : This area includes the cities of Khalkhal and Kosar and is about 319770 and 22.27 percent of the province area, the important water supply resources in this area are river of Firuz Abad ,Chay,Givi chay,Qazan, Harv Abad chay and Shahrud.the main crops are: wheat,barely,hay,beans,onion and jay.

Climate parameters

Studies on the physiology and growth stages of wheat that has been conducted has shown that certain Climate parameters in certain months of the year, a considerable effect Affect product performance, for example, during germination, which takes about 5 to 10 days after planting, temperature, rainfall and humidity effects are important. The amount of rainfall during elongation and heading the plant needs water and maximum operating temperature during flowering and grain filling is determined by the transition. As a result of investigations, the following 4 parameters Climate modeling were selected as the primary criteria: total annual precipitation, average daily mean temperature, mean number of days of late spring frosts, the average number of freezing days of winter.

Table 1

Analysis of the data

The study involves the use of methods or techniques that maximize performance at least at times, and we aim to achieve results and contribute to research. As to the question must be raised, and the choice of methods should be appropriate to the time and cost increase is prevented.

The following steps were used to analyze the data:

A) analysis of meteorological data using descriptive and inferential statistics (mean, standard deviation).

B) the use of GIS software functions to draw lines and isothermal precipitation in the range of Ardabil Province. To check the wheat plant phenology, and degree of deviation from the optimal conditions for active days and thermal gradient of about 36500 data monitoring stations selected minimum and maximum daily

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temperatures for a period of 10 years was used. Who goes on to identify and assess each of the methods used in the study described above.

Thermal (temperature) Gradient Method

In order to explore into the studied region in terms of temperature and in relation with rate of deviation from optimum conditions at various heights or optimal time states based on height, it was required adapting thermal gradient technique to determine temperature in height of some points which lacked measurement substation. Linear regression method has been utilized to derive these temperatures. By the aid of linear regression, coefficients of temperature variance plus their height have been calculated for months of a year and total year. To compute line equation, the following formula was used: $(y = ax + b)$ In this formula, y (independent variable) is the most important variable based on which it is predicted for the expected value (dependent variable) x. (a) denotes a fixed coefficient that is called intercept and (b) is slope or thermal (temperature) gradient that represents temperature loss along with height. The following formulas are employed to calculate a and b :

$$a = \frac{\sum(y) \sum (X^2) - \sum(x) \sum (xy)}{N\sum X^2 - (\sum X)} \quad \text{(eq.1)}$$

$$b = \frac{N\sum XY - (\sum X) (\sum Y)}{N\sum X^2 - (\sum X^2)} \quad \text{(eq.2)}$$

To derive the results and calculation of the above formulas, first a table is drawn for correlation among the components for selected substations and the studied time zones formed for each of them so that they will be mentioned as monthly and annual correlation elements for the selected substations.

Deviation from Optimum Percentage (DOP) technique

The best time in each region according to the meteorological station and daily temperature of the product is important. There are 4 in wheat phenological stages and each stage has an optimum temperature for improvements, the maximum of which is at the optimum temperature. With the identification of the optimum for each phenological stage and an average daily temperature of monitoring the minimum and maximum daily can be optimized for different periods of time, especially in the months of the year revealed in fact, it has the least deviation from optimal conditions, the optimal lead time.

Discussion Conclusion

Analysis of deviations from optimal conditions

Four phenological stages in wheat plants that have been studied from the point of view Agroclimatic with Ahmytnd The steps include: Stage of germination, stem elongation, flowering and maturity of each stage of an optimum temperature for the maximum or optimum growth at this temperature is optimal. To study the phenological wheat varieties according to a survey conducted among clay base is more abundant in the region. Table (2) the degree of deviation from optimal conditions for each phenological stage based on the average daily temperature at selected stations show. According to the results of germination, stem elongation, flowering and reach the station Meshkin Shahr, Ardabil, Pars Abad Magi have a deviation less than the other stations is optimum.

Table (2)

Deviation from the optimum conditions based on height

Thermal gradient

To investigate the extent of deviation from optimal conditions at different altitudes or optimal location based on height, Using linear regression coefficient changes with high degree days are calculated for the months of the year. To reach the top of the first table of results and calculation of correlation for the selected station and all time periods The studied were formed; The results are summarized in Table (3) the annual correlation of selected stations listed.

Table (3)

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The appropriate regions for types of cultivation (Dryland wheat)

Based on the analysis of climate and conditions for dryland wheat cultivation region Agroclimatic based on the listed regions suitable and unsuitable for a variety of dryland wheat cultivation (winter) at time of the study area as stated below. Early October is the best time for planting wheatArdabil Province, is. According to the map number (2) regions favorable for wheat growing areas of the province during the results show, The optimal place for dryland wheat crop in central and parts of the Northeast and the small area of research that has high potential in the area meshkinshahr.

Conclusion

Simulation models can provide an alternative, less time-consuming and inexpensive means of determining the optimal management practices requirements under climate change conditions. Despite progress in the field of plant breeding, control of pests, diseases and weeds, plant nutrition and fertilizer types are determining role in climate and vegetation type, quantity and quality of agricultural production of the play. Awareness of the relevance and applicability of agricultural activities in each region with the weather conditions it is necessary for any agricultural activity. Climatic conditions of agriculture as an economic crop species made it possible to be defined. Agriculture, agro-climate regions are determined on the basis of homogeneous areas and agricultural areas, climate favorable climate for the development of specific products and Special determined. Knowledge of how to fit and adapt to climate and agricultural practices in each area it is necessary for any agricultural activity. The country's wheat crop has an important role in providing food security and nutrition of the people. If due to thermal and moisture requirements of the product, identifies the areas favorable for wheat, yield per unit area can be practically achieved. This study aimed to assess the current status of rainfed land and climatic zonation using climatic data for wheat in the province of Ardebil. The results indicate that wheat climatic zonation map of cultivated wheat lands in Ardabil province is divided into four areas Agroclimatic approximately 20% very good, 10% good, 40% moderate and 30% is unsuitable for cultivation of wheat. The most suitable area for the cultivation of this crop, meshkinshahr and parts of the city of Ardabil, because it depends on the distribution of annual rainfall and Namsadtryn region and parts of the West anklet Ardabil province is included. The results show the optimal place for planting rainfed areas of the Northeast and the small territory in the center of the studies is that the potential is high; in fact, the meshkinshahr a deviation from optimal conditions, resulting in less favorable conditions for wheat than any other station in the world. Best cropping calendar based on the analysis of this study was to Agroclimatic wheat for selected stations in the wiki, Pars abad and meshkinshahr in late October, and anklets station is at the end of September. The wheat harvest calendar for station Ardabil, Meshkin Pars abad and June respectively, and anklets station is the end of July.

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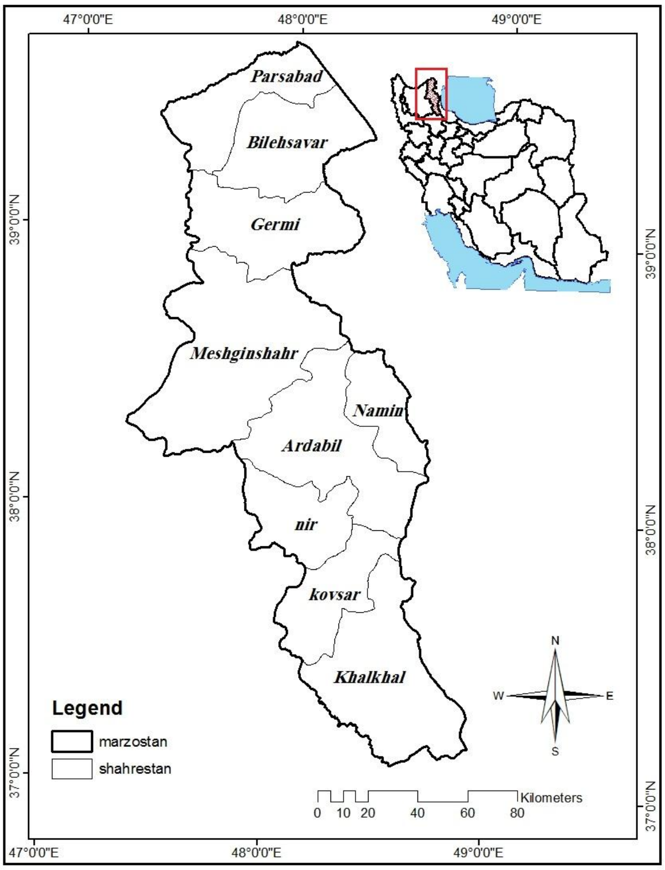

Fig 1. the studied region

Table 1. Characteristic of Meteorological Stations

Station	Station Type	Latitude	Longitude	Altitude, m
Ardabil	Main Synoptic	38-13	48-17	1365
Pars Abad	Main Synoptic	39-39	47-55	75
Khalkhal	Main Synoptic	37-38	48-30	1806
Meshkin Shahr	Synoptic	38-23	47-40	1485

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Table (2) determining the deviation from optimal conditions for wheat phenological stages Ardabil Province

Total deviations	ripening		Growth		Stem elongation		Germination		Growth stages / station
	Deviation from condition	optimum	Deviation from condition	optimum	Deviation from condition	optimum	Deviation from condition	optimum	
- 33/13	- 10/32	+35	- 8/10	23-20	- 6/60	24 -16	- 8/11	25 - 22	Pars Abad
- 35/85	- 11/40	+35	- 8/89	23-20	- 6/80	24 -16	- 8/76	25 - 22	Khalkhal
- 31/75	- 9/80	+35	- 7/05	23-20	- 7/30	24 -16	- 7/60	25 - 22	Ardabil
- 26/16	- 8/10	+35	- 6/61	23-20	- 5/15	24 -16	- 6/30	25 - 22	Meshkin Shahr

Table 3 Correlation of Ardabil Province elected annually during the phenological stations (thermal gradient)

ripening	Growth	Germination	Stage / Coefficients
0.001	-0.0006	-0.0087	B
-0.28	15.95	27.78	A
0.41	0.0015	0.29	R

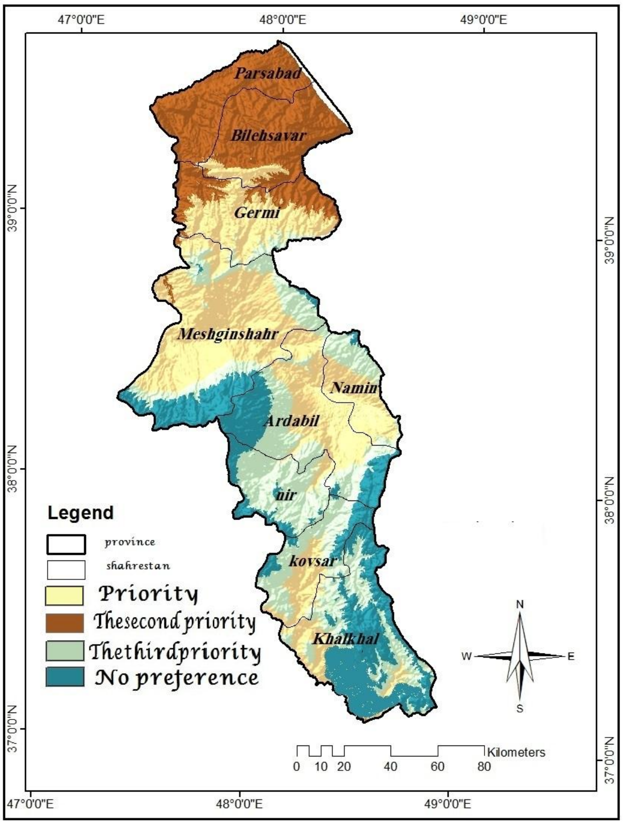

Fig. 2. The final map of suitable regions for wheat cultivation

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