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Full Length Research Paper

Evaluating climatic potential for palm cultivation in Iran with emphasis on degree-day index

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Climate is one of the major factors that affect all aspects of life. Realistic crops cultivation depends on proper understanding of climatic condition. Among agricultural products, date-palm has been a case of interest for scholars of agricultural sciences especially agro-climate researchers due to its importance in regard to nutritious elements and being full of carbohydrate materials. Date-palm has a product of great significance for Iran in economic, political, cultural and biological views. Therefore, in this research, it has been attempted to investigate and identify appropriate environment for cultivating this crop in Iran based on agro-climatology perspective while emphasizing climatic index of degree-day. For this purpose, the climatology data from year 1997 - 2007 have been used. These include the data of day temperature, mean of coldest month in a year, number of frosty days, number of cloudy days, mean of monthly precipitation and degree-day index for 60 meteorology stations of Iran. At the end, based on calculation of degree-day index for the investigated area, these results have been obtained: Birjand, Gorgan, Ilam, Kerman, Khorramabad, Manjil, Naeen, Maravatapeh and Sirjan do not have the minimum degree-day index; therefore, they do not have the required favorableness and appropriate potential for palm cultivation. But on the other hand, the most ideal stations for palm cultivation based on degree-day index are: Bam, Zabol, Kangan, Tabas, Lar, Booshehr and Dogonbadan cities and the consideration of further investment and attention to palm cultivation in these regions is suggested.

Key words: Climatic potential, agro-climate, climatic evaluation, degree-day index, date-palm, Iran.

INTRODUCTION

Climate is one of the major factors that affect all aspects of life and realistic crops cultivation depends on proper understanding of climatic condition. Proper understanding of climatic condition can help farmers in doing cultivation at an opportune time and supplying plant's needs during growth period. In this way, it can help the qualitative and quantitative development of agricultural products. For this purpose, various scholars have dealt with the effects of this significant factor on cultivation, crop management and harvest of agricultural products due to the significance of different climatic aspects (Daniel et al., 2009; Appendini and Liverman, 1994; Podesta et al., 2002; Tao et al., 2003; Getahun, 1980). Among various agricultural products, date has been a case of interest for scholars of agricultural sciences due to its various peculiarities such as oil, nutritious material fibers and being full of carbohydrate materials and has significant place among agricultural products.

Therefore, different specialists and scholars of sciences related to agriculture, nutrition, biochemistry, agro-climatology, etc., have always attempted to identify different features of this valuable product from different aspects. Therefore, in this research, investigation on appropriate environment for cultivating this product has been attempted from the view of agro-climatology while emphasizing degree-day index (Kolawole et al., 2007; Manzi and Coomes, 2009; Kriker et al., 2005; Mohamed and Awd, 2006; Al-Shayeb et al., 1995; Biglari et al., 2008 and Sumathi et al., 2008). Palm tree is a monocotyledon from palmaceous family and there are almost 200 genera and 4,000 species that grow in all regions

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Table 1. Date-palm reaction to environmental changes (Moghtaderi et al., 2004).

Zero point of procreation	Zero point of vegetation	Point of stopping vegetation growth	Beginning of decrees of growth	Best temperature for growth	Tolerable slope of temperature without any remarkable loss of plant
18°C	10°C	49°C	40°C	32 - 38°C	-5 - 50°C

(except cold ones) (Zaid, 1999). A few scholars stated that the original land from date is North Africa and India, but most scholars and researchers believed that the original land from date was Mesopotamia and that her people cultivated date-palm from 4,000 to 5,000 B.C. According to history, the date-palm has been ever considered as a sacred tree and a sign of productivity and affluence, and its fruit which is a valuable nutritive source, has been ever valued by humans, Moghtaderi et al., 2004.

The history of palm cultivation in Iran relates to thousand years ago and it is stated that Achamenian and Sassanian kings were in support of its cultivation and expansion in all ages. Shapoor the first, a Sassanian king, has written in Naghsh-e Rostam inscription: "Palm tree is a blessing that Ahurem Mazdem has granted to its creatures and can feed a lot of people. So, the King encouraged palm cultivation and asserts that during his kingdom, 100 palm trees in new tropical regions of Iran were grown and produced fruit for twenty times" (Panahi, 2002). Considering the recent concern on the increase of world population, lack of food and malnutrition becomes more reflective every second and the nutrition value of this strategic product becomes more peculiar. In addition, nourishment of people in date-productive regions of this blessing has caused the regional scarcities that happened in the country which does not lead to great human loss. Economic value of date as one of the non-petroleum export products is significant not only due to its yield in regard to foreign currency, but more because of the fact that regions where this product is produced are limited and the potential for competition on this strategic product is relatively less than other agricultural products. Date-palm is considered significant for Iran from economic, political, cultural and bioenvironmental aspects. In some parts of Iran for instance, Arabs of Khuzestan and Baloochi people extremely depend on palms economically and thus, the logic renders this policy that further attention is paid to the cultivation and expansion of this product to prevent immigration of residents of border areas and reinforcement of borders. Another issue that its consideration increases the significance of this matter is date, due to its peculiar specifications such as resistance to drought and water.

Scarcity and tolerance in adverse soil and water conditions, is among the limited plant species that could have made possible human's residence and dispersion in the lands, which were hot and arid in the past world (Moghtaderi et al., 2004). Date-palm cultivation is mostly done in lands and soils that are inappropriate for cultivation of other agricultural products and therefore, palm is undoubtedly significant in bioenvironmental view due to protection of water and soil resources. Iran is considered as one of the major producers of date-palm in the world (Pezhman, 2001). Since palm gardens constitute a large number of the country's orchards, it is potentially considered as a remarkable wealth for Iran. Its deprived regions, expansion of palm cultivation to other regions and protection of palm gardens are significant in different aspects and are a prominent goal. In general, date-product has special significance due to economic, social and political reasons as well as supplying food and energy, providing employment, export and supplying foreign currency and the possibility of being grown in relatively salty soil. From ecologic perspective, date-palm growth is possible in regions that have humid winters and hot and dry summers for it to be ripened and there should be no extreme rain or humidity during five to seven months from pollination period to harvesting. In regard to altitude, although palm grows up to the datum of 1500 m, the most suitable and maximum altitude is up to 1200 m. The best longitude for palm cultivation is from 24 to 34 degrees, but at the present time palm grows in longitude from 10 to 39 degrees in North hemisphere of the world. The most northern commercial palm groves are in the north hemisphere and Gazal Oroot of Turkmenistan that is located in longitude of 39 degrees in the margins of Turkmenistan desert (Reza, 1991).

From agricultural climatology perspective, thermal parameters are known as significant factors in deter-mining the duration of phonologic process (Yazdanpanah, 2001). There is no region that is considered very hot for palm, but in regions that are extremely hot and relatively low, humid ripening of date with sappy and sticky dose does not occur and is turned to hard and dry date (Mccoll, 1992 and Moghtaderi et al., 2004). Although relative high humidity does not cause the softness of date, if there is high humidity in the ripening period, it will be followed by its fall and sourness. Date is one of the most resistant plants to oscillation of cold and hot weather (Table 1).

Based on Masoon's theory, the growth of palm tree is not stopped unless the lowest day temperature is lower than that of the frost and the highest at meristem does not get lower than 9 or 10 (Zaid, 1999). As this research has considered the duration from pollination to ripening (procreation period), rainfall would not have any effect on the improvement of quality and quantity of product. In reverse, regions are suitable for palm cultivation that

have lower rate of precipitation in months of August, September and October. Another factor affecting palm cultivation is relative humidity, since it also affects fruit texture. Increase or decrease of relative humidity has many positive and negative effects on the quality of product. High rate of relative humidity causes softness and stickiness of fruit and also its fall and sourness (Abbasali, 1997). The most important effect of high relative humidity is that it provides identical temperature conditions around the palm which help the ripening of all fruits at the same time, but low relative humidity often causes fruits to get dry and hard. Considering what has already been mentioned in regard to relative humidity, it is difficult to determine the threshold of effective humidity for palm cultivation, since the rate of increase or decrease of relative humidity each has its own advantages and disadvantages.

Natural specifications of the studied region

As it is clear, the climate of any geographical area besides atmosphere conditions also depends on hydrology, geology and ecology. Whereas atmosphere conditions make the climatic framework of any area and specify the climate of large areas, local differences of non-atmosphere conditions cause formation of distinguished climatic areas in the center of larger areas. In Iran, rockiness as well as being close or far from sea is an important climatic factor.

The role of rockiness in the arrangement of climate areas in Iran is very significant. Here, the researchers especially pointed out that the role of great rockiness in Zagros mountain chains (in west and south-west) and Alborz Mountains (North) specifically determine local arrangement of temperature and rainfall. Iran is a rocky country and its average altitude datum is about 1300 m. However, the range of altitude is very large and it changes from Khazr sea shore in the north of Iran, where its altitude is lower than the level of free waters, to Damavand peak that its altitude datum is almost 5500 m. This rockiness variety is one of the major factors of climatic diversity in Iran. Figure 1 shows the climatic zonation of Iran based on Demarten index.

MATERIALS AND METHODS

The first factor which is considered in determining suitable areas for fruit (palm) cultivation is the annual mean of temperature (Manbaei, 1997; Moghtaderi et al., 2004). Researches done in this area indicate that in regions where annual mean of temperature is higher than 17°C, there is no limitation for palm cultivation (Mohammad and Disi, 2000). Cultivation of palm trees in regions where temperature gets lower from -18 to -20°C maximum every ten years is not economical (Gholamali, 2003). Based on researches done and investigation of current condition of palm groves, some thresholds have been considered and are illustrated in Table 2. In order to study climatic potential for palm cultivation, different data were used based on the following priorities. First, since the most effective climatic factor for vegetation and procreation of palm is temperature, to calculate this factor, degree-day index was used. Degree-day index is effective for classifying regions based on land usage and estimating the rate of success of cultivation of new products in a region (Abbasali, 1997). On this basis in this investigation, besides using data regarding rainfall and number of cloudy and frosty days, the data of day temperature of 60 synoptic and climatology stations in a 10-year statistical period from 1997 to 2000 were used to estimate temperature units. The above data were processed and analyzed based on Excel functions. Among the common methods for estimating temperature units in this research, the effective standard method has been used (function 1 Moghtaderi et al., 2004).

$$GDD^2 = \sum \left[\left(\frac{T_x + T_n}{2} - BaseTemp \right) \right] \quad \text{Equation (1)}$$

Here: $T_x =$ maximum day temperature and $T_n =$ minimum day temperature
Base Temp = physiologic zero point

Date-palm has both genetic and vegetation growth. Since the growth of palm is very slow and it becomes a fruitful tree at least after five years, calculation of its vegetation growth is not possible (vegetation growth point of palm is 10°C which means that its growth stops in temperatures below 10°C). In this research, Moonie method (1973) has been used which is on the basis of temperature units calculation based on physiologic zero of 18°C and more than 1,000 degree-day between the months of March and September. Comparative studies confirm the accuracy of the threshold presented by Moonie in Iran. Other scholars have also used 18°C as base temperature in this regard (Swingle, 1904; Kousen, 1979; Hossein, 1973; Manbaei, 1997; Panahi, 2001 as quoted by Mohammadi and Moghtaderi..). Since almost all the palm species in Iran blossom in early April and gives fruit in late September, duration of this period has been considered to be 186 days (from March 21 to September 22) and temperature units have been calculated in this time period. After calculation of temperature units, other climatic elements such as rainfall, number of clear and frosty days and mean of temperature in the coldest month of the year have been studied.

RESULTS

In view point of agricultural climatology, temperature parameters are considered as an important factor in determining the duration of phonologic process. Studying temperature is important because it is the first step in determining proper place for a special product. In developing expansive fruits like orchards to include palm groves, other conditions must be in their optimal status; but when there is no proper temperature condition, cultivating the product and developing an orchard is not possible. Therefore, the first step in finding the proper location for species is to study the temperature conditions.

Hence, in the first step towards the identification of regions that are proper for cultivation of palm, the usage of regions with annual temperature above 17°C for climatic evaluation of the potential for palm cultivation has been attempted. For this purpose, after studying the annual mean temperature for almost all synoptic and

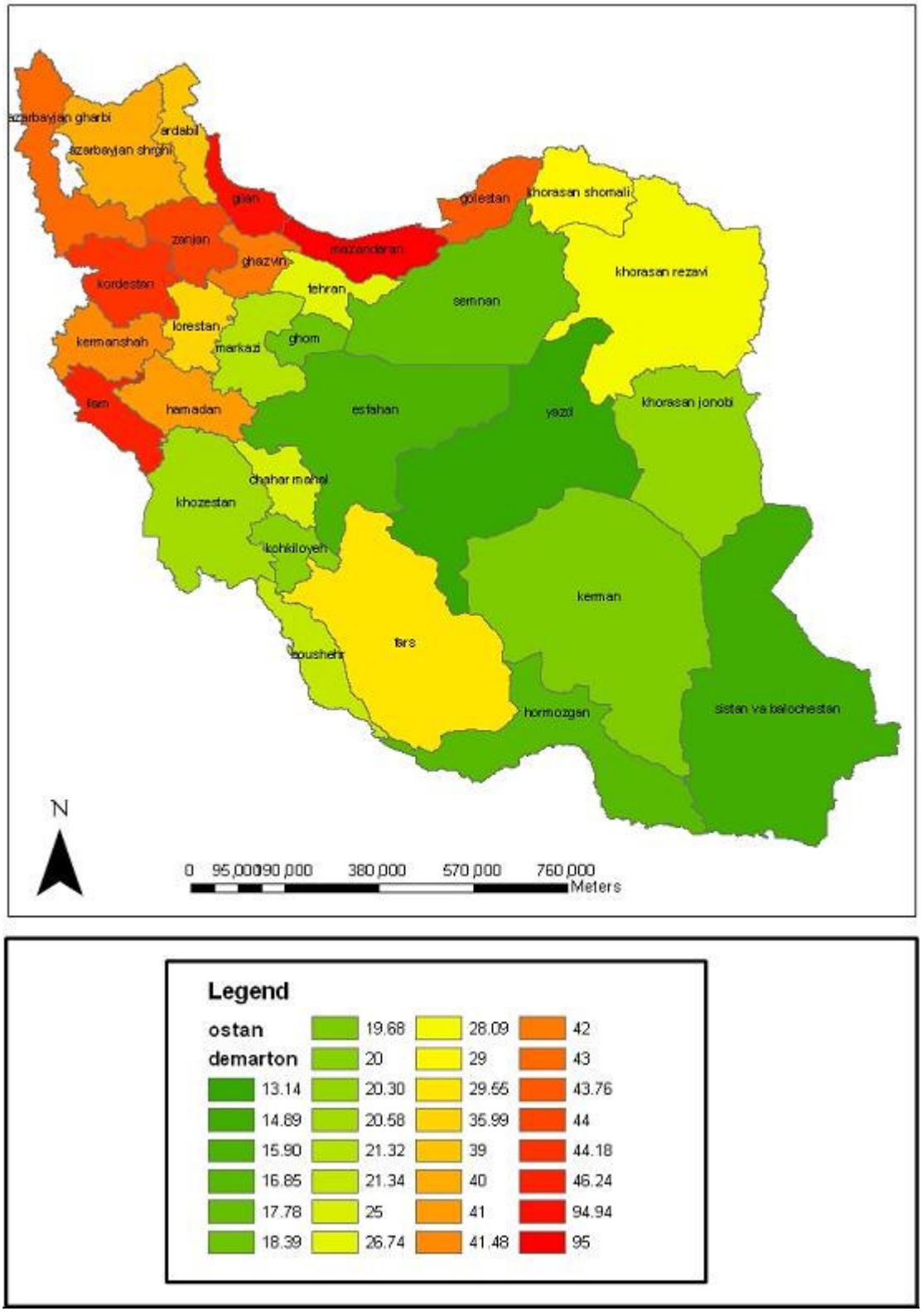

Figure 1. Iran climatic zoning map based on Demarten index.

climatology stations of Iran, only 60 stations with annual mean temperature of above 17°C were identified to be used as samples for further studies (Table 3). According to the fact that annual temperature of all the considered

Table 2. Minimum climatic threshold required for cultivation of fruit-bearing palm (Moghtaderi et al., 2004).

Variable	Condition	Source
Degree-day	Based on basic temperature (physiologic zero), 18°C, from March to September in northern hemisphere higher than 1000°C	Moniye (1973)
Annual mean of temperature	Higher than 17°C	Mc Kole (1992)
Mean of minimum temperature	Mean of minimum temperature of the coldest month of year lower than -5°C	Moghtaderi (2003)
Number of frosty days	Average of frosty days Less than 50 days	Moghtaderi (2003)
Number of clear days	Average number of clear days from January to October less than 40 days	Davsoon (1982)
Rainfall	Rainfall mean in three months of August, September, October, each less than 50 mm	Zaid (1999)

Table 3. Temperature units for the selected stations (Meteorology organization of the Islamic Republic of Iran).

Name of station	Longitude	Latitude	Height based on meter	Annual mean temperature based on centigrade	Mean of monthly lowest temperature	Number of frosty days	Effective degree-day based on 18°C
ABADAN	48 15 E	30 22 N	6.6	25	7.3	0	2748
OMIDIYEH	49 40 E	30 46 N	27.0	26.7	7.5	0	2821.8
BAFGH	55 26 E	31 36 N	991.4	23.7	2	1	1888.9
BAM	58 21 E	29 6 N	1066.9	23	4.9	1	2173
BANDARAB	56 22 E	27 13 N	10.0	27.3	12.3	0	2671.4
BEHBAHAN	50 14 E	30 36 N	313.0	25	7.1	0.5	2568.2
BIRJAND	59 12 E	32 52 N	1491.0	17	-2.2	6	806.9
BOSHROOY	57 27 E	33 54 N	885.0	20.6	-0.7	2	1552.3
BOSTAN	48 0 E	31 43 N	7.8	24.8	6.1	0	2458
BUSHEHR	50 50 E	28 59 N	19.6	24.6	10.2	0	2280.4
DARAB	54 17 E	28 47 N	1107.0	24.0	4.0	0	1966.4
DEHLORAN	47 16 E	32 41 N	232.0	26.8	8.0	0	2907
DEZFUL	48 23 E	32 24 N	143.0	24.3	5.6	0	2455.1
DOGONBAD	50 46 E	30 26 N	699.5	23.3	5.0	0.5	1999.3
DOUSHANT	51 20 E	35 42 N	1209.2	17.9	0.1	11	1197.7
FASSA	53 41 E	28 58 N	1288.3	20.3	1.3	1	1348.5
FERDOUS	58 10 E	34 1 N	1293.0	18.8	-1.0	4..5	999
GARMSAR	52 16 E	35 12 N	825.2	18.7	-0.9	3.5	1409.3
GHESHM	55 55 E	26 55 N	6.0	26.7	13.1	0.1	2656.4
GHOM	50 51 E	34 42 N	877.4	18.1	-1.5	6	1305.6
GONABAD	58 41 E	34 21 N	1056.0	18.9	-0.8	4	1078.5
GONBADE KAWOOS	55 10 E	37 15 N	37.2	19.7	3.1	2..5	1072.8
GORGAN	54 16 E	36 51 N	13.3	17.8	3.4	5	840.4
ILAM	46 26 E	33 38 N	1337.0	17.1	0.5	14.5	258.8
IZEH	49 52 E	31 51 N	767.0	23.1	4.8	0..5	1685.1
JASK	57 46 E	25 38 N	5.2 M	27.5	16.7	0	2441.7
KAHNOUJ	57 42 E	27 58 N	469.7	27.4	8.8	0	2988.9
KANGAN JAM	52 22 E	27 49 N	655.0	24.9	6.9	0.1	2206.8
KASHAN	51 27 E	33 59 N	982.3	19.8	-0.3	5..5	1568.3
KASHMAR	58 28 E	35 12 N	1109.7	18.7	0.4	5.6	1136.5
KENARAK	60 22 E	25 26 N	12.0	27.1	12.1	0	2496.3
KERMAN	56 58 E	30 15 N	1753.8	17.0	-3.0	5	623.6

Table 3. Cont'd.

KHORAMAB	48 17 E	33 26 N	1147.8	17.3	-0.0	6	884.4
KHOOR BIABANAK	55 5 E	33 47 N	845.0	20.8	1.0	2.6	1760.3
KHOOR BIRJAND	58 26 E	32 56 N	1117.4	22.1	0.6	0.5	1619.5
KISH	53 59 E	26 30 N	30.0	26.9	14.9	0	1619.5
LAMERD	53 15 E	27 22 N	411.0	27.5	7.6	0.1	2604.8
LAR	54 17 E	27 41 N	792.0	25.7	4.8	0	2274.6
MANJIL	49 24 E	36 44 N	333.0	17.0	3.3	7.7	801
MASJED SOLEYMAN	49 17 E	31 56 N	320.5	25.7	7.6	0.1	2769.6
MIANDEH JIROFT	57 48 E	28 35 N	601.0	26.1	6.8	0	2586
MINAB	57 5 E	27 6 N	29.6	28.7	12.2	0	2747.9
MORAVEH TAPPEH	55 57 E	37 54 N	460.0	17.2	3.5	12	932.1
NAEIN	53 5 E	32 51 N	1549.0	18.6	-1.7	4.3	880
NEHBANDAN	60 2 E	31 32 N	1211.0	21.5	0.7	2	1595.7
OMIDIYEH	49 39 E	30 46 N	34.9	25.5	7.1	0	2794.1
RAFSANJN	55 54 E	30 25 N	1580.9	19.1	0.4	2.2	1219.4
RAMHORMO	49 36 E	31 16 N	150.5	27.4	8.2	0	2900.9
ROBAT POSHTBADAM	55 33 E	33 2 N	1188.0	20.7	1.5	3	1390.2
SABZEVAR	57 43 E	36 12 N	977.6	17.6	-1.5	7.8	1158.3
SARAVAN	62 20 E	27 20 N	1195.0	22.4	3.8	0.2	1956.5
SAR POL ZOHAB	45 52 E	34 27 N	545.0	20.4	2.7	1.4	1440.4
SAVEH	50 20 E	35 3 N	1108.0	19.4	0.1	5.7	1311.5
SEMNAN	53 33 E	35 35 N	1130.8	18.3	-0.4	6	1329.4
SHIRAZ	52 36 E	29 32 N	1484.0	17.9	0.2	2.6	1018.5
SHOSHTAR	48 50 E	32 3 N	67.0	27.7	9.5	0	3029.6
SIRJAN	55 41 E	29 28 N	1739.4	17.7	-1.1	1.2	953.9
TABASS	56 55 E	33 36 N	711.0	22.4	1.7	0.8	2112.4
TEHRAN	51 19 E	35 41 N	1190.8	17.2	-0.5	12.3	1075.8
YAZD	54 17 E	31 54 N	1237.2	19.3	-0.4	4	1510.1
ZAHEDAN	60 53 E	29 28 N	1370.0	18.6	0.2	1.3	1174.2
ZABOL	61 29 E	31 2 N	489.2	22.7	1.9	0.5	2185.9

stations is above 17°C, it can be stated that none of the stations face any limitations in regard to vegetation growth, but the above study is mostly on the evaluation of the conditions for genetic growth. In the next step, the values of factors of frosty days, cloudiness, rainfall and the minimum temperature of the coldest month have been analyzed and the results are presented in Table 3.

In studying the considered climatic factors, it has although been observed in none of the stations that the factors of cloudiness, frost and minimum temperature of the coldest month imposes any limitations in palm cultivation, but the parameter of rainfall shows rains more than 50 mm in stations of Gorgan, Gonbad Kavoos and Maravtappe in the three months of August, September and October. This could lead to decrease in both quality and quantity of date production in the said regions and also decrease its value in regard to developing palm groves and lands. In considering the significance of degree-day index in the next step, temperature units of the selected stations of the country were calculated based on a standard method. Based on the conducted researches, (Moonie, 1973 as quoted by Mohammadi and Moghtaderi) Moghtaderi et al. (2004), have since based the minimum temperature unit of 18°C to be appropriate for cultivation of fruit-bearing palm on 1,000 degree-day and taking into account the results of the conducted studies, this point found out that some of the stations of the studied area do not meet these qualifications (Table 3) (Figures 2 and 3). Therefore, stations of Birjand, Gorgan, Ilam, Kerman, Khorramabad, Manjil, Naein, Maravtappe and Sirjan do not meet the minimum degree-day base and therefore do not enjoy desirability and proper potential for palm cultivation.

Although, the minimum value of degree-day required for palm growth is 1000, a region suffices in finding the best place for palm cultivation, management and harvesting if it has this qualification. No specific limit has been selected in regard to degree-day and as a result, its values for different stations should be measured with a specific criterion. Therefore, as date product of Bam is the best in Iran both in quality and quantity, its degree-day value has been considered as the base and the

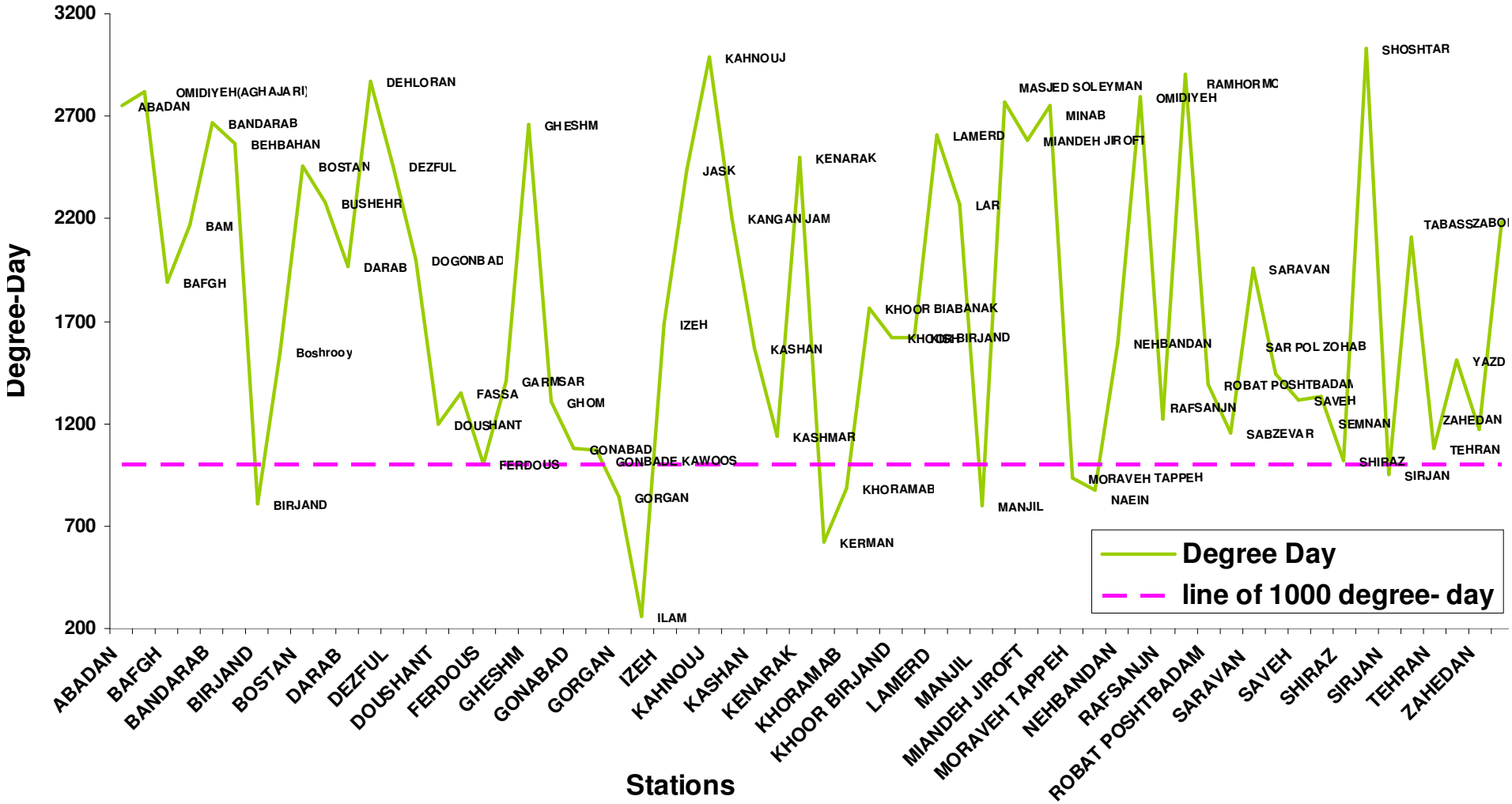

Figure 2. 1000 degree-day base line and the daily mean values of degree-day accounted for the studied region (March to September).

degree-day values of other stations are measured in comparison with it (Figure 4). Therefore, it is necessary to mention that this criterion is conventional and variable with regards to climatic and regional conditions of each country. The best and the most similar degree-day to that of Bam station can be studied in regard to two view-points. Firstly, the status in which the stations need more degree-day in order to get close to the conditions of Bam and secondly, the status in which the stations have higher degree-day in comparison with Bam. In the first category, Tabas, Dogonbadan, Darab and Saravan can be mentioned accordingly and for the second, Zabol, Kangan, Lar and Bushehr can be mentioned. The

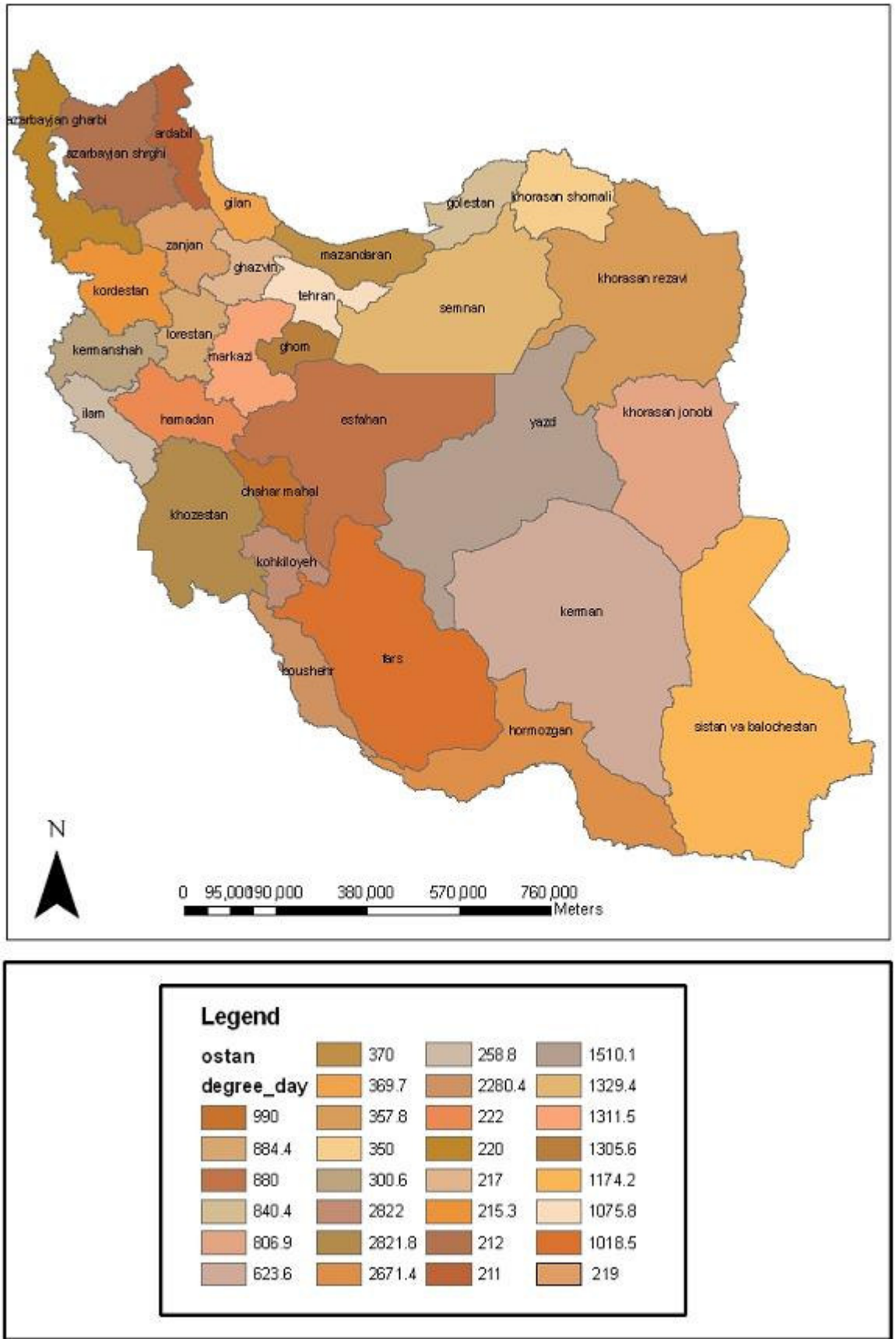

Figure 3. Zonation of degree-day climatic index for Iran.

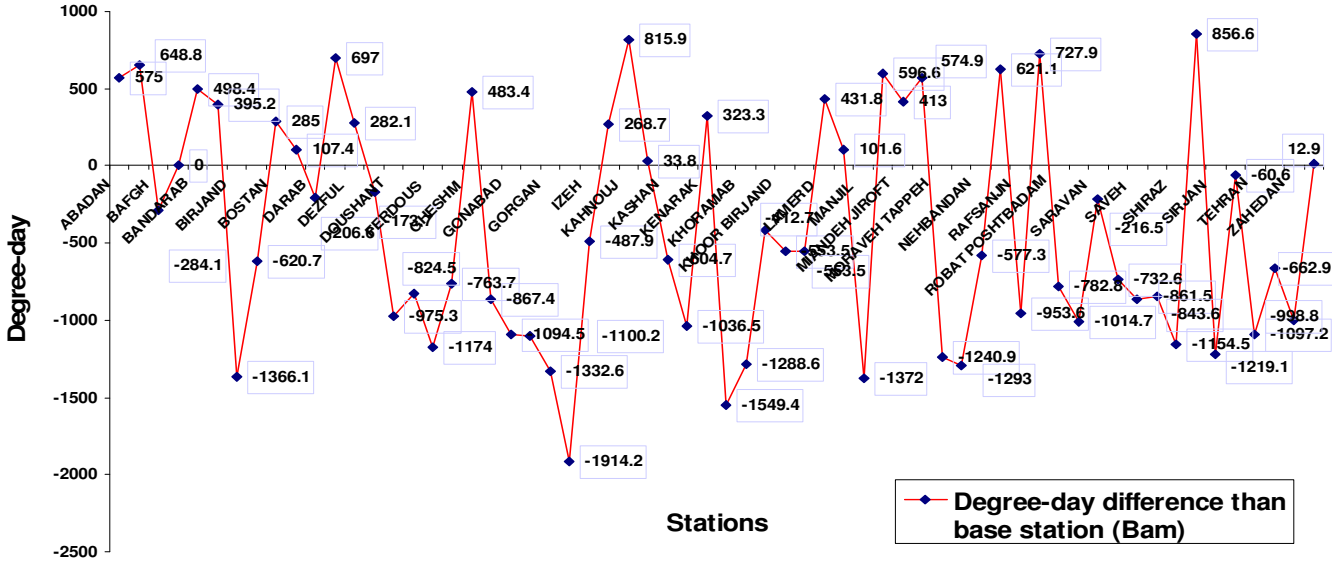

Figure 4. Difference of degree-day values of different stations in comparison with the base station of Bam.

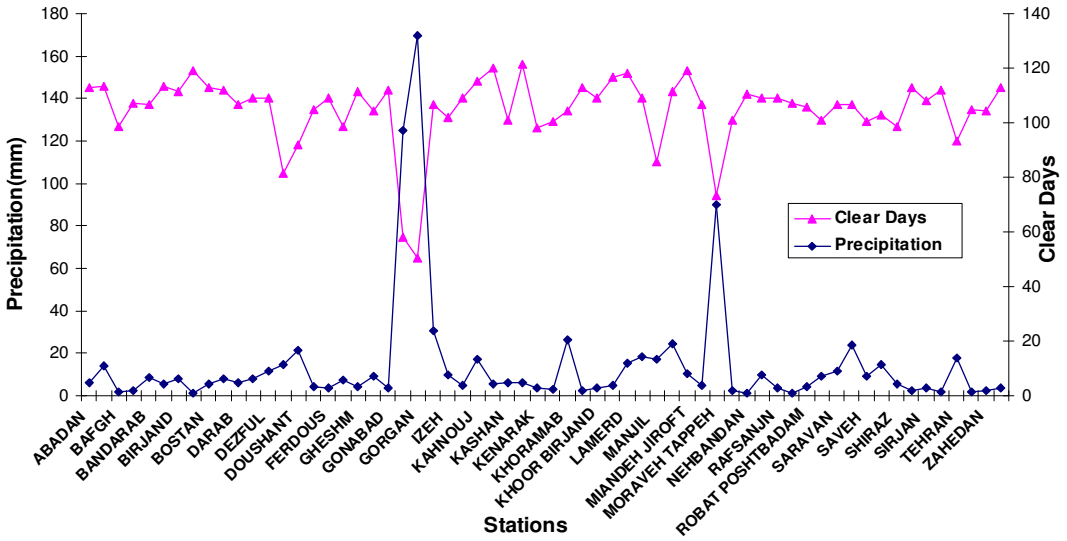

Figure 5. Average values of clear days (July to October) and average values of rainfall (August, September, and October) for the studied stations.

most similar station to Bam is Zabol which is 13 degree-days higher than Bam and the most unfavorable stations in comparison to Bam in regard to deficiency of degree-day index are Ilam, Kerman, Manjil, Birjand and Gorgan. Ramhormoz, Kahnooj and Shooshtar are introduced as stations with higher degree-day in comparison to Bam.

DISCUSSION

According to the results achieved from Table 3 and Figures 2, 3, 4 and 5 and completing these results with findings of the previous studies conducted on climatic conditions of Iran, the following can be pointed out: In Iran, the temperature is highly dependent on altitude, latitude and humidity content of atmosphere. Effect of altitude on air temperature is hundreds of times more significant than the effect of latitude. High pressure predominance near torrid regions especially in hot period of the year in latitudes that are more to the south and high pressure predominance of Siberia in cold period of the year and especially in northeast, has a great effect on temperature in Iran. In northern and southern coastal regions of Iran, humidity prevents intense oscillation of temperature, however, glasshouse effect of water vapor especially in coastal regions of Oman Sea which is very

rich in humidity has a great influence on temperature condition. Conversely, in middle parts of Iran, lack of humidity makes the predominance of a continental thermal condition possible. Locative dispersion of minimum temperatures reveals the high-pressure effect of Siberia in northeast and rockiness effect in northwest-southeast axis (superposed on Zagros axis) on temperature in Iran. In general, after total evaluation of synoptic and climatologic stations, about 60 stations with temperatures above 17°C were selected and none of them encounters any limitations in regard to vegetation growth. But, the above research is mostly about studying the conditions of genetic growth. From among the studied stations, Bandarabbas, Jask, Kahnooj, Kish, Ram-hormoz, Minab and Shooshtar have the highest annual temperature, while Qom, Khorramabad and Birjand have a lower annual mean temperature in comparison with other stations. According to the factor of mean temperatures of the year's coldest month, no limitations have been observed for the studied stations. According to Table 3, the lowest mean temperature of the coldest month of the year was observed in Kerman stations with -3°C which has a significant difference with a base of -5°C. Therefore in general, none of the stations have limitation in regard to parameters of annual temperature and the coldest month of year.

1. The most frost occurs in northwest-southeast mountains of the country which is mainly of radiation frosts type and secondly in northeast as a result of high-pressure influence on Siberia which is mainly of advection (wind) frosts type (Seyed and Kaviani, 2008). According to Table 3, none of the studied stations have experienced more than 50 frosty days. Therefore, as the second effective climatic factor in palm cultivation, all the studied stations do not suffer from the factor of frost period (Table 3).
2. In Iran, cloudiness shows inverse relationship with temperature and is found more in cold than hot period of the year as a result of low-pressure systems, fronts, and mid waves. The most cloudiness has been observed in March and April and the least in September. Principally, northern belt of Iran is twice cloudier than the southern parts around 36-degree latitude. Across all the regions that are located between 25 to 36-degree latitudes, cloudiness has an oscillation of about 25%. The cloudiest area of Iran is located from 36 to 38.5-degree latitude, which means there is an increase by 2.5 degree (Seyed and Kaviani, 2008). Although in cold seasons, the results of sky cloudiness have been different from what is shown in Figure 5, meanwhile by considering the level of cloudiness of the months of July to October it is observed that none of the stations experience more than 40 cloudy days (Figure 5). This is because of west winds withdrawal to higher latitudes and predominance of high-pressure azure plume in Iran.
3. Iran with average rainfall of 250 mm is located in dry zone, so time and place variations of rain are very high in it. In general, in years when Mediterranean system passes a route farther towards the south and coincides with Sundance system, there is a great deal of rainfall in Iran. In general, northern coastal regions of the country have a proper amount of rainfall due to convection of cold and dry weather of Siberia on Caspian Sea (Seyed and Kaviani, 2008), but, southern coastal and central regions are deprived of enough rain accordingly, due to high-pressure azure system and are being surrounded by Zagros Mountains. Although none of the previous climatic factors has bring about limitations for palm cultivation in any of the stations, according to Figure 5 it has been observed that stations of Gorgan, Gonbad Kavoos and Maravtappe receive rainfalls of more than 50 mm in August, September and October (Figure 5).
4. In Iran, the state of being sunlit is mostly due to latitude and cloudiness. In summers when the sun is in the northern hemisphere, daylong increases from south to north; while in winter, half of the year daylong decreases from north to south. Therefore, the south and north regions of the country in winters and summers respectively, have more sunlit power.
5. In this research, considering the significance of degree-day index for palm cultivation, Moonie method (1973) which is based on calculation of temperature units on the basis of physiologic zero from 18°C and more than 1000 degree-day from March to September has been used. According to calculation of degree-day for the studied area, stations of Birjand, Gorgan, Ilam, Kerman, Khorramabad, Manjil, Naein, Maravtappe and Sirjan do not meet the minimum degree-day base, therefore, they are not qualified and do not have the proper potential for palm cultivation. But to evaluate and specify the proper place for cultivation, management and harvest of palm and date product has no chosen specific area for estimation of degree-day. For this purpose, the value of degree-day of different stations based on a specific criterion has to be measured. Therefore, since date product of Bam is the best in regard to quality and quantity in Iran, its degree-day value has been considered the base and the difference of other stations' degree-day value has been measured in comparison to it. From among the studied stations, the most similar to Bam in regard to degree-day value are Zabol, Kangan, Tabas, Lar, Boushehr and Dogonbadan accordingly. Therefore, at the end of this study the final result could be as follows: except for those stations in which limitation of rainfall and deficiency of degree-day index have been observed, other stations possess the climatic potential for palm cultivation.

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