Chapter

Expansion in Cultivating Almond Trees in Egypt

Mahmoud Sami Abourayya and E.K. Nabila

Abstract

Egypt spends a lot of hard currency annually to import nut fruits (almond- walnut and pistachio) to apply market needs of these crops especially in Ramadan month. It is known that there are wide uncultivated areas in Sinai despite of its suitability for cultivation. Cultivating nut trees can share in development of Sinai. There are scarcity of these trees in Egypt in spite of the relevance of environmental conditions for growing almond trees in different regions. Since the last 25 years I and a group of scientists studied the possibility of achieving self sufficiency of almond by cultivating in Sinai Peninsula and different regions after carrying out climatic, economical, water requirements, nutrition and genetic studies. Many fruit trees require cold temperatures during the winter to overcome their seasonal dormancy. Most fruit species that evolved in temperate or cool subtropical climates have such chilling requirements that need to be fulfilled each winter to achieve homogeneous and simultaneous flowering and regular crop yields coldness. Monthly historical data of minimum temperature from Central laborator for Agricultural climate of four districts were analyzed in order to determine the changes in minimum temperature from October to February during the period from 2001 to 2010. Understanding monthly temperature changes from October to February during the period 2001–2010 was the first step in carrying out this study. The highest minimum temperature was found during 2010 year during the studied period in the October month for all districts except in November and December, the highest minimum temperature was observed in the year of 2009. Saint Catherine district was the lowest minimum temperature in all months during the studied period. Understanding average monthly temperature trends of the studied time serious from 2001 to 2010 was the second step in carrying out this study. October month was the highest values of minimum temperature and January was the lowest value of minimum temperature at the four districts. The highest and lowest values for temperature were found in Ras Sudr and Saint Catherine respectively. The third step in carrying out this study is to understanding the annual trend of minimum temperature for the period 2001–2010 at the Suez, Ras Sudr, El Tur and Saint Catherine districts. Data shows the average annual minimum temperature at the four districts during the years from 2001 up to 2010 and it can be observed that, Ras Sudr district has the highest average annual minimum temperature while Saint Catherine has the lowest one among the studied districts. It can be concluded that the carried out climatic studies, estimate the irrigation water requirements of almond trees and genetic studies help in solving the problem of achieving self sufficiency of almond fruits through expansion of cultivating almond trees in Egypt.

Keywords: Almond, Chilling Hours, Chilling model, Hard currency, Self sufficiency

1. Introduction

Many fruit trees require cold temperatures during the winter to overcome their seasonal dormancy [1, 2]. Most fruit species that evolved in temperate or cool subtropical climates have such chilling requirements that need to be fulfilled each winter to achieve homogeneous and simultaneous flowering and regular crop yields. In order to select appropriate fruit species and cultivars for the climate of a given site, researchers have developed chilling models, which convert temperature records into a metric of coldness [3, 4]. Chilling units are most meaningfully described and measured using an hourly time scale. Chill hours below a threshold are one of the most common methods for calculating chill. If the temperature is above 10°C then it is too warm for the plant to accumulate chilling. If the temperature is below 10°C then the plant is affected by the cold temperatures, with colder temperatures producing bigger effects. As soon as temperature drops below the base temperature for one hour, one chill unit is accumulated. Using the same chilling model to [5] quantify both a cultivar's chilling requirement and the amount of winter chill available at a given location enables growers to predict whether the cultivar will perform well under the specific temperature conditions of their sites. Chilling models also constitute tools to understand and manage the interannual variation in the time, at with tree crops complete their dormancy. The implications of climate change for winter chill have occasionally been investigated Baldocchi and Wong, [6] but no studies have compared the effects of temperature increases on winter chill, when quantified with different chilling models.

2. Material and methods

Depending on species cultivated and location of production, growers in Egypt use one of two different models to quantify chilling. The two most commonly used models are the Chilling Hours Model, developed in the 1930s and 1940s. The Chilling Hours Model (sometimes referred to as Weinberger Model; [7, 8]), as originally proposed, simply calculates the number of hours, when the temperature (T) is below 7.2°C. Other model when the temperature (T) is below 10°C.

3. Results

Tables 1–**4** show the accumulation chilling hour from November 2014 to February 2015 for different location (Suze, Ras Sadr, Saintkatran and El Tore). The height chilling hour was found at Saintkatran followed by El Tore. The lowest chilling hour was found at Ras Sadr under the two chilling model 10 and 7.2.

The temperature changes over four districts in Egypt (Suez, Ras_Sudr, El_Tur and Saint Catherine) during the period from 2001 to 2010.

No.	Area	T < 10°C	T < 7.2°C
1	Suez	0	0
2	Ras Sudr	0	0
3	Saint katherin	208	90
4	El Tur	72	6

Table 1.
Chilling hour during November 2014.

No.	Area	T < 10°C	T < 7.2°C
1	Suez	152	0
2	Ras Sudr	36	0
3	Saint katherin	566	292
4	El Tur	272	57

Table 2.
Chilling hour from November to December 2014.

No.	Area	T < 10 °C	T < 7.2°C
1	Suez	250	20
2	Ras Sudr	169	28
3	Saint katherin	982	621
4	El Tur	594	267

Table 3.
Chilling hour from November 2014 to January 2015.

No.	Area	T < 10 °C	T < 7.2°C
1	Suez	514	44
2	Ras Sudr	252	48
3	Saint katherin	1335	882
4	El Tur	825	404

Table 4.
Chilling hour from November 2014 to February 2015.

3.1 Climate data

Monthly historical data of minimum temperature from Central laboratory for Agricultural climate of four districts were analyzed in order to determine the changes in minimum temperature from October to February during the period from 2001 to 2010.

3.2 Monthly temperature changes

Understanding monthly temperature changes from October to February during the period 2001–2010 was the first step in carrying out this study. **Table 5** shows the minimum temperature of the four studied districts (Suez, Ras_Sudr, El_Tur, and Saint Catherine) and it can be observed that the highest minimum temperature has been found in Ras Sudr district and the lowest minimum temperature has been found in Saint Catherine district among the studied districts in all months during the period 2001–2010. The highest minimum temperature was found during 2010 year during the studied period in the October month for all districts except in November and December, the highest minimum temperature was observed in the year of 2009. Saint Catherine district was the lowest minimum temperature in all months during the studied period.

Month	Year	Suez	Ras_Sudr	El_Tur	Saint Catherine
October	**2001**	18.0	19.6	13.6	13.3
	2002	18.6	20.3	14.4	14.6
	2003	19.6	21.3	15.9	14.8
	2004	19.1	20.8	15.2	15.2
	2005	19.1	20.9	15.4	15.6
	2006	18.6	20.4	14.2	14.0
	2007	19.0	20.6	14.8	15.0
	2008	19.0	20.8	15.6	15.6
	2009	20.0	20.8	16.5	14.4
	2010	20.4	21.9	16.2	15.7
November	**2001**	16.6	18.6	10.9	9.3
	2002	16.5	18.2	11.0	9.1
	2003	17.0	18.9	12.1	10.8
	2004	17.6	19.3	12.4	10.5
	2005	16.6	18.4	11.4	9.5
	2006	16.5	18.3	10.9	8.7
	2007	15.9	17.8	10.4	8.4
	2008	17.1	18.9	11.9	9.6
	2009	20.0	20.8	16.5	10.5
	2010	16.7	18.5	11.2	9.5
December	**2001**	13.4	15.2	8.0	5.6
	2002	14.2	16.1	8.1	5.7
	2003	13.5	15.5	7.8	5.9
	2004	13.3	15.1	7.7	5.3
	2005	13.6	15.5	7.8	4.2
	2006	15.3	17.3	9.9	7.2
	2007	12.6	14.6	6.9	3.6
	2008	13.7	15.7	8.3	4.7
	2009	20.0	20.8	16.5	6.4
	2010	15.0	16.7	9.1	6.6
January	**2001**	12.2	14.3	6.7	4.1
	2002	11.1	13.1	5.1	2.8
	2003	13.8	15.6	8.1	5.2
	2004	12.7	14.6	6.8	4.4
	2005	12.4	14.3	6.6	4.0
	2006	12.2	14.3	7.0	3.7
	2007	12.0	14.0	6.2	3.3
	2008	11.3	13.4	5.5	1.8
	2009	12.7	14.7	7.3	3.9
	2010	14.1	16.0	9.0	6.1

Month	Year	Suez	Ras_Sudr	El_Tur	Saint Catherine
February	**2001**	12.6	14.6	7.4	5.1
	2002	12.2	14.1	6.8	4.2
	2003	13.2	15.1	8.1	6.1
	2004	12.1	14.0	6.1	3.9
	2005	12.0	14.0	6.8	4.4
	2006	12.3	14.4	7.6	4.7
	2007	13.1	15.0	8.2	5.9
	2008	13.1	14.9	7.7	5.3
	2009	11.1	13.2	5.6	3.3
	2010	12.4	14.4	7.2	5.4

Table 5.
The monthly minimum temperature of the Suez, Ras_Sudr, El_Tur, and Saint Catherine for the months from October to February during the period from 2001 up to 2010.

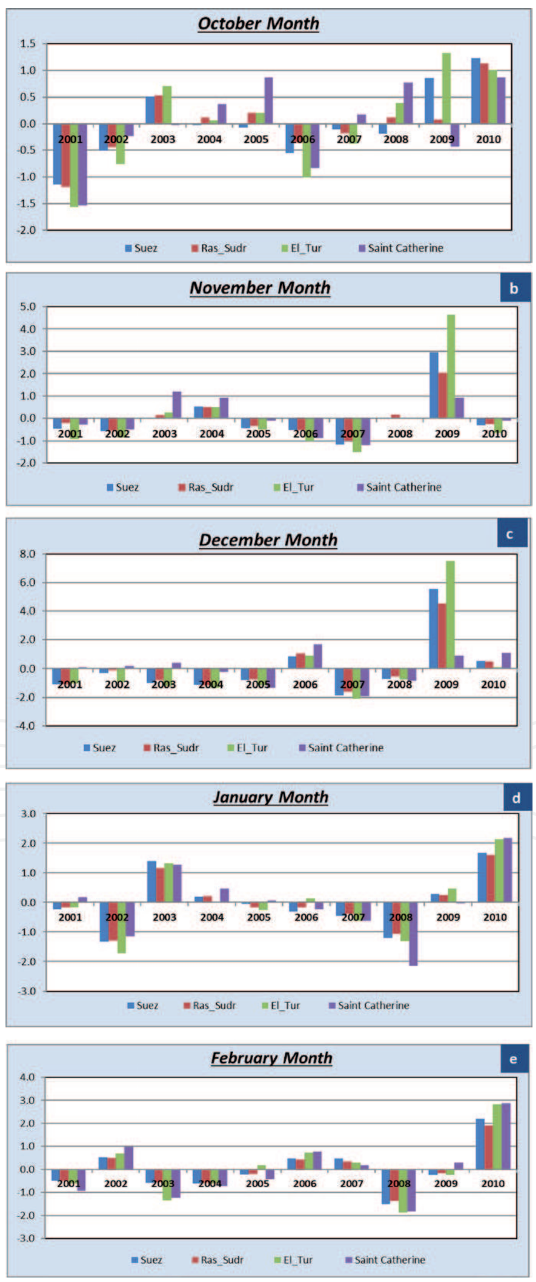

Figure 1.
The minimum temperature change from the normal minimum temperature of the Suez, Ras_Sudr, El_Tur, and Saint Catherine districts during the period from 2001 up to 2010 for the month of a) October, b) November, c) December, d) January, and e) February.

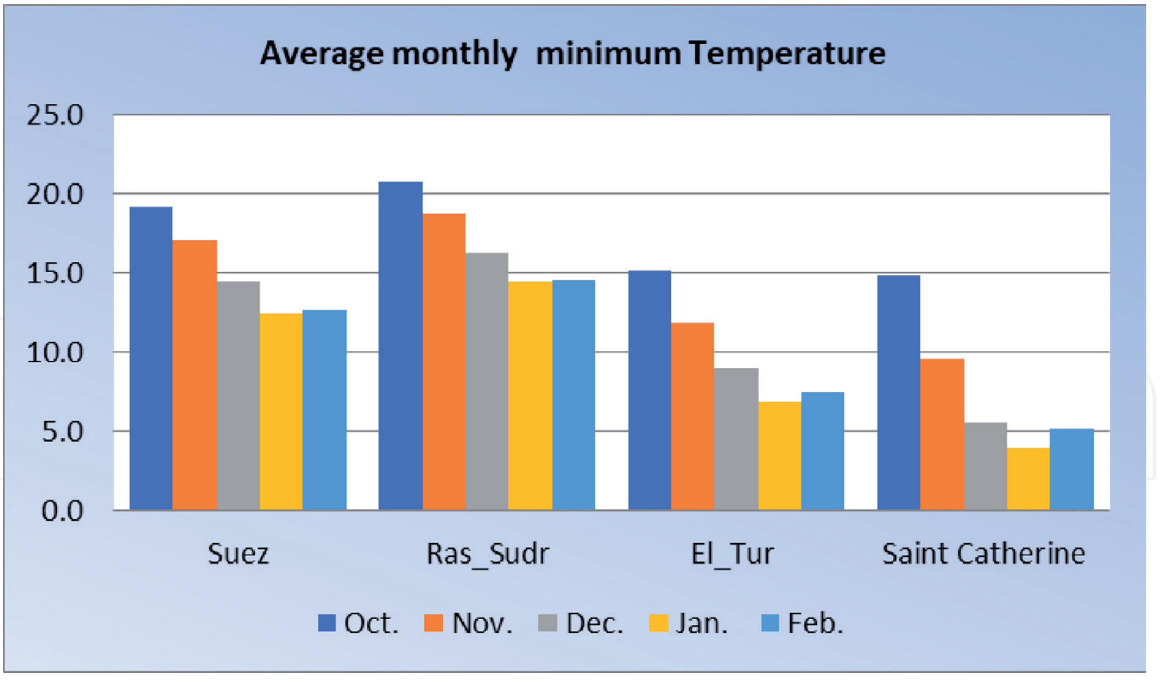

Figure 2.
Illustrate the comparison between historical minimum temperatures for the years 2001–2010 from October to February for four districts.

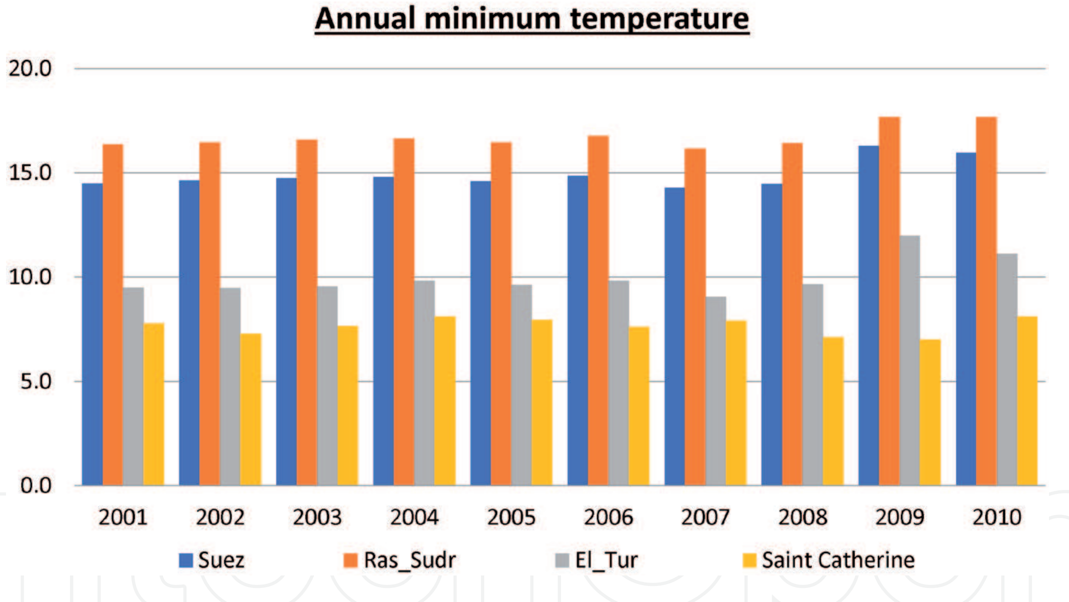

Figure 3.
The average annual minimum temperature e at Suez, Ras_Sudr, El_Tur and Saint Catherine during the years from 2001 up to 2010.

3.3 Average monthly temperature

Understanding average monthly temperature trends of the studied time serious from 2001 to 2010 was the second step in carrying out this study. **Figure 1** shows the average monthly minimum temperature from October to February during the period 2001–2010 at four districts (Suez, Ras Sudr, El Tur and Saint Catherine). October month was the highest values of minimum temperature and January was the lowest value of minimum temperature at the four districts. The highest and lowest values for temperature were found in Ras Sudr and Saint Catherine respectively.

The third step in carrying out this study is to understanding the annual trend of minimum temperature for the period 2001–2010 at the Suez, Ras Sudr, El Tur and Saint Catherine districts. **Figures 2** and **3** shows the average annual minimum temperature at the four districts during the years from 2001 up to 2010 and it can be observed that, Ras Sudr district has the highest average annual minimum temperature while Saint Catherine has the lowest one among the studied districts.

4. Conclusion

Many fruit trees require cold temperatures during the winter to overcome their seasonal dormancy [1, 2]. In order to select appropriate fruit species and cultivars for the climate of a given site, researchers have developed chilling models, which convert temperature records into a metric of coldness [3, 4, 9].

Monthly historical data of minimum temperature from Central laboratory for Agricultural climate of four districts were analyzed in order to determine the changes in minimum temperature from October to February during the period from 2001 to 2010. Understanding monthly temperature changes from October to February during the period 2001–2010 was the first step in carrying out this study.

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