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THE EFFECT OF CLIMATIC ACCIDENTS ON PEACHES ÎN R.S.F.G. CONSTANȚA

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Abstract

In Dobrogea the culture of the peach tree has had great perspectives even from the beginning due to the extremely favorable climate. The peach species loves warm weather and has always found good growing and harvesting conditions in the south-eastern part of Romania. In this period, 7 Romanian and foreign peach tree cultivars were studied at Research Station for Fruit Growing (RSFG) Constanta: 'Mimi', 'Catherine sel.1', 'Springcrest', 'Raluca', 'Cardinal' 'Filip' and 'Cora'. This paper presents the manner in which certain peach tree cultivars reacted to frost in the springtime of 2020, 2021 and 2022, as well as the effect of the hail on Jun 14th, 2022 on the peach production. The greatest losses caused by the frost were registered in the spring-time of 2020 as far as the fructiferous buds are concerned: 90% at 'Springcrest', 80% at 'Cardinal', 60% at 'Raluca' and 'Filip', 40% at 'Mimi', 'Cora' and 'Catherine sel.1', 20%. The losses caused by the hail on July 14th, 2022 affected the production of the 'Springcrest' cultivar by 80% and of the 'Cardinal' and 'Cora' by 70%. The climatic changes that have been registered throughout the past 10 years have negatively influenced the culture of the peach tree and the effects have been classified according to the cultivar and its biology, as well as to the topographic placement of the allotments. The studies that have been carried out, together with the obtained results demonstrate the importance of choosing the cultivar assortment taking into account the favorability of the area, as well as the importance of installing anti-hail nets when setting up fruit-growing plantations

Key words: *climate change, cultivar, hail, Prunus persica.*

INTRODUCTION

This paper deals with the manner in which the frost and the hail influenced the fruit production of certain peach tree and nectarine tree cultivars cultivated in Dobrogea in the years 2020, 2021 and 2022.

The frosts which occur in March and April after a relatively warm period are more dangerous than those which occur during the obligatory resting period (December-January). The floriferous buds in the pink button stage can resist to temperatures as low as -3.9°C for 2-3 hours; the blossomed flowers can tolerate a temperature of -2.8°C, while the newly tied fruit can resist to temperatures as low as -1.1°C (Chira et al., 2005).

The species of peaches and nectarines develop well in the climatic and soil conditions of Romania, especially in the area of Dobrogea (Dumitru, L.M,, 2003; Mihăilescu I. F.L. and Pavel M., 1993).

Previous research papers have revealed that the impact of climatic changes upon fruit-growing species can already be felt. For instance, by the end of the 1990s, the flowering of the trees in Germany was occurring several days earlier (Chmielewschi et al., 2004 and 2005). The vegetative season in Europe became longer by 10 days in the past 10 years (Chmielewschi and Rotzer, 2002). Due to the early flowering of the trees, in certain regions of Europe there was an increase in the risk of damage caused by late frosts (Anconelli et al., 2004; Sunley et al., 2006; Legave and Clazel, 2006; Legave et al., 2008; Chitu et al., 2004 and 2008) or by the disorders in the pollination and fruit setting processes (Zavalloni et al., 2006).

According to the estimations of the weather forecasts, there have been presented in the frame of the 4th report of the International Committee for Climatic Changes in the year 2007, the whole Europe and implicit Romania will be confronted in future with a process of global warming, characterized by increasing of temperatures with 0.5-1.5°C for the period

2020-2029 and with 2-5°C for the period 2029-2099. In the period 2090-2099 Romania will confront with pronounced drought during the time of summer. Researches from many countries, in the frame of climatic research methodology have the approached aspects regarding climatic changes effects on growth and development of some fruit tree species (Chmielewski and Rotzer et al., 2002; Olensen, 2002; Sunley et al., 2006; Chitu et al., 2010; Sumedrea et al, 2009). Climatic changes occurred also in Romania, they have determined meteorological phenomena, which are manifesting with augmented amplitude and intense frequency (severe drought, intense flooding, tornados, hail).

MATERIALS AND METHODS

The experimental plot is situated within the RSFG Constanța, with its headquarters in the village of Valu lui Traian, Constanța county, Dobrogea region, Romania. The geographical coordinates are: 44°10' North, 28°29' East, 70-72 m altitude.

During the period of 2020-2027 peach tree genotypes were studied, organised in a demonstrative plot that was created in 2011. The plot has 20 trees per row, with a planting distance of 4m × 4 m (625 trees/ha), with the canopy shape a vase and the rootstock a wild Tomis 1. Among the studied cultivars there, as well as cultivars promoted in the regional and national assortment, these are: 'Mimi', 'Catherine Sel.1', 'Springcrest', 'Raluca', 'Cardinal, 'Filip' and 'Cora'. The system used for the soil management system was with cultivated strips both between the rows as well as in the row. The soil is a calcareous chernozem (CZka), with a loamy texture and a high, alkaline pH (8.2) in its entire profile. All in all, the climatic conditions were favourable to the growth and fructification of the peach trees. The applied culture technology is the one specific to the peach tree: pruning phytosanitary treatments, soil works, irrigation, harvesting, conditioning and capitalisation of the fruit.

Due to climatic changes over the past few years, the resistance of peach trees seems to have become very different from one year to another. However, there are other factors involved as well, such as the topographic position of the orchard lot in which the peach trees are planted (in the case of the studied cultivars the land was the same - a plateau), the alternation between minimum and maximum temperatures during winter, which renders the trees less resistant and last but not least, the severity of climatic accidents.

The study focused on how certain peach tree cultivars reacted to hail damage and change in climatic conditions in the winters of the above-mentioned years.

In addition, the overall climatic conditions were favorable to the growth and fructification of the trees, with exception of the years 2020-2022, when a very strong frost was registered in both April and March, leading to the loss of some of the floriferous buds, while the hail on Jun 14th, 2022 affected the production of the Springcrest and Cora cultivars. With regard to these cultivars we observed the main fructification phenophases: the beginning of the blossoming, upon the appearance of the pink button; the beginning of the flowering, upon the appearance of the first open flowers; the ending of the flowering, when most of the flowers have lost their petals. The duration of the flowering phenophase at a certain cultivar can vary according to the action of the maximum temperatures during the day and the intensity of the wind, correlated with the degree of differentiation of the trees (i.e. the amount of flowers per tree). The intensity of the flowering was graded on scale from 0 to 5 - 0 being used when the cultivars displays no flowers at all, while 5 is used when the cultivar displays a plethora of flowers. The hardening of the core was determined by means of piercing it with a needle at regular intervals, usually 2 days. The process was carried out progressively and calendaristically, in the same day for all the observed cultivars. The harvesting maturity is largely influenced by a series of climatic and agro-technical factors, such as: temperature, drought, quantity of fruit per tree, shape of the head, density of the trees, etc. The observations and determinations were carried out 3-5 days after the climatic accidents recorded in 2020, 2021 and 2022, respectively and the production was assessed after the hail occurrence on July 11th, 2022. The hail, with a dimension of approximately 5-20 mm, seriously damaged the

fruit production of some of the peach tree cultivars, more exactly those who had not been harvested until July 14th, 2022. The climatic data were recorded with the aid of an automatic meteorological station (the WatchDog type) and were processed as daily averages.

RESULTS AND DISCUSSION

In the period 2020-2022 the blossoming of the floriferous buds of the peach trees occurred between the following limits: between 09.03 and 16.03 for the 'Mimi' cultivar, between 18.03 and 27.03 at the 'Catherine Sel. 1' cultivar, between 13.03 and 27.03 at the 'Springcrest' cultivar, between 23.03 and 30.03 at the 'Raluca' cultivar, between 22.03 and 28.03 at the 'Filip, between 18.03 and 29.03 at the 'Cora' cultivar. Calendaristically the blossoming at the apricot tree occurred between 25.03 and 10.04 (16 days) in the studied years 2020-2022. (Table 1)

Table 1. The main stagers of fructfication and peach in the 2020-2022 period

No.	Cultivar	Year	The swelling of the floriferous buds	The flowering			Intensity	The hardeng of the stone	Harvesting maturity
				Beginning	Ending	Duration (days)			
1	Mimi	2020	11.03	24.03	08.04	15	5	04.06	29.07
		2021	09.03	22.03	04.04	14	5	10.06	27.07
		2022	16.03	25.03	10.04	16	5	09.06	22.07
		Limits ? / x	**09.03-16.03**	**18.03-24.03**	**08.04-14.04**	**14-16**	**5**	**04.06-10.06**	**22.07-29.07**
2	Catherine Sel. 1	2020	18.03	30.03	11.04	11	5	10.06	02.08
		2021	27.03	02.04	20.04	18	5	08.06	07.08
		2022	22.03	05.04	24.04	19	5	17.06	15.08
		Limits ? / x	**18.03-27.03**	**30.03-05.04**	**11.04-24.04**	**11-19**	**5**	**07.06-10.06**	**02.08-15.08**
3	Springcrest	2020	13.03	30.03	15.04	15	1	03.06	18.06
		2021	27.03	28.03	16.04	18	2	08.06	16.06
		2022	22.03	05.04	18.04	13	4	07.06	21.06
		Limits ? / x	**13.03-27.03**	**28.03-05.04**	**15.04-18.04**	**13-18**	**1-4**	**03.06-08.06**	**16.06-21.06**
4	Raluca	2020	26.03	04.04	17.04	13	2	06.06	18.07
		2021	30.03	09.04	23.04	14	3	10.06	20.07
		2022	23.03	20.04	28.04	8	4	08.06	24.07
		Limits ? / x	**23.03-30.03**	**04.04-20.04**	**17.04-28.04**	**8-14**	**2-4**	**06.06-10.06**	**18.07-24.07**
5	Cardinal	2020	22.03	05.04	20.04	15	2	07.06	15.07
		2021	28.03	11.04	18.04	7	3	10.06	13.07
		2022	23.03	20.04	30.04	10	3	08.06	18.07
		Limits ? / x	**22.03-28.03**	**05.04-20.04**	**18.04-30.04**	**7-15**	**2-3**	**07.06-10.06**	**13.07-18.07**
6	Filip	2020	22.03	09.04	19.04	10	4	07.06	17.07
		2021	28.03	03.04	12.04	9	5	09.06	20.07
		2022	25.03	05.04	12.04	7	5	10.06	22.07
		Limits ? / x	**22.03-28.03**	**03.04-09.04**	**12.04-19.04**	**7-10**	**4-5**	**07.06-10.06**	**17.07-22.07**
7	Cora	2020	18.03	01.04	10.04	10	5	07.06	20.06
		2021	29.03	06.04	17.04	11	4	09.06	27.06
		2022	25.03	18.04	27.04	9	5	10.06	25.06
		Limits ? / x	**18.03-29.03**	**01.04-18.04**	**10.04-27.04**	**9-11**	**4-5**	**07.06-10.06**	**20.06-27.06**

The beginning of the flowering. For all the studied cultivars the beginning of the flowering in the period 2020-2022 was recorded; however, the cultivars entered this phenophases at different times, albeit not necessarily significant (a few days from one cultivar to the next), so that mutual pollination was fully ensured. The limits for this phenophase were 18.03 and 20.04.

The ending of the flowering. In the studied period 2020-2022 the ending of the flowering occurred between 08.04 and 14.04 for the 'Mimi' cultivar, between 11.04 and 24.04 for the 'Catherine Sel. 1' cultivar, between 15.04 and 18.04 for the 'Springcrest' cultivar, between 17.04 and 28.04 for the 'Raluca' cultivar, between 18.04 and 30.04 for the 'Cardinal' cultivar, between 12.04 and 19.04 for the 'Filip' cultivar, between 10.04 and 27.04 for the 'Cora' cultivar. The dates were recorded as the days when the flowers lost their last petals. The duration of the flowering at the peach tree (average for the three studied years) expressed in number of days varied between 7 days (the 'Cardinal' cultivar in 2021) and 19 days (the 'Catherine Sel. 1' cultivar in 2022).

The intensity of the flowering. In 2020, 2021 and 2022 the following cultivars displayed a weak intensity of the flowering: 'Springcrest', 1 (2020), 'Auraș', 2 (2012), 'Springcrest', 2 (2021) and 'Raluca and Cardinal', 2 (2020).

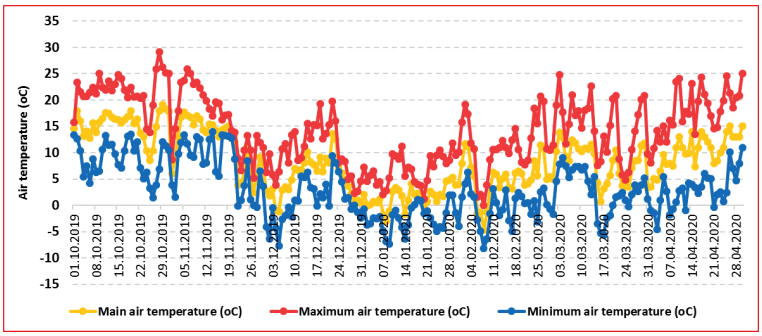
The hardening of the core. This phenophase occurred in the first half of the month of June (between 3th and 10th) in the years 2020, 2021 and 2022.

The harvesting maturity. Calendaristically, each ripening period has large variation limits from one year to another, depending on how the climatic factors determine the type of vegetation in a specific year: early, late or extra late. The harvesting maturity of the fruit had as variation limits the 16th of June and the 15th of August.

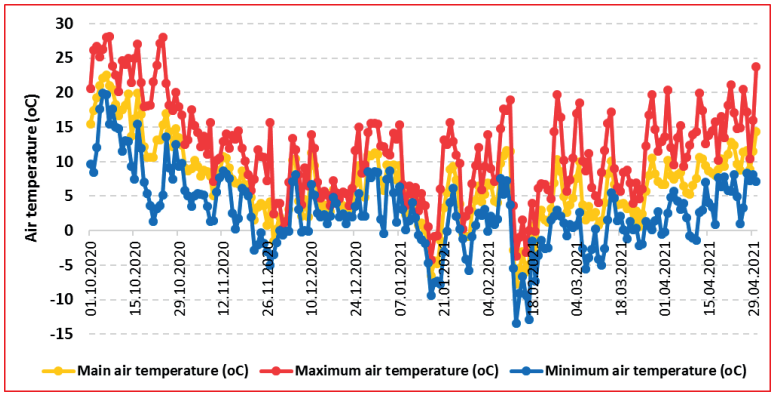
Figure 1a shows that the coldest month was January 2020, with an average minimum temperature of -2.5^{o}C and an absolute minimum temperature of -7.3^{o}C. Although the average minimum temperatures for the months of March and April were positive, absolute minimum temperatures of -5.6^{o}C (17.03.2020) and -4.3^{o}C (3.04.2020) were recorded, which caused the loss of floriferous buds.

Figure 1b shows that the coldest month was February 2021, with an average minimum temperature of -1.1^{o}C and an absolute minimum temperature of -13.4^{o}C. In March, an absolute minimum temperature of -5.5^{o}C was recorded (7.03.2021), which contributed to the loss of fruit buds.

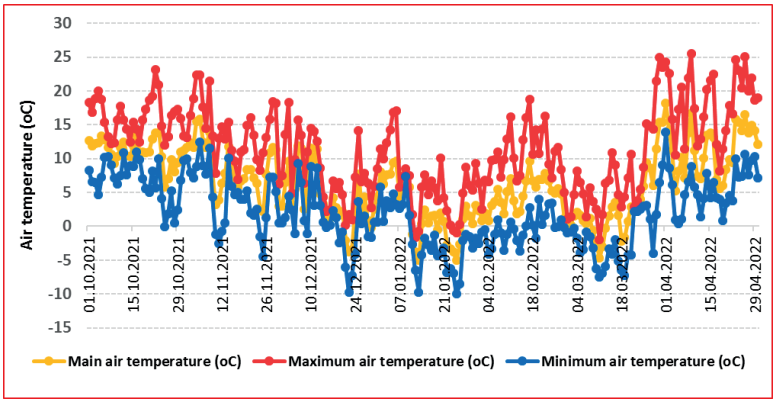
For the period January-April 2022, it can be observed that the coldest month was March, with an average minimum temperature of -2.2^{o}C and an absolute minimum temperature of -7.5^{o}C (Figure 1c), which caused the loss of fruit buds.



1a



1b



1c

Figure 1. a, b, c. Air temperature (°C) in October 2019-April 2020 (a), October 2020-April 2021 (b), October 2021- April 2022 (c) at Valu lui Traian, Constanța

The observations were carried out with the aim of assessing the losses of floriferous buds because of temperature variations during winter and the low temperatures during the day.

Thus, for the 'Mimi' cultivar the losses recorded for 2020 were of approximately 40%, 42% for 2021 and 30% for 2022, there being difference from one cultivar to another. The winter frost caused losses for the 'Catherine Sel. 1' cultivar of 20% in 2020, 30% in 2021 and 10% in 2022. For the 'Springcrest' cultivar, the losses were of 90% in 2020, 80% in 2021 and 60% in 2022. The 'Raluca' cultivar recorded losses of 60% in 2020, 24% in 2021 and 24% in 2022. For the 'Cardinal' cultivar, the losses were of 80% in 2020, 70% in 2021 and 55% in 2022. The 'Filip' cultivar recorded

losses of 60% in 2020, 40% in 2021 and 30% in 2022. The 'Cora' cultivar recorded losses of 40% in 2020, 70% in 2021 and 30% in 2022 (Figure 2).

We must bear in mind the fact that the losses caused by the winter frost of 2020, together with those caused by hoarfrosts and late frosts were very severe, taking also into account the surface of the Station's orchards cultivated with this cultivar.

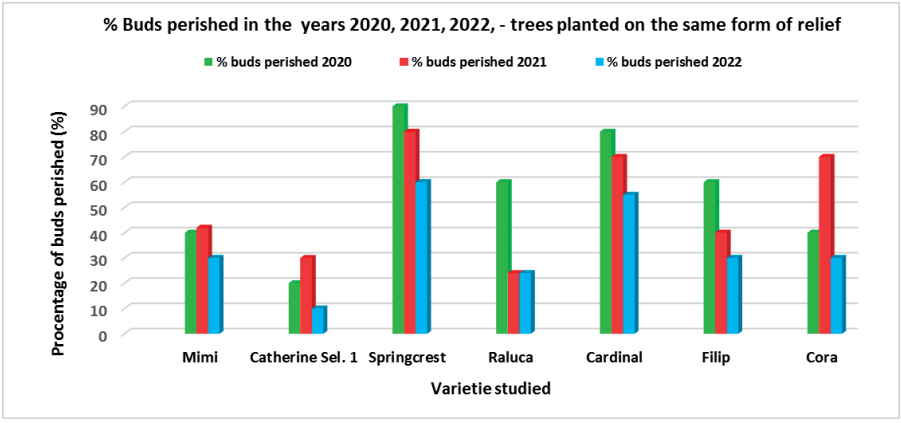


Figure 2. Percentage of peach tree flowering buds perished due to frosts during the winter of 2020, 2021 and 2022 at Valu lui Traian, Constanta

A good resistance to frost during the winter of the three studied years was displayed by the peach cultivar, with the following percentages: 'Catherine Sel.1', 20% and 'Raluca', 24% (Figure 3).

In these conditions, the 'Cardinal', and 'Springcrest' cultivars were more than 63-70% damaged.

At R.S.F.G. Constanta, in the second week of June 2022, more exactly on July 14th, the amount of precipitations was accompanied for 10 minutes by hail, which affected 80% of the fruit production for the Springcrest cultivar (the fruit were just beginning to ripe) and 70% for the 'Cardinal and Cora' cultivar (Figures 4 and 5). The hail bruised the fruit, the shoots and the stems, thus creating a good environment for future infections and diseases. The bruises on the fruit, despite some of them becoming scars, diminished the commercial aspect and the quality of the production.

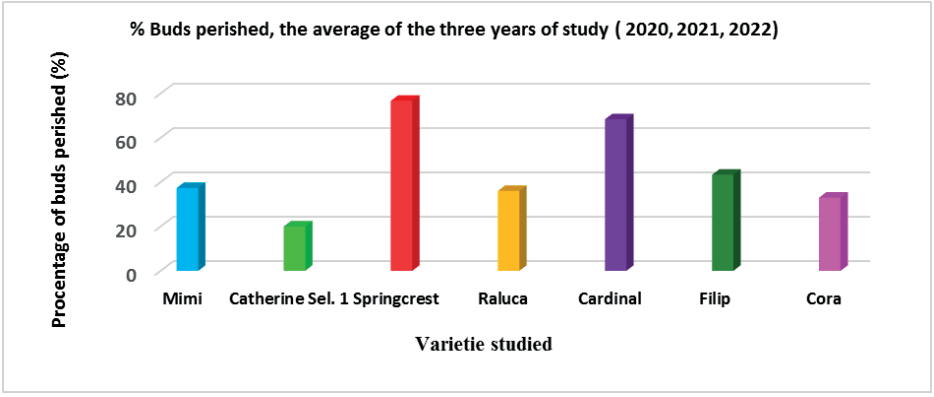


Figure 3. Percentage of peach tree flowering buds perished because of frosts (average over the three years), Valu lui Traian

Figure 4. The 'Springcrest' cultivar affected by the hail on July 14th, 2022 (full maturity)

Figure 5. The 'Cardinal' cultivar affected by the hail on July 14th, 2022

CONCLUSIONS

The greatest production losses were recorded for the 'Springcrest' cultivar in 2020 - 90% in 2021 - 80% and 60% in 2022.

The smallest losses during the three studied years were recorded by the peach tree cultivars 'Catherine Sel.1'.

The hail from July 14th, 2022, which lasted for only 10 minutes, affected the 'Springcrest' cultivar (80%) and the 'Cardinal and Cora' cultivar (70%).

These cultivars were affected by the hail that occurred on July 14th, 2022, which facilitated the development of moniliasis especially at cultivars that were in full harvesting maturity.

In order to protect the trees from hail occurrences we recommend that the orchards be equipped with anti-hail nets.

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