Fruit Growing Research, Vol. XXXV, 2019 DOI 10.33045/fgr.v35.2019.15
http://publications.icdp.ro/index.php

ASPECTE PRIVIND MENTINEREA CALITATII PIERSICILOR DUPA RECOLTARE
ASPECTS CONCERNING THE MAINTAINING OF THE PEACHES' QUALITY AFTER HARVEST

Lamureanu Gheorghe[1], Caplan Ion[1], Veringa Daniela[2], Chira Lenuta[3], Titisina Mirela[2], Stoli Ioan[1]
[1] Research Station for Fruit Growing Constanta, Romania
[2]Institute of Research and Development for Industrialization and Marketing of Horticultural Products Bucharest, Romania
[3]University of Agronomic Sciences and Veterinary Medicine of Bucharest, Romania

Abstract

This paper presents the resistance of peaches to storage, in different technological conditions. Two varieties of peach were studied: 'Jerseyland' and 'Collins', cultivated in the experimental fields of the Research Station for Fruit Growing Constanta (RSFG). Their storage testing was performed at the Institute of Research and Development for Industrialization and Marketing of Horticultural Products Bucharest (RDIMHP). The technological variants pursued were: 'Collins' variety: V1 - 20-22°C (ambient temperature), V2 - 10-12°C, V3 - 3-5ºC + AM (modified atmosphere), 'Jerseyland' variety: V1 - 20-22°C, V2 - 10-12° C, V3 - 3-5°C + AM. The mass losses and the qualitative depreciation of the fruits were determined during the storage, as well as the initial level and the evolution of the firmness and of the main biochemical components of the fruits. The results obtained during the study period (2015-2018) showed that peaches are sensitive to storage, the quality maintenance period after harvesting being of maximum 20 days, depending on the storage conditions and variety. The best results were obtained, in both varieties, in the case of storing the fruits under conditions enriched in CO2 (3-5° C + AM), the total losses being significantly lower compared to the other storage methods. Of the two varieties, 'Jerseyland' has the ability to maintain a better quality after harvest.

Cuvinte cheie: păstrare, pierderi, fermitate, biochimie, atmosferă modificată.
Keywords: storage, losses, firmness, biochemistry, modified atmosphere.

1. Introduction

The fruits harvested are living organisms, in which the characteristic vital processes are continued, for a variable period of time, until their total depreciation. This storage period varies depending on the nature of the products and the conditions under which they are subjected (Purcarea et al., 2012).

Peach is a thermophiles species, found in the culture of Constanta County, with special characteristics and biological and economic peculiarities, with multiple possibilities of diversification for consumption, but also with a degree of profitability.

In our country, peaches are highly appreciated by consumers, due to their special organoleptic properties (appearance, taste and aroma) but also due to their dietary properties. Their higher dietary properties are determined by their content in vitamins (A, B, C, E), mineral substances and trace elements (calcium, iron, iodine, magnesium, phosphorus, potassium, sodium, zinc), cellulose, acids and pectin substances (Lill and King, 1999).

Unfortunately, the appearance of peaches on the market is seasonal and therefore, for the prolongation of the consumption period there is interest for creating varieties with different periods of fruit ripening, but also for knowing and popularizing the different methods of maintaining the quality of peaches after harvesting (Alexe et al., 2012; 2014; Chira et al., 2014).

The modernization of the conditioning and preservation of fresh peaches, as an integral part of the field of technologies of valorization of the horticultural products, has constituted and still constitutes basic concerns in numerous units of research and horticultural higher education of the whole world. The maintenance the quality of these products after harvesting involves practically a series of adjacent fields (agronomic, biological, economic, technical, financial, commercial, etc.). The results of the researches allowed the elaboration of European commercial and technological norms and standards (CEE / UN, EU) and international (OECD, ISO, Codex Alimentarius) regarding the quality or maintenance of the fruit quality.

The ripening stage is very important in evaluating the quality of the fruit. Therefore, quality indicators must be clearly defined and measured by objective methods. The optimum values of these indicators serve the correct choice of harvest date. The correct determination of the timing of the ripening

(depending on which the date of harvesting is established) is of major importance in terms of the ability to preserve the fruit after harvesting (Olaru et al., 1999).

During the growth, maturation and capitalization of fruits, their biochemical components undergo certain modifications, based on biosynthesis, biodegradation or transformation into other components. Therefore, in the capitalization technology it is recommended to apply different technological storage procedures (low temperatures, modification of the air composition), which will determine the inhibition of the biochemical and physiological processes in the fruits, in order to maintain their commercial value for as long as possible (Brecht et al., 1982; Bartley, 1970).

This paper presents the influence of the variety and of the different storage methods on the quality preservation capacity after harvesting the peaches from the 'Collins' and 'Jerseyland' varieties.

2. Material and method

We worked with fruits from the 'Jerseyland' and 'Collins' varieties (Figure 1) from the experimental fields of the Research Station for Fruit Growing Constanta (RSFG), harvested in the yellow ripeness phase. In the specialized literature these varieties are described as follows:

'Collins" - medium to high vigor tree, with good productivity and very good frost resistance. It blooms abundantly, it is self-fertile. The fruit is medium in size - 145 g, yellow, covered with marbled red. Pulp is yellow, succulent, sweet taste, finely aromatic, semi adherent to stone (https://olma.ro/soi-pom-fructifer-piersic/134-soi-piersic-collins.html).

'Jerseyland' - vigorous tree, with medium or large fruits 170-230 g, spherical, slightly asymmetrical. The skin is orange yellow, covered with dark red on half of the surface. The pulp is yellow, sometimes with strong red infiltrations, quite consistent, succulent, finely aromatic, good for eating and industrial (https://florafruct.com/soiuri-pomicole/piersic).

Testing of fruits for storage was performed at the Institute of Research and Development for Industrialization and Marketing of Horticultural Products Bucharest **(**RDIMHP), in the following technological variants:

- 'Collins' variety:
  - V1 - 20-22°C (ambient temperature)
  - V2 - 10-12°C
  - V3 - 3-5ºC + AM (modified atmosphere)
- 'Jerseyland' variety:
  - V1 - 20-22°C
  - V2 - 10-12°C
  - V3 - 3-5°C + AM

The mass losses and the qualitative depreciation of the peaches during the storage, the initial level and the evolution of the firmness and of the main biochemical components of the fruits were determined.

Because the two varieties have different ripening periods, the organization of the storage experiments has been done in different periods: for the 'Collins' variety starting July 1, and for the 'Jerseyland' variety starting July 25.

3. Results and discussions

The biometric data for the fruits are shown in Table 1, which shows that the fruits of the 'Jerseyland' variety are larger compared to those of the 'Collins' variety. The average fruit weight is 64.89% higher in the 'Jerseyland' variety compared to the 'Collins' variety.

The shape index has values close to the two varieties, however it is a little closer to 1 in the 'Collin's variety.

From the observations made during the storage period of the fruits under different conditions, it was highlighted that in general the fruits were sensitive to the storage, the storage duration being 5-20 days, depending on the storage conditions (Table 2).

The main problem of the fruits during the storage was the very large volume of losses due to damage, which occur at temperatures of 20-22ºC and 10-12ºC, which is 20.34% in the case of storage for 5 days at 20-22°C and 28.72% respectively in case of storage for 15 days at 10-12°C in the 'Collins' variety (Figure 2).

In the 'Jerseyland' variety, the losses due to damage were lower, as follows: 12.46% for 5 days at 20-22°C and 16.21% for 15 days at 10-12° C (Figure 3).

The obtained results lead to the idea of avoiding keeping the fruits at room temperature for a period of more than 2-3 days and avoiding keeping them in spaces with a temperature of 10-12ºC for a period longer than 10 days.

The best results, clearly superior, were obtained in cold conditions, with the temperature of 3-5ºC, with the modified atmosphere. When stored with the modified atmosphere, the CO_2 concentration of the

air in the containers was maintained around 5% throughout. In this variant, after 20 days, there were extremely small mass losses (less than 1%) in both varieties, and the losses by damage were quite reduced compared to the other variants, respectively 8.85% in the Collins variety and 3.58% in the 'Jerseyland' variety (Figure 4).

Harvesting in the yellow ripeness phase and storage in refrigerated spaces with modified atmosphere can ensure a fruits life of approx. 20 days, with reduced losses. And the choice of variety is important, varieties more resistant to storage (e.g. 'Jerseyland'), obtaining a better quality maintenance, with much lower losses.

The values of the textural firmness, at harvesting and after storage in the 3 experimental variants, of the fruits from the 'Collins' and 'Jerseyland' varieties are presented in table 3.

It is found that when harvested, the fruits from the Collins variety have lower values of firmness (59.27 PU), compared to the 'Jerseyland' variety (48.20 PU).

During storage at room temperature for 5 days, the fruits from both varieties easily lost their firmness, due to the rapid ripening, reaching 137.71 PU in 'Collins' variety and 103.75 PU in 'Jersayland' variety.

By keeping at lower temperatures (10-12° C), the intensity of the ripening process decreased, so it was found that the structo-cellular degradation of the fruits slowed down, reaching after 15 days a firmness of 120.83 PU in the 'Collins' variety, respectively 90.38 PU in the 'Jerseyland' variety.

Enriching the atmosphere with carbon dioxide in the storage spaces allowed the fruits to be stored for 20 days, maintaining firmness at 106.52 PU in the 'Collins' variety and 78.00 PU in the 'Jerseyland' variety.

The content of the fruits in the main biochemical indicators (soluble dry matter, soluble carbohydrates, organic acids-malic acid, vitamin C) is presented in table 4.

From the data presented in Table 4, it appears that initially, when introduced to storage, the fruits from the 'Collins' and 'Jerseyland' varieties had a content of: 12.1% respectively 13.0% soluble dry matter, 1.03% respectively 1.15% titratable acidity, 8.21% respectively 8.70 % total sugar and 8.79 mg respectively 7.71 mg / 100g vitamin C. Initially, the 'Collins' variety had lower soluble dry matter content, malic acid and total sugar and more vitamin C compared to the 'Jerseyland' variety.

The high temperature during storage favored the high intensity of the biochemical processes in fruits, so that after 5 days of storage at 20-22° C the content in soluble dry matter increased, and that in soluble carbohydrates, respectively in malic acid decreased a lot, compared to the other storage methods.

The lower temperature (10-12° C) during storage led to the slowing down of these biochemical processes, so that the soluble dry matter increased by 11.57% in the 'Collins' variety and by 10.69% in the Jerseyland variety compared to the time of harvest, and the content in soluble carbohydrates and titratable acids decreased by a smaller percentage.

The effect of the cold is even more pronounced in the case of the change of the gaseous composition of the air, by increasing the concentration of carbon dioxide in the storage space, so that under the conditions of storage in the modified atmosphere for 20 days the content of fruits in the soluble dry substance increased by only 6.61% in the 'Collins' variety and 3.08% in the 'Jerseyland' variety compared to the initial moment, and the acidity decreased by only 7.70%, respectively 5.22% compared to the same moment.

4. Conclusions

The results showed that, in general, peaches were sensitive to storage, the maximum storage time being 5-20 days, depending on the storage conditions.

Impairment losses were between 0 and 22.5%, depending on the variety, conditions and duration of storage. The degradation of the fruits during storage was caused, by the attack and the development of the diseases, which spread rapidly in the fruit mass.

The most favorable storage method for maintaining the fruits quality after harvesting was found to be that with the temperature of 3-5°C, to which was added the modified atmosphere (enriched with 5% CO_2), in which they were recorded, after 20 days of storage, quantitative and qualitative losses with much less compared to keeping for 5 days at 20-22°C or 15 days at 10-12°C.

The structural-textural firmness was modified in the post-harvest period, as a result of cellulose biosynthesis, biodegradation of pectin substances, hemicelluloses etc. and by elimination of water in the transpiration process. In conditions of low temperatures and higher concentration of carbon dioxide, due to the strong decrease in the intensity of the metabolic processes, the decrease of the firmness was much slower, by only 79% in the 'Collins' variety and 62% in the 'Jerseyland' variety for a duration of 20 days. Under conditions of 20-22ºC, the percentage decrease of this indicator was 132% in the 'Collins' variety and 115% in the 'Jerseyland' variety for a period of 5 days.

The fruits from the 'Jerseyland' variety are more resistant to storage than the 'Collins' variety, whose fruits degrade faster and more than others, regardless of storage conditions. There are differences between varieties in terms of their ability to maintain firmness and their response to applied storage technology. Analyzing the weight loss, loss through breakdown and loss of firmness recorded during the storage of the fruits of the two varieties, it is found that the 'Jerseyland' variety has a better storage capacity compared to the 'Collins' variety.

During the storage period of the fruits, the biochemical composition of the mentioned varieties presents variations. Thus, as the content of soluble dry matter increases, the content of soluble carbohydrates and acidity decreases in both varieties of peach studied ('Collins' and 'Jerseyland'). The intensity of these processes differs depending on the storage conditions.

References

1. Alexe Constanta, Vintila M., Popescu Simona, Dumitru Liana Melania, Lamuranu Gh., Chira Lenuta, 2012. Researches on the influence of technological production and valorization factors on the commercial quality of Cardinal peaches cultivar. Scientific papers. Series B. Horticulture. Vol. LVI, 2012, Bucharest, USAMV Bucharest.
2. Alexe Constanta, Vintila M., Popescu Simona, Dumitru Liana Melania, Lamuranu Gh., Chira Lenuta, 2014. Quality assessment of Southland cultivar peaches according to certain technological factors of culture and storage. Scientific Papers, Series B. Horticulture, vol. LVIII, 2014. USAMV Bucharest.
3. Bartley N.W., 1970. Effects of Controlled Atmosphere Storage on Specific Biochemical Changes in Apricot and Peach Fruits, J. Amer. Soc. Hort. Sci. 97: 636-638.
4. Brecht J.K., Kader A.A., Heintz C.M, Norona C.M., 1982. Controlled atmosphere and ethylene effects on quality of California canning apricots and clingstone peaches. J. Food Sci. 47:432-436.
5. Chira Lenuta, Chira A., Delian Elena, Alexe Constanta, Marin Lixandru, 2014. Research concerning the influence of different storage conditions on the preservation capacity of some new apple varieties. Scientific Papers, Series B. Horticulture, vol. LVIII, 2014. USAMV Bucharest.
6. Lill R.E., King G.A., 1999. Postharvest physiology of peach and nectarines. Hort. Rev. 11: 413-452.
7. Olaru M, Schileru I., Pamfilie R., Paraian E., Purcarea A., 1999. Fundamentele Stiintei Marfurilor, Expert Publishing, Bucharesti.
8. Purcarea Cornelia, Ipate Iudith, Popa A., Duca Maria, 2012. Rolul stiintelor si tehnologiilor in siguranta alimentara in corelatie cu alimentatia sanatoasa si rolul sau in prevenirea unor boli metabolice. Osterreichish-Rumanischer Akademischer Vebein. Vienna.
9. https://florafruct.com/soiuri-pomicole/piersic.
10. https://olma.ro/soi-pom-fructifer-piersic/134-soi-piersic-collins.html.

Tables and Figures

Table 1. Biometric data of peaches

No.	Variety	Height (mm)	Diameter (mm)	Shape index	Weight (g)
1	Collins	55.2	56.6	0.98	112.68
2	Jerseyland	65.1	69.1	0.94	185.80

Table 2. Losses during peaches storage (%)

Variant	Variety	Storage conditions (°C)	Storage period (zile)	Mass loss (%)	Damage losses (%)	Total losses (%)
V1	Collins	20-22° C	5	14.75	20.34	34.82
V2	Collins	10-12° C	15	10.77	28.72	39.49
V3	Collins	3-5°C+AM	20	0.15	8.85	9.00
	Average			**8.55**	**19.30**	**27.77**
V1	Jerseyland	20-22° C	5	14.48	12.46	2721
V2	Jerseyland	10-12° C	15	8.91	16.21	25.12
V3	Jerseyland	3-5° C+AM	20	0.10	3.58	3.68
	Average			**7.83**	**10.75**	**18.67**

Table 3. Initial level and evolution of peaches firmness during storage

Variant	Variety	Storage temperature (°C)	Pulp firmness (PU)*	Decrease of firmness during storage (%)
-	Collins	Initial	59.27	-
V1	Collins	20-22°C	137.71	132
V2	Collins	10-12°C	120.83	104
V3	Collins	3-5°C+ AM	106.52	79
	Average		**106.08**	**105**
-	Jerseyland	Initial	48.20	-
V1	Jerseyland	20-22°C	103.75	115
V2	Jerseyland	10-12°C	90.38	88
V3	Jerseyland	3-5°C+ AM	78,00	62
	Average		**80.80**	**88**

*) PU-Penetration unit = 0.1mm

Table 4. Initial level and evolution of the main chemical components in peaches after harvesting

Varianta.	Variety	Storage conditions (°C)	Soluble dry matter (%)	Acidity (%)	Total sugar (%)	Vit.C mg/100g
-	Collins	initial	12.1	1.03	8.21	8.79
V1	Collins	20-22°C	13.9	0.70	6.28	9.75
V2	Collins	10-12 °C	13.5	0.84	8.07	9.37
V3	Collins	3-5 °C+ AM	12.9	0.95	8.00	8.91
	Average		**13.43**	**0.83**	**7.45**	**9.34**
-	Jerseyland	initial	13.0	1.15	8.70	7.71
V1	Jerseyland	20-22°C	14.4	0.65	6.77	8.97
V2	Jerseyland	10-12 °C	13.9	0.90	7.90	8,58
V3	Jerseyland	3-5 °C+ AM	13.4	1.09	8.10	8.59
	Average		**13.9**	**0.88**	**7.59**	**8.71**

Fig. 1. The appearance of fruits from 'Jerseyland' and 'Collins' varieties

Fig. 2. 'Collins' variety. The appearance of fruits damaged kept in conditions of 10-12ºC

a b

Fig 3. Jerseyland variety - Storage at room temperature
a. ensemble; b. detail

a. b.

Fig. 4. Keeping the fruits at 3-5ºC, with modified atmosphere
a. ensemble; b. detail