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STUDIES REGARDING THE INFLUENCE OF POSTHARVEST INTERVENTION UPON THE QUALITY AND THE STORAGE PERIOD OF SOME APRICOT AND PEACH CULTIVARS

Adrian CHIRA, Lenuţa CHIRA, Elena DELIAN, Ligia ION

University of Agronomic Sciences and Veterinary Medicine of Bucharest, 59 Marasti Blvd, District 1, Bucharest, Romania

Corresponding author email: lenutachira@yahoo.com

Abstract

Apricots and peaches are perishable fruits which require great care both at harvesting and during storage. In order to reduce losses and prolong their storage period, intervention during the post harvesting period is advisable through adequate techniques. The 'Dacia' and 'Olimp' apricot varieties have been taken under study, as well as the 'Nabby', 'Royal Glory', 'Raluca', 'Filip', and 'Sweet Dreams' peach varieties. These were harvested from the experimental field of the Faculty of Horticulture of University of Agronomic Sciences and Veterinary Medicine Bucharest. The preservation variants were: V1 - AN = the normal atmosphere typical to a storage space, the ambient temperature=24^{0}C and the relative humidity = 64%; V2 - AF = low temperature conditions (1-2^{0}C) and the relative humidity = 80-85%; V3 - AM = modified atmosphere resulted by applying a plastic pellicle (LDPE 5228 type) of 15 µm over the preserving containers, at the 1-2^{0}C temperature and 85-90% relative humidity. The assessment of the main physic-chemical characteristics of the fruit, as well as of the weight losses and the qualitative depreciation (attack by Monilinia sp.) during the preservation period was performed both at the time of the harvesting and after period of preservation. The optimal duration of fruits storage in modified atmosphere conditions was: 14-20 days for apricots and 10-14 days for peaches. The total losses recorded during storage were lower fruits harvested at the advanced ripening stage and stored in modified atmosphere conditions.

Key words*: harvesting time, parameters, physic - chemical, postharvest, storage period.*

INTRODUCTION

Apricots and peaches have outstanding organoleptic qualities and contain high amounts of fiber and vitamins, making it ideal in the human diet. Consequently, these versatile fruits are consumed in fresh, canned, dried and other processed forma (Southwick, 2003).

The apricot and peach fruits pose a serious challenge during their utilization due to the high level of perishability and to the very high temperatures during the harvesting time (Balan, et al., 2008). At present, in the varietal conveyer of these fruit tree species in Romania, in some climatic conditions, many deficient or high productions are reported. Therefore, maintaining the fruit quality for a certain period of time in order to diversify the fruit sort out of season and to stimulate the export are very timely problems (Chira et al., 2018).

The peach cultivars present on the market place are often judged flavorless and appear to lack the strong "peach flavor" expected by consumers, even when harvested an optimum maturity stage (Chira, 2008). The improvement of peach quality represents a crucial aspect for promoting consumption, prompting breeders toward the selection of novel and more flavorful cultivars that can develop flavors before the onset of the softening process (Cirilli et al., 2016).

From this point of view, using the selective plastic in making the physiological wrappers may be considered a good biotechnology that intervenes in the post harvesting phase autonomously or combined with preservation techniques that are already established (Hitka, 2011).

MATERIALS AND METHODS

The experimental work was performed on fruits of the well-known apricot cultivars: 'Dacia' and 'Olimp' (Figures 6, 7) and on the new peach cultivars: 'Nabby', 'Royal Glory', 'Raluca', 'Filip', and 'Sweet Dreams' (Figures 1-5). New commercial cultivars are distinguished by their fruit large size (Stănică et al., 2011). Attractive colour of the skin, intense blush and very firm,

slow softening flesh that facilitates shipping and handling. In many cases, however the improvement of the technological characteristics occurs in flavour detriment (taste and aroma) causing consumer dissatisfaction: consumers are attracted by the aesthetic features but are disappointed by the poor eating quality (Piagnani et al., 2013). The trees from which the fruits were sampled belong to a micro orchard from University of Agronomic Sciences and Veterinary Medicine Bucharest, Faculty of Horticulture, the system of experiment being the randomized block.

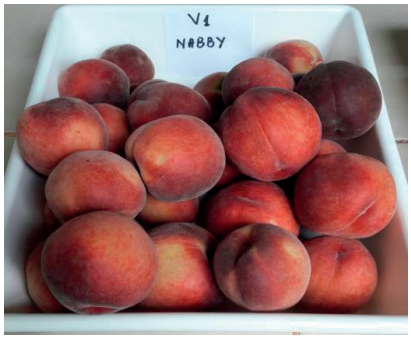

Figure 1. The 'Nabby' cultivar
Source: own photo

Figure 2. The 'Royal Glory' cultivar
Source: own photo

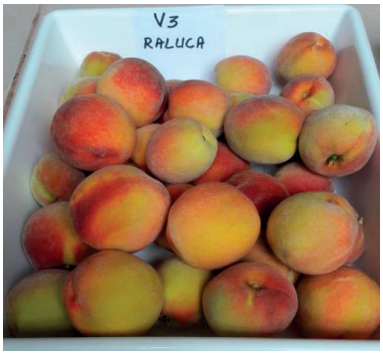

Figure 3. The 'Raluca' cultivar
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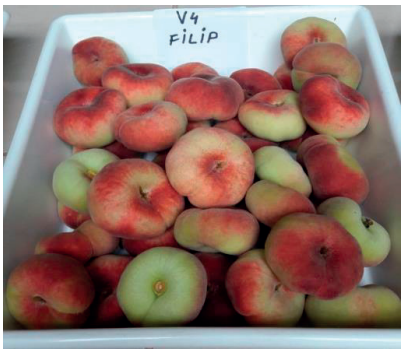

Figure 4. The 'Filip' cultivar
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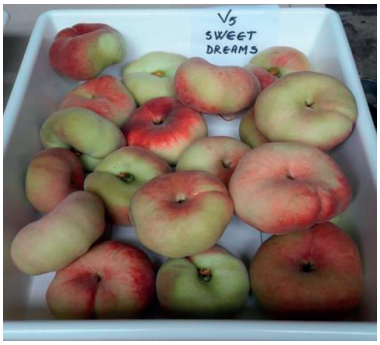

Figure 5. The 'Sweet Dreams' cultivar
Source: own photo

Figure 6. The 'Olimp' cultivar
Source: Apricot tree and apricot fruits book

Figure 7. The 'Dacia' cultivar
Source: Apricot tree and apricot fruits book

Fruits of every species were harvested at the ripening stage (one cultivar), at the advanced ripening stage (the other cultivar), than were brought to the laboratory for physic-chemical analysis and preservation. These have been distributed in three variants, each in three repetitions, with a quantity of 2 kg for each repeat (Chira et al., 2014).

The preservation variants were:

V1 - AN = normal atmosphere typical to a storage space, ambient temperature = 24°C and relative humidity = 64%;

V2 - AF = low temperature conditions = 1-2°C and relative humidity = 80-85%;

V3 - AM = modified atmosphere resulted by applying a plastic pellicle (LDPE 5228 type) of 15µm over the preserving containers, at 1-2°C and 85-90% relative humidity.

The evaluation of the physic-chemical parameters of the fruit was performed both at the time of harvesting and after the period of preservation. In addition, the weight losses and the quantitative depreciation (attack by *Monilinia* sp.) during the preservation period were also assessed (Chira et al., 2017).

The physic-chemical analysis methods used in the experiment were as follow: the fruit firmness was determined by using an Effegi penetrometer with 8 mm piston diameter; the total soluble solids content was determined by using the refractometer method; the total titratable acidity was determined by titration with NaOH and the ascorbic acid content was determined by iodometric method.

RESULTS AND DISCUSSIONS

The physic-chemical fruit parameters at the harvest time

By comparatively analysing the level of some essential components of fruit quality an evolutional transformation of the fruit size could be observed, as well as that of the sugar content, of the titratable acidity, of the ascorbic acid and the pulp firmness (Table 1), from the ripening stage to the advanced ripening one.

Limiting our comments only to the total soluble solids / titratable acidity ratio, that is a synthetic indicative of the quality; one can see that its value is increasing despite of the cultivar or species, from the ripening towards the advanced ripening stage. For example, from 6.7 at the 'Olimp' cultivar to 8.2 at the 'Dacia' cultivar for apricots, respectively from 9.8 to 19.7 for peaches cultivars.

The evolution of the physic-chemical parameters of the fruit during their storage period

The obtained results are presented in Table 2, showing that:.

The pulp firmness continuously decreased during the storage due to the solubilisation of the pectic substances, but with different values depending of the storage conditions. For example: the 'Dacia' cultivar firmness decreased from 2.0 kgf/cm^2 at the harvest time, to 0.9 kgf/cm^2 at V1, respectively to 1.0 kgf/cm^2 at V2 and V3 at the end of storage period. The total soluble solids recorded an increase despite the cultivar and the storage variant, but with higher values in the fruit stored in normal atmosphere (V1) due to the effect of the high temperature, and lesser values in the fruit stored in modified atmosphere (V3), due to the slowing-down of the metabolic process under the influence of the low temperature and of the increased concentration of CO_2 (5%, measured by using an gas analyser) from storage containers. For example: at the 'Dacia' cultivar, these values increase from 14.0% at picking to 16.5% V1; 15.6% V2 and 15.0% V3 after storage period. The titratable acidity had lower values in comparison with the ones at harvest times with differences between cultivars and according to the storage conditions. The lowest values have been recorded in the fruit stored in normal atmosphere (V1), due to the intense oxidation of the organic substances at the high temperature, while in the cold and in the modified atmosphere, the determined values were higher. For example: at the 'Dacia' cultivar values ranged from 1.7% at picking, to 1.2% (V1); 1.3% (V2) and 1.5% (V3), respectively.

The values of the total soluble solids/titratable acidity were higher in the fruit harvested at an advanced ripening stage despite of the species. For every cultivar, according to the storage conditions, the values were a little higher for the fruit stored in normal atmosphere, comparing to the ones stored in low temperature conditions or in modified atmosphere. That leads us to suggest that the modified atmosphere, by reducing the metabolic processes and prolonging the fruit lifetime is recommended to be used for the products that reach toward the maximum of their organoleptic qualities (the consuming maturity). For example: for the 'Dacia' cultivar these values increase from 8.2 at picking to 13.8 (V1), 10.0 (V2 and V3) after the storage period.

Table 1. The physic-chemical fruit parameters at the harvest time

Cultivar	The phase of the harvest	Medium weight (g)	The firmness (kgf/ 0.5 cm^2)	Asorbic acid (mg/100 g F.W.)	Total soluble solids (%)	Titratable acidity (% malic acid)	Total soluble solids/Titratable acidity
'DACIA' apricot	Advanced ripening	52.5	2.0	7.04	14.0	1.70	8.2
'OLIMP' apricot	Ripening	46.0	3.0	4.67	11.8	1.76	6.7
'NABBY' peach	Advanced ripening	71.0	2.5	5.42	11.8	0.88	13.4
'ROYAL GLORY' peach	Ripening	66.0	3.8	3.52	9.6	0.98	9.8
'RALUCA' peach	Advanced ripening	62.4	3.5	5.42	11.8	0.60	19.7
'FILIP' flat peach	Ripening	60.2	3.4	3.52	10.0	0.76	13.2
'SWEET DREAMS' flat peach	Ripening	61.5	3.2	3.85	10.8	0.82	13.1

Table 2. The physic-chemical fruits parameters at the end of the storage period

Species	Cultivar	Storage variant	The firmness (kgf/0.5cm^2)	Ascorbic acid (mg/100 g F.W.)	Total soluble solids (%)	Titratable acidity (% malic acid)	Total soluble solids/ Titratable acidity
Apricot	'DACIA'	V1	0.9	5.40	16.5	1.2	13.8
		V2	1.0	5.72	15.6	1.3	10.0
		V3	1.0	6.16	15.0	1.5	10.0
Apricot	'OLIMP'	V1	1.2	4.12	13.8	1.4	9.8
		V2	1.3	4.32	13.4	1.5	8.9
		V3	1.3	4.44	12.6	1.6	7.9
Peach	'NABBY'	V1	0.9	3.52	12.2	0.78	15.6
		V2	1.0	3.52	13.0	0.84	15.5
		V3	1.0	4.16	13.4	1.80	15.5
Peach	'ROYAL GLORY'	V1	1.2	3.52	10.9	0.78	13.7
		V2	1.4	3.52	11.0	0.87	12.6
		V3	1.4	4.16	10.2	0.75	13.6
Peach	'RALUCA'	V1	1.0	2.64	12.6	0.72	17.5
		V2	1.5	2.64	12.4	0.69	17.8
		V3	1.2	3.52	12.9	0.69	17.7
Flat peach	'FILIP'	V1	1.0	2.64	10.6	0.72	14.7
		V2	1.8	3.52	10.8	0.70	15.4
		V3	1.4	3.52	10.5	0.75	14.0
Flat peach	'SWEET DREAMS'	V1	0.9	2.68	10.5	0.73	14.3
		V2	1.8	3.48	10.8	0.72	15.0
		V3	1.5	3.50	10.8	0.75	14.4

The capacity for fruit temporary storage

The optimal duration of fruit storage varied for every species according to the moment of fruit harvesting (Table 3), which highlights that the fruit harvested at the ripening phase had a longer storage period. The organoleptic quality of the fruit was inferior comparing to the fruit harvested at the advanced ripening stage as reported in Tables 1 and 2. The storage conditions influenced the storage duration to a great extent, as follows:

4-8 days for apricots in normal atmosphere (V1),

3-4 days for peaches in normal atmosphere (V1),

5 days for plate peaches in normal atmosphere (V1),

14-20 days for apricots in modified atmosphere (V3),
10-13 days for peaches in modified atmosphere (V3),
14 days for plate peaches in modified atmosphere (V3).

The total losses recorded (Table 3) during storage were higher for all species, in the cultivars for which the fruit have been harvested at ripening stage, and the storage conditions influenced a lot the level of these losses, that were high in normal atmosphere (V1) and 2-3 times lower in modified atmosphere conditions (V3). This fact reveals the efficiency of this type of wrapping that represents a means of reducing the weight losses due to the lower fruits transpiration, under the 85. 90% relative humidity value, measured inside the package unit.

Table 3. The fruits storage capacity under different conditions

Species	Cultivar	Storage conditions	Storage duration (days)	Weight losses (%)	Quality losses (%)	Total losses (%)
Apricot	'DACIA'	V1	4	8.9	1.7	10.6
		V2	10	5.9	0	5.9
		V3	14	5.6	0	5.6
Apricot	'OLIMP'	V1	8	15.3	6.4	21.7
		V2	14	7.1	6.2	13.3
		V3	20	3.7	0	3.7
Peach	'NABBY'	V1	4	7.9	0	7.9
		V2	7	6.7	0	6.7
		V3	10	3.2	0	3.2
Peach	'ROYAL GLORY'	V1	4	7.9	0	7.9
		V2	9	6.9	0	6.9
		V3	13	4.6	0	4.6
Peach	'RALUCA'	V1	4	8.5	6.0	14.5
		V2	10	12.2	0	12.2
		V3	12	8.4	0	8.4
Flat peach	'FILIP'	V1	5	8.8	2.4	11.2
		V2	10	8.7	0	8.7
		V3	14	3.5	0	3.5
Flat peach	'SWEET DREAMS'	V1	5	8.9	2.2	11.1
		V2	11	7.5	0	7.5
		V3	14	3.8	0	3.8

CONCLUSIONS

The fruit belonging to the apricot and peach cultivars evolve toward maturity after harvest, achieving superior qualitative levels when the fruits are harvested at an advanced ripening phase;

The fruit qualitative levels at the end of the storage period were higher for the fruit maintained in normal atmosphere (ambient), and a little lower for the fruit stored in modified atmosphere (physiological wrappers);

It is recommended that the storage of the apricot and peach fruits should be done in modified atmosphere conditions, providing that the fruit are harvested at a stage closer to the full maturity, when the organoleptic qualities have maximal levels;

It is recommended to organize commercial units based on physiological wrappers that avoid the repeated handling and therefore fruit depreciation, that will come into contact with the ambient environment only at the final stage of the commercial circuit;

The optimal duration of fruit storage in modified atmosphere conditions were:

- 14-20 days for apricots,
- 10-14 days for peaches.

The total losses recorded during storage were lower in the fruit harvested at the advanced ripening stage and stored in modified atmosphere.

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