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PRELIMINARY RESULTS REGARDING THE INFLUENCE OF SOME FOLIAR BIOLOGICAL TREATMENTS ON THE PRESERVING CAPACITY AFTER HARVESTING OF THE APRICOTS

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Abstract

The paper presents the results obtained in 2018 on quality maintaining of the apricots varietiy 'Orizont'. The apricot trees were fertilized with the biological fertilizer Cropmax wich was applied together with some biological fungicides, insecticides and/or acaricides in three variants: v1= Cropmax + Konflic + Funres; v2= Cropmax + Oleorgan + Canelys; v3= Cropmax + Canelys + Mimoten. Apricots were kept in different technological conditions: room temperature (20-22ºC), temperature of 10-12°C (refrigerant conditions) and temperature of 3-5ºC, with and without modified atmosphere (cold storage), for 7, 15 and 30 days, respectively. The initial level and the evolution during storage of the firmness of the fruits were determined. After storage determinations were performed on the total losses, quantitative losses and qualitative depreciations. It was found that the quality of the apricots and their storage capacity vary according to the foliar biological treatments applied to the apricot trees and to the conditions in the storage environment. The v1 variant induces the best quality and storage capacity. Of the four studied storage methods, the best results were obtained within the cold storage with modified atmosphere, which recorded the smallest losses during storage.

Key words*: biological treatments, storage conditions, firmness, quantitative and the qualitative losses.*

INTRODUCTION

The apricots are very popular with consumers, both as a dessert fruit and, as well as processed in various ways. The high demand for fruits is determinate by their qualitative and technological attributes, by the complex biochemical composition and by the very pleasant taste and specific flavour etc. (Akin et al., 2008).

The aapricots obtained through the biological agriculture variant have a higher nutritional, hygienic and tasteful value compared to conventional products (Davidescu & Davidescu, 1994; Ion, 2004).

The biological fungicides, insecticides, acaricides and fertilizers have a lower cost and other advantages, such as: low level of the poluation for people and environment, small quantities of residues on the fruits, high selectivity to useful ecosystem fauna etc.

In Romania, it was tested a large range of foliar fertilizer for cultivated plent's and among fruit trees species (Platon & Soare, 2002; Rusu et al., 2002; Dinu et al., 2009; Bochis & Ropan, 2011; Petrisor et al., 2014; Singh, 2017) with special regarding on tree growing and increasing of fruit yield.

The question that arises here is about the correlation that may be carried between foliar biological treatments applied to the apricot trees and the preserving quality after harvesting of the apricots (Hitka, 2011).

Apricots are extremely perishable, which raises serious problems concerning the maintaining of their quality, from the moment they are harvested until they reach the consumer. Being highly perishable, the apricots are typically consumed or canned within two weeks of harvest. For extending this time, they must be

storage under certain temperature and humidity conditions which slow down the normal processes of senescence, characterized by altering the physiological, biochemical and morphological attributes of the fruits, which ultimately cause their depreciation.

In our country, doesn't exist enough information on the apricots storage in refrigerant and controlled atmosphere (CA) but, this type information is available in the literature, especially concerning the effect of CO2 level in CA. Veringa et al. tried to establish the influence of the variety and storage conditions on the preserving capacity after harvesting of the apricots belonging to two cultivars: Mamaia and Olimp, obtained from conventional agriculture.

In Italy, Europe's main producer of apricots (Andrich & Fiorentin, 1986) studied two varieties of apricots to determine their storage stability and to examine the effect of the CO2 level on weight decrease, firmness, total titrated acidity, pH, refractometric degree, physiological and pathological modifications. In other countries, the researchers determined the effect of controlled atmosphere storage of the ethylene relating different biochemical changes in apricot fruit (Palou & Crisosto, 2003).

The aim of this work is to establish the influence of some foliar biological treatments applied to the apricot trees on the obtaining and preserving the quality after apricots harvesting, in different storage conditions.

MATERIALS AND METHODS

The analysed fruits were obtained from the orchard of the experimental area of the Research Station for Fruit Growing Constanta. The apricots, variety 'Orizont', were harvested and tested in 2018.

In the technical literature (Stefan et al., 2018) this variety is described as follows: The tree is of medium vigour, fruiting mostly on May bouquets. Variety is self-fertile with very medium blooming period. The fruit (Figure 1) is of medium to large size (45-62 g), orange skin covered with red carmine on the sunny side, orange pulp, fine texture, juicy, sweet and pleasant flavored, with stone of medium sized, non adherent to the pulp (freestone). It yields in the 3rd-4th year after planting, and has a production capacity of 16.5 t/ha (635 trees/ha). It is tolerant to frost and drought, fruit destination being for fresh consumption and industrial pprocessing as jam, compote, dried fruit.

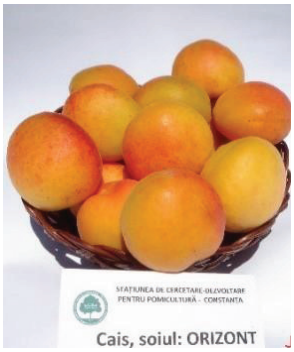

Figure 1. Apricots, 'Orizont' variety

The apricot trees were fertilized with the biological fertilizer Cropmax which was applied together with some biological fungicides, insecticides and/or acaricides, with the STIHL 400 SR atomizer (Figure 2).

Figure 2. Aplication of biological products to apricot trees

The experimental variants are:

- V1 - Cropmax 0.15% + Konflic 0.3% + Funres 0.3%;
- V2 - Cropmax 0.15% + Oleorgan 0.3% + Canelys 0.3%;
- V3 - Cropmax 0.15% + Canelys 0.3% + Mimoten 0.3%;
- V4 - control –untreated.
- The products which were used are described below:
- Cropmax - super-concentrated, foliar fertilizer (100% natural).

- Konflic - organic insecticide; it is a natural product used against the pest population (white fly, trips, aphids).
- Oleorgan - insecticide; it is a natural product which contains vegetable oils, used to combat and reduce the population of pests (white fly, trips, aphids) from horticultural crops.
- Funres - fungicide; it is a natural herbaeous extract intended to combat diseases of the horticultural crops, such as *Botrytis.* sp., *Sclerotinia* sp., *Peronospora* sp., *Phytophthora* sp.
- Mimoten - fungicide, with a preventive and curative effect on most fungi and bacteria that attack the crops and fruit trees, by inhibiting their growth and development (*Botrytis* sp., *Septoria* sp., *Sphaeroteca* sp.).
- Canelys - acaricide, a natural product successfully used to control the population of mite spiders *(Tetranichus* sp.) and of some pathogen fungi, as *Oidium* sp.

The apricots were kept at the Research and Development Institute for Processing and Marketing of the Horticultural Products Bucharest, in different technological conditions:
- room temperature (T = 24-27°C, RH = 69-71%), in 1 kg packaging - warm;
- fridge storage (T =10-12°C, RH = 75-78%), in packs of 1 kg (Figure 3);
- cold storage (T = 3-5°C, RH = 82-86%), in packs of 1 kg;
- cold + MA storage (T = 3-5°C, RH = 92-96%), in 1 kg hermetic packages, so that the composition of the atmosphere inside was modified, by the reducing of the O_2 amount and the increasing the CO_2 amount and also of air relative humidity - storage in modified atmosphere - MA.

Figure 3. Fridge storage of apricot

The storage period (days) varied according to the technological storage conditions, as follows:
- warm storage: 7;
- fridge storage: 15;
- cold storage: 30;
- MA storage: 30.

Before introducing to storage, biometric measurements were made, relating to: weight, height, high and small diameter.

The initial level and the evolution during storage of the firmness of the fruits were determined, with OF penetrometer (firmness tester), measuring the depth of penetration of the needle with diameter = 4 mm and length = 24 mm.

After storage, the determinations were performed on the total losses, quantitative losses (expressed by evaporate-transpiration) and qualitative depreciations.

RESULTS AND DISCUSSIONS

1. Biometric data

The results regarding the biometric data of the apricots are presented in Table 1, which shows that they are relatively close, as size and weight of the fruits, for variants which were fertilised with foliar fertiliser.

Table 1. Biometric data of the apricots

Variant	Height (mm)	Diameter (mm)		Average weight (g)
		high	small	
V1	43.2	40.7	33.9	52.70
V2	41.8	40.6	33.2	51.59
V3	42.5	41.6	34.2	51.96
V4	36.2	35.8	28.7	44.54

The apricots belonging variant V4 (unfertilised and untreated) are smaller, the difference between this variant and variant V1 being of 8.16 g.

2. Firmness

The results presented in Table 2 reveal the fact that at harvest the firmness of the apricots ranges from 100.53 PU at the V1 variant to 135.44 PU at the V4 variant, the average per cultivar being of 119.52 PU.

Table 2. The firmness of the apricots of the 'Orizont' cultivar upon harvesting and after storage

MU = PU

Moment of evaluation	Variant				Average/cultivar
	V1	V2	V3	V4	
At harvest	100.53	125.26	115.86	135.44	119.52
After warm storage	145.44	169.33	168.89	181.44	166.27
After refrigerated storage (10-12ºC)	144.22	145.67	145.11	146.66	145.41
After cold storage (3-5ºC)	105.66	128.44	129.22	144.22	126.89
After AM storage	101.08	126.21	116.66	136.98	120.41

* PU-Penetrometer Unit = 0.1 mm

During the warm storage (ambient temperature), the apricots lose easy their firmness, because of the quick ripening. Their firmness decreased to 166.27 PU at the level of variety, with the lesser value at the V4 variant (181.44 PU) and higher value at the V1 variant (145.44 PU).

It was observed that, by refrigerating storage, the structural-cellular degradation process of the apricots become slow-up, average firmness being, after 15 days, of 145.41 PU for variety, with close values between variants (144.22 PU for V1 variant, 145.11 UP for V3 variant, 145.67 PU for V2 variant and 146.66 PU for V4 variant).

When the apricots are stored in cold conditions, the intensity of the ripening process diminishes, so that the fruit maintain their structural and textural firmness for a longer period of time (126.89 PU for variety, after 30 days of storing). In the same time, the differences between variants become larger: 105.66 PU for V1 variant, 128.44 PU for V2 variant, 129.22 PU for V3 variant, 144.22 PU for V4 variant).

The enrichment of the atmosphere in carbon dioxide allowed the storage of apricots for 30 days with the maintenance of the firmness at 120.41 PU at variety level, with variations between 101.08 PU for V1 variant and 136.98 PU for V4 variant.

3. Quantitative and qualitative losses

The losses recorded during the warm storage for 7days are presented in Table 3.

It found that in case of storage in ambient temperature - warm for 7 days, total losses are higher in all 4 types of treatment, due to both by depreciation losses, but especially those mass (weight) losses. At the V4 variant - control we meet the highest losses (37.24%), and at the V1 variant - the lowest (26.53%).

Table 3. Losses recorded during warm storage of the apricots

Variant	Losses - %		
	Total	weight	depreciation
V1	26.53	14.22	12.31
V2	33.86	17.70	16.16
V3	31.70	16.49	15.21
V4	37.24	18.23	19.01
Average per cultivar	**32.33**	**16.66**	**15.67**

But skipping the variant of the treatment, the total losses recorded during the warm apricots storage of the 'Orizont' variety are 32.23% (16.66% weight losses and 15.67% by depreciation losses).

The impairment of the fruit is due to late infections caused by fungi *Monilinia laxa* and *M. fructigena* before harvesting, when they are barely visible. After harvesting, during transport and storage, their attack is rapidly evolving (depending on temperature) and the entire fruit rots. Moreover, during storage, it can lead to the rotting of the healthy, surrounding fruit, the mycelium penetrating directly or through almost invisible lesions. Also, fruit can be infected through wounds, blows or compression produced during harvesting and handling, by the molds *Botrytis cinerea* and *Rhizopus stolonifera*.

At temperature of 10-12ºC the apricots were recorded, after 15 days of storing, from 12.33% at V1 variant, till 14.36% at V4 variant - mass losses, from 11.10% for the V1 variant till 17.43% for V4 variant - depreciation losses, and from 23.43% (V1 variant) to 31.79% (V4 variant) - total losses (Table 4).

The level of the losses due to damage made mainly the difference between the four variants in terms of storage resistance under given conditions.

Table 4. Losses recorded during refrigerated storage (10-12ºC) of the apricots

Variant	Losses - %		
	total	weight	depreciation
V1	23.43	12.33	11.10
V2	26.49	13.45	13.04
V3	25.98	13.66	12.32
V4	31.79	14.36	17,43
Average per cultivar	26.92	13.45	13.47

By using the cold storage of the apricots, for 30 days, losses were recorded, both quantitative (weight) and qualitative (depreciation), much smaller than warm keeping (Table 5). Thus, the values found at the 'Orizont' variety, were: mass losses = 10.52%, depreciation losses = 10.29% and total losses = 20.81%.

Table 5. Losses recorded during cold storage (3-5ºC) of the apricots

Variant	Losses - %		
	total	weight	depreciation
V1	16.51	8.42	8.09
V2	20.97	10.85	10.12
V3	19.94	10.14	9.80
V4	25.80	12.67	13.13
Average per cultivar	**20.81**	10.52	10.29

V1 variant is also remarkable, with 16.51% total losses (8.42% quantitative losses + 8.09% qualitative losses), followed by V3 variant (losses: 19.94%, 10.14% and 9.80%, respectively). On the last place, with total losses of 25.80%, ranks V4 variant.

Very good results were obtained through the option of cold + MA storage, in which case the losses during preservation for 30 days were much lower compared to storage in cold conditions, without modified atmosphere (Table 6).

Table 6. Losses recorded during AM storage of the apricots

Variant	Losses - %		
	total	weight	depreciation
V1	0.23	0.23	-
V2	6.99	0.31	6.68
V3	6.47	0.33	6.14
V4	12.17	0.31	11.86
Average per cultivar	**6.47**	**0.29**	**6.18**

Thus, the level of the total losses, for 'Orizont' variety, was of 6.47% and those of weight losses was of 0.29%.

The V1 variant was not reported losses of the quality, and the quantitative losses were almost non-existent (0.30%). Even in the V4 variant the losses were significantly reduced, those being of 12.17%, 0.31% and 11.86%, respectively.

From the experimental data results that from the biological fertilization + treatments variants of orchard apricots, the best results in terms of losses during storage, from all the four technological methods, is V1 variant, followed by V3 variant. The worst results were obtained in V4 variant.

CONCLUSIONS

The results revealed the fact that, in general the apricots were sensitive to storage, the maximum storage duration being 7-30 days, depending on the storage conditions.

From the point of view of the firmness, the best results were obtained by the apricots of the V1 variant (Cropmax 0.15% - fertiliser + Konflic 0.3% - insecticide + Funres 0.3%- fungicide) which has the fruits with the best structural firmness. It was noticed that the speed of metabolising pectin substances and the decrease of the fruit's firmness differs according to the culture's treatment scheme but especially to the temperature and air composition in the storage room. During warm storage, the apricots rapidly lose their firmness because of the rapid ripening of the fruit. In the case of cold storage, the intensity of the ripening process is reduced, the fruit maintaining their structural and textural firmness for a longer period of time (30 days). By enriching the atmosphere in the storage room with carbon dioxide, the metabolic processes become even slower and the apricots' firmness is maintained for a longer period of time.

The ability to maintain the quality of the apricots fruit varies also depending by the scheme of treatment and the storage conditions of the environment and especially by temperature and gaseous air composition. The V1 variant induces the best storage capacity, with the lowest quantitative (weight) and

qualitative (depreciation) losses. Foliar fertilizers provide, besides the contribution of macro-and micro-nutrients and other organic substances that stimulate the metabolism of chlorophyll assimilation, energy efficiency and ultimately the quality of the fruits. The fungicide Furnes and insecticide Konflic used to combat diseases and pests, along with the Crompax fertilizer, contributes to obtaining healthier, better quality fruits, with better storage capacity. The most efficient methods of the fruits storage is cold room + modified atmosphere in which were recorded the lowest losses during storage.

Very good results were also obtained through the option of cold storage, in which case the losses during preservation for 30 days were much lower compared to storage at room temperature for 7 days.

Because the experiments have been performed for only one year, the results are provisional. In order to obtain definitive results, we will continue the research, trying higher concentrations of the used substances, in which case the differences between the variants will be sure more conclusive.

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