Scientific Papers. Series B, Horticulture. Vol. LVII, 2013
Print ISSN 2285-5653, CD-ROM ISSN 2285-5661, Online ISSN 2286-1580, ISSN-L 2285-5653

# TECHNICAL ASPECTS CONCERNING THE QUALITY PRESERVATION IN FRESH AND DEHYDRATION OF APRICOTS

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***Abstract***

*The researches carried on in ICDIMPH-Horting had in view to emphasize the influence of the variety and post-harvest temperature on quality preservation in fresh and dehydration of apricots from internal production. In this way, three varieties of apricots (Royal, Mari de Cenad, Cea mai buna de Ungaria), coming from the same orchard and being simultaneously harvested, were kept in different conditions (environmental temperature, refrigeration and cold storage) for testing the capacity of quality preservation of fresh fruits. At the same time,the apricots have been tested during dehydration process, the researches being focused on conduct, quality and output of the product. Taking into consideration losses level and the evolution of firmness and some chemical components, resulted that in environmental conditions Royal variety gave better results, Cea mai buna de Ungaria emphasized its good behaviour in refrigerated rooms and Mari de Cenad kept better quality than the others in cold conditions. Concerning dehydration, the results stated that the variety and maturity stage influence the output and duration of the process. The variety Mari de Cenad registered the highest drying ratio and the shortest time for dehydration process.*

***Key words:*** *apricots, storage, dehydration, quality preservation.*

## INTRODUCTION

The apricots are very appreciated on local and international markets. Growing conditions are also very good in our country, every yard from the south part of the country having some trees with savory sweet fruits. In Romania are many local valuable varieties, but foreign varieties are also grown with good results in specific conditions from different areas.

Differing from other countries that consider apricots exports (fresh, dehydrated or processed) a good income resource, our apricot production is in present time only an internal and seasonal resource. Romanian fresh apricots can be found on the market only 1-2 months during main harvesting period, the imported lots covering the market demand in the rest of the year. And the presentation on the market is poor in comparison with the imported fruits.

This old deficiency is still present despite EC Regulation 851/2000 and Romanian Standard SR 3178/2003 containing precised rules regarding the packaging and presentation for selling.

In order to assure the preservation of the quality and to prolong the trading time of horticultural products, actual postharvest technologies are based on cold chain used from the producer to the consumer.

The storage optimum temperature recommended by Cantwell M., 2002 and Hardenburg and colab. 1986 is -0,5...0ºC and 90-95% relative humidity. The authors do not recommend controlled atmosphere for fresh apricots. Jamba A. and Carabulea B.,2002 are considering that the proper temperature for cold storage of apricots is 0...+0,5ºC and 7...+10ºC for refrigeration purpose. They admit CA with 3% O2 si 5% CO2 for extension of cold storage life of apricots.

In order to find out the behavior of the apricots from internal production in different storage conditions (ambiental temperature, refrigerated and cold storage), specific comparative researches have been done in ICDIMPH-Horting institute using three varieties from the actual range of cultivars.

The dehydration of fruit and vegetables has many advantages, among which can be:

- all over the year consuming, especially during the fruits and vegetable absence, ensuring the human body needs with vitamins, minerals and other components

which sustain the immune system and its balance;
- using, whatever the time of the year, of the food recipes based on vegetables and fruits, by the rehydration of industrial dried products, both in restaurants and in pizzerias, bakeries and candied fruits;
- the dried fruits and vegetables with a rich content in vitamins and minerals, besides their important role in the diet, helps to prevent cardiovascular and digestive tract diseases;
- the dried foods have high nutrient content in low volume and weight, about 5-7 times less compared to the fresh ones, presenting a significant advantage in storage and transport.

## MATERIALS AND METHODS

The organization of experimental variants have been done on the basis of variety and storage conditions and that is presented in table 1.

Table 1. Organization of apricot experiments

| Variant | Variety | Storage conditions |
|---|---|---|
| V1 | Royal | Environmental (20-22°) |
| V2 | - idem - | Refrigeration (10-12°) |
| V3 | - idem - | Cold storage (3-5°) |
| V4 | Mari de Cenad | Environmental (20-22°) |
| V5 | - idem - | Refrigeration (10-12°) |
| V6 | - idem - | Cold storage (3-5°) |
| V7 | Cea mai buna de Ungaria | Environmental (20-22°) |
| V8 | - idem - | Refrigeration (10-12°) |
| V9 | - idem - | Cold storage (3-5°) |

Preparation of apricot experiments is illustrated in the figure 1.

Figure 1. Apricot experiments during preparation

Apricots belonging to three varieties (Royal, Mari de Cenad and Cea mai buna de Ungaria) were stored in different thermal conditions (environmental temperature, refrigeration and cold conditions). The evolution of losses (by weight and decay), structural firmness and some chemical fruit compounds during storage have been determined.

The experiments was developed in 2012, on the dehydration plant existing in the pilot station of ICDIMP-Horting Bucharest.

The dehydration plant used (fig. 2) is consist of vegetables and fruit dryer (70-300 kg / batch capacity), using hot air as drying agent. The installation program allows measurement and automatic/manual programming (Figure 3) of working parameters: temperature, humidity, air speed, driving valve and it is provided with an interface for connection to PC for data acquisition.

Drying temperature was 65-70$^0$C, held in this area for 12 hours. During the dehydration process was followed the evaluation of the combined effects of various drying parameters, such as drying temperature, speed and direction of the stream of air movement.

Figure 2. Dryer

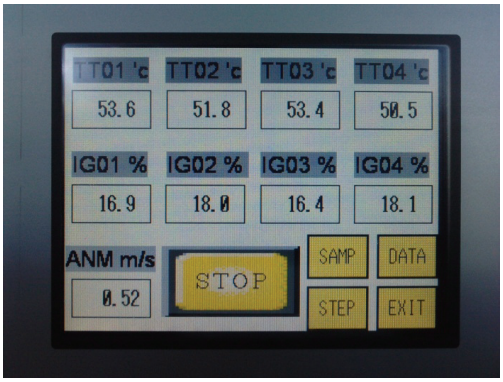


Figure 3. Programmer

## RESULTS AND DISCUSSIONS

The level of weight and decay losses during storage of apricots are presented in the table 2 and the fruit firmness evolution in the table 3.

The results followed from the data presented in the table 2 show that in ambiental conditions the apricot can be kept maximum 5 days with 32,22% total average losses. The fruits from Royal variety presented 26,27% total losses, less than others. The highest level of losses was registered at Mari de Cenad with 41,53% total losses. Many of these fruits had wrinkled, spotted and bruised appearance.

In refrigerated conditions the apricots have been stores 15 days with 16,54-20,59% weight losses (according to variety) and 4,44-37,77% decay losses (according to variety). The total losses ranged from 23,41 to 58,36 (according to variety) with an average of 38,69%. The most resistant in refrigerated storage was Cea mai buna de Ungaria variety with minimum decay and medium weight losses.

In cold storage conditions the apricots have been stores 20 days with 10,64-17,67% weight losses (according to variety) and without any decay losses. For all that, the varieties presented some differences. The Royal variety fruits presented some discolorations (darker zones of the skin) and maturation process. And Cea mai buna de Ungaria variety presented also a visible maturation process and slight wrinkled skin of some fruits. But for Mari de Cenad apricots the cold storage had a good effect on the maintaining the quality. It reduced the postmaturation process and was favourable in keeping the fruit appearance and health.

Table 2. Losses during storage of apricots (%)

| Variety | Environmental losses (%) | | | Refrigeration losses (%) | | | Cold storage losses (%) | | |
|---|---|---|---|---|---|---|---|---|---|
| | weight | decay | total | weight | decay | total | weight | decay | total |
| Royal | 18,12 | 8,15 | 26,27 | 16,54 | 17,78 | 34,32 | 10,64 | 0 | 10,64 |
| Mari de Cenad | 20,03 | 21,50 | 41,53 | 20,59 | 37,77 | 58,36 | 17,67 | 0 | 17,67 |
| C.m.b.de Ungaria | 18,62 | 10,25 | 28,87 | 18,97 | 4,44 | 23,41 | 11,51 | 0 | 11,51 |
| **Average** | **18,92** | **13,30** | **32,22** | **18,70** | **19,99** | **38,69** | **13,27** | **0** | **13,27** |
| Storage period | 5 days | | | 15 days | | | 20 days | | |

Table 3. Evolution of apricot firmness during storage

| Var. no. | Variety | Storage temperature (°C) | Storage period (days) | Pulp firmness (PU) * | Difference (%) |
|---|---|---|---|---|---|
| | Royal | initial | - | 119,30 | - |
| V1 | -idem- | 20-22° | 5 | 148,90 | +24,8 |
| V2 | -idem- | 10-12° | 15 | 145,95 | +22,3 |
| V3 | -idem- | 3-5° | 20 | 149,35 | +25,2 |
| | Mari de Cenad | initial | - | 96,75 | - |

| | | | | | |
|---|---|---|---|---|---|
| V4 | -idem- | 20-22° | 5 | 169,15 | +74,8 |
| V5 | -idem- | 10-12° | 15 | 162,65 | +68,1 |
| V6 | -idem- | 3-5° | 20 | 98,05 | +1,3 |
| | C.m.b. de Ungaria | initial | - | 103,13 | - |
| V7 | -idem- | 20-22° | 5 | 150,55 | +46,0 |
| V8 | -idem- | 10-12° | 15 | 125,25 | +21,4 |
| V9 | -idem- | 3-5° | 20 | 143,85 | +39,5 |

**penetrometric unit (PU) = 0,1mm*

The data from table 3 show that initially firmness of the apricots is 96,75-119,30 PU (according to the variety), the maturity degree of different varieties being closed enough. In all experimental variants stored fruits presented a decreasing of fruit pulp firmness with 1,3-74,8% from the initial value.

In environmental conditions Royal apricots had a constant evolution of fruit firmness that decreased with 22,3-25,2% from the initial value (according to the storage conditions and storage period). In such conditions the Royal apricots kept better its quality in comparison with the competitors Mari de Cenad and Cea mai buna de Ungaria that registered a decreasing of 74,8% respectively 46% of the initial firmness.

The Mari de Cenad apricots presented extreme firmness values according to the storage conditions having a great liability face to the temperature level. This variety was placed on the latest places concerning storage resistance to environmental and refrigerated conditions with 68,1-74,8% firmness decreasing, but occupied first place with only 1,3% decreasing in cool conditions.

Cea mai buna de Ungaria variety had a different firmness evolution, being adapted to refrigeration. This variety registered during refrigerated storage the lowest pulp firmness decreasing (21,4%). However at lower temperature, specific to the cold storage, the fruits of this variety are wasting 39,5% from the initial firmness, the apricot quality being thus affected in a way.

The initial content and evolution of some chemical compounds during storage are presented in the table 4. The data show that the initial content of fruits is as follows: 16,4-17,4% soluble solids, 0,91-1,01% acidity and 9,27-10,37% total sugars (according to the variety).

Table 4. Initial level and evolution of some chemical compounds of apricots during storage

| **Var. no.** | **Variety** | **Storage temperature (°C)** | **Soluble solids (%)** | **Acidity (%)** | **Total sugars (%)** |
|---|---|---|---|---|---|
| | Royal | initial | 17,4 | 0,91 | 10,37 |
| V1 | - idem - | 20 - 22° | 17,3 | 1,00 | 11,02 |
| V2 | - idem - | 10 - 12° | 17,4 | 1,20 | 11,84 |
| V3 | - idem - | 3 - 5° | 16,8 | 1,23 | 10,07 |
| | Mari de Cenad | initial | 17,2 | 0,87 | 9,88 |
| V4 | - idem - | 20 - 22° | 17,6 | 1,21 | 10,33 |
| V5 | - idem - | 10 - 12° | 16,2 | 1,40 | 9,43 |
| V6 | - idem - | 3 - 5° | 17,3 | 1,72 | 10,98 |
| | C.M.B.U. | initial | 16,4 | 1,01 | 9,27 |
| V7 | - idem - | 20 - 22° | 16,6 | 1,15 | 9,89 |
| V8 | - idem - | 10 - 12° | 16,7 | 1,25 | 10,19 |
| V9 | - idem - | 3 - 5° | 14,3 | 1,52 | 7,44 |

The Royal fruis presented the highest soluble solids and sugar content and Cea mai buna de Ungaria the highest acidity.

The evolution of these compounds differs from a variant to another. Soluble solids content presented after storage figures very close to initial ones. Some lower values have been determined for Mari de Cenad stored in refrigeration conditions and Royal and Cea mai buna de Ungaria stored in cold rooms.

The postharvest fruit acidity presented generally a increasing tendency for all varieties and in all storage conditions. The growth is reduced in case of ambiental storage condition, moderate in refrigerated conditions and higher in cold storage conditions

Total sugar content has an increasing tendency for all apricots stored in environmental conditions and for Royal and Cea mai buna de Ungaria varieties kept in refrigerated rooms. In cold conditions the same Royal and Cea mai buna de Ungaria varieties presented however a decreasing of sugar content in the fruits, opposing to Mari de Cenad that registered higher sugar content and a good storage result.

Appearance of the apricots after 5 storage days in environmental conditions is presented in the figure 4, after 15 days in refrigerated conditions in the figure 5 and after 20 days in cold conditions in the figure 6.


Figure 4. Appearance of apricots after 5 storage days in environmental conditions


Figure 5. Appearance of apricots after 15 storage days in refrigerated rooms


Figure 6. Appearance of apricots after 20 storage days in cold rooms

The variation of air humidity inside the place for dehydration-analyzing the graph (Figure 7), can be notice that at the beginning of the process the humidity was 76-80% in the four measuring points of the place.

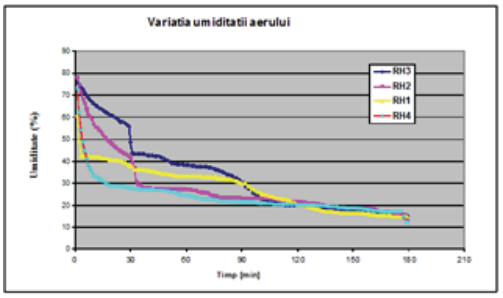


Figure 7. The variation of humidity inside the place for dehydration in the first 3 hours

During the first 30 minutes occurs a sudden decrease of humidity to a value of 35 – 40%. Over the next two hours the humidity decrease is achieved more slowly, reaching values of 20-30%. In the period between 120 and 180 minutes after starting the process can be seen a stabilization of the humidity values between 12-16% with a tendency to form a tray at the value of 14%, which indicates a uniformity of the air humidity inside the place for dehydration.

*The temperature variation*-analyzing the graph (Figure 8) can be seen that the start temperature was 30-33°C, ambient temperature respectively. The first hour of operation reveals a faster growth temperature values of 50-60°C. Over the next 120 minutes occurs a slow increase of temperature, stabilizing its values around 70-73°C, after 180 minutes from the process starting.

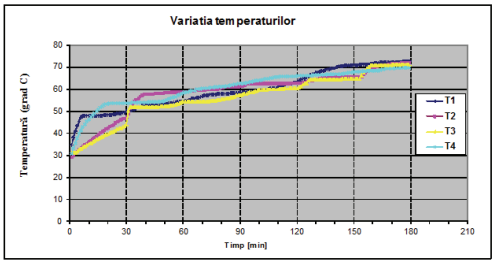


Figure 8. The variation of temperature inside the place for dehydration in the first 3 hours

## CONCLUSIONS

Storage temperature is the main factor that determines the duration of apricot quality preservation. In this way the apricots have been kept maximum 5 days in ambiental temperature with 32,2% total average losses, 15 days in refrigerated rooms with 38,7% total average losses and 20 days in cold storage with 13,3% total average losses. Optimum duration is however 3 days in ambiental temperature, 10 days in refrigeration and 15 days in cold conditions.

Apricot varieties had different behaviour in similar storage conditions. If Royal apricots had better results in ambiental temperature, Cea mai buna de Ungaria gave better results in refrigerated storage and Mari de Cenad kept better quality than others in cold conditions.

Firmness is a good indicator of fruit quality and its evolution during storage allowed a good evaluation of quality preservation in different storage conditions. Fruit firmness decreased with about 25% in all storage conditions. The

variety Mari de Cenad presented the largest variation of fruit firmness that decreased with 74,8% in ambiental conditions and only with 1,2% in cold conditions.

The evolution of some chemical compounds (soluble solids, acidity and total sugar) can be an important indicator of the capacity of quality maintain in variable storage condition and of the maturity stage of apricots. The chemical evolution differs from a variety to another. Mari de Cenad presented an increase of soluble solids and sugar content of the fruits in cold store conditions and a decreasing tendency in refrigerated rooms in opposition with other varieties. At the same time fruit acidity of this variety stored in cold conditions increased with 100% compared with only 35-54% registered by other varieties in similar conditions.

Stating experiences results in dehydration allow the following conclusions:

- After 180 minutes inside the place for dehydration the temperature and humidity were stabilized, in whole its volume;
- For the same keeping period of 12 hours under the same conditions of temperature, humidity and air drying speed, were obtained different values of the final humidity of the fruits, which indicates that the texture, thickness and epidermis influenced the dehydration process.

In 80% proportion the dehydrated products existing in the Romanian market come from imports. Due to current conditions and the absence of the performing technologies is required the modernization and optimization of the specific dehydration technologies, which can ensure the obtaining of competitive local products (apricots, apples, plums etc.), competitive for both internal market and for export.

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