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# QUALITY ASSESSMENT OF 'SOUTHLAND' CULTIVAR PEACHES ACCORDING TO CERTAIN TECHNOLOGICAL FACTORS OF CULTURE AND STORAGE

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***Abstract***

*Because of the great taste attributes, aspect and specifically flavor, plus their importance in nutrition, peaches occupies an important place in consumption in both, fresh and processed condition. Their superior dietary attributes are determined by the content of vitamins, minerals, cellulose, acids and pectin. This paper aimed to present the impact of some production (fertiliser regime) and valorisation (preserving conditions) factors upon the quality and its maintaining capacity during nectarines preserving. The organoleptic appreciation, fruits' firmness, biochemical compose, quantitative and qualitative loses were determinated. The 'Southland' cultivar (created in 1946, America), is very much appreciated all over the world for its great fruits (200-220g) and productivity (30-35 kg/tree). It was provided from the experimental plots of the Research Station for Fruit Growing Constanta, fertilized in different manner, with organic and chemical fertilizers, applied on soil and/or foliar. The peaches were stored at RDIPMHP-Bucharest in three variants: in the ambient temperature (T=26-28$^0$C), in cold conditions (T = 2-4°C) and cold + modified atmosphere conditions, during 7, 28 and 35 days, respectively. The best results were obtained in case of the fertilisation with chemical fertilisers applied on soil + foliar, which induces the best quality and maintainance during stored. The results also indicate the superiority of fruit storage in the modified atmosphere comparing with the others methods.*

***Key words*****:** *loses, quality, storage capacity, temperature*

## INTRODUCTION

The peaches are extremely perishable fruits, which raises serious problems concerning the maintaining of their quality during the valorisation process, from the moment which they are harvested until they reach the consumer (Alexe et al., 2013).

The realisation and maintenance of fruit quality depends on an ensemble of factors which intervene in all the technological links related to culture and valorisation, from the choosing of the cultivar and the maintenance of the culture to harvesting, conditioning and shipping. The peach tree cultivars display different characteristics as concerns their storage and valorisation over a longer period of time (Jamba and Carabulea, 2002). The storage capacity of peaches depends on the quality of the raw material meant to be stored, as well as on the conditions during storage. The chemical composition of peaches, which determines the level of biochemical processes during storage and therefore, the storage capacity is highly influenced by the fertilisation regime. The dosage in which the organic or mineral fertilisers is applied influences the chemical composition of the fruit, having an important effect upon the storage capacity

(Salunke, 1974; Ion, 2004).
Within valorisation technologies, it is recommended that certain technological processes regarding storage be applied, so that they determine the inhibition of physiological and biochemical processes within the fruit, leading to the maintenance of their commercial value for a period which as long as possible (Burzo, 1986; Lill and King, 1999; Burzo et al., 2005;).
The purpose of this paper is to evaluate the obtaining and maintenance of fruit quality of the peaches of the 'Southland' cultivar (American cultivar, created in 1946, appreciated in all world up to now for its great fruits and productivity), according to the fertilising regime of the culture and the storage conditions, after harvesting.

## MATERIALS AND METHOD

The peaches were harvested from the experimental plot of R.S.F.G. Constanta. The 'Southland' (Figure 1 and 2) is an semi-late cultivar, the maturity period of fruits are in the third decade of the July and first decade of August. The fruit have a big weight (200-220 g) and a spherical shape, flattened laterally and ventral furrow is shallow.
The skin is thick, hairy and adherent to flesh, color is yellow-orange, covered with red-purple spots on the sunny side of fruit.

Figure 1. Branch with fruit of the Southland

The pulp is golden-yellow, with slight red seepage around the kernel, with great taste and flavor, relatively crisp, sweet-acidified, succulent. The stone is medium size, ovoid, with inlay in the form of pockets and grooves, dark brown and non adherent to the pulp. The tree is auto-fertile, vigorous, with a very high yield potential (30-35 kg/tree), is resistant to frost, drought and disease, except *Taphrina deformans.*


Figure 2. Peaches of the Southland cultivar

Fruits are utilised for direct consumption and processing. They present resistance to handling and transport.
In ochard, the trees was conducted in 4 different fertilisation variants:
- V1 – control (unfertilised)
- V2 – organic fertilisation (fermented manure)
- V3 – chemical fertilisation of the soil (NPK complex fertilisers, in relation to 15:15:15.)
- V4 – chemical fertilisation of the soil + foliar fertilisation (on soil with NPK complex fertilisers, in relation to 15:15:15 and of the plant with the foliar fertiliser Murtonik 20:20:20 + microelements: Mn, Fe, Cu, Zn, Bo, chelation form).
At the Research and Development Institute for Processing and Marketing of the Horticultural Products (RDIPMHP Bucharest), the fruits were stored in three storage variants:
- ambient temperature (T = 26-28°C, RH = 65-70%), in 1kg packaging - warm;
- refrigeration room (T = 2-4°C, RH = 83-87%), in packs of 1 kg covered with perforated polyethylene film - cold storage;
- refrigeration room (T = 2-4°C, RH = 92-96%), in 1 kg hermetic packages, so that the composition of the atmosphere inside has modified, by the reducing of the $O_2$ content and the increasing the $CO_2$ content and also of air

relative humidity-storage in modified atmosphere - MA.

The storage duration (days) varied according to the technological storage variant as follows:

- warm storage: 7
- cold storage: 28
- AM storage: 35

Immediately after harvesting, before the beginning of the storage and at the end of this period, certain determinations were carried out concerning the fruits' firmness, as well as organoleptic observations and biochemical analyses of the main components (soluble dry matter, soluble carbohydrates, titratable acidity). In addition, losses were quantified, both the quantitative (concerning the weight) and the qualitative ones (by depreciation), losses which occurred during the storage.

The firmness was determined by means of a OFD weight penetrometer, which measures in penetrometric units (1 PU = 0.1 mm) the depth to which the conic needle is able to penetrate the pulp of the fruit (length = 24 mm, diameter at its basis = 4 mm). The measurements were performed upon a number of 25 fruits/variant, each fruit being penetrated in four points in the equatorial area.

The appreciation of the organoleptic quality was carried out by means of a sensorial testing of a fruit, the evaluation method being a scale with point from 1 to 100. Tasting sheet were used which comprises three criteria: aspect, firmness, taste. Each of these three criteria weighs differently within the general grading, according to their importance: the aspect represents 15%, the firmness 35%, while the taste represents 50%. Taking into account the total score, there are five quality categories as follows:

| **Grade (quality category)** | **Points** |
|---|---|
| Very good | 80-100 |
| Good | 60-79 |
| Acceptable | 40-59 |
| Mediocre | 20-39 |
| Unsuitable | 0-19 |

The methods used in order to determine the biochemical components were:

- refractometry, using an ABBE refractometer, to determine the soluble dry matter;
- the Bertrand titrimetric method to determine the soluble carbohydrates;
- the titrimetric method for the determination of the titratable acidity.

Throughout the storage, the thermo-hydric factors from the cold room were checked on a daily basis, in order to ensure the fact that the best conditions for maintaining the quality were respected. At the same time, the capacity of the maintain fruit quality was evaluated, including the occurrence and development of different storage diseases.

## RESULTS AND DISCUSSIONS

### a. Organoleptic quality

The results obtained following the organoleptical testing (Figure 3) reveals the fact that at harvest, the peaches obtained a high score (96.08 points), because of their attractive aspect (12.75 points), good firmness (35.00 points) and pleasant taste (48.33 points).

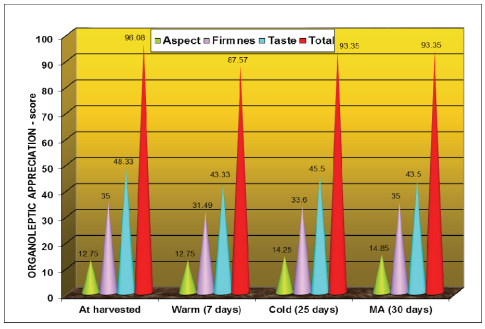


Figure 3. Organoleptic appreciation of 'Southland' cultivar

The grade, according to the obtained points, was "very good" for the fresh peaches - at harvest (Table 1).

Table 1. The organoleptic appreciation of peaches at harvest and after storage

| **Moment of determination** | **Grade** |
|---|---|
| At harvest | very good |
| After warm storage | very good |
| After cold storage | very good |
| After AM storage | very good |

After 7 days of storage in an ambient temperature, the organoleptic properties of the peaches remained in good parameters (87.57

points) so that, although the score dropped a little due to the diminishing of the firmness (31.49 points) and taste (41.33 points), the final grade was also “very good”.
After cold storage for 28 days, the peaches of the 'Southland' cultivar maintained their beautiful aspect, good firmness and pleasant taste and, following the organoleptic testing, obtained a high score (93.35 points) and the grade “very good”. After storage under conditions of modified atmosphere for 37 days, the peaches also maintained their firmness (35.00 points) and pleasant taste (43.50 points), but increased their beautiful aspect (43.50 points) and obtained the grade “very good”, having a score of 93.35 points.

**b. Firmness**

At harvest time, the values of the firmness range between 21.56 PU at the fruit from the V1 variant and 63.89 PU at the fruit from the V3 variant, the average per cultivar being of 40.08 PU (Table 2).
During warm storage, the peaches lose easy their firmness, because of the quick ripening (175,08 PU). When the peaches 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 (107,06 PU after 28 days of storing).
By enriching the atmosphere in the storage space with carbon dioxide, the metabolic processes become even slower and the peaches maintain their firmness (106,94 PU) for a longer period of time (35 days).

Table 2. The firmness of peaches of the 'Southland' cultivar at harvest time and after storage period

| Variant | Penetration value – PU | | | |
|---|---|---|---|---|
| | at harvest | after storage | | |
| | | warm | cold | MA |
| V1 | 21,56 | 200,11 | 124,78 | 105,22 |
| V2 | 43,44 | 166,89 | 93,33 | 101,33 |
| V3 | 63,89 | 151,11 | 92,33 | 114,33 |
| V4 | 31,44 | 182,22 | 117,78 | 106,89 |
| **Average per cultivar** | **40,08** | **175,08** | **107,06** | **106,94** |

**c. Biochemical composition**

The content of 'Southland' peaches, at harvest time (initially), in main biochemical components, is presented in Table 3. The results show that the values of biochemical indicators from the fruits vary according to variant of fertilization applied to peach culture.
Analyzing the soluble dry matter content on variants, it occurred that the V1 variant had the lowest value of this indicator (10.64%), and V4 variant had the highest value (11.18%), closely followed by V2 variant (11.14%).
The soluble carbohydrate content presents the highest value for the V2 variant (8.76%) and lowest in V1 variant (8.15%).

Table 3. The main chemical components of 'Southland' cultivar peaches at harvest time

| Variant | Solub. dry matter ($^0$R) | Solub. carbo-hydrates (%) | Titratable acidity (malic acid/ 100g) |
|---|---|---|---|
| V1 | 10.64 | 8.15 | 0.81 |
| V2 | 11.14 | 8.76 | 0.77 |
| V3 | 10.68 | 8.21 | 0.77 |
| V4 | 11.18 | 8.64 | 0.76 |
| **Average variety** | **10.91** | **8.44** | **0.78** |

In case of titratable acidity the differences between the four variants are small, however the V4 variant has the lowest content in malic acid (0.76%), and V1 variant, the highest content (0.81%).
The biochemical modifications occurred during storage in the three variants are shown in Tables 4 to 6.
The high temperature during storage favors the deployment with a great intensity of biochemical processes in fruits, such as after 7 days of cold storage the content in soluble dry matter increased much, whereas the soluble sugars, respectively malic acid fell much, compared with the others storage methods (Table 4).

Table 4. The main chemical components of 'Southland' cultivar after warm storage

| Variant | Solub. dry matter ($^0$R) | Solub. carbo-hydrates (%) | Titratable acidity (malic acid/ 100g) |
|---|---|---|---|
| V1 | 12.11 | 6.35 | 0.73 |
| V2 | 12.09 | 7.17 | 0.64 |
| V3 | 12.00 | 5.93 | 0.68 |
| V4 | 12.09 | 7.12 | 0,63 |
| **Average** | **12.07** | **6.64** | **0.67** |

The lower temperature during cold storage leads to the slow rhythm of these biochemical processes, such as soluble dry matter increased with 6.32% from the time of harvest and the content in soluble carbohydrates and titratable acids decreased with 2.13% , respectively 2.56% (Table 5).

Table 5. The main chemical components of 'Southland' cultivar after cold storage

| Variant | Solub. dry matter ($^0$R) | Solub. carbo-hydrates (%) | Titratable acidity (malic acid/ 100g) |
|---|---|---|---|
| V1 | 11.57 | 8.11 | 0.76 |
| V2 | 11.80 | 8.51 | 0.76 |
| V3 | 11.24 | 8.00 | 0.74 |
| V4 | 11.81 | 8.43 | 0.76 |
| **Average** | **11.60** | **8.26** | **0.76** |

The cold effect is more pronounced during the change of the gaseous composition of the air, by increasing the concentration of the carbon dioxide in storage space, such as during storage in modified atmosphere, the soluble dry matter content of the peaches has grown by only 1.55% against initial moment, and titratable acidity decreased with only 1.28% on the same time, as evidenced in Table 6.

It was found that in case of storage in normal temperature - warm (ambient temperature) for 7 days, total losses are higher in all 4 types of fertilization, due to both mass (weight) losses, but especially those by depreciation.

Table 6. The main chemical components of 'Southland' cultivar after storage in M.A

| Variant | Solub. dry matter ($^0$R) | Solub. carbo-hydrates (%) | Titratable acidity (malic acid/ 100g) |
|---|---|---|---|
| V1 | 10.73 | 8.19 | 0.76 |
| V2 | 11.36 | 8.51 | 0.78 |
| V3 | 10.77 | 7.85 | 0.80 |
| V4 | 11.46 | 8.39 | 0.76 |
| **Average** | **11.08** | **8,23** | **0.77** |

### d. Qualitative and quantitative losses

The losses of the peaches recorded during the storage are presented in Table 7.

Table 7. Losses recorded during the storage of peaches under different technological conditions

| Losses - % | Variant | | | | |
|---|---|---|---|---|---|
| | V1 | V2 | V3 | V4 | Average |
| **Warm:** - total | 43.11 | 23.07 | 32.54 | 18.85 | 29.39 |
| - weight | 14.42 | 13.12 | 14.24 | 12.09 | 10.97 |
| - depreciation | 28.69 | 9.95 | 18.30 | 16.76 | 18.42 |
| **Cold:** - total | 15.05 | 6.65 | 7.41 | 4.91 | 8.50 |
| - weight | 1.49 | 1.45 | 2.10 | 1.61 | 1.66 |
| - depreciation | 13.56 | 5.20 | 5.31 | 3.30 | 6.84 |
| **AM:** - total | 7.90 | 0.22 | 3.35 | 0.19 | 2.91 |
| - weight | 0.20 | 0.22 | 0.32 | 0.19 | 0.23 |
| - depreciation | 7.70 | - | 3.03 | - | 2.68 |

At the V1 variant – control we recorded the highest losses (43.11%), and the V4 variant - chemical fertilization in soil + foliar feeding, the lowest (18.85%). But skipping the variant of the fertilization, the total losses recorded during the warm peaches storage of the Southland are 29,39% (10.97% weight losses and 18.42% by depreciation losses).

The fruit impairment, in case of peaches, are due to late infections caused by fungi *Monilinia laxa* and *M. fructigena* before harvest, when they are too little visible. After harvest, during transport and storage, the attack rapidly evolves (depending on temperature) and the entire fruit rots. Moreover, during the storage can lead to the rotting of the surrounding healthy fruit, mycelium penetrating into them directly or through injuries almost invisible.

The fruits can also be infected through wounds, blows or pressure produced during harvest and handling by the molds *Rhizopus stolonifer* and *Botrytis cinerea*.

By using cold storage of peaches, losses were recorded both quantitative (weight) and qualitative (depreciation), much smaller than warm keeping. Thus, the values found at the 'Southland' cultivar, were: mass losses = 1.66%, depreciation losses = 6.84% and total losses = 8.50%.

V4 variant is also remarkable, with 4.91% total losses (1.61% mass losses + 3.30% qualitative losses), followed by V2 variant (losses: 6.65%, 1.45% and 5.20%, respectively). On last place, with total losses of 15.05% ranks V1 variant.

The losses determined after 35 days of storage in modified atmosphere conditions were significantly lower values compared with the others methods of storage.

The 'Southland' cultivar recorded total losses of 2.91% (0.23% mass losses + 2.68% by depreciation losses) only. The V4 variant of fertilization was not reported losses of quality and the quantitative losses were almost zero (0.19%). A similar situation is found in the V2 variant too, with total losses of 0, 22%. Even in the V1 variant the losses were significantly reduced, those being of 7.90%, 0.20% and 7.70% respectively.

From experimental data results that the fertilization variant of orchard peaches, the best results in terms of losses during storage, from all the three technological methods, is V4 variant, followed by V2 variant, and the worst results were obtained in V1 variant.

## CONCLUSIONS

The peaches of the 'Southland' cultivar are appreciated from an organoleptic point of view, given the fact that they obtained a fairly good score upon their organoleptic testing at harvest. The evolution of the quality during storage depends on the conditions in the storage environment and especially on the temperature and gaseous composition.

From the point of view of the firmness, the best results were obtained by the peaches which were fertilised with foliar fertilisers. It was noticed that the speed of metabolising pectin substances and the decrease of the fruit's firmness differs according to the culture's fertilising regime but especially to the temperature and air composition in the storage room.

Contents of peach fruit in main biochemical indicators (soluble dry matter, soluble carbohydrate, organic acids) varies depending on crop fertilization system. In terms of biochemical, peaches from the culture fertilized with organic fertilizers and those from culture fertilized with chemical fertilizer incorporated into soil and foliar fertilization gave the best results. The biodegradation of organic acids and carbohydrates is influenced by storage temperature. As the storage temperature is higher, the biodegradation is even more pronounced. The chemical composition of the air in storage space is also an important factor.

The ability to maintain the quality of peach fruit varies also depending by the fertilization system, and storage conditions of the environment and especially by temperature and gaseous air composition. The V4 variant (chemical fertilization on soil + foliar feeding) induces the best storage capacity, with the lowest quantitative (weight) and qualitative (depreciation) losses. The most efficient methods of fruits storage is refrigeration room + modified atmosphere in which were recorded the lowest losses during storage.

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