

RESEARCHES CONCERNING THE PRESERVATION OF PERISHABLE FRESH FRUITS SHELF-LIFE DURING THE STORAGE

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Abstract

The study presents a comparison of the quality of fruits, evolution of some chemical components and the loss that the fruit suffer during the storage period in traditional, refrigeration and controlled atmosphere storage. There were gathered biochemical data for two Romanian strawberry varieties: Premial, Magic, and two cherry varieties: Stella and Daria, respectively a Canadian variety and a Romanian variety. The determined biochemical aspects were the following: total solids, total sugar, total acidity and ascorbic acid. The quality parameters measured was general aspect, firmness, and taste. The duration of shelf-life in three different storage conditions was measured in days for each variety selected for the survey. The refrigeration storage was better in comparison with the traditional storage, and the controlled atmosphere was better in comparison with the refrigeration storage, that being confirmed by the evolution of biochemical composition, total pointing and duration of storage. The lowest dehydration was for the strawberries and cherries stored in the controlled atmosphere cells. Function the storage method, at the cherries and strawberries varieties, the lowest loss was shown by Daria cherry variety and Magic strawberry variety. To keep the very perishable fresh fruits in optimum conditions, the genetic characteristics of each cultivar and the cultivar behavior to each storage method are required.

INTRODUCTION

The paper presents the experimental results obtained from researches developed with de purpose to prove the evolution of some fresh fruits quality parameters of two strawberry varieties and two cherry varieties multiplied in Romanian nurseries, in three different conditions of experimental storage: 1-chilly rooms; 2-refrigeration at 3°C; 3-controlled atmosphere: 3°C, 4% CO₂.

MATERIAL AND METHODS

The experimentation used fruits classified as commodities excessively perishable and very perishable, respectively: strawberries and cherries. The choice of trials is based on hypothesis that each variety from one specified species and each species give a different fruits responses on factors involved in quality assurance, during the storage.

In order to have relevant data concerning storage life for excessively perishable and very perishable fruits, there were selected as trials two varieties for each species of fruit: Romanian Magic and Premial varieties for strawberry, and Canadian Stella variety and Romanian Daria variety for cherry. These species and varieties are cultivated in the experimental collection of Didactic and Experimental Station "Moara Domneasca" and also are cultivated in small areas in East and South-Eastern part of Romania. Each trial consists in sample of 100 kg fresh fruits harvested in the stage of proper maturity for each variety, in the summer conditions of 2008.

Each trial was placed in three experimental conditions: 1-chilly room (V1, V4), 2-refrigeration (V2, V5), 3-controlled atmosphere (V3, V6). The V0 variant is the stage of fresh fruits, immediately after harvest, when the fruit is perfectly balanced for fresh consumption. Each experimental condition had an optimal number of days of storage, recommended by some previous scientific results and scientific papers. The storage conditions were programmed in order to maintain the level of hydro-thermo parameters and also the composition of atmosphere (table 1-4).

The storage hydro-thermo parameters were: 60-70% relative humidity, 25-27°C temperature. In refrigerated spaces the parameters for preserving trials were: 90% relative humidity, 3°C temperature. The third experimental condition, controlled atmosphere, had the following technical characteristics: 90% relative humidity, 3°C temperature, 4% CO₂ - as increased level of CO₂ in atmosphere.

Tasting appreciation was made using the taste grill, each variant being noted by 3 criteria: general aspect, texture and taste. The appreciation was made using the 100 points scale. The qualifying was established in correlation with the pointing level and according the classification where the taste appreciation is divided in four main groups: very good (80-100 points); good (60-79 points); acceptable (40-59 points); mediocre (20-39 points); improper (0-19 points).

For each trial, there were made specific determinations concerning: level of mass loss and depreciation, evolution of structural and textural firmness, evolution of main biochemical components of fruits (total solids, total sugar, total acidity and ascorbic acid) and also taste parameters (aspect, firmness and taste).

The evolution of total solids contents of fresh perishable fruits during the storage period, measured in percent, was made with ABBE refractometer. The content of total sugar of trials, measured in percent, was made using Bertrand. The evolution of total acidity from the moment of harvesting until last day of storage for each sample was determinate using volumetric method and results were measured in g malic acid/100g commodity.

The ascorbic acid content was determinate using the spectrophotometer by measuring the intensity of chloroform coloration (the extraction of the ascorbic

acid was realized with oxalic acid solution and treatment with indophenolic stain extracted from chloroform). The results were measured in mg/100g commodity.

The results concerning the evaluation of the fruits quality parameters during the storage, for strawberry and cherry varieties, can be used as guidelines in proper selecting of the storage method in some specific conditions of the horticultural farms.

RESULTS AND DISCUSSION

1. Analyze of the shelf-life strawberry varieties after the storage period

There were measured seven quality parameters in order to analyze the evolution of strawberry fruits stored under the three experimental conditions. The selected duration of strawberry fruits storage, measured in days, for each experimental condition was: 3 days in chilly room; 7 days in refrigeration; 21 days in controlled atmosphere (table 1).

The highest mass losses during the storage period on strawberry fruits were noted on Premial variety (V4 -10.37%), after 3 days of storage in chilly rooms. The mass losses in the case of controlled atmosphere storage, after 21 days, were low for both strawberry varieties, being noted as significant at Magic variety, with 0.73% of mass loss.

The evolution of fruits firmness measured in penetrometer degree is appreciated as favorable for V2 and V5 variant, for both varieties, with a favorable difference for Premial variety in V5 variant (+23,2).

The general taste appreciation was marked as superior the 88 pointing for Magic variety, V2 variant. The pointing was low for both varieties stored 3 days in chilly rooms (V1- Magic variety 65.5 points and V6 - Premial variety 63.34 points).

The biochemical analysis was made in two moments of post-harvest life of strawberry fruits: first immediately after harvest and second on the 21st day of storage, for each variety and experimental condition and indicates that the storage method influence the evolution of some biochemical components of fruits (table 2).

The lowest modification of total solids content was noted on the case of highest duration of storage in controlled atmosphere condition, being indicated also by the differences calculated between V0 and V1-V6.

The total acidity has increased during the storage period for all variants with different values. The highest increasing for total acidity was recorded on Magic variety (V2 - 0.17%).

The increasing of total sugar content has noted as significant values on Magic variety (+1.39%) in the case of controlled atmosphere storage conditions on 21st day of storage. The content of total sugar for Premial variety indicates a lowest increase for all variants.

The content of ascorbic acid indicates a decrease with 4.89 mg/100g on Magic variety, from the harvest moment until the 21st day of the storage, and also for the same experimental variant, 3.09 mg/100g on Premial variety (table 2).

Table 1

Results concerning some quality parameters during the strawberry fruits storage, Didactic and Experimental Station Moara Domneasca, 2008

Variant	Duration of storage (days)	Mass losses (%)	Firmness (penetrometer degrees)		Taste appreciation (pointing)	
			Values	Difference by V ₀	Values	Difference by V ₀
Magic variety						
V ₀ -on harv.	0	0	146.2	0	89.67	0
V ₁ -chilly rms.	3	6.76	261.8	+115.6	65.50	-24.17
V ₂ -refriger.	7	7.59	193.2	+47	88.00	-1.67
V ₃ -contr. atm.	21	0.73	205.1	+58.9	70.50	-19.17
Premial variety						
V ₀ -on harv.	0	0	178.7	0	75.83	0
V ₄ - chilly rms.	3	10.37	348.6	+169.9	63.34	-12.49
V ₅ -refriger.	7	10.09	201.9	+23.2	80.40	+4.57
V ₆ -contr. atm.	21	0.93	238.3	+59.6	68.50	-7.33

Table 2

Results concerning the main biochemical components during the strawberry fruits storage, Didactic and Experimental Station Moara Domneasca, 2008

Variant	Total solids (%)		Total acidity (g malic cid/100g)		Total sugar (%)		Ascorbic acid (mg/100g)		Duration of storage (days)
	Value	Difference by V ₀	Value	Difference by V ₀	Value	Difference by V ₀	Value	Difference by V ₀	
Magic variety									
V ₀ -on harv.	8.4	0	0.82	0	4.24	0	42.30	0	0
V ₁ -chilly rms.	9.9	+1.5	0.96	+0.14	5.38	+1.18	69.25	26.95	3
V ₂ -refriger.	9.9	+1.5	0.99	+0.17	5.50	+1.26	69.15	26.85	7
V ₃ -contr. atm.	8.3	-0.1	0.90	+0.08	5.63	+1.39	37.41	-4.89	21
Premial variety									
V ₀ -on harv.	8.4	0	0.84	0	4.49	0	43.80	0	0
V ₄ - chilly rms.	9.2	+0.8	0.85	+0.01	4.87	+0.38	60.10	16.3	3
V ₅ -refriger.	9.3	+0.9	0.88	+0.04	5.00	+0.51	59.20	15.4	7
V ₆ -contr. atm.	8.5	+0.1	0.90	+0.06	5.00	+0.51	40.71	-3.09	21

2. Analyze of shelf-life of cherry varieties after the storage period

The evolution of cherry fruits from varieties Stella and Daria, in selected experimental conditions was reflected by some quality parameters. The duration of cherry fruits storage, selected for each experimental condition was: 4 days in chilly room; 11 days in refrigeration; 30 days in controlled atmosphere.

The biggest mass losses during the storage period on strawberry fruits were noted on Daria variety (V4 - 9.58%), after 3 days of storage in chilly rooms. The mass loss in the case of controlled atmosphere storage after 30 days, were low for both strawberry varieties, being noted as significant Stella variety, with just 0.73% of mass loss.

The evolution of fruits firmness measured in penetrometer degrees is appreciated as favorable for V3 and V6 variant, for both varieties, with a favorable difference for Stella variety in V3 variant (+11,9).

The general taste appreciation has marked as superior the 88 pointing for Daria variety, V5 variant. The lowest pointed was noted on Daria variety stored 30 days in controlled atmosphere condition (V6 variant) (table 3).

Table 3

Results concerning some cherry fruits quality parameters during the storage, Didactic and Experimental Station Moara Domneasca, 2008

Variant	Duration of storage (days)	Mass losses (%)	Firmness (penetrometer degrees)		Taste appreciation (pointing)	
			Value	Difference by V ₀	Value	Difference by V ₀
Stella variety						
V ₀ -on harv.	0	0	327.2	0	88.14	0
V ₁ -chilly rms.	4	7.18	487.8	+160.6	90.50	+2.36
V ₂ -refriger.	11	6.67	379.2	+52	90.57	+2.43
V ₃ -contr. atm.	30	0.28	339.1	+11.9	79.00	-9.14
Daria variety						
V ₀ -on harv.	0	0	340.7	0	97.57	0
V ₄ - chilly rms.	4	9.58	430.6	+89.9	85.67	-11.9
V ₅ -refriger.	11	7.18	389.9	+49.2	92.86	-4.71
V ₆ -contr. atm.	30	1.27	363.3	+22.6	84.00	-13.57

The biochemical analysis was made in two moments, first immediately after harvest moment and second on the 30th day of storage period, for each variety and experimental condition and results suggest that the storage method influence the evolution of some biochemical components of cherry fruits (table 4).

The storage during 30 days in controlled atmosphere indicates the lowest modification of total solids content by making differences between V0 and V3, on Stella variety (V3).

The increasing of total acidity, comparing with V0 variant during the storage period was higher on Stella variety (+0.21%) for V3 variant. The increasing of total acidity was low on Daria variety (V2 - 0.17%) for all experimental variants.

The increasing of total sugar content noted significant values on Stella variety (+0.31%) in the case of controlled atmosphere storage conditions in 30th day of storage. The content of total sugar for Daria variety indicates a decrease for all variants, the higher decrease being recorded for V6 variant.

Content of ascorbic acid, indicates the higher decreasing (-6 mg/100 g) on Stella variety, from the harvest moment until the 30th day of the storage in controlled atmosphere, and 5.44 mg/100 g for the same experimental variant in the case of Daria variety (table 4).

Table 4

Results concerning the main biochemical components during the cherry fruits storage, Didactic and Experimental Station Moara Domneasca, 2008

Variant	Total solids (%)		Total acidity (g malic cid/100g)		Total sugar (%)		Ascorbic acid (mg/100g)		Duration of storage (days)
	Value	Difference by V ₀	Value	Difference by V ₀	Value	Difference by V ₀	Value	Difference by V ₀	
Stella variety									
V ₀ -on harv.	15.8	0	0.34	0	8.74	0	14.72	0	0
V ₁ -chilly rms.	14.75	-1.05	0.41	+0.07	8.74	0	12.57	-2.15	4
V ₂ -refriger.	14.60	-1.2	0.38	+0.04	8.99	+0.25	12.31	-2.41	11
V ₃ -contr. atm.	15.20	-0.6	0.55	+0.21	9.05	+0.31	8.72	-6	30
Daria variety									
V ₀ -on harv.	16.5	0	0.41	0	10.7	0	15.29	0	0
V ₄ - chilly rms.	17.3	+0.8	0.49	+0.08	9.12	-1.58	12.42	-2.87	4
V ₅ -refriger.	17.1	+0.6	0.46	+0.05	8.93	-1.77	10.97	-4.32	11
V ₆ -contr. atm.	17.2	+0.7	0.47	+0.06	9.62	-1.08	9.85	-5.44	30

CONCLUSIONS

1. The evolution of fruits quality parameters reflected by the differences of each experimental variant (3 days storage in chilly room, 7 days storage in refrigeration, 21 days storage in controlled atmosphere) and V₀ variant (immediately after harvest) can be appreciate as favorable for Magic, strawberry variety and Daria, cherry variety.

2. The storage during 21 days under refrigeration and controlled atmosphere (90% relative humidity, 3°C temperature, 4% CO₂ - as increased level of CO₂) preserve the fruits shelf-life of strawberry varieties.
3. The storage during 30 days under refrigeration and controlled atmosphere (90% relative humidity, 3°C temperature, 4% CO₂ - as increased level of CO₂) preserve the fruits shelf-life of cherry varieties.

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