COMPARATIVE STUDIES REGARDING THE INFLUENCE OF FILM TREATMENTS ON APPLE FRUIT QUALITY OF GENEROUS AND STARKRIMSON VARIETIES STORED REFRIGERATED

STUDII COMPARATIVE PRIVIND INFLUENȚA UNOR TRATAMENTE PELICULARE ASUPRA CALITĂȚII FRUCTELOR DE MĂR DIN SOIURILE GENEROS ŞI STARKRIMSON PĂSTRATE FRIGORIFIC

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Abstract. *Among the newest procedures to prevent quality degradation during storage of horticultural products include the treatments with coating film. Films are edible and provide external tissue fortifications protecting the original product structure and texture, can prevent loss of moisture, are semi-permeable to gas, allowing controlled gas exchange between the product and the external environment. Also, provides a sterile surface, preventing losses due to pathogen attack. After harvest, before refrigerated at 2^0C, the apples of varieties Generous and Starkrimson were treated with three types of film: film of wax, film of carboxymethyl celullose and chitosan film. Physico-chemical analysis, after seven months of cold storage, have demonstrated that fruits treated has a higher quality compared to the control, with better firmness and high dry soluble substance and organic acids.*
Key words: statistical analysis, edible films, fruits quality

Rezumat. *Printre cele mai noi procedeele de prevenire a degradării calității produselor horticole pe timpul depozitării se numără şi tratamentele de acoperire a suprafeței cu peliculă inertă. Peliculele sunt comestibile şi pot oferi fortificații ale țesuturilor externe, protejând structura şi textura inițială a produsului, pot preveni pierderile de umiditate, sunt semipermeabile pentru gaze, permițând schimbul controlat de gaze dintre produs şi mediul exterior. De asemenea oferă o sterilitate de suprafață, prevenind pierderi importante datorită atacului de agenți patogeni. După recoltare, înainte de a fi introduse în celulele frigorifice, la temperatura de 2^0C, merele din soiurile Generos şi Starkrimson au fost tratate cu trei tipuri de peliculă: peliculă de ceară, peliculă din carboximetilceluloză şi peliculă din chitosan. Analizele fizico-chimice efectuate după şapte luni de păstrare frigorifică au demonstrat că fructele tratate pelicular prezintă o calitate superioară față de martor, printr-o fermitate mai bună şi un conținut ridicat în substanță uscată solubilă şi acizi organici.*
Cuvinte cheie*:* analiza statistică, pelicule comestibile, calitatea fructelor

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INTRODUCTION

The quality of the apples stored refrigerated is given, mainly, by physical-chemical parameters: acidity, dry soluble substance, structo-textural firmness, respiration intensity, degree of hydrolysis of starch (Anghel, 2011).

Values give us clues about the food and dietetics value of fruit studied, at the end of the storage period (Anghel, 2011).

In this study we proposed to analyze the influence of films treatments on quality of two varieties apple fruit, by statistical interpretation data from physico-chemical analysis, concerning the preserved fruit store.

By comparing the results obtained shall be established if the treatment carried out was of any significance or not statistically.

MATERIAL AND METHOD

The analyzed material was represented by the results of chemical analysis and physical measurements of two varieties of apple, Starkrimson and Generos, stored during by October 2010-April 2011 at the cold storage Sârca, SCDPP Iasi (Anghel, 2011).

Fruits were applied a treatment, with the following films: wax, chitosan and cellulose from carboxymethyl.

These variants were made a series of chemical and physical measurements, in order to assess the quality of fruit preserve, both during and at the end of this period.

The results obtained from these determinations have been processed statistically, with Fisher test, variance analysis – using ANOVA, in Excel application. This application is used for testing significant difference between multiple environments (Oancea, 2007).

Analysis of variance aims to analyse any differences that arise between the variants considered: to study the effect of film treatment on the quality of fruit, compared with blank variant (Jităreanu, 2006).

Statistical analysis was performed on the results of the following qualitative parameters: acidity, dry soluble substance and structo-textural firmness.

RESULTS AND DISCUSSIONS

As a result of the determinations in April 2011 (tab. 1), the values obtained for quality parameter dry soluble substance content (^{0}Bx) were:

Table 1

The dry soluble substance content (^{0}Bx) fruit of the Generos variety

Variant	Repetition 1	Repetition 2	Repetition 3
Blank	12,0	11,9	12,1
Treatment with wax film	14,0	13,9	14,1
Treatment with chitosan film	13,6	13,5	13,7
Treatment with CMC film	13,8	13,7	13,9

Influence of films treatments on the dry soluble residue content, at the end of the period of storage is represented as follows:

Table 2

Statistical results treatment of matching the values of dry soluble substance in the apple of Generos variety

Variant	F	F crit	P-value	Influence
Treatment with wax film	600	7,708647	0,00001	***
Treatment with chitosan film	384	7,708647	0,00003	***
Treatment with CMC film	486	7,708647	0,00002	***

*** - very significant influence

As a result of the determinations in April 2011 (tab. 3), the values obtained for quality parameter titrable acidity (g mailc acid/100 g poduct) were:

Table 3

The titrable acidity content (g mailc acid/100 g product) fruit of the Generos variety

Variant	Repetition 1	Repetition 2	Repetition 3
Blank	0,36	0,35	0,37
Treatment with wax film	0,40	0,39	0,41
Treatment with chitosan film	0,38	0,39	0,37
Treatment with CMC film	0,39	0,38	0,40

As regards the content of organic acids (tab. 4) noted that the operations carried out in this variety had a meaning less important.

Table 4

Statistical results treatment of matching the values of titrable acidity in the apple of Generos variety

Variant	F	F crit	P-value	Influence
Treatment with wax film	24	7,708647	0,00805	**
Treatment with chitosan film	6	7,708647	0,070484	Ns
Treatment with CMC film	13,5	7,708647	0,021312	*

** - distinctly significant influence

Ns – insignificant influence

* - significant influence

The most effective treatment proved to be the film of wax, with a distinctly significant influence, followed by treatment with carboxymethyl cellulose film that had a significant influence. Treatment with chitosan film showed no statistical significant influence, the organic acids content of apple fruit from variety Generous.

Aple`s structo-textural firmness (UP), measured in the last mount of cold storage (tab. 5) presented the following values:

Table 5

Structo-textural firmness values (UP) of fruit from Generos variety

Variant	Repetition 1	Repetition 2	Repetition 3
Blank	42	41	43
Treatment with wax film	38	39	37
Treatment with chitosan film	38	39	37
Treatment with CMC film	39	40	38

Wax film and chitosan films treatments (tab. 6) were statistically distinct significant differences from the blank, while treatment with carboxymethyl cellulose film had only a significant influence on fruit firmness of the apple of Generos variety.

Table 6

Statistical results treatment of matching the values of structo-textural firmness in the apple of Generos variety

Variant	F	F crit	P-value	Influence
Treatment with wax film	24	7,708647	0,00805	**
Treatment with chitosan film	24	7,708647	0,00805	**
Treatment with CMC film	13,5	7,708647	0,021312	*

** - distinctly significant influence

* - significant influence

The fruit of Starkrimson variety (tab. 7) were obtained the following values of soluble dried substance (^{0}Bx):

Table 7

The dry soluble substance content (^{0}Bx) fruit of the Starkrimson variety

Variant	Repetition 1	Repetition 2	Repetition 3
Blank	12,4	12,3	12,5
Treatment with wax film	14,6	14,7	14,5
Treatment with chitosan film	14,4	14,2	14,6
Treatment with CMC film	14,4	14,3	14,5

Table 8

Statistical results treatment of matching the values of dry soluble substance in the apple of Sarkrimson variety

Variant	F	F crit	P-value	Influența
Treatment with wax film	726	7,708647	0,0000112	***
Treatment with chitosan film	600	7,708647	0,0000164	***
Treatment with CMC film	600	7,708647	0,0000164	***

*** - very significant influence

For fruit of Starkrimson variety (tab 8) the influence of film treatment on dry soluble substance content was highly statistically significant.

Total organic acids content (g malic acid /100 g product) Starkrimson variety of fruits (tab 9) is as follows:

Table 9

The titrable acidity content (g mailc acid/100 g product) fruit of the Starkrimson variety

Variant	Repetition 1	Repetition 2	Repetition 3
Blank	0,20	0,21	0,19
Treatment with wax film	0,25	0,24	0,26
Treatment with chitosan film	0,21	0,20	0,22
Treatment with CMC film	0,22	0,23	0,21

Film wax treatment had a distinct significant influence on organic acids content of apple fruit from Starkrimson variety (tab.10).

The other two treatments analyzed - film of chitosan, respectively film carboxymethyl cellulose, showed statistically significant influences.

Table 10

Statistical results treatment of matching the values of titrable acidity in the apple of Sarkrimson variety

Variant	F	F crit	P-value	Influence
Treatment with wax film	37,5	7,708647	0,003602	**
Treatment with chitosan film	1,5	7,708647	0,287864	Ns
Treatment with CMC film	6	7,708647	0,070484	Ns

** - distinctly significant influence

Ns – insignificant influence

The structo-textural firmness of the fruit from variety Starkrimson in cold storage last month (tab. 11) has the following values:

Table 11

Structo-textural firmness values (UP) of fruit from Starkrimson variety

Variant	Repetition 1	Repetition 2	Repetition 3
Blank	38	39	37
Treatment with wax film	33	32	34
Treatment with chitosan film	35	36	34
Treatment with CMC film	37	36	38

Table 12

Statistical results treatment of matching the values of structo-textural firmness in the apple of Sarkrimson variety

Variant	F	F crit	P-value	Influence
Treatment with wax film	37,5	7,708647	0,003602	**
Treatment with chitosan film	13,5	7,708647	0,021312	*
Treatment with CMC film	1,5	7,708647	0,287864	Ns

** - distinctly significant influence

* - significant influence

Ns – insignificant influence

In the case structo-textural firmness of apple fruit (tab. 6) we see that the applied treatments have varying degrees of influence.

Treatment with wax film has the most influence on this parameter.

CONCLUSIONS

1. All treatments were generally applied significant influence on apple fruit studied, regardless of the variety of origin;

2. The soluble solids content to say that these treatments had the greatest impact, statistical analysis showing that all films have very significantly influenced the content of this parameter on both varieties studied;

3. The organic acid content, film treatments had better effect in Generous variety;

4. Regarding structo-textural firmness of apple fruit was significantly influenced significantly distinct, except carboxymethyl cellulose treatment in Starkrimson variety;

5. Generally, we can say that film treatments were applied different effectiveness depending on the variety, so the variety Generous relatively good results were obtained for all treatments, but the variety Starkrimson carboxymethyl cellulose film had no statistical influence than in terms of soluble substances content.

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