

STUDIES ON THE BEHAVIOR OF THE CHERRIES IN THE STORAGE WITH MODIFIED ATMOSPHERE OF CARBON DIOXIDE

STUDII PRIVIND COMPORTAREA FRUCTELOR DE VIȘIN LA PĂSTRAREA ÎN ATMOSFERĂ MODIFICATĂ ÎN DIOXID DE CARBON

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Abstract. *A number of previous studies have established that the transportation and storage of fruit at low temperatures is insufficient in many cases and has to ensure optimal part of the gaseous medium characterized by certain concentrations of oxygen, carbon dioxide and nitrogen. The researchs hows the results obtained from the fruit of the cherry maintained in a modified atmosphere of carbon dioxide at various concentrations and for different periods of maintenance. We intended to correlate the administration of carbon dioxide with the exposure time to his treatment so thatby alternating carbon dioxide – rich atmosphere to reduce losses. The experiments revealed a series of issues related to weight loss which had a decreasing proportion related to the size of the CO₂ concentration. Regarding the organoleptic analysis were found differences between the experimental values used.*

Key words: carbondioxide, cherry, storage

Rezumat. *O serie de cercetări anterioare au stabilit că transportul și păstrarea fructelor la temperaturi scăzute este în multe cazuri insuficientă și trebuie să se asigure o componentă optimă a mediului gazos caracterizat de anumite concentrații ale oxigenului, dioxidului de carbon și azotului. Cercetările efectuate prezintă rezultatele obținute la fructele de vișin menținute în atmosferă modificată cu dioxid de carbon în diferite concentrații și diferite perioade de menținere. S-a urmărit corelarea administrării dioxidului de carbon cu timpul de suprapunere la acest tratament astfel încât prin alternarea atmosferei bogate în dioxid de carbon cu atmosfera normală, să se reducă pierderile. În urma efectuării experimentelor au rezultat o serie de aspecte referitoare la pierderile în greutate care au avut o evoluție descendentă proporțional cu mărimea concentrației de CO₂. În ceea ce privește analiza organoleptică s-au constatat diferențe între valorile experimentale utilizate.*

Cuvinte cheie: dioxid de cabon, fructe de vișin, păstrare

INTRODUCTION

Transporting perishable fruit in modified atmospheres have been studied in recent decades by several researchers. They found that the transport and storage of fruit at low temperatures is insufficient in many cases and has to ensure optimal

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component of the gaseous medium characterized by certain concentrations of oxygen, carbon dioxide and nitrogen, the use of gas activities having an inhibitory effect on metabolic and pathogens (Peleg, 1985; Ryall and Pentzer, 1979; FAO., 1988).

The effect of carbon dioxide in high concentrations on the preservation of fruit and vegetables is known for a long time and is differentiated not only in terms of species but also on the various actions positive or negative exerted on fruit (Thayer and Rajkowska, 1999; Thompson, 1998; Pratella *et al.*, 1991).

The essential aspect of positive action highlighted by research in recent years relate mainly to the possibility of preventing parasitic deterioration and slowing the natural process aging.

The negative aspect is the pathophysiological type (phytotoxicity and induction of metabolic alterations).

In research done was attempted correlation of CO₂ management administration with time of submission to this treatment to eliminate shortcomings discovered.

MATERIAL AND METHOD

The research was conducted in laboratory conditions using the variety cherries 'Nana', regarding simulating conditions on the transport of cherries in modified atmosphere with carbon dioxide through intermittent treatment with this gas.

Were performed following conditioning room maintained:

V₀₁- Control variant - Desiccator with normal atmosphere in keeping with the duration of 3 days; V₀₂- Control variant - Normal atmosphere keeping in desiccator lasting 6 days; V₁ - Modified atmosphere with CO₂ at a concentration of 10% for 1 day and 3 days hold time; V₂ - Modified atmosphere with CO₂ at a concentration of 20% for 1 day and 3 days hold time; V₃ - Modified atmosphere with CO₂ at a concentration of 30% for 1 day and 3 days hold time; V₄ - Modified atmosphere with CO₂ at a concentration of 10% for 2 days and hold time 3 days; V₅ - Modified atmosphere with CO₂ at a concentration of 20% for 2 days and hold time 3 days; V₆ - Modified atmosphere with CO₂ at a concentration of 10% for 3 days and hold time 3 days; V₇ - Modified atmosphere with CO₂ at a concentration of 10% for 1 day and 6 days hold time; V₈ - Modified atmosphere with CO₂ at a concentration of 20% for 1 day and 6 days hold time; V₉ - Modified atmosphere with CO₂ at a concentration of 30% for 1 day and 6 days hold time; V₁₀ - Modified atmosphere with CO₂ at a concentration of 10% for 2 days and 6 days hold time; V₁₁ - Modified atmosphere with CO₂ at a concentration of 20% for 2 days and 6 days hold time; V₁₂ - Modified atmosphere with CO₂ at a concentration of 30% for 2 days and 6 days hold time.

There were observations and determinations in dynamic, on: appearance of fruit; firmness; organoleptic analysis; weight loss; fruit plant health.

RESULTS AND DISCUSSIONS

The research was conducted in laboratory conditions, cherries were sorted before starting experiments. They were carried out 3 replications for each version being stored in climate room at a temperature of 2 C. After one day (Table 1) or

two days (Table 2), carbon dioxide was removed by ventilation, with the aid of a compressor.

The first control on plant health of the fruit was performed after 3 days for variants V01, V1, V2, V3, V4, V5, V6, organoleptic analysis repeating it after 2 days (it is believed that within two days the fruit will be sold). During control was determined also the weight loss progress. The second inspection was carried out after 6 days for variants V02, V7, V8, V9, V10, V11, V12 followed by the same procedures.

Table 1

Losses realized in experiments on the behavior of cherries after treatment with CO₂ during one day

Option	Symbol	Total loss		Write-downs by					
				Weight loss		Impairment losses soaking		Mildwed losses	
		3 days	6 days	3 days	6 days	3 days	6 days	3 days	6 days
Control	V ₀ ₁	16,2	-	3,4	-	12,8	-	-	-
Modified atmosphere with CO ₂ -10%	V ₁	12,34	-	1,04	-	11,3	-	-	-
	V ₇	-	22,06	-	1,91	-	20,15	-	-
Modified atmosphere with CO ₂ -20%	V ₂	11,25	-	0,99	-	10,26	-	-	-
	V ₈	-	17,55	-	1,7	-	15,85	-	-
Modified atmosphere with CO ₂ -30%	V ₃	10,18	-	0,85	-	9,33	-	-	-
	V ₉	-	16,28	-	1,68	-	14,6	-	-

Table 2

Losses realized in experiments on the behavior of cherries after treatment with CO₂ during two days

Option	Symbol	Total loss		Write-downs by					
				Weight loss		Impairment losses soaking		Mildwed losses	
		3 days	6 days	3 days	6 days	3 days	6 days	3 days	6 days
Control	V ₀₂	-	26,9	-	4,6	-	22,1	-	0,2
Modified atmosphere with CO ₂ -10%	V ₄	13,4	-	0,98	-	12,6	-	-	-
	V ₁₀	-	18,57	-	1,86	-	16,71	-	-
Modified atmosphere with CO ₂ -20%	V ₅	12,11	-	0,9	-	11,21	-	-	-
	V ₁₁	-	17,45	-	1,68	-	15,77	-	-
Modified atmosphere with CO ₂ -30%	V ₆	11,41	-	0,81	-	10,6	-	-	-
	V ₁₂	-	17,17	-	1,65	-	15,52	-	-

Analyzing the data in Tables 1 and 2 we find:

- a downward trend of losses by weight, in proportion to increase in carbon dioxide concentration and with duration of treatment;
- for variants with CO₂ treatment during 2 days, weight loss percentage is slightly lower than the duration of treatment option for 1 day. The same observation applies to softening and, also, total losses, exception being 30% solution where the results were weaker;
- mold appeared only in control version (6 days of storage), so CO₂ atmospheres totally inhibit mold attack.

For evaluating the organoleptic, there were held tests after each Control version. Organoleptic analysis was repeated after 2 days (during the fruit is sold) under the same conditions. The appreciation was recorded in charts, highlighting: appearance, firmness and taste of the fruits, according tasting sheets (Table 3).

Table 3

Appreciation of cherries organoleptic qualities after three days keeping in modified atmospheres

Organoleptic qualities	V ₀₁	V ₁	V ₂	V ₃	V ₄	V ₅	V ₆
Apperance	12,85	12,00	13,14	13,71	13,57	15	12,42
Firming	27	28	29	30	28	29	29
Taste	38,57	34,71	36,85	33,14	37,14	35,57	27,14
Total	78,42	74,35	78,99	76,85	78,71	79,57	68,56
Ranking	4	6	2	5	3	1	7

In terms of appearance of V₅ variant (20% CO₂ and two days treatment) has the maximum score, other variants fits between nice and very beautiful.

Regarding firmness, variant V₃ (30% CO₂ and 1 day treatment) is close to very good (maximum score 35) and the other, between good and very good (range 28-35 points).

In terms of taste control, Control version, has the highest score and falls near good qualifier. The other variants are between acceptable and good (30-40 points).

Doing all scores, ranked, is the first version V₅ (20% CO₂ and 2 days treatment).

Table 4

Appreciation of cherries organoleptic qualities after 3 days in modified atmosphere and 2 days in normal atmosphere

Organoleptic qualities	V ₀₁	V ₁	V ₂	V ₃	V ₄	V ₅	V ₆
Apperance	12,6	10,6	12,6	11,4	11,4	13,2	13,8
Firming	21	26,6	27	27,2	28	28,2	30,8
Taste	38,5	36,14	37,87	30,71	35,57	37,14	30,0
Total	72,1	73,34	77,47	69,31	74,97	78,54	74,6
Ranking	6	5	2	7	3	1	4

Version V_5 (20% CO_2 with 2 days treatment) has the most beautiful appearance, even after the second test.

V_{01} and V_6 variants are between nice (12 points) and very nice (15 points). Regarding firmness, the version with the highest score is V_6 (30% CO_2 , 2 days treatment).

For taste, Control version kept the highest score and other variables approaching adjective "good". V_3 and V_6 variants had the qualifier "acceptable".

The first place is version V_5 (20% CO_2 and 2 days treatment), than closely was V_2 variant (20% CO_2 and 1 day treatment) and V_4 variant (10% CO_2 and 2 days treatment).

After 6 days of maintenance in modified atmospheres and two days in normal atmosphere have made the same tests which are presented in Table 5 and Table 6.

Table 5

Appreciation of cherries organoleptic qualities after 6 days in modified atmosphere

Organoleptic qualities	V_{02}	V_7	V_8	V_9	V_{10}	V_{11}	V_{12}
Appearance	14	14,14	14,57	14,57	15	15	14,57
Firming	24	26,71	30	30	31	32	26,71
Taste	45,71	41,42	40,0	37,14	38,57	38,57	37,14
Total	83,71	82,27	84,57	81,71	84,57	85,57	78,41
Ranking	4	5	2	6	2	1	7

Appearance has maximum at 2 versions: V_{10} and V_{11} , the others approaching „Very Nice”.

Version V_{11} (20% CO_2 and 2 days treatment) has the best score at the farm. In terms of taste, version Control has the highest score.

The variants V_7 and V_8 had between good and very good (40-50 points).

After ranking, V_{11} (20% CO_2 and 2 days treatment) ranks first, followed by variants V_8 and V_{10} with the same score.

Table 6

Appreciations of cherries organoleptic qualities after 6 days in modified atmospheres and two days in normal atmosphere

Organoleptic qualities	V_{02}	V_7	V_8	V_9	V_{10}	V_{11}	V_{12}
Appearance	13	13	13,5	13,5	13,5	14	13
Firming	26,83	29,16	30,0	29,16	29,16	30,0	29,16
Taste	43,33	41,33	40,0	33,66	40,66	40,33	36,33
Total	83,16	83,49	83,5	76,32	83,32	84,33	78,49
Ranking	5	3	2	7	4	1	6

After the second test, version V_{11} (20% CO_2 and 2 days treatment) looks the most beautiful.

In terms of firmness, V_8 and V_{11} variants are between good and very good. Taste has good value in Control version.

Consulting ranking, we found that version V₁₁ (20% CO₂ and 2 days treatment) is on the first place, followed by the V₈ variant (20% CO₂ and 1 day treatment).

After being held for five days in exicator, under high relative humidity and temperature in the laboratory (cca. 20°C) shows that fruits go through a physiological degradation process, which externalizes by highlighting surface stains fade. Referring to plant health, finds that after 5 days at 20 ° C, with 30% CO₂ and 2 days treatment, has the lowest percentage of fruit affected by pathogens.

Also, between the variants with 20 and 30% CO₂ and 1 day treatment, the differences are very small. After 9 days of maintenance in these conditions, the fruit surface was covered with a rich *Rhizopus mycelium stolonifer*.

CONCLUSIONS

Laboratory tests undertaken followed correlation of carbon dioxide during the administration of allegiance to the treatment of cherries, so that by altering carbon dioxide-rich atmosphere with normal atmosphere to eliminate or reduce the deficits detected in previous tests.

The conclusions after carrying out experiments with cherry are:

- losses decreased with increasing CO₂ concentration and duration of maintenance treatment;
- weight loss in variants with CO₂ are lower by 60% - 70% compared to losses in control variant;
- organoleptic properties of cherries are rated with the highest scores at variant with 20% CO₂ and 2 days treatment;
- the percentage of fruit affected by pathogens decreases with increasing CO₂ concentration and duration of maintenance treatment with 50-70% compared to Control variant;
- Optimal treatment for cherry version for transport is considered to be 20% CO₂ atmosphere maintained for 2 days and a temperature of approx. 2° C.

REFERENCES

1. Cociu V., Oprea Șt., 1989 - *Metode de cercetare în ameliorarea plantelor pomicele*. Ed. Dacia, Cluj, p. 29, 124-129.
2. Davarynejad G.H., Szabo Z., Nyeki J., Szabo T., 2008 - *Phenological Stages, Pollen Production Level, Pollen Viability and in vitro Germination Capability of Some Sour Cherry Cultivars*. Asian Journal of Plant Sciences, 7: 672-676.
3. Tofan Clemansa, 2001 – *Igiena și securitatea produselor alimentare*. Editura AGIR, Bucuresti, p. 56.
4. ***, 2009 – *Agricultura UE*. Comisia Europeană.