

INFLUENCE OF SMARTFRESH TREATMENT ON THE STORAGE OF “BRAEBURN” APPLES

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Summary: The study confirms that the treatment with SmartFresh (active ingredient 1-methylcyclopropene) of fresh apples stored in gastight rooms significantly delays the negative effects of ethylene, thus apples keep their firmness, taste, color and quality for a longer period of time.

Keywords: SmartFresh, ethylene, firmness, apples, storage, post-harvest treatments.

Introduction

Braeburn apple variety was bred in New Zealand in 1952 and became popular worldwide, including European Union with reported production volume of 322 thousand MT in 2015. The popularity of this variety is due to its attractive appearance and balanced taste. In the Republic of Moldova the Braeburn variety was registered in 2015 and is recommended for planting in the South of the country, particularly the districts of Basarabasca, Vulcănești, Cahul, Cantemir, Comrat, Leova, Ștefan-Vodă, Taraclia, Ciadâr-Lunga, Cimișlia and Căușeni. The fruits have medium size with weight of 160-165 g, conical extended form to spherical-conical. The skin is consistent, shiny, green-yellowish with a red/orange streaky appearance on up to 80% of surface. The pulp is white-creamy, firm, juicy, with a combination of sweet and tart flavor and very tasty. The harvest period of this apple in Moldova is the last week of October. In Moldova, this apple variety is planted on an area less than 100 ha, with an average yield of up to 60 MT/ha under intensive production schemes [1].

Being a new variety for the Republic of Moldova with specific production and storage characteristics, at the demand of the growing community, research was performed regarding the storage of Braeburn apples in regular atmosphere (control of temperature, relative humidity and air speed) which is the most used in the country [2].

The previous research undertaken in USA, Europe, and New Zealand has identified particular storage disorders, including Braeburn Browning Disorder and fungal rots. Post-harvest manipulation is essential for quality maintaining and fruits validity term extending, necessary for an efficient competing on UE market and in supermarket networks that are extending in CIS countries.

For vital activity decreasing of vegetal organisms, to avoid some physiological disorders, reduction of the intensity of breath, the fruits are stored in a refrigerate form, in refrigerated spaces with normal or controlled atmosphere. According to technical regulation «Fruits, vegetables and fresh mushrooms packing, transporting and storing», in general, apples are kept at 0...4°C, air relative humidity 85-93% up to 1 year [3]. Apples kept in refrigerated rooms with controlled atmosphere (CA) allows a longer storage than normal atmosphere, because besides temperature and air relative humidity is controlled with special systems and composition of the atmosphere in the room [4]. CA/ULO technologies (Controlled Atmosphere/ Ultra-Low Oxygen) are interesting for

Republic of Moldova, because allows producers to deliver competitive products in January-May period at the prices much higher than the harvest season.

The problem of application to CA technology is significantly hampered by high initial investments in renovation of old refrigerators. Alternative technologies, as SmartFresh, that don't require large initial investments, are very interesting for Republic of Moldova. Although it was recently introduced in practice (1999-2000 years), SmartFresh technology is widely used by all big apples producers in the world (UE, USA, China, Japan, Chile).

This scientific research had the goal to study the influence of treatment of Braeburn apples stored for 9 months in regular atmosphere with SmartFresh ethylene inhibitor (active ingredient: 1-methylcyclopropene, 1-mcp) on the key parameters that define the apple quality from harvest to consumer.

Materials and methods

Considering that SmartFresh is a growth regulator (ethylene inhibitor) applied on fruits stored in air-tight rooms, the research protocol was developed taking into consideration the following standards [5,6].

The apples were stored in regular atmosphere (RA) at 10C and 92% RH for 6 and 9 months, followed by storage at room temperature of 20C for 7 days (RA+NA).

Experiment set-up

Braeburn apples were harvested from the orchard of Farm-Prod Ltd located in Olănești, Ștefan-Vodă at optimal harvest parameters, including coloring.

In the same day, the apples were transported to the cold storage of the same company located close to the orchard, where the SmartFresh treatment was performed. Half of the harvested quantity was treated with SmartFresh for 24 hours at concentration of 1000 ppm, while the non-treated apples represented the control sample („Control”). After treatment, the apples of both variants („Control” and „SmartFresh”) were stored in the same room at the specified storage parameters described above.

Results and discussions

Exterior appearance

The evaluations at the end of the storage period has demonstrated the capacity of SmartFresh to maintain the background color of Braeburn apples close to the green color recorded at the harvest moment. In contrast, for „Control” apples, the background color went from green to yellow.

The evaluations also identified the capacity of SmartFresh treatment to reduce the incidence of greasiness. As result of maintaining of the background color and reduction of fruit greasiness, the treated Braeburn apples have a "fresher" appearance, more appealing to consumers.

Firmness

The evaluations at the end of the storage period has demonstrated the capacity of SmartFresh to maintain the firmness of Braeburn apples. Thus, the firmness of „Control” apples has decreased by 2.32 kg/cm² after storage for 24 weeks, while the firmness of treated apples decreased by only 0,48. The same characteristics was observed for all other storage periods (RA and RA + NA).

Table 1. Evolution of firmness (kg/cm²)

Variant	Harvest	RA, 24 weeks	RA, 24 weeks + NA, 7 days	RA, 36 weeks	RA, 36 weeks + NA, 7 days
Control	9.81	7.49	7.38	6.83	6.79
SmartFresh		9.41	9.33	8.95	8.88

Content of dry soluble substances

For all variants and all storage periods, the evaluations determined the increase of dry soluble substances content due to transformation of starch into sugars.

Table 2. Evolution of dry soluble substances content (%)

Variant	Harvest	RA, 24 weeks	RA, 24 weeks + NA, 7 days	RA, 36 weeks	RA, 36 weeks + NA, 7 days
Control	13.0	14.0	14.2	14.0	14.2
SmartFresh		13.3	14.1	14.0	14.2

Titration acidity as content of malic acid

As expected, the titration acidity decreased progressively during the storage, this being more pronounced for „Control” variant.

Table 3. Evolution of titration acidity as content of malic acid (%)

Variant	Harvest	RA, 24 weeks	RA, 24 weeks + NA, 7 days	RA, 36 weeks	RA, 36 weeks + NA, 7 days
Control	0.30	0.26	0.24	0.22	0.20
SmartFresh		0.28	0.27	0.26	0.25

Storage disorders

The evaluations determined the capacity of SmartFresh treatment to control some storage disorders. Thus the "Control" apples developed superficial scald on 48% of fruit after 24 weeks, while this disorder was not observed at „SmartFresh” variant, even after 36 weeks of storage.

Conclusions

The research has determined the positive influence of SmartFresh treatment for a series of apple quality parameters:

- a. Maintenance of apple firmness
- b. Maintenance titration acidity
- c. Maintenance of external appearance (background color, reduced greasiness)
- d. Control of physiological disorders (superficial scald).

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