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STUDIES REGARDING THE INFLUENCE OF PRE -HARVEST AND POST - HARVEST TREATMENTS UPON THE QUALITY OF SOME APPLE FRUIT VARIETIES

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Abstract

Losses during storage of fruits are still considerable in some cases: about 20 - 30% of all produced harvested worldwide is not consumed because of fungal or physiological disorders. In the present paper, we show the research results of the pre-harvest treatments using the products: Rover - 0.2%, Sumilex - 0.1% and Topsin - 0.1%, as well as the post-harvest treatments using: Rover - 0.2% and Sumilex - 0.1%. The treatments performed in the orchard before the harvesting period have had a major effect to reduce the percent of rotten fruits in the storehouse. The reduction was above 50% in the case of Rover - 0.2%, as compared with the untreated control. The studied apple varieties ('Jonathan', 'Generos' and 'Golden Delicious') originated from the private farmers in Voinesti - Dambovita.

Key words*: pre-harvest, post-harvest, rotten fruits.*

INTRODUCTION

The biggest part of apples production is intended for storage, which allows the commercialization for long periods after harvest (Hackbarth C. et al., 2017).
In the apple growth technology, the most important link is constituted by the phytosanitary treatments performed in the orchard, as well as during the storage period. The losses due to the fungus impact during the storage period are considerable, being up to 20% from the total yield.
Improving the cultural practices and choosing the best varieties has an important contribution to yield increase and to the fruit quality.
Pre-harvest and post-harvest phytosanitary treatments represent an indispensable link for apple culture.
Optimal postharvest treatments for fresh produce seek to slow down physiological processes of senescence and maturation, reduce / inhibit development of physiological disorders and minimize the risk of microbial growth and contamination (Mahajan et al., 2014).
Economical losses caused by parasite fungus justify the phytosanitary treatments during the vegetation period, but at the same time, imply a special care of diminishing the pesticide residuum on fruits (Bompeix G., 1985).
During storage period, apples can be attacked by a high number of fungus pathogens that cause their diseases. Infection can begin from the orchard or during transport and storage period (Franchet J., 1991).

MATERIALS AND METHODS

The experience was carried out at Voinesti, in the private orchards of some members of The Dambovita Fruit Growing Association.
The purpose of this experience was that of evaluating the apple fruits storage capacity and the maintenance of quality, following the phytosanitary treatments applied in the orchard and after harvest, in the autumn of the year 2017. Fruits samples were also analysed, with a view to appreciate the physicochemical characteristics, at the end of the storage period, for 'Jonathan', 'Golden Delicious' and 'Generos' varieties.
In our country the traditional variety is 'Jonathan' (20%), but in the last decades new and valuable varieties have been introduced,

such as 'Generos', 'Florina' and so on. These feature a genetic resistance to scab (Stanica Fl., 2011).

It is necessary to mention that in the orchard the treatments were performed on 0.5 ha/ farmer, and after harvest the fruits were exposed to phytosanitary treatments, 100 kg fruits on each variety.

The fungicides used pre-harvest were Rover 0.2%; Sumilex 0.1% and Topsin 0.1%.

These were applied 20 days before harvesting and are recommended to prevent and control the major apple fruits storage diseases, produced by fungus: *Penicillium* sp.*; Botrytis cinerea* and *Gloeosporium album*.

The fruits were stored in a unit with natural ventilation, with the following conditions: temperature 14 - 15^{0}C and air relative humidity 70 - 75%.

Spraying was performed as a post-harvest treatment, using the products: Rover 0.2% and Topsin 0.1%. For the two experimental variants both the fruits and the packaging were treated.

RESULTS AND DISCUSSIONS

As far as the pre-harvest treatment is concerned, from the data presented in Table 1 it can be noticed that for all varieties, the best results were obtained with the product Rover at 0.2%.

The attack percent was 6.8% in the case of 'Jonathan'; 6.9% for 'Generos' and 9.2% for 'Golden Delicious', but after different storage period, depending on the variety.

From the tested products, the poorest results were obtained in the case of Topsin, the apple fruits being attacked in a percent of 8.6% - 'Jonathan'; 9.4% - 'Generos' and 11.3% - 'Golden Delicious'.

The Sumilex product was more efficient than the fungicide Topsin, but less efficient than the Rover product.

Table 1. Pre-harvest treatments efficacy during storage period

Variety	Variant	Concentration (%)	Storage period (days)	Rotten fruits (%)
'Jonathan'	Control	-	80	17.2
	Rover	0.2	80	6.8
	Sumilex	0.1	80	7.0
	Topsin	0.1	40	8.6
'Generos'	Control	-	60	14.0
	Rover	0.2	60	6.9
	Sumilex	0.1	60	7.9
	Topsin	0.1	60	9.4
'Golden Delicious'	Control	-	95	19.0
	Rover	0.2	95	9.2
	Sumilex	0.1	95	10.4
	Topsin	0.1	95	11.3

We can state that the treatments performed in the orchard before harvest period have had a major effect on reducing the percent of rotten fruits in the storehouse. The reduction was above 50% in the case of Rover 0.2%, as compared with the untreated control.

Also, it was observed that 'Jonathan' cv. the principal pathogen was *Penicillium* sp. which produce the moist rot, while for 'Golden Delicious', the most important was the lenticelary rot produced by the fungus *Gloeosporius album*.

If we consider the storage period, that was 80 days for 'Jonathan', 60 days for 'Generos' and 95 days for 'Golden Delicious', we can say that the last variety had a very good behaviour during storage, in relation with the major pathogens.

As concerning the post-harvest treatment, as it can be observed in Table 2, these were more efficient than those performed during the vegetation period, on the same product and at the same concentration.

The Rover product in a concentration of 0.2% stood out again and it gave the best results. 'Golden Delicious' had a high percent of rotting fruits, as a consequence of the longest storage period.

Table 2. Pre-harvest treatments efficacy during storage period

Variety	Variant	Concentration (%)	Storage period (days)	Rotten fruits (%)
'Jonathan'	V1-Control	-	80	13.2
	V2-Rover (fruits)	0.2	80	5.9
	V3 –Rover (wraps+fruits)	0.2	80	1.6
	V4 –Sumilex (fruits)	0.1	80	6.6
	V5 – Sumilex (wrap+fruits)	0.1	80	3.4
'Generos'	V1-Control	-	60	11.2
	V2-Rover (fruits)	0.2	60	5.8
	V3 –Rover (wraps+fruits)	0.2	60	1.2
	V4 –Sumilex (fruits)	0.1	60	6.6
	V5 – Sumilex (wrap+fruits)	0.1	60	2.8
'Golden Delicious'	V1-Control	-	95	14.2
	V2-Rover (fruits)	0.2	95	7.2
	V3 –Rover (wraps+fruits)	0.2	95	1.9
	V4 –Sumilex (fruits)	0.1	95	8.5
	V5 – Sumilex (wrap+fruits)	0.1	95	3.8

From the present data it can be noticed that the pre-harvest and especially the post-harvest treatments - including wraps disinfecting - are efficient to control pathogens during storage period. Finally, at the end of the storage period, physicochemical tests were run, with a view to characterise the fruit quality. Results are presented in Table 3 and Table 4.

It was emphasized that during the storage period, the water contents decreased and there was a higher soluble carbohydrate content, a diminishing of fruits weight as a consequence of water losses, and a decrease of fruits firmness because of pectin's enzymatic breakdown.

In the case of fruit originated from the treated variants, the fruit storage capacity was better and the qualitative characteristics were higher as compared to the untreated control.

Table 3. Fruits chemical analysis

Variety	Water content (%)	Total dry weight (%)	Soluble dry weight (%)	Total acidity (%)	Acid ascorbic (mg/100 g fw.)	Minerals (%)
'Jonathan'	81.40	18.60	15.60	0.27	3.96	0.25
'Generos'	80.50	19.50	14.90	0.43	4.76	0.27
'Golden Delicious'	78.60	21.40	15.10	0.18	4.25	0.23

Table 4. Fruits physical analysis

Variety	Mean weight (g)	Specific weight (g/cm^3)	Firmness (kgf/cm^2)
'Jonathan'	120	0.744	3.9
'Generos'	135	0.780	3.7
'Golden Delicious'	138	0.760	3.6

CONCLUSIONS

The treatments performed in the orchard before the harvesting period have had a major effect to reduce the percent of rotten fruits in the storehouse. The reduction was above 50% in the case of Rover 0.2%, as compared to the untreated control.

For all varieties, the lower rotting percentage has been registered for the variant were both the fruits and the wraps were treated, because these are an important source of pathogen infection.

In the case of fruit originated from the treated variants, the fruit storage capacity was better and the qualitative characteristics were higher as compared with the untreated control.

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