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THE SUITABILITY OF APRICOT FOR DRIED FRUIT PRODUCTION BY THE COMBINED TECHNOLOGY

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Abstract: The apricot is considered as one of the most delicious temperate fruit, a highly appreciated stone fruit and a valuable raw material for processing. The Republic of Serbia is one of the leading apricot producers in Southeast Europe, but the assortment is limited by a small number of cultivars harvested, mostly in the ripening season of "Magyar kajszi". In order to introduce the most suitable cultivars in the production, having high yield and high quality for consumption and various forms of processing, introduced and domestic cultivars have been intensively studied. In Serbia, apricots are mostly marketed fresh and processed for jams and spirits, but demand for high-quality dried fruits is increasing. To preserve the nutritional and sensory quality of fresh apricots, choosing the best drying technique is significant, and the most preferred technique is the reduction of moisture through convective drying. The aim of the paper was to compare the potential of the apricot cultivars "Magyar kajszi", "Novosadska rodna", "NS-4" and "NS-6" for dried fruit production by two-phase technology – combined osmotic and convective drying, as well as the profitability of apricot drying on small family farms. Cultivars "NS-4" and "Novosadska rodna" were found to be suitable for combined drying technology. The highest score in the sensory evaluation of the dried apricots was given to "NS-4", and then to "Novosadska rodna". The results indicate that the combined osmotic and convective drying of apricot rather than selling fresh fruits can be a profitable and important added value tool for small family farms.

Key words: fruit, osmotic and convective drying, profitability, *Prunus armeniaca.*

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Introduction

The apricot (*Prunus armeniaca* L.) is considered as one of the most delicious temperate fruits, highly appreciated for its taste and aroma. Apricot characteristic flavour is a complex of sugars, organic acids, phenolic compounds, and volatiles, among others, which differ greatly among cultivars (Roussos et al., 2016). Apricots are rich in carbohydrates, minerals and β-carotene (Drogoudi et al., 2008). Due to harmonised chemical composition, apricots are appreciated stone fruits and a valuable raw material for further processing by drying (Milić and Vukoje, 2008). Apricots are mainly grown in the Mediterranean Basin and regions with moderate climate including ex-Soviet Union countries, Iran, China, Japan, South Africa and the United States (Asma, 2007). Turkey (16.6% of worldwide production) has been the leading producer in the last 10 years, according to the FAO (2020).

The Republic of Serbia is one of the leading apricot producers in Southeast Europe, with an average annual production of 30.000 t (FAO, 2020). The apricot assortment in Serbia is characterised by a small number of cultivars having a short period of maturation (Milatović et al., 2012). Most apricots are harvested in the season of "Magyar kajszi", which is the most grown cultivar, or ten days afterwards. To improve the assortment, the creation of new domestic cultivars conducted 30 years ago resulted in eleven new apricot cultivars released so far. In order to introduce the most suitable cultivars in the production, having high yield and high quality for consumption and various forms of processing, introduced and domestic cultivars have been intensively studied (Milatović et al., 2012, 2015; Rahović et al., 2013).

Apricot is a climacteric fruit, and while it is fresh, it cannot be stored for a long time, partly due to a high respiration rate and a rapid ripening process. Drying is one of the oldest techniques to prolong the shelf life of foods. It is a complex technological method that reduces the moisture level to preserve the natural characteristics of fruit so that the final product has high-quality physical, chemical, structural, mechanical and organoleptic characteristics. For its biochemical structure, the apricot is considered very suitable for drying. It features a high content of provitamin A, vitamin C, as well as a complex of other vitamins that are beneficial to human organisms (Pavkov et al., 2009). In order to preserve the nutritional and sensory quality of fresh apricots, it is necessary to choose the most suitable drying technique (air-drying, vacuum drying or freeze-drying) and optimise the drying conditions (Sablani, 2006). The most preferred technique is the reduction of moisture through convective drying (Mundada et al., 2010), but applied as the sole technological drying operation produces dried apricots of unsatisfactory quality. Using combined drying technology with osmotic drying as one of the fundamental technological operations rectifies this problem (Babić et al., 2006; Riva et al., 2005). In 2002, The Faculty of Agriculture in Novi Sad began developing a new technology of combined drying of fruits (Babić and Babić, 2003; Babić et al., 2005), comprising osmotic and convective drying. Osmotic drying is one of the possible methods for preparing fruits for convective drying and was traditionally used to improve the nutritive and sensory quality of fruits (Peiro-Mena et al., 2006). It reduces the negative influence of heat on flavour and colour, inhibits the browning of enzymes and decreases energy costs (Khan, 2012). Osmotic dehydration is a method used to partially remove water from plant tissues by immersion in a hypertonic sugar and/or salt solution to reduce the moisture content of foods before the actual drying process. This technique enhances the mass transfer rate and shortens the duration of drying time. Also, the quality of osmotically dehydrated products is better, and shrinkage is considerably lower as compared to products dried conventionally. Moreover, the air incorporated in the porous structure of the tissue leaves the tissue after immersion that provides a larger surface area for osmotic drying (Ramaswamy and Van Nieuwenhauzen, 2002). This technique helps to conserve the overall energy relative to other drying procedures.

In Serbia, apricots are mostly marketed fresh, but also, the dominant markets for domestic apricots are distilleries. Recently, there has been an increasing demand for high-quality dried fruits. Drying of apricots is economically justified, especially when performed in dryers suitable for family farms (Milić et al., 2007; Vukoje and Pavkov, 2010). Combined drying on family farms can be very profitable, engaging 2–3 family members at the same time over the year.

The aim of the research was to compare the potential for combined (two-phase) drying of some newly released apricot cultivars and the most often planted "Magyar kajszi", and to select the ones whose fruits can be used for dry apricot production. Also, we analysed the possibility of increasing family farm profitability by switching from selling fresh apricots to on-farm fruit processing and selling dry apricots, having added value.

Materials and Methods

Plant material

Apricot cultivars "Magyar kajszi", "Novosadska rodna", "NS-4" and "NS-6" were studied for three years. Fruits were collected in the orchard in full production. The trees were grafted onto Myrobalan seedlings (*Prunus cerasifera*), with the plum cultivar "Stanley" used as an interstock and planted at a spacing of 5×4 m. The orchard was under irrigation and was maintained using standard management practices, including disease and pest control. The fruits were harvested when the ground colour changed to yellow-green, and fruit firmness was still high. After harvesting, a sample of 30 fresh fruits, of each cultivar, was taken in order to determine the initial weight and moisture content. Weight was measured on an analytical balance, while moisture content was determined by the thermal-gravimetric method.

Drying

Drying of apricot fruits was carried out at the Laboratory for Bio-systematic Engineering, Department of Agricultural Technique, Faculty of Agriculture, Novi Sad. The flow chart of apricot drying is presented in Figure 1.

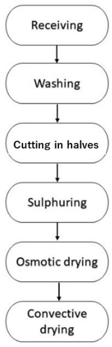

Figure 1. The flow chart of apricot drying.

The fresh fruit was washed under a water stream and spread in a single layer for drying. Too ripe or immature ones were eliminated from further processing. After washing, 5 kg of fruit was cut along the suture, the stone was removed, and the end of the petiole of the fruit was cut off. For the purpose of monitoring the changes in the moisture content of the apricot halves, a laboratory dryer and an analytical balance were used. The analytical balance was used to measure the weight of empty dishes and the weight of dishes containing fresh samples. The dishes with the samples were then put into the laboratory dryer, previously heated to 80°C. The weight of the dishes with dried samples was also determined. The moisture of the halves was calculated as the difference in the weight of the samples before and after drying, according to the following equation:

$$\omega = \frac{(m_0 - m_p) - (m_1 - m_p)}{(m_0 - m_p)} \times 100 \quad (1)$$

where:
ω – the moisture of the halves [%];
m_0 m_1 – the weight of the material and the dish [g] before and after drying;
m_p – the weight of an empty dish [g].

Then the halves that had been placed in a plastic woven container were treated with 2 g kg^{-1} of powdered sulfur dioxide. The chamber was closed airtight. Sulphuring lasted for four hours, and after that, the batch was unloaded from the chamber. All apricot halves were manually removed and placed in a single layer in order to collect surface moisture by tissue.

The preparation of the osmotic solution with the sucrose concentration of 50°Bx comprised the preparation of the fresh solution or adjusting the used one. Per 10 kg of apricot halves, the fresh osmotic solution was prepared by dissolving 20 kg of sucrose in 40 l of distilled water, while for adjusting sucrose concentration in already used osmotic solution, 350 g of sucrose (on average) was used. The osmotic solution was then heated to 50°C in the osmotic dryer. The drying lasted for 2 hours, then the weight of the halves was measured. Convective drying using the laboratory dryer "IVA-2" lasted for 24 hours at the temperature of 50°C. After 24 hours, the halves were taken out of the dryer and the weight of the halves was measured.

The descriptive sensory evaluation of the dried apricots was conducted by scoring: for colour – max 7, aroma – max 4, taste – max 4, and attractiveness – max 5. Sensory evaluation was conducted on the sample of five halves per cultivar by five independent experts.

Data analysis

Data for all measurements were expressed as average values. The obtained results were processed by ANOVA in the statistic program STATISTICA Version 6.0 for Windows (Stat Soft Inc., Tulsa, Oklahoma). The LSD test was used to detect significant differences ($p \leq 0.05$) between the values. The economic analysis of the profitability of drying apricot includes a compilation analysis for drying different apricot cultivars using the same equipment.

Results and Discussion

Fruit ripening is associated with several phenomena such as changes in respiration, ethylene production, soluble solids, sugars and beta-carotene contents (Dinnella et al., 2006). The ripening induced texture softening, which is associated with pectin depolymerisation and solubilisation. The ripening phase had a significant influence on the drying characteristics of apricot fruits, and the maturity grading before drying is an essential step to ensure the homogeneous drying process and its efficiency (Deng et al., 2019). Based on the results of Bureau et al. (2006) and Egea et al. (2006), the fruits for drying were harvested at the phase closer to the full ripening, when they had a small area of straw-green skin and hard texture. Before and during fruit drying, a change in moisture content was observed.

As shown in Table 1, the highest content of moisture in fresh fruit was found in "NS-6" (89.39%) and the lowest in "NS-4" (86.25%). After osmotic drying, the loss of moisture was highest in "Novosadska kasnocvetna" amounting to 2.95% and the lowest in "NS-4" (1.94%).

Table 1. The moisture content in fresh and dried apricot fruits (%).

Cultivar/selection	Moisture of fresh fruit	Moisture after osmotic drying	Loss of moisture after osmotic drying	Moisture after convective drying	Loss of moisture after convective drying
NS–4	86.25a*	84.31a	1.94b	36.37a	49.88a
NS–6	89.39a	87.32a	2.07b	35.87a	53.52a
N. rodna	87.94a	85.54a	2.40b	36.00a	51.94a
N. kasnocvetna	88.62a	85.67a	2.95a	35.42a	53.20a
Magyar kajszi	87.82a	85.27a	2.55b	36.92a	50.90a

*Different letters in the same column denote a significant difference according to the LSD test, $p < 0.05$.

Total moisture after combined drying ranged from 35.42% ("N. kasnocvetna") to 36.92% ("Magyar kajszi"). Convective drying resulted in the highest moisture loss in "NS-6" (53.52%) and "Novosadska kasnocvetna" (53.20%), without any statistically important differences. Compared to "Magyar kajszi", all the cultivars except for "NS-4" had a higher loss of moisture, which means they are more suitable for processing by using the combined method of drying. The moisture content in the dried fruits is a very important trait since it affects the taste (Rahović 2006; Rahović et al., 2013) and shrinkage (Janjai et al., 2009). Meteorological factors, especially precipitation, directly influence harvest duration and moisture content in fruits during fruit ripening (Đurić et al., 2005).

As shown in Table 2, the amount of dry fruit produced depended on the cultivar and ranged from 4.6 ("NS-4") to 5.7 kg ("Novosadska kasnocvetna").

Table 2. The weight of finally dried fruits and the drying ratio.

Cultivar/selection	Weight of dry fruit (g) produced from 5 kg of fresh fruit	Dry fruit yield (%)	Weight of fresh fruit per 1 kg of dry fruit (kg)
NS–4	1084.71a*	21.69a	4.6a
NS–6	921.34a	18.43a	5.4a
N. rodna	1027.38a	20.55a	4.9a
N. kasnocvetna	884.17a	17.68a	5.7a
Magyar kajszi	962.02a	19.24a	5.2a

*Different letters in the same column denote a significant difference according to the LSD test, $p < 0.05$.

“NS-4” and “Novosadska rodna” showed better results and were more suitable for drying in comparison to “Magyar kajszi” although a statistical difference among cultivars for the fresh/dry ratio was not observed. The dry fruit yield of evaluated cultivars was slightly lower than observed by Akça et al. (1999) for 15 apricot cultivars widely grown in Turkey that varied between 19.36% and 29.80%.

Descriptive sensory evaluation

Maintaining natural colour in dried food products is very important as the visual appearance is one of the first judgments made by consumers. Colour, size, gloss, shape, etc. form the appearance and represent a valuable indicative parameter used in quality control. One of the most challenging aspects of drying is performing the process to produce an attractive colour for the final product. An osmotic dehydration pre-treatment can improve the colour attributes in plant materials, as confirmed by Cano-Lamadrid et al. (2017) in their study on pomegranate arils. Considerable changes in the physical structure of the product, such as a reduction in volume, can occur during the drying process. The application of osmotic drying using sucrose as the first step during drying reduced the shrinkage and improved the rehydration capacity and sensory evaluation (Cano-Lamadrid et al., 2017).

The sensory evaluation of the finally dried fruits obtained from the tested apricot cultivars is expressed in scores and given in Table 3. The highest score for all the properties was given to the dried fruits of “NS–4“, followed by “Novosadska rodna”, “NS-6”, and “Magyar kajszi”, whereas the lowest score was given to “Novosadska kasnocvetna”.

Table 3. The descriptive sensory evaluation of finally dried apricot fruits.

Cultivar/Selection	Colour	Aroma	Taste	Attractiveness	Total score
NS–4	5.3a*	3.2a	3.4b	3.8ab	15.8b
NS–6	4.9a	3.0a	3.2b	3.5abc	14.6ab
N. rodna	5.6b	2.9a	2.9a	3.8ab	15.2ab
N. kasnocvetna	5.5a	2.9a	2.4a	3.2c	13.7ab
Magyar kajszi	4.8a	3.0a	2.8a	3.2c	13.8a

*Different letters in the same column denote a significant difference according to the LSD test, $p < 0.05$.

A statistically important difference confirmed that colour, taste and attractiveness are genotype-dependent. In line with the results of Inserra et al. (2017) that conclude that the sulphuring treatment significantly decreases the aroma compound profile of the dried apricots, scores varied in a small range and were not statistically different.

Economic analysis of drying apricots

Apricots are dried in the period from mid-July to mid-August. After that period, usually fruits with later ripening compared to apricot are dried, so it can be assumed that the equipment will be used for drying plums, apples and other fruits.

Table 4. The economic analysis of drying apricots.

No	Item	Rationale	Total cost
1	Fresh apricots	The capacity of dryers is 80 kg h^{-1}; for two shifts (16 hours per day), one can process 38,400 kg of fresh apricots per month. The price for 1 kg of fresh apricots (kg) – 0.98€	37,632 €
2	Sugar	Approximately 1500 kg for preparation of osmotic solution with the sucrose concentration of 50°Bx and adjustment after each loading. The price per 50kg of sugar – 26.72€	802€
3	Energy	The total energy consumption for two shifts (16 hours per day) is 1,200 kWh^{-1} per month. Energy cost – 0.376 € per kWh^{-1+}.	451.2 €
4	Labour	2 employees are needed for one shift (4 employees for 2 shifts^{++}). One seasonal worker salary is 400 € per month	1,600 €
5	Equipment maintenance	The maintenance of both driers is 20 € per month§.	20 €
6	Depreciation	The drying process is carried out with two types of drying machines: osmotic and conventional. The price for an osmotic dryer is 3,000 €, while the price for a conventional dryer is 4,000 €. The lifespan of a dryer was estimated to be twenty-five years with zero salvage value. It is assumed that the equipment will be used for drying other products around the year, and costs allocated to apricot drying are therefore set at 50%.	140 €
7	Interest	Taking into account the 2% annual interest rate, it is assumed that the equipment will be used for drying other products around the year, and costs allocated to apricot drying are therefore set at 50%.	70 €
8	Total cost per season		40,715.2 €
9	The quantity of “NS-4” dried apricots produced in a season		8,347.82 kg
	The market value of “NS-4” dried apricots produced in a season*		47,976.47 €
	The profit from drying “NS-4” apricots		7,261.27 €
10	The quantity of “Magyar kajszi” dried apricots produced in a season		7,384.61 kg
	The market value of “Magyar kajszi” dried apricots produced in a season		42,387.66 €
	The profit from drying “Magyar kajszi” apricots		1,672.46 €
11	The quantity of “Novosadska kasnocvetna” dried apricots produced in a season		6,736.84 kg
	The market value of “Novosadska kasnocvetna” dried apricots produced in a season		38,669.46 €
	The profit from drying “Novosadska kasnocvetna” apricots		-2,045.74 €

*(market price for 1 kg of dried apricots is 5.74 €), $^{+}$Osmotic dryers use 2 kWh^{-1} while convective dryers use 0.5 kWh^{-1}, $^{++}$The estimates have been made from practical experience, §The information provided by the dryer suppliers of both dryers.

The period of equipment depreciation is 25 years, with no salvage value left in the equipment. In this analysis, the equipment was used in two eight-hour shifts. Different ratios, fresh vs. dried, have mainly caused differences in profitability of three different cultivars, ranging from 4.6 (“NS-4”), 5.2 (“Magyar kajszi”) to 5.7 (“Novosadska kasnocvetna”). Based on economic analysis, a decision was made about which apricot cultivars were profitable to dry and which cultivar achieved the highest profit. According to the results from Tables 2 and 4, one can draw a conclusion that choosing the right apricot cultivar for drying is crucial. “NS-4” has the most favourable fresh-to-dry conversion rate and gives high profits per month (7,261.27 €), while “Magyar kajszi” has a moderate conversion rate, and one can make additional profits of 1,672.46 € if apricot fruits are dried instead of sold fresh. “Novosadska kasnocvetna” has an unfavourable conversion rate, so it is not suitable for drying and results in a loss of 2,045.74 €.

Conclusion

Based on the data provided in this research, it can be concluded that the highest content of moisture was found in the cultivar “NS-6” (89.39%) and the lowest in “NS-4” (86.25%) (measured using the thermal gravimetric method). Cultivars “NS-4” and “Novosadska rodna” are suitable for drying with a combined drying method since 4.6 and 4.9 kg of fresh apricots, respectively, are needed to obtain 1 kg of dried fruit. The highest score in the sensory evaluation of dried apricots was given to “NS-4”. Furthermore, the application of osmotic drying using sucrose as the first step during drying reduced the shrinkage and improved the rehydration capacity, as well as the sensory quality.

Drying apricots rather than selling fresh apricots, can be a profitable and important added value tool for small farms. According to the study, there is a significant difference between the profitability of drying of different cultivars. Therefore, choosing cultivars with better conversion rate can increase profitability of fruit drying.

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References

Akça, Y., Özkan, Y., & Asma, B.M. (1999). A study on determination of yield and fruit characteristics of certain Turkish dried apricot cultivars and types. *Acta Horticulturae, 488,* 129-1341.

Asma, M.B. (2007). Malatya: world's capital of apricot culture. *Chronica Horticulturae, 47,* 20-24.

Babić, Lj., & Babić, M. (2003). Coupled osmotic and convective drying of apricot. *Journal on Processing and Energy in Agriculture, 7,* 1-3.

Babić, Lj., Babić, M., & Pavkov, I. (2006). Apricot drying by a new technology. *Journal of pomology, 40,* 245-253.

Babić, M., Babić, Lj., Matić-Kekić, S., & Pavkov, I. (2005). Energy sustainable model of dried fruit production by combined technology. *Journal on Processing and Energy in Agriculture, 9,* 112-115.

Bureau, S., Chahine, H., Gouble, B., Reich, M., Albagnac, G., & Audergon, J.M. (2006). Fruit ripening of contrasted apricot varieties: physical, physiological and biochemical changes. *Acta Horticulturae, 701,* 511-516.

Cano-Lamadrid, M., Lech, K., Michalska-Ciechanowska, A., Wasilewska, M., Figiel, A., Wojdyło, A., & Carbonell-Barrachina, Á. (2017). Influence of osmotic dehydration pre-treatment and combined drying method on physico-chemical and sensory properties of pomegranate arils, cultivar Mollar de elche. *Food Chemistry, 232,* 306-315.

Deng, L.Z., Zhongli, P., Zhang, Q., Liu, Z.L., Zhang, Y., Meng, J.S., Gao, Z.J., & Xiao, H.W. (2019). Effects of ripening stage on physicochemical properties, drying kinetics, pectin polysaccharides contents and nanostructure of apricots. *Carbohydrate Polymers, 222,* 114980.

Dinnella, C., Cicco, N., Gargaro, M.T., Monteleone, E., Infantino, V., Lattanzio, V., & Xiloyannis, C. (2006). Influences of ripening stage on quality indexes in apricot for fresh market and processing. *Acta Horticulturae, 701,* 523-528.

Drogoudi, P.D., Vemmos, S., Pantelidis, G., Petri, E., Tzoutzoukou, C., & Karayiannis, I. (2008). Physical characters and antioxidant, sugar, and mineral nutrient contents in fruit from 29 apricot (*Prunus armeniaca* L.) cultivars and hybrids. *Journal of Agricultural and Food Chemistry, 56,* 10754-10760.

Đurić, B., Keserović, Z., Korać, M., & Vračar, Lj. (2005). Newly developed apricot cultivars in Vojvodina). *Journal of Pomology, 39,* 279-284.

Egea, J., Romojaro, F., Pretel, M.T., Martinez-Madrid, M.C., Costell, E., & Cascales, A. (2006). Application of sensory analysis to the determination of the optimum quality and harvesting moment in apricots. *Acta Horticulturae, 701,* 529-532.

FAOSTAT (2020): FAO Statistical data base. Available from http://www.fao.org/faostat/en/#data/QC/ accessed: 5.9.2020.

Inserra, L., Cabaroğlu, T., Şen, K., Arena, E., Ballistreri, G., & Fallico, B. (2017). Effect of sulphuring on physicochemical characteristics and aroma of dried Alkaya apricot: a new Turkish variety. *Turkish Journal of Agriculture and Forestry, 41,* 59-68.

Janjai, S., Lamlert, N., Intawee, P., Mahayothee, B., Boonrod, Y., & Haewsungcharern, M. (2009). Solar drying of peeled longan using a side loading type solar tunnel dryer: Experimental and simulated performance. *Dry Technology, 27,* 595-605.

Khan, M.R. (2012). Osmotic dehydration technique for fruits preservation-A review. *Pakistan Journal of Food Sciences, 22,* 71-85.

Milatović, D., Đurović, D., Nikolić, D., & Zec, G. (2012). Improvement of apricot cultivar assortment in Serbia. *Acta Horticulturae, 966,* 131-135.

Milatović, D., Đurović, D., & Zec, G. (2015). Phenological characteristics, yield and fruit quality of introduced apricot cultivars in the region of Belgrade (Serbia). *Proceedings of the Sixth International Scientific Agricultural Symposium „Agrosym 2015''* (pp. 383-388), Jahorina, BiH.

Milić, D., & Vukoje, V. (2008). The production, economic and utility value of apricot. *Journal on Processing and Energy in Agriculture, 12,* 57-59.

Milić, D., Lukač, Bulatović, M., & Kukić, Đ. (2007). Economics justification of dried fruits production on familiar farm. *Journal on Processing and Energy in Agriculture, 11,* 14-16.

Mundada, M., Hathan, B.S., & Maske, S. (2010). Convective dehydration kinetics of osmotically pretreated pomegranate arils. *Biosystems Engineering, 107,* 307-316.

Pavkov, I., Babić, Lj., Babić, M., & Radojčin, M. (2009). Osmotic drying of apricot (*Prunus armeniaca*) in sucrose solution. *Agriculturae Conspectus Scientificus, 74,* 253-257.

Peiro-Mena, R., Camacho, M., & Martinez–Navarette, N. (2006). Compositional and physicochemical changes associated to successive osmodehydration cycles of pineapple (*Ananas comosus*). *Journal of Food Engineering, 79,* 842-849.

Rahović, D. (2006). Influence of pomologic-technological characteristics cultivars and way of drying on quality of dry apricot. *Poljoprivredne aktuelnosti, 1-2*, 41-50.

Rahović, D., Keserović, Z., Čolić, S., Pavkov, I., & Radojičin, M. (2013). Pomological traits of Novi Sad apricot cultivars and selections. *Contemporary Agriculture, 62*, 14-20.

Ramaswamy, H.S., & Van Nieuwenhuijzen, N.H. (2002). Evaluation and modeling of two-stage osmo-convectiv drying of apple slices. *Drying Technology, 20,* 651-667.

Riva, M., Campolongo, S., Avitabile, A., Maestrelli, A., & Torreggian, D. (2005). Structure–property relationships in osmoair-dehydrated apricot cubes. *Food Research International, 38,* 533-542.

Roussos, P., Denaxa, N.K., Tsafouros, A., Efstathios, N., & Intidhar, B. (2016). Apricot (*Prunus armeniaca* L.) In: Simmonds M., Preedy V. (Eds): *Nutritional Composition of Fruit Cultivars* (19-48). Academic Press.

Sablani, S.S. (2006). Drying of fruits and vegetable: retention of nutritional/functional quality. *Drying Technology, 24,* 123-135.

Vukoje, V., & Pavkov, I. (2010). Analysis of economic justification of drying of apricots by combined technology. *Journal on Processing and Energy in Agriculture, 14,* 40-43.

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POGODNOST KAJSIJE ZA SUŠENJE KOMBINOVANOM TEHNOLOGIJOM

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R e z i m e

Kajsija je jedna od najcenjenijih kontinentalnih vrsta voćaka čiji se plodovi konzumiraju kao stono voće ili se upotrebljavaju kao vredna sirovina za preradu. Republika Srbija je jedan od lidera u Jugoistočnoj Evropi u proizvodnji kajsije, ali je ponuda ograničena na mali broj sorti koje sazrevaju u vreme kad i „Mađarska najbolja". U cilju uvođenja u proizvodnju novih sorti koje se odlikuju visokim rodom, kao i kvalitetom za stonu upotrebu i različite vidove prerade, sprovode se intenzivna istraživanja introdukovanih i novostvorenih domaćih sorti. Kajsija se u Srbiji uglavnom prodaje u svežem stanju, ali je i potražnja za sušenim plodovima u porastu. Kako bi se sačuvala nutritivna svojstva i senzorne karakteristike svežih plodova, veoma je važan izbor tehnike za sušenje, a najčešće korišćeno je konvektivno. Cilj istraživanja bio je da se uporedi potencijal sorti kajsije „Mađarska najbolja", „Novosadska rodna", „NS-4" i „NS-6" za sušenje primenom dvofazne tehnologije, odnosno kombinacijom osmotskog i konvektivnog sušenja, kao i da se utvrdi profitabilnost primene ove tehnologije na porodičnim poljoprivrednim gazdinstvima. Sorte „NS-4" i „Novosadska rodna" pokazale su najbolje rezultate i pogodnost za sušenje kombinovanom metodom. Najviše ocene za senzorsku evaluaciju suve kajsije dobile su „NS-4", a zatim „Novosadska rodna". Rezultati ukazuju na to da je sušenje kajsije kombinovanom tehnologijom, odnosno primenom osmotskog i konvektivnog sušenja profitabilnije od prodaje svežih plodova, kao i da na malim porodičnim gazdinstvima može biti značajan alat za stvaranje dodatne vrednosti poljoprivrednih proizvoda.

Ključne reči: plod, osmotsko i konvektivno sušenje, profitabilnost, *Prunus armeniaca.*

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