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# COST-EFFECTIVENESS ANALYSIS OF ORGANIC HONEY PRODUCTION IN SERBIA

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Marija Nikolić<sup>1</sup>, Nebojša Nedić<sup>2</sup>, Suzana Đorđević-Milošević<sup>3</sup>

\*Corresponding author E-mail: [mnikolic@agrif.bg.ac.rs](mailto:mnikolic@agrif.bg.ac.rs)

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## ABSTRACT

Economic justification of organic honey production is analyzed in the paper. The emphasis was placed on specific revenues and expenses that occur in organic honey production, and economic justification was examined by calculating indicators of economic efficiency, profitability and labour productivity. Based on the collected data, a calculation of production was made and a profitability threshold was established, which is achieved with 38 bee colonies, or with production volume of 570 kg of honey. Farms with more colonies have better indicators of production success. The expenses arising from the transition from conventional to organic production will be most quickly covered by farms with 200 bee colonies that generate enough income from organic honey production to operate positively in the third year of organizing such production.

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## Introduction

The demand for organic food is growing stronger in the world, not only because of its beneficial effects on consumers' health but also because of the high level of respect for the environment. There is a particular interest in organic honey, which is most commonly consumed as fresh and unprocessed quality food, a natural substitute for sugar, and in some cases, as a complementary medicine (Miguel et al., 2017). With increasing interest and demand for organic bee products in the world, the production capacities are growing. Organic honey was produced in over 3.2 million hives worldwide in 2017, accounting for 3.5% of the total number of beehives (Willer, Lernoud, 2019). There

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- 1 Marija Nikolić, Ph.D., Assistant Professor, University of Belgrade, Faculty of Agriculture, Nemanjina 6, 11080 Zemun, Serbia, E-mail: [mnikolic@agrif.bg.ac.rs](mailto:mnikolic@agrif.bg.ac.rs), ORCID ID (<https://orcid.org/0000-0002-8691-7113>)
  - 2 Nebojša Nedić, Ph.D., Associate Professor, University of Belgrade, Faculty of Agriculture, Nemanjina 6, 11080 Zemun, Serbia, E-mail: [nedicn@agrif.bg.ac.rs](mailto:nedicn@agrif.bg.ac.rs), ORCID ID (<https://orcid.org/0000-0002-7671-5139>)
  - 3 Suzana Đorđević-Milošević, Ph.D., Associate Professor, Singidunum University, Environment and Sustainable Development Studies, Danijelova 32, 11000 Belgrade, Serbia, E-mail: [sdjordjevicmiloševic@singidunum.ac.rs](mailto:sdjordjevicmiloševic@singidunum.ac.rs), ORCID ID (<https://orcid.org/0000-0003-2401-8742>)

are five European countries among the ten leading countries in organic beekeeping capacities, namely Italy, Bulgaria, France, Romania and Spain (Willer, Lernoud, 2015).

North Macedonia has the highest number of hives for organic honey production in neighbouring countries. After initial intense interest in organic beekeeping, the number of beehives in Macedonia increased to over 15,000 in 2009, but it was decreased to 6,932 in 2015 (Kolev, 2018). Croatia has 3,418 hives, followed by Slovenia (1,400), Montenegro (1,057), and Bosnia and Herzegovina (238). According to the data from the National Association for the Development of Organic Agriculture of Serbia – Organica, there are 471 hives for organic production, while the rest up to 2,504 is in the conversion process (Table 1).

**Table 1.** The number of beehives certified for organic production and in conversion in Serbia

Year	2012	2013	2014	2015
No. of hives	961	1,940	894	2,504

*Source:* Simić I. (2017): Organic Agriculture in Serbia: at a glance 2017, p. 17

Producers' commitment to organic production is determined by many factors, including education level, level of knowledge of this type of production, prerequisites for conversion and certification, and others, but one of the main incentives for engaging in organic production is economic benefits that can be obtained.

Agrarian structure in Serbia is characterised with small farms, particularly in the South of the country, with high presence of extensive agriculture. It is also the case in some other European countries, such as Poland. Duguleana et al. (2018) believe that these small farms are easily converted in organic production since they are often "organic by default" and that it is one of the reasons for steady evolving of organic agriculture in this country since Poland's accession into the European Union in 2004. This also contributes to Serbia's high potential for organic agriculture, and explains the willingness of farmers to be involved in such production if it provides sufficient economic benefit.

With increasing consumer interest in organic products, including organic honey, this production has attracted growing attention in the literature. Nevertheless, the volume of papers analyzing the specificities of organic honey production from an economic point of view is relatively low. This paper aims to record in transparent manner revenues and costs arising from organic honey production to examine the economic justification of this production.

### Materials and methods

The data used in this study can be divided into three groups. The basis for making the calculation related to honey production was the data collected through the survey of opinions of 98 beekeepers from three regions of the Republic of Serbia (Belgrade Region, Region of South and East Serbia, and Region of Šumadija and West Serbia).

The survey was conducted in 2017 using a face-to-face survey questionnaire. The questionnaire was designed following the defined research objectives.

The second group of data about specifics of organic production was collected by the method of in-depth interviews with selected beekeepers with large number of bee colonies and beekeepers practicing organic production. In addition to honey producers, data were also collected from interviews with wholesalers and honey processors. The third group of data, which primarily relates to the prices of inputs in organic beekeeping and prices of organic honey, were collected on the market of the Republic of Serbia.

Descriptive statistical analysis was used to process the data collected through the primary survey. The obtained data were analyzed by the method of calculation, which made it possible to calculate the total revenues and expenses.

As a basic indicator of the economic success of organic honey production, the financial result was calculated as the difference between total revenues and total expenses. To assess the economic justification of organic honey production, standard gross margin, the profitability threshold, and the indicators of economic efficiency, profitability, and productivity were calculated.

### **Theoretical and research background**

Analysis presented in the paper demanded thorough research related to the revenues and costs of organic honey production. In this part of the paper theoretical background and explanations related to the implemented methods of calculation are given.

### **Revenues in organic honey production**

Revenues and expenditures in organic beekeeping have certain specificities that have been taken into account when making the calculation presented in this paper.

Total revenues from organic honey production consist of revenue from the sale of products and subsidies per beehive, while revenues from the sale of beeswax are excluded. In conventional production, in addition to the sale of honey, revenue is also generated by the sale of beeswax (and, in some cases, by sale of other bee products), but this is not a practice in organic production. The use of organic wax is one of the critical prerequisites for organic beekeeping and an essential measure during the conversion period (Naturland, 2005). In the absence of organic beeswax on the market, beekeepers can produce it on their own if wax cap are free of contamination with substances not authorised for use in organic production. The total revenue from the sale of products in organic beekeeping does not include revenues from the sale of beeswax since organic beeswax is used in one's own production and is rarely marketed. Besides, the market of organic products in Serbia is poorly developed, even when it comes to final products, such as honey, while it is virtually non-existent for intermediates such as beeswax. This means that revenues in organic beekeeping consist of sales of organic honey and subsidies per beehive.

The revenue from honey sales depends on the yield per hive, which is lower in organic production than in the conventional one, and the market price, which is, as a rule, higher for organic products.

Yields in conventional and organic production differ due to different production systems, characteristics of inputs, and other factors. Yields in organic production are lower than those achieved in traditional by five percent to as much as 34 percent (Seufert et al., 2012), although with good production practices and high level of producer training, differences in yield levels can be significantly reduced.

Regardless of the type of production, revenues are primarily determined by the level of market prices. Honey is one of the few agricultural products that reach consumers almost unchanged. The part of honey's image is as a wholesome, natural food, and therefore, there is a keen interest in organic honey. Producers who can supply certified organic honey, which has a strong demand within EU market, can expect to get a premium price (Bradbear, 2009).

### **Prices of organic honey**

There is an agreement in the literature that prices of organic products are higher than those of conventional production, but different views can be found about the scope of this difference. Ma et al. (2017) state that organic farmers receive higher incomes due to higher prices received, compared to conventional farmers, while according to Barbu and Băra (2010) organic product prices are 20 to 60 percent higher than for conventional products. Yin et al. (2017) found that consumers are willing to pay more for food carrying Chinese organic label, and even more for EU organic label than those carrying no label. Bradbear (2009) points out that the price of organic honey is higher than the price of conventional honey, which means that higher revenues are generated in organic production. Vlahović and Šojić (2016) believe that the difference in price depends on the country of production, product type, and length of the supply chain, but that organic food products on the Serbian market are about 50 percent more expensive on average than conventional ones.

In the Serbian market, prices of organic products are limited by the demand for these products and the level of the living standard of the population, the scope of supply, but also by the degree of development of organic products market. Depending on the type of product, marketplace, supplier, and season, the prices of organic agricultural and food products in Serbia are higher from 50 to even 400 percent compared to the prices of the same conventional products.

There are significant differences between the price of organic honey in wholesale and retail. The wholesale price of organic honey is determined by the fact that the wholesale purchase of organic honey is not developed on the market of the Republic of Serbia and that only one company is purchasing. The retail price depends significantly on marketing channels. Selling directly at a farm does not burden a product with significant sales costs and prices are generally lower. On the other hand, the sale of organic honey in specialist stores, in special smaller packages, results in extremely high prices.

### **Distribution of organic honey**

Beekeepers do not sell all the honey they produce. Part of the production is retained on the farm for natural consumption, gifts, and promotion, and what is even more critical, for reproduction purposes in organic production. It is recommended that organic beekeepers use their own honey for winter bee consumption, or, if necessary, sugar or sugar syrup of organic origin may be added (Nатурland, 2005).

The quantities of honey that are offered to market depend on the number of beehives, or the volume of production. In addition, sales are carried out through different market channels. Part of the marketed production is sold to wholesale buyers and part in retail at different prices, which directly affects revenues.

A prerequisite for using different channels of honey marketing is the existence of a well-structured and developed market. Weak market structures characterized by lack of some players, such as wholesale purchasers and processors of honey, limit producers in marketing products and make it challenging to sell significant quantities in a shorter period. The use of direct marketing channels, that is, supplying final consumers, is characteristic of beekeepers with a smaller number of colonies, which allows them to reach satisfactory prices and avoid intermediaries. It is not uncommon for organic products to be sold locally. Research showed that in the organic farmers' market, 35% of products had travelled less than 50 km (Partalidou, 2015). Al-Ghamdi et al. (2017) found that in an underdeveloped honey market, about 60% of beekeepers, even those with over 100 colonies, use direct marketing channels in the absence of large wholesale honey buyers and processors. The authors further emphasize that the existence of intermediaries buying significant quantities of honey from producers is significant and that such a market structure may increase the interest of beekeepers to apply modern beekeeping practices to increase the production of honey on their farms.

The organic market in Serbia is still underdeveloped, and a particularly important factor limiting demand is low consumer education and awareness of the importance of organic products consumption. This market is additionally burdened with the strong competition from abroad, which makes the sales of organic honey in Serbia very challenging.

### **Subsidies in organic honey production**

In addition to honey sales revenue, subsidies are included in total organic production revenues. The European Union, the world's second-largest producer of honey after China, subsidizes beekeeping significantly, having in mind its crucial role in agriculture. Honey bees play a central role in agriculture as pollinators and they are valuable to the ecosystem as that pollinate more than 90% of insect-pollinated plants (Getachew, 2018). In the period from 2020 to 2022, apicultural programmes in the EU are supported with 240 million Euros, and the allocation of funds is based on the number of beehives in each EU country (EC, 2019, August 28). Other countries also provide subsidies for organic farmers. Ma et al. (2017) state that China government provide financial support to certifies organic farmers' organisations such as agricultural cooperatives.

Incentives for organic agricultural production in Serbia are regulated by Law on Incentives in Agriculture and Rural Development, RS Official Gazette, 10/2013, 142/2014, 103/2015 and 101/2016, which stipulates that they are at least 40% higher than incentives in conventional production and amount to 8.5 Euros per hive. All beekeepers with between 20 and 1,000 beehives receive subsidies.

In addition to production subsidies, beekeepers can use other forms of support. Financial support in the form of reimbursement of certification costs was first introduced in 2005/06 at a relatively modest amount, but it was multiplied after 2011 (Vehapi, 2014).

### **Costs of organic honey production**

Costs in organic beekeeping can be divided into fixed and variable costs. Fixed costs include depreciation of hives, equipment, and vehicles; costs of permanent labour, that is, the work of beekeepers, honey analysis, costs of selling (leasing stalls), and other expenses, such as costs of memberships in different associations. Variable costs include hiring a veterinarian and purchasing medicines, maintaining beehives, replacing frames, queen bees and honeycombs, feeding costs, packaging per unit and seasonal workers, and fuel costs for visiting and moving beehives.

The largest share in the structure of total costs is attributable to the costs of the permanent labour, especially the income of beekeepers. These costs include health and compulsory pension and disability insurance, plus the minimum wage in the Republic of Serbia in 2017 when the survey was conducted.

The use of selected medicine, especially in the control of *varroa* parasites, is one of the biggest obstacles in organic production (Willer, Lernoud, 2019). Medicines used in organic honey production can be purchased on the market of the Republic of Serbia, but they are significantly more expensive than those used in conventional production. The procurement of swarms and especially queen bee's replacements is also specific. In organic production, 50% of queen bees are changed annually, with all inputs in organic production being more expensive, resulting in higher total costs.

One of the critical items in organic beekeeping is the replacement of honeycombs. A significant number of beekeepers independently produce honeycombs made of organic beeswax. The analysis conducted is based on the fact that beekeepers are with experience and certified organic production. Therefore, in calculating the cost of replacing honeycombs, the starting point was the fact that a beekeeper can use organic beeswax, which they have independently produced, melt it, and produce honeycombs, which is the practice of organic beekeepers in Serbia indeed. The use of organic wax for the production of honeycombs is the main reason that the income from the sale of beeswax in organic beekeeping is not included.

## Results and discussion

This paper analyzes the economic success of organic honey production. Beekeepers are divided into four categories with 30, 50, 100, and 200 bee colonies each. The starting assumption was that all producers practice mobile beekeeping, as well as that all of them already have certified organic production; that is, they have undergone a conversion period, with certification being individual.

### Total revenues in organic honey production

Total revenues in organic honey production were calculated based on the previous analysis and they consist of sales of organic honey and subsidies per beehive (Table 2). Sales incomes depend on yields and prices of organic honey. This analysis started from the yields in conventional production, which averaged 22.2 kg per hive, with variations by beekeeper groups (Nedić et al., 2019). It was assumed that yields in organic honey production were 25 percent lower than in conventional production, which means that yield ranging from 15 to 18 kg per hive were applied. Organic honey prices were collected on the market of the Republic of Serbia in March and April 2019. A wholesale price of organic honey of 4.8 Euros per kg was applied, which is 1.8 times higher than the wholesale price of conventional honey. The choice of price has been confirmed by beekeepers practicing organic beekeeping and represents a realistic market price. Despite the stated price range for organic honey, a single lower value of 13.6 Euros for all types of honey was used in the calculations in the paper, which was obtained based on a survey among beekeepers.

**Table 2.** Revenues in organic honey production by the size of beekeeping farms

Revenue type		Number of colonies			
		30	50	100	200
Honey sales	Euros	4,884	6,925	10,388	18,803
	Participation (%)	95.0	94.2	92.4	91.7
Subsidies for organic production	Euros	256	427	854	1,709
	Participation (%)	5.0	5.8	7.6	8.3
<b>Total revenues (Euros)</b>		5,140	7,352	11,242	20,512

*Source:* Authors' calculation based on the conducted research

Other important issue is the distribution of organic honey. Based on the responses collected by the beekeepers surveyed, the following method of income calculation was applied in this analysis. Beekeepers with 30 colonies sell 80% of their quantities in retail, while the rest is kept on farms. Beekeepers with 50 colonies sell 55% of their products in retail and 25% to wholesale buyers. Producers with 100 colonies sell 65% of their output to wholesale buyers and one-fourth in retail, while beekeepers with the most significant number of colonies sell 80% to wholesale buyers and only 10% in retail. The remaining amount of produced honey (up to 100%) is kept on farms.

Beside sales income, subsidies are included in total organic production revenues. Subsidies in organic production range from 5.0% of total revenues for beekeepers with the smallest number of colonies, to as much as 8.3% for beekeepers with 200 colonies, which means that with the increase in the number of colonies their share in the structure of total revenues increases. Compared to conventional production, the revenue generated from organic production is about 50% higher on average.

### Total costs of organic honey production

Costs in organic beekeeping are divided into fixed and variable costs. Costs of certification were 250 Euros for farms with 30 colonies, 350 Euros for 50 colonies, 450 Euros for 100 colonies, and 550 Euros for farms with 200 bee colonies.

The largest share in the structure of total costs is the costs of the permanent labour. These expenditures have a high share in the structure of total costs, especially for hobby beekeepers with 30 colonies (52.1% of total costs), while for beekeepers with the most significant number of colonies they have a share of 24.0%. Such findings are consistent with other studies (Yildirim, Agar, 2008; Marinković, Nedić, 2010).

**Table 3.** Expenses in organic beekeeping by categories of beekeeping farms

Type of costs	Number of colonies				
	30	50	100	200	
Variable costs:					
Feeding	580	967	1,933	3,866	
Drugs and veterinary service	240	393	777	1,543	
Beehive maintenance and material replacement	286	477	953	1,906	
Fuel costs for visiting and moving beehives	508	509	560	1,017	
Seasonal workers	92	152	305	610	
Certification costs	250	350	450	550	
Other variable costs	137	181	162	213	
<b>Total variable costs</b>	Euros	2,093	3,029	5,140	9,705
	%	37.5	45.9	56.9	68.5
Fixed costs:					
Depreciation of equipment and beehives	318	402	721	1289	
Compulsory contributions to pension fund for permanent labour (beekeeper)	610	610	610	610	
Beekeeper's salary	2,293	2,293	2,293	2,293	
Other fixed costs	265	265	265	265	
<b>Total fixed costs</b>	Euros	3,486	3,570	3,889	4,457
	%	62.5	54.1	43.1	31.5
<b>Total expenses</b>		5,579	6,599	9,029	14,162

*Source:* Authors' calculation based on the conducted research

In organic production, feeding bees is allowed only in extreme climatic or other specific conditions, and then only with organic honey (Annand, 2010), preferably from the same production unit (Mirecki et al., 2011). In production conditions in Serbia, it is allowed



to feed bees with honey, sugar syrup, or sugar from organic production if the survival of bees is threatened by weather conditions (The Rulebook on Control and Certification in Organic Production and Organic Production Methods, RS Official Gazette, 48/2011 and 40/2012, Article 49). Organic sugar is available on the market of the Republic of Serbia exclusively in specialized stores in packages of 500 g or less at prices ranging from 6.0 to 9.8 Euros per kg, which is higher than the wholesale price of organic honey indicating that its use in feeding bees is unprofitable. Therefore, the analysis envisaged that, if necessary for the survival of colonies, organic honey is used in supplementary feeding of bees, namely, 6 kg of organic honey per beehive.

Two relocations are planned during a production year, though three relocations are required in organic honey production in the years with worse climatic conditions. Moving costs include the cost of hiring workers and the cost of purchasing fuel. The hives can be moved to appropriate locations following the conditions prescribed in the legislation of the Republic of Serbia, which is harmonized with the EU legislation in this field (The Rulebook on Control and Certification in Organic Production and Organic Production Methods, RS Official Gazette, 48/2011 and 40/2012, Article 42).

Nemes (2009) states that if fixed costs in organic production do not include labour costs, then they account for a smaller fraction of total costs and are not crucial in determining the economic success of a farm. In this analysis, fixed costs cover the costs of hiring permanent labour and therefore represent a significant proportion of total expenses, especially for beekeepers with lower capacity. With increasing production capacity, variable costs have a greater share in the structure of total costs, accounting for 68.5% of total costs for beekeepers with 200 colonies. Fixed costs, especially those for permanent labour, are higher for beekeepers with fewer colonies (Table 3). Certification costs account for about 5% of total expenses.

The total expenses in organic production are higher than the expenses incurred in conventional honey production at all levels of production capacities, which is due to the inclusion of certification costs, but also to the fact that more expensive inputs are used in organic production. Expenses in organic honey production on farms with 200 colonies are 59% higher than expenses in conventional production, which is consistent with the findings of other authors who found that costs in organic honey production could be about 70% higher than in conventional production (Güemes-Ricalde et al., 2006).

### **Economic justification of organic honey production**

After considering the revenues and expenses that arise in the production of organic honey depending on the size of production capacities, selected economic indicators were calculated on the basis of which the economic feasibility of this production was examined.

De Figueiredo et al. (2016) found that honey value chains could have greatly increased performance with higher pay-off strategies, among which organic certification contributed the most to performance. This study also showed the positive contribution

of organic beekeeping on economic benefits of producers.

The financial result achieved by category of beekeeping farms indicates that the production of organic honey on farms with 30 colonies is not economically justifiable since they operate with a loss (Table 4). The profitability threshold is the volume of production at which total revenues exceed expenses, i.e. above which a positive financial result is achieved. The profitability threshold in organic honey production in Serbia is reached at 38 beehives or at the volume of production of 570 kg of honey.

Organic honey production is not economically justifiable for less than 38 hives. It is, therefore interesting to analyze why individual producers engage in this production if they incur losses. Namely, fixed costs represent a significant burden, especially for hobby beekeepers with up to 30 colonies. Particularly significant from this group of costs are the costs of permanent labour, that is, the payment of minimum personal income and pension and health insurance.

One of the main reasons for including these costs in all categories of beekeepers is the tendency to show in the calculation all costs that could be incurred in this production, as well as to consider the real economic justification for organizing the production of organic honey. However, there are different views in the literature as to whether these costs need to be shown on the expenditure side. Some authors point out that these costs should not be included because the activities in the apiary are carried out by beekeepers and members of their households (Knaus, Milotić, 2001). This is characteristic of small producers, for whom beekeeping is not a core business. In other studies, only mandatory beekeepers' pension insurance is included in the total costs (Gugić et al., 2010).

If these costs are included in the calculation, the category of beekeepers called "hobby" does not generate enough income to cover all the expenses. If these costs are excluded from the total costs of organic honey production, beekeepers with 30 colonies incur expenditures at the level of 2,676 Euros, with revenues unchanged at 5,140 Euros. In other words, if the so-called hobby beekeepers exclude labour costs from the calculation, they have a positive financial result, i.e. a profit of 2,464 Euros. This explains the willingness of beekeepers with fewer colonies to engage in organic honey production.

Gross margin is calculated as the difference between revenue and variable costs, with revenue calculated as the product of the selling price of honey and the realized volume of production (subsidies are not included). All farms have a positive gross margin, or in other words the value of production without subsidies is greater than the variable costs for all groups of beekeepers.

Economic efficiency is the ratio of total revenues and total expenses incurred in production. According to the conducted research, economic efficiency on farms with 50 bee colonies is 1.11 and on farms with 100 colonies 1.24, which means that each Euro invested in production results in 1.11 and 1.24 Euros in income. Greater economic efficiency is achieved on farms with 200 colonies where each Euro invested generates 1.45 Euro in revenue.

**Table 4.** Economic indicators in organic beekeeping by farm category (Euros)

Selected indicators	No of hives			
	30	50	100	200
Product sales revenue	4,884	6,925	10,388	18,803
<b>Total revenues</b>	5,140	7,352	11,242	20,512
Variable costs	2,093	3,029	5,140	9,705
Gross margin	2,791	3,896	5,248	9,098
Fixed costs	3,486	3,570	3,889	4,457
<b>Total expenses</b>	5,579	6,599	9,029	14,162
Financial result	-439	753	2,213	6,350
Economic efficiency	-	1.11	1.24	1.45
Profitability	-	10.24	19.68	30.96
Productivity of labour	-	76.05	184.82	303.01

*Source:* Authors' calculation based on the conducted research

Profitability is the ratio of financial results to total revenue. The profitability ratio shows that farms with 50 or more beekeeping colonies are profitable. Finally, labour productivity shows how many units of financial result were generated per unit of working hours. The total amount of work spent in this analysis is obtained as the sum of working hours by permanent workers (beekeepers) and seasonal workers engaged in harvesting honey and moving beehives. As expected, the highest labour productivity is on farms with 200 colonies.

### **The economic aspect of the transition from conventional to organic honey production**

Based on the information collected through the in-depth interview method conducted with beekeepers practicing organic beekeeping, three periods of importance for the review of cash flow were defined: preparation period, the transition period to organic production, and full organic production.

The preparation period refers to the period before the transition to organic production. During this period, producers are actively preparing to organize organic honey production. This process runs on two separate tracks. One segment involves preparing beekeepers themselves in terms of gathering the necessary information and gaining knowledge related to organic honey production, selecting a certification company, and other activities. The second segment covers preparations in the production process, in particular, the separation of honeycombs.

The transition to organic production includes the year of conversion and the first year in organic honey production. Although these two years differ in terms of dealing with organic production, they are the whole from the economic point of view, because the flows of revenues and expenses are significantly different from other two periods. One of the main challenges in organic beekeeping is the conversion period, which, according to the legislation of the Republic of Serbia, lasts for at least one year (Rulebook on Control and Certification in Organic Production and Organic Production Methods, RS

Official Gazette, 48/2011 and 10/2012). The most common problem at this stage is a lack of knowledge about organic beekeeping and the certification process (Willer, Lernoud, 2019). It is essential that farmers have at least some knowledge related to organic farming. Ma et al. (2017) found that farmers with only basic knowledge may be willing to adopt organic farming, but farmers who acquired specific information about organic farming are more likely to show their willingness to adopt organic farming.

When analyzing cash flows, the assumption was that the conversion period lasts for one year, since beekeepers prepared for organic production in the previous phase. Honey yields per hive are lower in this year, and honey is sold at prices for conventional honey, resulting in lower revenues. The costs are higher than usual for organic honey production, and the costs of replacing conventional wax with organic wax in societies are particularly high. Increased costs and significantly lower revenue generated in the conversion year result in a loss on all farms, regardless of their capacity.

The first year in certified organic production is also connected with many challenges. The honey yield per beehive is the same as in the previous year, but honey can be sold at higher prices, i.e., as organic honey. The subsidies are not included in the revenues. Losses are still recorded in this year, as total revenues are limited by production volume.

The period of full production of organic honey begins with the second year in organic production and lasts as long as production is organized. The analysis of the economic effects of organic honey production presented in the first part of this paper relates to an arbitrary  $n^{\text{th}}$  year from this period.

Considering the significant investments and high costs in the initial years of organizing organic honey production, the question arises as to how long it would take for these losses to be settled, that is when beekeeping farms will start to achieve positive financial results. The length of this period depends on the size of production capacity and the amount of profit that is achieved in the period of full organic production, so in the transition to organic production, farms with higher capacity and higher profits will cover losses in a shorter period.

Beekeepers with the smallest number of organic honey colonies have a negative financial result, which means that there is no way to cover the costs incurred in the transition to organic production. This confirms that organizing organic honey production on farms with 30 bee colonies is not economically justified.

Farms with 200 colonies will generate revenue to cover losses from the previous period and cover regular production costs incurred in the third year of organic honey production. The smaller capacity causes a longer period to cover the losses incurred during the transition to organic production, so beekeepers with 100 colonies would take six, a beekeepers with 50 colonies even 12 years to achieve a positive financial result.

As the previous analysis showed that permanent labour costs are the determining factor for the economic success of organic honey production, it was examined in what period beekeepers could expect to achieve a positive financial result when switching to

organic production if permanent labour costs were excluded from fixed costs, and all other parameters remain the same.

In this case, all farms, regardless of production capacities, report losses in the year of conversion and the first year of organic production. However, in the second year of organic production, all four categories of farms would generate enough income to make up for the losses from the previous two years and have a positive financial result. This reaffirms the significant burden of permanent labour costs.

### Conclusions

The paper presents the results of the analysis of the economic justification of organic honey production in Serbia, depending on the size of a farm. The results showed that farms with 30 bee colonies operate at a loss, i.e. that the profitability threshold is reached with 38 colonies. On farms with 100 colonies, after covering all costs, the profit is 2,213 Euros, while farms with double the capacity generate 6,350 Euros or 529 Euros per month. After the transition from conventional to organic production, largest farms take three years to cover the costs incurred during the conversion period, while farms with 100 colonies take six years if permanent labour costs are included in the total costs. In other words, with the increase in capacity in organic honey production economic results are multiplied. Unlike conventional production, where a gradual increase in production capacity is recommended, that is, an increase in the number of colonies, the obtained results indicate that organic honey production is more economically viable if beekeepers already have experience and that it is economically more profitable to start production with higher capacity. With the development of the market for organic honey inputs and an increasing interest of domestic consumers for this product, further improvement of organic honey production in Serbia can be expected.

### Conflict of interests

The authors declare no conflict of interest.

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