

ANALYSIS AND PREDICTION OF PRODUCTION CHARACTERISTICS AND PRICES OF HONEY PRODUCTION IN THE VOJVODINA REGION

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ABSTRACT

The aim of the research is to establish the state of honey production based on the current production and economic characteristics in order to predict their tendency for the period 2023-2026. The analyzed data refer to the number of beehives, total production, and yields of honey for the period 2006-2021, which were provided by the Statistical Office of the Republic of Serbia. In order to analyze the characteristics of honey production and prices the method of descriptive statistical analysis was applied: arithmetic mean (\bar{x}), extreme values (min and max), coefficient of variation (CV), and the annual rate of change (r). The analyzed data indicate that total honey production and the number of beehives increased at an average annual rate of 6.09% and 6.27%, respectively, while the yield has declined slightly at an average annual rate of 0.17%. The trend of increasing the number of beehives and total production, and decreasing yields will continue in the prediction period. The purchasing price of honey has a tendency to increase ($r=4.97$). In 2026, the price is projected to be 5533 euro/ton, which means that the expected price of honey will be higher than the average by 3184 euro/ton.

Key words: honey production, prices, prediction.

INTRODUCTION

Bees play very important role in agriculture production. Not only producing honey, but bees play a crucial role in the pollination of plants and in that way crops produce better yields.

The Republic of Serbia, as well as the Vojvodina region, has excellent conditions for beekeeping thanks to its natural conditions, moderately continental climate, and rich flora. The main product of beekeeping is honey, whereas the production of other products is low. Such a structure of bee products is the result of the fact that other products in beekeeping are labor-intensive and require frequent visits to the apiary. This can be achieved on professional beekeeping farms, focused exclusively on this production, but such producers are in the minority, while more numerous are beekeepers with a smaller number of colonies (Nedić et al. 2019).

Forecasting in agriculture is very important and useful both for the agricultural producers and the agribusiness sector as a whole, as well as for the agricultural policymakers (Geoffrey et al (1994), Li et al (2022), Niyigaba and Peng (2020)). Thus, the aim of the research is to establish the state of honey production based on the current production characteristics and prices in order to predict their tendency for the prediction period 2022-2026. In addition, adequate measures how to improve the production of honey in the Vojvodina region will be proposed based on the obtained results.

MATERIAL AND METHODS

The tools of descriptive analysis used to observe the production parameters of honey production for the period 2006-2021 in Vojvodina region are the mean value, interval of variation (minimum and maximum), coefficient of variation (CV), and average rate of change (r). Two methods were used to predict the production and economic characteristics of honey production: the ARIMA model and extrapolation of the average rate of change. Since the ARIMA model did not give satisfactory results due to a short time series (15 years), annual rates of change were used to extrapolate the production characteristics for the period 2023-2026. The rate of change shows the average annual relative change in occurrence in the analyzed time period. It is calculated directly from the absolute data of the analyzed time series using the expression:

$$G = \left(\frac{Y_n}{Y_1} \right)^{\frac{1}{n-1}} ; r = (G - 1) * 100$$

Where: r - average annual rate of change, G - average annual index of change, Y1 - absolute value of the first member of the time series, Yn - absolute value of the last member of the time series, n - length of the time series.

The economic indicator that was analyzed was the purchasing price, as an absolute indicator. The period to which the price analysis refers is 2002-2021, starting thus from the year the euro was introduced. The prediction period is 2023-2026.

All data on production and economic parameters of honey production were obtained from the website of the Statistical Office of the Republic of Serbia.

RESULTS AND DISCUSSION

Analysis of production and economic parameters of beekeeping and honey production in the Vojvodina region

Production and supply of honey in Serbia is still largely unorganized. In recent years, the production of honey has been engaged by a greater number of people, but still, it can be only talked conditionally about as an organized and continuous production (Ignjatijević et al. (2015)).

According to the Statistical Office of the Republic of Serbia, in the last 15 years, production and economic parameters have the tendency to increase which indicates that the technology of honey production in the Vojvodina region has progressed (Table 1 and Graph 1). Vojvodina has produced approximately 1620 tons of honey; the average number of beehives is 143 thousand while the average yield is 11.41 kg per beehive (Table 2).

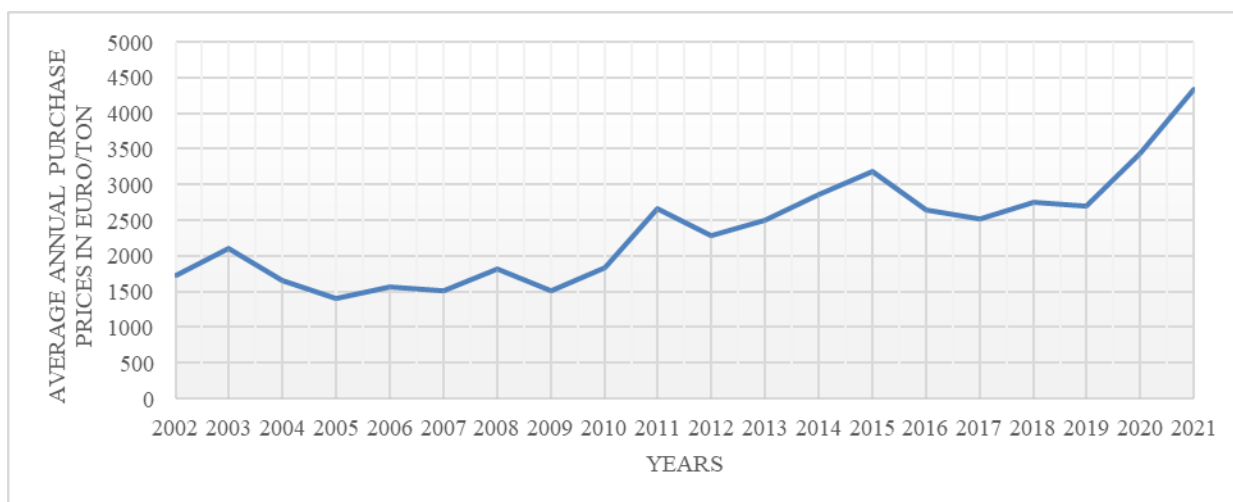
Analyzing the obtained production parameters of honey production on the territory of Vojvodina (table 2), it can be concluded that there is a tendency of increasing the number of beehives at an annual rate of change of 6.27% and the total honey production of 6.09%. However, when it comes to yield analysis, the situation is slightly different as yield records a minor tendency of decreasing at the rate of -0.17%.

Table 1. Number of beehives, total production of honey, and yields/beehives in AP Vojvodina for the period 2006-2021.

Years	Number of beehives (000)	Total production of honey (000) tons	Yields kg/beehives
2006	92	948	10.30
2007	81	970	11.97
2008	91	921	10.12
2009	92	911	9.90
2010	97	981	10.11
2011	111	1134	10.22
2012	124	1415	11.41
2013	150	2532	16.88
2014	123	1396	11.35
2015	143	2415	16.89
2016	149	1652	11.09
2017	165	2093	12.68
2018	209	2440	11.67
2019	205	1649	8.04
2020	219	2172	9.92
2021	229	2301	10.05

Source: Statistical Office of the Republic of Serbia

The purchasing prices of honey in Serbia in the period 2002-2021 are presented in graph 1. Furthermore, descriptive statistics of the purchasing prices of honey (table 2) show that the average annual purchasing price of honey in the analyzed period was 2348 euro/ton and it varied from the minimum recorded 1400 to the maximum realized 4341 euro/ton. The variability of the prices of honey is high (32.42%). The purchasing price of honey will grow at an annual rate of 4.97%.



Graph 1. The average annual purchase prices of honey for the period 2002-2021.

Source: Statistical Office of the Republic of Serbia

Table 2. Descriptive statistic of the production and economic parameters of beekeeping and honey production in AP Vojvodina

	Min	Max	Average	CV (%)	Average annual rate of change (%)
Number of beehives (000)	81	229	143	35.13	6.27
Total production in tons	911	2532	1621	38,14	6.09
Yield (kg/bee hive)	8.04	16.88	11.41	20.95	-0.17
Purchasing price (euro/ton)	1400	4341	2348	32.42	4.97

Source: Authors' calculations

Prediction of production and economic parameters of beekeeping and honey production in the Vojvodina region

Table 3 shows the obtained results based on data of the number of beehives, total honey production yield, and for the period 2006-2021. which predict the production parameters for the period 2023-2026. According to them, it can be predicted that in 2026 the number of beehives will be around 310 thousands, the total production should reach the level of around 3092 tons, and the average yield could be around 9.96 kg/bee hive. It can be concluded that in 2026 the expected number of beehives will be higher by 167.85 than the average for the period from 2006 to 2021, the production will be higher by about 1472 tons, and the yield will be slightly lower by 1.45 kg/bee hives. Moreover, the predicted purchasing prices of honey for the period 2023-2026 are also presented in the table 3. The results show that the beekeepers can expect 5533 euro/ton in 2026 which is 3184 more than average for the period 2002-2021.

Table 3. Prediction of the production and economic parameters of honey production in Vojvodina region for the period 2023-2026.

Year	Prediction period			
	2023	2024	2025	2026
Number of beehives (000)	259	275	292	310
Total production in tons	2590	2748	2915	3092
Yield (kg/bee hive)	10,01	10,00	9,98	9,96
Purchasing price (euro/ton)	4783	5021	5271	5533

Source: Authors' calculations

It is important to note that the obtained results should be considered, because beekeeping and honey production are heavily affected by other numerous factors such as natural and climatic conditions etc., that can destabilize both production and the market.

CONCLUSION

In the last 15 years, beekeeping and production of honey in the Vojvodina region have shown a tendency to increase the number of beehives and total production, but also a slight decrease in yield. Moreover, the average annual purchasing price of honey in the Vojvodina region also tends to increase. The average purchase price of honey for the period 2002-2021 was 2349 euro/ton, and the prediction results indicate that beekeepers can expect 5533 euro/ton in 2026 which is 3184 more than the average for the period 2002-2021. Honey and products of honey are a great export opportunity for Vojvodina region and the Republic of Serbia. The

quality of honey must be controlled in order to be competitive in the EU market. In order to maintain the growing trend of beekeeping production and to provide competitiveness in the EU markets, it is necessary to harmonize the legal regulations of Serbia with the regulations of the EU. Moreover, the government should also support beekeepers through subsidies and other financial instruments. Furthermore, it is crucial to have strong cooperation between beekeepers, fruit growers, winegrowers, farmers, and vegetable growers in order to have successful agricultural production. Otherwise, bees will suffer, and plant production will have a lower yield and poorer product quality. Last but not least, the education of beekeepers is also very important. Not only to educate them on how to be successful beekeepers but to bring the importance of bees, their benefit for crops as well as the preservation of biodiversity to their attention.

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