Raspberry Production Trends in Serbia

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Abstract. *Raspberry represents the main export „brand" of fruit production in Serbia. In the paper, the production of raspberries was analyzed using a quantitative research method, with the aim of determining the trend of its production indicators, i.e. area, production and yield. The time period of the analysis included available data obtained from the database of the Republic Institute of Statistics from 2006 to 2023. The results showed that raspberry production is dominant in relation to its production in the surrounding, i.e. neighboring countries. The areas under this fruit, as well as its production, show an increasing trend, while the raspberry yield in the observed period records a slight decreasing trend. The research provides a solid basis for further research in this area of fruit production in Serbia, as well as for making further rational macroeconomic decisions.*

Keywords: **Raspberry, production, trend, Serbia**

Introduction

Fruit growing represents an important segment of Serbian agriculture. As such, fruit growing generates a new workforce, new processing facilities, development of new varieties, expansion and development of a country's research capacities and markets, as well as a greater supply of the population with the necessary healthy and safe food. Serbia has an untapped potential for a far greater development of fruit production than it is now, and therefore more opportunities in strengthening today's agriculture and strengthening and breaking into new food markets.

Kljajić (2014) emphasizes that the advantage of our fruit growing is in spatial and biological diversity, favorable climate and tradition in fruit production. There is a significant interest of farmers in fruit growing, which with state incentive measures and the establishment of cooperatives (association of agricultural producers) can achieve good results. Due to its great nutritional and dietary value, berry fruits, including raspberries, play a major role in fruit growing. According to Keserović (20004) biological production characteristics, high profitability of cultivation, suitable climatic conditions, as well as the possibility of placing fruits and berry products on the domestic and foreign markets, are the basic prerequisites for further expansion and planned raising of high-intensity berry plantations. Fruit growing is one of the most productive branches of agriculture Babović et al., 2005 in which 20 times more workers are employed per unit area than wheat production.

Raspberry is a specific fruit crop. As Kljajić (2014) notes, due to the specific chemical composition, and especially due to the high content of vitamins, minerals, certain microelements, etc., raspberry fruits have a very significant medicinal effect. It belongs to the most profitable fruit species in Serbia, which is supported by the fact that the raspberry has been Serbia's long-standing export brand when it comes to fruit. According to Bulatović (2020) raspberries can be processed into a wide variety of products such as concentrates, juices, syrups, jams, compotes, liqueurs, brandies, etc. All cultivated and edible wild raspberry varieties can be used for hot and cold processing. However, there are significant varietal differences in their suitability for different uses and processing procedures. In addition, according to Cecić et al., (2006) the backbone of rural development in certain areas, an important economic branch and much more than that. Petrović and Milošević (2002) give the following factors that determine the economic importance of raspberries, namely: high and diverse use value of the fruit, relatively high rate of profitability in favorable agro-ecological conditions, high marketability of the product, supplementary employment of the workforce and indirect influence on the overall socio-economic development, raspberry as a honey plant and others.

High yield of raspberries and long-term export to world market significantly influenced the development and intensification of its production in Serbia. Realizing the economic interests of raspberry producers, as well as achieving profit, was crucial in making the decision to invest in perennial raspberry plantations and start an economically profitable business. (Kljajić, 2014)

In their earlier research, many authors, both local and foreign, dealt with forecasting trends in agricultural production (Abid et al., 2018; Badmus and Ariyo, 2011; Baser et al., 2018; Kilic Topuz et al., 2018; Mutavdžić et al., 2019; Nedeljković and Vujić, 2020; Novković et al., 2010; Sher and ahmad, 2008; Tahir and Habib, 2013).

Thus, using quantitative research methods in fruit growing, Bulatović et al., (2019) predict the number of productive apple trees as well as the volume of this fruit in Serbia, while Sharma et al., (2014) predict the trend of apple production in India. Užar et al., (2019) analyze the production parameters of apples in Serbia based on the trend model. Nedeljković and Potrebić (2020) analyze and predict the movement of apples in the Republic of Srpska based on the most suitable trend model. Also, in his work, Nedeljković (2021) analyzes and predicts the movement of plums in the Republic of Srpska based on a trend model. Kljajić (2014) looks at the current state of raspberry production in Serbia and based on that, analyzes the efficiency of investments in raspberry production.

In market economic conditions, successful production depends on monitoring, analysis and forecasting, results and the most important factors that influence it, Mutavdžić (2010) and in support of everything previously mentioned, the aim of this work would be to analyze the production parameters of raspberries in Serbia, i.e. determine trend of production indicators of this fruit in Serbia.

Methodology

Analysis of the situation and forecasting can be based on an ordered series of data in equal time intervals, that is, on the analysis of time series of observed phenomena Novković et al., (2010) and for this purpose, the current database of the Statistical Office of the Republic of Serbia was used, that is, the time period from 2006. until 2023. In addition, the FAOSTAT database and other available professional and scientific literature in the subject area were used for the purposes of the analysis. Quantitative research method was used as a working method, which covered raspberry production

indicators in an eighteen-year time period. The data were processed with standard statistical instruments (arithmetic mean, interval of variation, coefficient of variation, rate of change).

The display of the movement of the parameters is obtained using the linear trend of the analyzed data and based on the following expression:

$\hat{Y}t = a + bx$

where in:

x-independent variable,

$\hat{Y}$-dependent variable,

a-value of the function at the origin,

b-indicator of the direction of the trend.

We determine the tendency of the data in the observed period through the rate of change. The rate of change was calculated from the absolute values of the time series based on the following expression:

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

where in:

r-rate of annual change,

G-constant relative change of appearance,

Y_1-absolute value of the leading member of the time series,

Y_n-absolute value of the last member of the time series,

n-number of series members (number of years) (Užar et al., 2019).

Results and discussions

In 2022, raspberries were grown on 116,393 ha in the world, while production reached the level of 947,852.03 tons. In the same year, the largest producers were Russia with 212,300 tons and Mexico with 173,741.71 tons, while Serbia was right behind them with a total production in that year of over 116,000 tons. It is followed by Poland with 104,900 tons and the USA with 76,480 tons (FAOSTAT, 2023). According to the same source, this respectable result in production was accompanied by the export of this fruit of 2,923 tons, which is far less than leading exporters such as Spain (67,851.13), Morocco (56,322.97) and the USA (49,805.41) which is the largest importer of this berry fruit with 488,916.74 tons.

When we look at the surrounding countries, we easily come to the conclusion that Serbia is the dominant producer of raspberries in the region, and that the production in the observed year was at the level of over 12% of the world's raspberry production. (table 1)

Table 1. Raspberry production in neighboring countries (2022)

Countries	Production (t)
Serbia	116,093.00
B&H	12,188.00
Croatia	170.00
N. Macedonia	382.00
Hungary	580.00
Romania	170.00
Bulgaria	5,690.00
World	**947,852.03**

Source: Authors' own research based on data SORS,2023 and FAOSTAT, 2023.

The following table 2 shows the average production values of raspberry indicators in the eighteen-year period in Serbia. Thus, we can see that the average area under raspberry in the observed period was slightly over 16,454 hectares and that it had its maximum in 2020. Raspberry production in the analyzed period was 96,681 tons with a maximum of 127,010 tons achieved in 2018. The next graph 1 gives us a visual representation of the movement of areas as well as raspberry production. When it comes to the average yield, it ranged from a minimum of 4t/ha in 2020 to a maximum of 7t/ha recorded in the first four years of the observed period, which also shows graph 2. Apart from the areas under raspberry, a relatively stable movement was recorded in the yield and production of raspberries in the analyzed period, measured by the coefficient of variation. A slightly more unstable shortening was only noticeable in areas under raspberry, and that was almost 30%.

Based on the calculated rates of change, we can see that the area and production of raspberries showed a tendency to grow by 3.0% and 1.27%, respectively, while the yield showed a slight tendency to fall by 1.7%. (table 2) We certainly owe the slight tendency of yield decline to the bad weather conditions of previous years, as well as to the variation in the purchase price of raspberries in our country. Precisely in 2020, only the increase of the area, i.e. the maximum achieved under this fruit, maintained production, given that this is the year in which the lowest yield of this fruit was achieved.

**Table 2. Raspberry production indicators in the Republic of Serbia (2006-2023)**

Indicators	Average	Interval of variation		Rate of change (%)	Coefficient of variation (%)
		Min.	Max.		
Area (ha)	16,454.22	110,49.00	240,28.00	3.04	29.75
Production (t)	96,681.39	703,20.00	127,010.00	1.27	18.57
Yield (t/ha)	5.78	4.00	7.00	-1.73	16.88

Source: Authors' own research based on data from SORS, 2023.
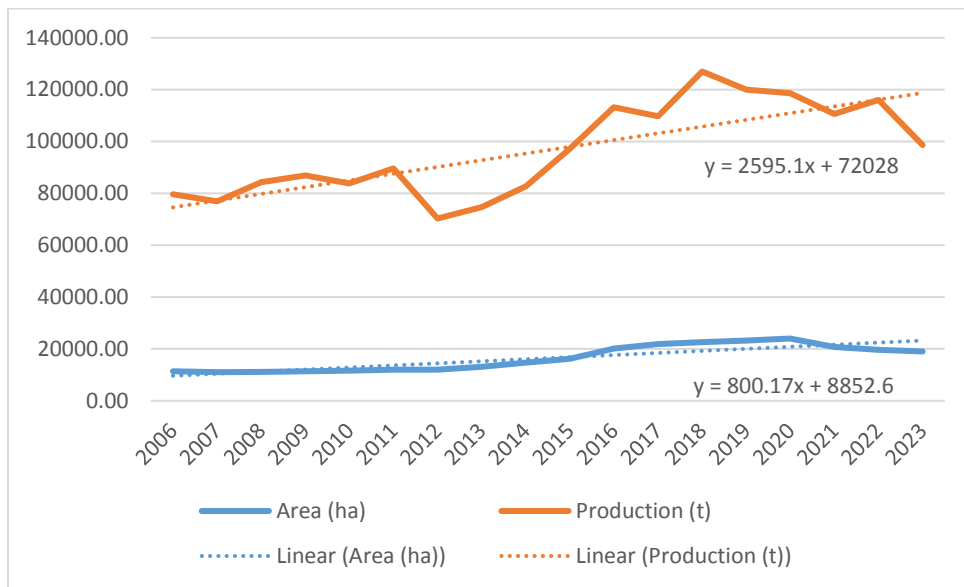
Figure 1. Development of areas and Raspberry production in Serbia

Source: Authors' own research.
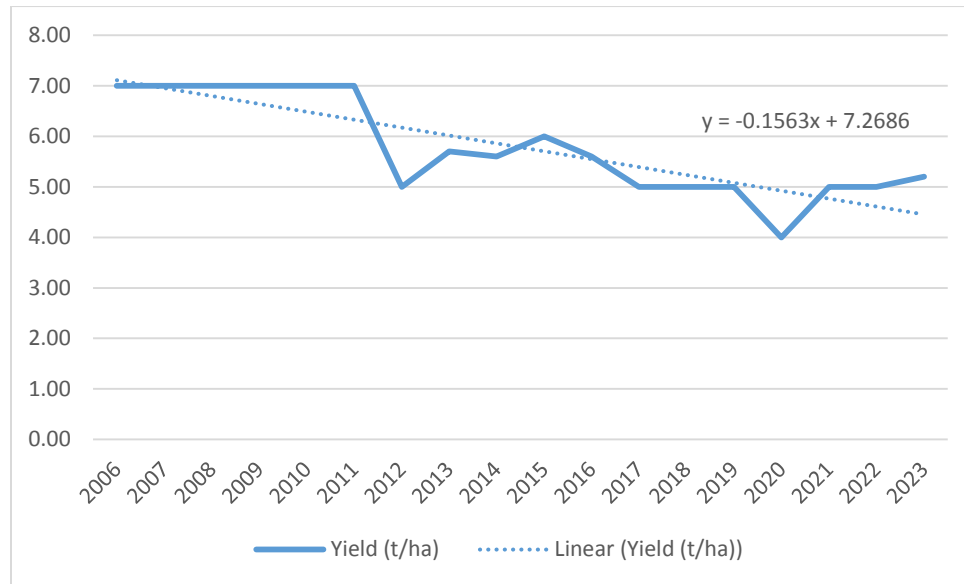
Figure 2. Raspberry yield trends

As stated by Kljajić (2014), fruit growing, and therefore also raspberry growing, is an important activity in agricultural production because a significant inflow of foreign currency can be achieved through export, and it employs a lot of active labor, which affects a considerable increase in the national income. In order to achieve this in raspberry growing, it is necessary to produce in a more organized manner with minimal fluctuations in the market and in production, and with increased participation of scientific knowledge, that is, the introduction of new methods of production, new varieties, etc. Our country has favorable conditions for cultivation, and as Keserović (2004) points out, in hilly and mountainous conditions, 10-15 times higher value of production per hectare can be achieved, than when producing wheat and corn.

Conclusion

On the basis of what was previously said in the paper, we can conclude that Serbia has good conditions and a tradition of growing raspberries. Raspberry production in Serbia ranks high in terms of production in the world and represents the leading export item of fruit production. It is dominantly cultivated in Serbia compared to the surrounding countries of the Western Balkans. Over the last eighteen years, the area under raspberry shows a slight growth trend and a relatively unstable movement, while raspberry production with a slight growth trend shows a relatively stable movement in the observed period. Yields are stable but with a downward trend, which was largely influenced by the fluctuating weather conditions and the poor purchase price in some years of the analysis. Given that it is possible to increase the influence of this production in the national income, further research related to this fruit species should examine the possible relationship between the value of exports and the quantities produced, and determine the impact of costs on raspberry production itself and its future export potential, both locally and internationally on the world market. Certainly, this research represents a good basis for such a thing.

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