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STATE AND PERSPECTIVE OF FRUIT PRODUCTION IN SERBIA[1]

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Abstract: *The aim of the research in this paper work is to examine the state of fruit production in terms of volume and yield in the Republic of Serbia for the period 2019-2023 as well as a proposal for measures to successfully increase the volume of production and improve it. The results show that the chances for the development of fruit growing are high thanks to the presence of both local and natural resources. The improvement of fruit production is possible with the allocation of larger funds for subsidies and other types of financial support from the state, as well as through the education of agricultural producers on the application and importance of innovations in fruit production.*

Key words: *fruit growing, production, yield, average annual rate of change, import/export, prices, recommendations.*

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INTRODUCTION

Fruit production is an important factor in the development of a country's agriculture and industry (whether it is the food, pharmaceutical or chemical industry) because high fruit production can influence the overall economic development. On the other hand, fruit production can directly or indirectly affect the development of other branches of industry and their products, such as the production of power and auxiliary machines, then the production of mineral fertilizers, plant protection products and many other inputs. Productivity in fruit growing is many times higher than the productivity of some field crops such as wheat or corn. Therefore, in fruit production, a much greater engagement of the labor force leads to greater employment of people (Kljajić et al, 2012; Lukač-Bulatović, 2020). In the Republic of Serbia, according to the volume of production, the first place is the plum, the second place is the apple, and the third place is occupied by the raspberry, while other fruit species are less represented (Maksimović, 2018).

Despite favorable natural conditions, intensive fruit production in the Republic of Serbia is not at the level of possible expectations. Favorable agricultural conditions that condition spatial and biological diversity, tradition in production, interest of agricultural producers in fruit production, various state incentives and the formation of associations, can lead to a significant intensification of fruit production (Milić and Bulatović, 2005; Milić et al, 2005a; Veljković et al, 2007; Kljajić et al, 2014; Dimitrijević et al, 2023). In this context, the goal of this research is to consider the trends regarding the volume and height of the most represented fruit crops in Serbia for the period from 2019 to 2023. In this way, the possibilities and potentials for the development of fruit growing as a highly profitable branch of agriculture can be recognized.

Plums have antioxidant and antiallergic properties, and their consumption improves cognitive functions, affects bone health and reduces cardiovascular risk factors. It is extensively cultivated all over the world, but it is best suited to areas with a moderate climate. The main challenges in plum production are variations in the application of agrotechnical measures, fluctuations in the achieved yield or fruit quality, the use of numerous varieties, the occurrence of some diseases

as well as weak marketing, frequent instability of the market, both nationally and internationally, etc. To reach full reproductive potential and profitability in plum production, an adequate choice of variety is required in accordance with the available production environment (Igwe and Charlton 2016; Nedeljković et al, 2023; Nedeljković et al, 2021; Subić et al, 2021; Sifat et al, 2021). In recent years, there have been more and more intensive plum plantings with a planting density of 800-1200 plants per ha and a yield of about 14 t/ha. The main regions of plum production in Serbia are Valjevo, Osečina, Blace, Čačak and Topola (Sectoral analysis of fruit production and processing in the Republic of Serbia).

Apple is one of the most important and widespread types of fruit in the world and in our country. The structure of apple producers in Serbia has changed over time, from traditional individual producers with a production area of 2 to 5 ha, to commercial farms with an area of over 10 ha, modern machinery and cold storage facilities with the involvement of experts, in line with the application of advanced technologies in apple production itself. Also, there is a large number of companies in Serbia with plantations of 30 to 250 ha and high apple yields of 50 to 70 t/ha (Magazin et al, 2022; Kljajić et al, 2023a; Dimitrijević et al, 2023).

Raspberry is one of the most profitable fruit species in Serbia. Attempts to grow raspberries in Vojvodina, where raspberries are not traditionally grown, confirmed that the centers of its production are still Valjevo, Arilje, Požega, Ivanjica in Western Serbia. This area is characterized by a specific micro-pedo-climatic potential, extremely suitable for this type of fruit (Kljajić et al, 2023; Nikolić et al, 2023).

Sour cherry is one of the oldest fruit species. Its production is continuously increasing in our country and also in the world. However, despite the modest requirements regarding natural conditions for production results, the sour cherry market is scarce not only in Europe, but also in the whole world. According to the area it occupies as well as according to production, the sour cherry occupies a high place among the leading fruit species. It is a very promising species in our country from the aspect of export to the international market. Fruit that is used both fresh and as raw material for processing is valued and has significant nutritional, medicinal, dietary and technological value (Vukoje et al, 2013; Sredojević, 2011).

MATERIAL AND METHODS OF THE RESEARCH

The paper covers the period from 2019 to 2023 for the analysis of areas and realized yields of selected fruit crops (plums, apples, raspberries, cherries) in the territory of the Republic of Serbia. The data of the Republic Institute of Statistics, Belgrade, as well as the available scientific and professional literature dealing with this topic, were used. The data are presented in tables and graphs with the application of standard mathematical and statistical methods.

RESEARCH RESULTS AND DISCUSSIONS

Of the total used agricultural land in the Republic of Serbia (3,488,752 ha) in 2022, orchards occupied 5.2% of the area of 184,265 ha. The most abundant fruit species is the plum, with a share of 39% in the total area under orchards. Then come apples with 15%, raspberries with 11% and sour cherries with 11% of the total area under orchards, and other fruit species with 24% (Graph 1 and Graph 2), (Statistical Yearbook of the Republic of Serbia for 2023).

Chart 1. *Utilized agricultural area, 2022*

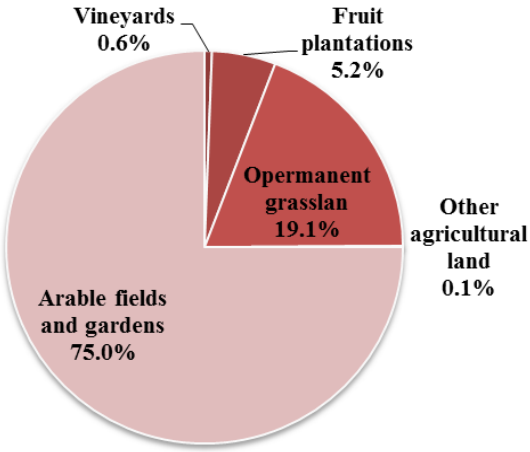
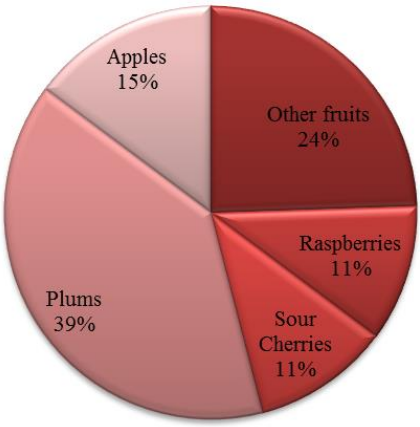


Chart 2. *Share of the most important fruit crops in the total area under fruit (%)*



Source: Republican Bureau of Statistics, www.stat.gov.rs

The areas on which the selected fruit species are grown in Serbia are shown in Table 1. The largest areas are under plum trees (for a five-year period, the areas under plum trees amount to an average of 72,927 ha), and the smallest under sour cherry plantations (for a five-year period, the areas under cherry trees amount to an average of 19,551 ha).

Table 1. *The fertile area of some fruit crops in the Republic of Serbia for the period from 2019 to 2023 (in ha)*

Fruit type	Harvested area, ha/bearing area, ha					Average	Average annual rate of change (%)
	2019	2020	2021	2022	2023		
Plums	72,316	73,010	72,569	72,323	74,418	72,927	0.72
Apples	26,089	26,360	27,034	27,253	27,412	26,830	1.24
Raspberries	23,249	24,028	20,807	19,703	19,016	21,361	-4.90
Sour cherries	19,114	19,601	19,551	19,875	19,614	19,551	0.65

Source: Author's calculation based on data from the Statistical Office of the Republic of Serbia, Belgrade, https://www.stat.gov.rs/

In the period from 2019 to 2023, the total area under apple planting increased by 1.24% on average per year, the total area under plum planting increased by 0.72% on average per year, the total area under raspberry planting decreased by 4% per year on average .90%, and the total area under sour cherry plantations increased by 0.65% on average per year.

Changes in the area in the analyzed period are shown using selected indicators of descriptive statistics (Table 2).

Table 2. *Arithmetic mean, standard deviation and coefficient of variation of areas under fruit crops in the Republic of Serbia for the period from 2019 to 2023*

Fruit type	Arithmetic mean (ha)	Standard deviation (ha)	Coefficient of variation (%)
Plums	72,927	786.93	1.08
Apples	26,830	515.61	1.92
Raspberries	21,361	1961.24	9.18
Sour cherries	19,551	245.93	1.26

Source: Author's calculation according to the data from Table 1.

Variations of areas under fruit crops are different. The biggest changes in areas were found in raspberry, with a coefficient of variation of 9.18%, while the smallest changes in areas are visible in plum, where the coefficient of variation is 1.08%.

The realized yield of the selected fruit crops for the five-year period is shown in Table 3.

The yield of apples decreased by 1.51% on average per year, the yield of plums decreased by 3.04% on average per year, the yield of raspberries increased by 0.38% on average per year, and the yield of sour cherries increased by 7.73% on average per year (Table 3.). The coefficient of variation is the highest in raspberry (6.23%), which indicates a more pronounced yield stability. The highest coefficient of variation is for plum (17.88%), followed by cherry (10.96%) and then apple (16.62%) (Table 4).

Table 3. *Realized yield (t/ha) of fruit crops in the Republic of Serbia for the period from 2019 to 2023*

Fruit type	Yield (t/ha)					Average	Average annual rate of change (%)
	2019	2020	2021	2022	2023		
Plums	7.7	8.0	5.7	6.8	4.9	6.6	-3.04
Apples	19.1	18.6	19.0	17.8	13.9	17.7	-1.51
Raspberries	5.2	4.9	5.3	5.9	5.2	5.3	0.38
Sour cherries	5.1	8.5	7.9	8.3	7.4	7.4	7.73

Source: Statistical office of the Republic of Serbia, www.stat.gov.rs

Table 4. *Arithmetic mean, standard deviation and coefficient of variation of yield (t/ha) of fruit crops in Serbia from 2019 to 2023*

Fruit type	Arithmetic mean (ha)	Standard deviation (ha)	Coefficient of variation (%)
Plums	6.6	1.18	17.88
Apples	17.7	1.94	10.96
Raspberries	5.3	0.33	6.23
Sour cherries	7.4	1.23	16.62

Source: Author's calculation according to the data from Table 3

Foreign trade exchange

During 2023, the total export of fresh apples of 129,247 t had a value of 98,333 million USD (Table 5). Out of the total export of apples, most apples are exported to Russia. Other export countries are Saudi Arabia, the European Union (28), the United Arab Emirates, the countries of the CEFTA agreement, India, the United Kingdom of Great Britain and Northern Ireland, Qatar, Bosnia and Herzegovina, Montenegro and others. The total amount of exported plums was 107675 t worth 1292467 million USD. Scherries and sour cherries (fresh), which are shown in the statistics in summary, in 2023 were exported in the amount of 10057.3 t worth 14786.2 million USD, and raspberries (fresh) in the amount of 970.5 t worth 2218 million USD. Raspberries are mostly

exported in a frozen state, so this is only a small part of the total exports of raspberries from the Republic of Serbia. The mentioned fruit is mostly exported to EU and CEFTA countries (www.stat.gov.rs).

Tabela 5. *Import and export of fruits to/in the Republic of Serbia in the period 2019-2023 (Balance Sheet)*

Import		**2019**	**2020**	**2021**	**2022**	**2023**	***Average***	***Balance***
Plums and wild plums, fresh	Quantity /t	299.3	1100.7	761.2	583.9	871.1	723.24	
	Value / 000 USD	254.4	486.3	674.3	431.9	761.3	521.64	
Apples, fresh	Količina/t	33209.9	26565.4	20713.1	37483.3	21573.0	27908.94	
	Vrednost/ 000 USD	8518.7	11208.6	6714.5	7822.0	6536.7	8160.1	
Cherries and sour cherries, fresh	Količina/t	1289.7	458.8	144.7	208.2	317.7	483.82	
	Vrednost/ 000 USD	961.9	488.7	226.0	242.6	478.6	479.56	
Raspberries, fresh	Količina/t	81.4	30.8	42.6	500.3	51.2	141.26	
	Vrednost/ 000 USD	220.6	152.7	465.2	1656.7	387.0	576.44	
Export		**2019**	**2020**	**2021**	**2022**	**2023**	***Average***	
Plums and wild plums, fresh	Quantity /t	20430.0	27544.4	23878.5	25097.0	16622.1	22714.4	**+21991.16**
	Value / 000 USD	8498.8	14843.5	16902.5	14070.5	11208.6	13104.78	**+12583.14**
Apples, fresh	Količina/t	217000.2	173098.4	179639.9	148077.4	129246.6	169412.5	**+141503.56**
	Vrednost/ 000 USD	118517.4	125400.7	127390.3	107674.7	98333.5	115463.32	**+107303.22**
Cherries and sour cherries, fresh	Količina/t	17524.2	17674.2	11876.9	14269.4	10057.3	14280.4	**+13796.58**
	Vrednost/ 000 USD	14864.9	18440.8	14120.9	19043.0	14786.2	16251.16	**+15771.6**
Raspberries, fresh	Količina/t	4922.4	1563.6	1900.1	1386.8	970.5	2148.68	**+2007.42**
	Vrednost/ 000 USD	6721.3	3056.9	6802.3	6317.6	2218.1	5023.24	**+4446.8**

Source: Statistical Office of the Republic of Serbia, www.stat.gov.rs

Necessary conditions for increasing exports are, first of all, increasing fruit production, adapting the assortment of fruit to the requirements of the export market, raising the quality of produced fruit for the reason of competitiveness on the market. The result of all of the above would be the achievement of good economic effects for producers (Vlahović et al, 2015).

In 2023, 21,573.0 tons of apples were imported, with an import value of about USD 6,536.7,000. In the last five years, an average of 27,909 tons of apples were imported into the Republic of Serbia per year (Table 6). Apples are mostly imported from the countries of the CEFTA agreement, North Macedonia, EU (28), Poland, Italy, the Netherlands, Albania, Russia, Greece, Bosnia and Herzegovina and others. Plums were imported in the amount of 25,097 tons in the value of RSD 16,622 million, predominantly from EU and CEFTA countries. The import of cherries and sour cherries was much lower than the export, so in 2023 it amounted to 318 t with a value of 478.6 million USD. Also, 51 t of fresh raspberries with a value of 387 million USD were exported from Serbia. Fruit is exported mainly from EU and CEFTA countries (www.stat.gov.rs).

Therefore, according to the data of the Republic Institute of Statistics, the dominant markets for the export/import of fruit from/to the Republic of Serbia are the group of countries of the European Union, the Russian Federation and the signatory countries of the CEFTA agreement. The population of these countries belongs to consumers of high standards, which results in a high demand for fruit on the foreign market. The balance of import and export is positive for our most abundant fruit species (Table 5).

The fruit market is free, the price of fruit is determined by the principle of "supply and demand". Accordingly, the purchase prices of fruit vary by year (Table 6).

Table 6. *Purchase prices of fruit for the period from 2019 to 2022*

Purchase price (din/kg)	**2019**	**2020**	**2021**	**2022**	**Average (2019-2022)**
Plums	40.43	53.32	59.74	58.17	52.92
Apples	41.23	49.46	50.79	45.27	46.69
Raspberries	143.64	196.28	377.37	488.13	301.36
Sour cherries	114.51	77.34	118.74	84.13	98.68

Source: Statistical Office of the Republic of Serbia, www.stat.gov.rs

For the examined period, the average purchase price of plums was 52.92 din/kg, the average purchase price of apples was 46.69 din/kg,

raspberries were sold at an average purchase price of 301.36 din/kg and source cherries at an average purchase price from 98.68 din/kg.

IMPROVEMENT OF FRUIT PRODUCTION

In order to improve fruit production in Serbia, it is necessary to implement adequate, pre-planned measures. Some of the most important measures are:

- long-term strategy of fruit production in Serbia;
- reionization of fruit production;
- raising new, modern plantings;
- introducing new innovative technologies into the production system;
- association of fruit growers and formation of agricultural cooperatives;
- promoting fruit and fruit products as well as producers on the domestic and international market;
- safe placement of fruit, etc.

CONCLUSION

The state of fruit production is one of the essential indicators of the state of agriculture of our country. The paper presents the results of the analysis of the production and yield of the most represented fruit species in the Republic of Serbia for the period from 2019 to 2023, as well as the foreign trade exchange and the movement of purchase prices of these fruit species. Based on the trends in production, yield and balance of foreign trade, it can be seen that fruit production takes place permanently thanks to the knowledge, tradition, experience of agricultural producers and their striving for advancement, education, innovation, etc.

Fruit production in the Republic of Serbia in the last decade has been marked by significant changes, starting with the introduction of new varieties of boca, through the establishment of modern plantations, the consolidation of fruit plots, the association of fruit growers to the

introduction and adoption of modern technologies and innovations in the production itself. This was contributed to a significant extent by associations and incentive measures by the Republic and Provincial institutions for new technologies adapted to climate change.

The Republic of Serbia could be one of the leading centers in Europe for the production, processing and export of fruit if a positive development policy were to be continued and systemic solutions applied at the level of the entire country in the field of fruit crops. Agrarian policy measures need to intensify fruit production while adapting to new opportunities on the market.

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STANJE I PERSPEKTIVE PROIZVODNJE VOĆA U SRBIJI

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Sažetak: *Cilj istraživanja u ovom radu je da se sagleda stanje proizvodnje voća u pogledu obima i prinosa u Republici Srbiji za period 2019-2023. godine kao i predlog mera za uspešno povećanje obima proizvodnje i poboljšati ga. Rezultati pokazuju da su šanse za razvoj voćarstva velike zahvaljujući prisustvu kako lokalnih tako i prirodnih resursa. Unapređenje voćarske proizvodnje moguće je izdvajanjem većih sredstava za subvencije i druge vidove finansijske podrške države, kao i kroz edukaciju poljoprivrednih proizvođača o primeni i značaju inovacija u voćarskoj proizvodnji.*

Ključne reči: *voćarstvo, proizvodnja, prinos, prosečna godišnja stopa promene, uvoz/izvoz, cene, preporuke.*