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## PRODUCTION AND FOREIGN TRADE EXCHANGE OF RASPBERRIES: CASE STUDY OF SERBIA<sup>1</sup>

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### Abstract

In paper are presented the derived research results on raspberries production in the Republic of Serbia, at total and by regions. Research results are clearly showing that raspberries are dominantly grown in Šumadija region and Western Serbia (around 84.8% of raspberries from Serbia are produced there). Mentioned region offers optimal conditions for raspberries production, in terms of microclimate characteristics, soil potential and available water resources. In recent years, raspberries production has been intensively expanding to those areas where it has not traditionally been cultivated until now. This refers primarily to the Region of Vojvodina, while existing and new plantations are also being expanded in the region of Southern and Eastern Serbia.

Serbia is ranked among the largest producers and exporters of raspberries worldwide. The largest part of raspberry production in Serbia is exported as frozen to the global market, but mostly to the market of Western Europe. Almost negligible part of produced raspberries is exported as fresh. Purchase price of raspberry has been increasing in previous period, giving the additional motivation to producers to intensify production, or invest in it.

**Key words:** Raspberries, production, import, export, prices.

**JEL<sup>5</sup>:** Q11, Q13, Q17

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## Introduction

Fruit growing is among the most profitable sectors of agriculture (Kljajić, Vuković, 2014; Kljajić et al., 2017a), where raspberries (*Rubus idaeus L.*) are in group of the most important fruit species. Their cultivation has a long history. After almost a century of selection and crossing of varieties, and optimization of the conditions for raspberry production, today raspberries represent the fruit spread all over the world (Yang et al., 2020; Zhang et al., 2022).

As one of the most important species of the berry fruit, raspberries occupies a special place in overall fruit production in Serbia (Kljajić et al., 2013). They can be used as fresh, or as they represent excellent raw material for the processing industry, they can be also used as food products in a form of jams, juices, syrups, compotes, wine, etc. In Serbia, about 90% of raspberries are used in frozen condition, as frozen fruits can be used throughout the whole year. Small quantities of raspberries are used as fresh.

There are several specific features of raspberries that give them advantages over other fruit species grown in Serbia. Some of them are easy propagation, fruiting in the first year after planting, full bearing after three years, etc. Raspberries have an exceptional medicinal effect towards the complex content of vitamins, minerals, certain microelements, etc. Therefore, the useful value of raspberries is extremely high and has a wide range of positive effects on the human body. They are used to lower blood sugar and regulate blood pH, as a medicine to soothe the rheumatic pains, or as light sedative, to treat throat diseases and various feverish conditions, or to improve digestion, as a laxative, to increase immunity, etc. The medicinal value of the raspberry leaf is also used for making raspberry tea, while the root is used to rinse the oral cavity in case of inflammation of the mucous membrane, inflammation of the pharynx, etc. It is proven that raspberry leaves have a wide range of active compounds, including terpenoids, flavonoids, phenolics and other anti-aging components, as well as antioxidants (Kljajić, 2012; Chwil, Kostryco, 2018; Zhang et al., 2022; De Santis et al., 2022).

Production of raspberries in Serbia is dominantly carried out on family farms, while all farm members are actively involved with additional employment of external labor during the harvest season. Duration of harvest, which is usually three to four weeks, increases the overall costs of harvest, but in same time fresh raspberry fruits are on the market for a longer period (Kljajić et al., 2022).

In the production structure of raspberries in Serbia, the dominant variety is “Vilamet”, covering about 87% of the area under raspberries plantations. It is followed by “Miker” variety, whose productivity is slightly lower compared to the previous

one. Besides, increasing number of raspberry producers are introducing the Polish variety “Polana” into their plantations, which provides yields from 15 to 20 tons of fresh raspberry fruit per hectare (Zarić et al., 2013). Due to its stability, this variety can be grown without tying into a trellis, while its biggest advantage, which has brought it great popularity among producers, is that it belongs to bearing fruit twice or autumn raspberries. This enables a prolonged harvest of raspberries, from July until the end of October.

Profitability of production is necessary condition for the sustainability and development of agricultural holding, as to its competitive power on the market. High profitability appears in raspberries production, explaining why producers are increasingly choose this production (Wroblewska et al., 2019). From the economic aspect, raspberries are characterized by a relatively large income and profit per unit of invested assets and labor force. In optimal production conditions, with the use of all necessary agrotechnical measures and certified planting material, a high yield is ensured, production costs are reduced, while the producer’s profit is increased. The competitiveness and profitability of raspberries production depends on number of economic and climatic factors, but individual decisions and choices made by producers also have a great influence (Bojkovska et al., 2021). The investment in raising raspberries plantations is safe and invested assets are quickly returned (Sredojević et al., 2013; Gogić, Ivanovic, 2013). According to economic analysis of organic raspberries production (Bodiroga, Sredojević, 2017), the transition from conventional to organic production would results in better profitability on family farms.

### **Materials and Methods**

The subject of research is raspberry as a very profitable fruit species produced in the Republic of Serbia. The main research goal is to analyze raspberry production and its export potential for Serbia, as a fresh or frozen. Given that raspberries have the epithet of a strategic product for Serbia, as well as they represent healthy food, therefore it has a strategic importance in export structure of agro-food products made in Serbia. Research also aims to determine the necessary conditions for increasing its production and export.

The paper is designed in such a way that in the first part it presents the basic elements linked to areas under raspberries, achieved production and yields of raspberries in the world and Europe, as well as to present the top raspberry producers for the period 2012-2021. The year 2021 was taken as the last year of data presentation, as the FAO statistics has data up to mentioned year. Also, in the first part of the paper, the same data were presented for overall Serbia and its

regions, for the period 2013-2022. The analyzing period takes the year 2022 as the final one, according to the data availability in the Statistical Office of the Republic of Serbia database. In the second part of paper, the foreign trade exchange of raspberries (frozen and fresh) is presented, while it was followed the export to worldwide countries and the EU countries. Besides, the average annual purchase prices of raspberries in Serbia for observed ten-year period was presented.

For the purposes of research, Statistical Office of the Republic of Serbia data (SORS), United Nations Food and Agriculture Organization data (FAO), as well as available scientific and professional literature in this field were used. The research is based on the application of desk research method with data processing using standard mathematical and statistical methods. Derived results have been presented tabularly and graphically and interpreted in accordance with the appropriate evaluation criteria, by applying the average annual rate of change, relevant changes in the area under raspberry and total production.

### Research Results with Discussion

There are many national and international surveys linked to raspberry in terms of its medicinal properties, production elements, export, market realization, investment in production, improvement of production, etc.

#### *Basic characteristics of raspberry production*

Raspberry production is based on economic justification, sustainability and the production of nutritious and healthy fruit (Stojanov et al., 2019).

**Table 1.** Production areas, overall production and yields of raspberries worldwide (period 2012-2021)

Years	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Average
Area Harvested (ha)	102,678	93,045	93,576	101,902	114,759	117,934	127,238	119,886	110,173	110,567	109,176
Production Quantity (t)	569,352	588,277	628,673	674,933	822,854	797,048	876,102	842,307	899,197	886,539	758,528
Yield (t/ha)	5.5	6.3	6.7	6.6	7.2	6.8	6.9	7.0	8.1	8.0	6.9

Source: FAOSTAT, 2023.

FAOSTAT data for the ten-year period (2012-2021) show that raspberries are grown worldwide in average at 109,176 ha. On this area, the production of 758,528 t is achieved with an average yield of 6.9 t/ha (Table 1.).

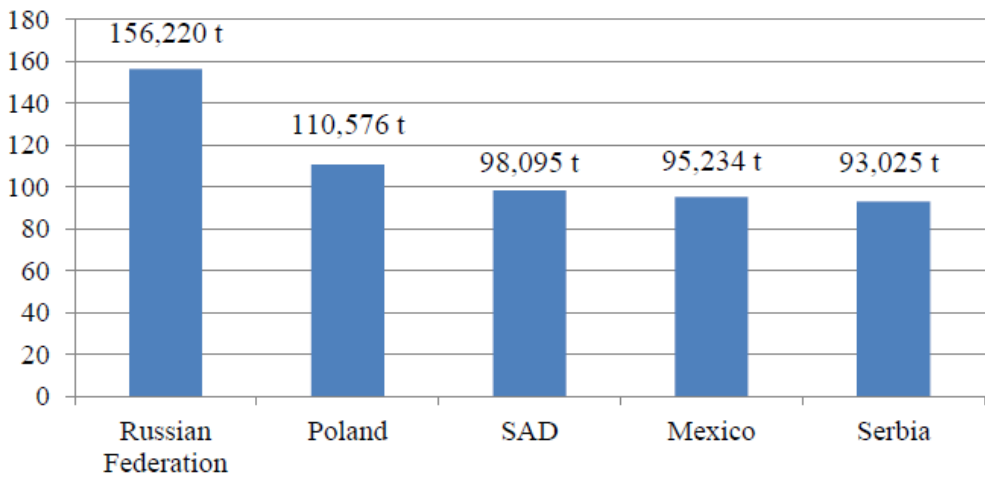
Raspberries are predominantly produced in Europe (up to 70%), in both Americas up to 30%, while the rest of raspberries production, up to 2%, is distributed on other continents (Table 2.).

**Table 2.** Production areas, overall production and yields of raspberries in Europe (period 2012-2021)

Years	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Average
Area Harvested (ha)	83,802	74,339	74,003	79,586	90,067	93,062	102,786	96,603	86,325	86,283	86,686
Production Quantity (t)	430,585	433,922	447,529	445,865	546,642	528,587	601,354	574,977	612,482	602,100	592,810
Yield (t/ha)	5.1	5.8	6.0	5.6	6.1	5.7	5.9	6.0	7.1	7.0	6.0

Source: FAOSTAT, 2023.

Serbia is among the largest raspberry producers worldwide (Stojković et al., 2020). Particularly Western Serbia represents the main region for raspberries growing (Pavlović et al., 2016). Globally observed, the top five raspberry producers are Russia, Poland, USA, Mexico and Serbia (Chart 1.).

**Chart 1.** Raspberries production in worldwide leading countries (period 2012-2021, in t)

Source: Authors' presentation based on FAOSTAT, 2023.

### *Raspberries production potential in the Republic of Serbia*

Raspberries production in Serbia dates back to 1880, when it was cultivated as an ornamental plant. Today, raspberries are grown very professionally and intensively at the territory of Serbia, while the largest production is still occurring in Western Serbia. In recent years, raspberries production has been expanded to areas where it was not cultivated before (AP Vojvodina), and it is increasingly cultivated in Southern and Eastern Serbia.

According to SORS, the average areas under raspberries plantations in last ten-year period (2013-2022) are 19,662 ha, with the realized production of 106,987 t of raw raspberries, and average yield of 5.5 t/ha (Table 3.).

**Table 3.** Average value of harvested areas and yields of raspberries in the Republic of Serbia (period 2013-2022)

Period of research	Harvested area, ha / growing area, ha	Ch. Index	Total production (t)	Ch. Index	Yield, t/ha	Ch. Index
2013	13,118	-	74,682	-	5.7	-
2014	14,792	112,76	82,683	110,71	5.6	98,25
2015	16,211	109,59	97,165	117,52	6.0	107,14
2016	20,194	124,57	113,172	116,47	5.6	93,33
2017	21,861	108,25	109,742	96,97	5.0	89,29
2018	22,654	103,63	127,010	115,74	5.6	112,00
2019	23,249	102,63	120,058	94,53	5.2	92,86
2020	24,028	103,35	118,674	98,85	4.9	94,23
2021	20,807	86,59	110,589	93,19	5.3	108,16
2022	19,703	94,69	116,093	104,98	5.8	109,43
<i>Average</i>	<b>19,662</b>		<b>106,987</b>		<b>5.5</b>	
<b>Average annual rate of change (%)</b>	<b>4.62</b>		<b>5.02</b>		<b>-0.19</b>	

Source: SORS, 2023.

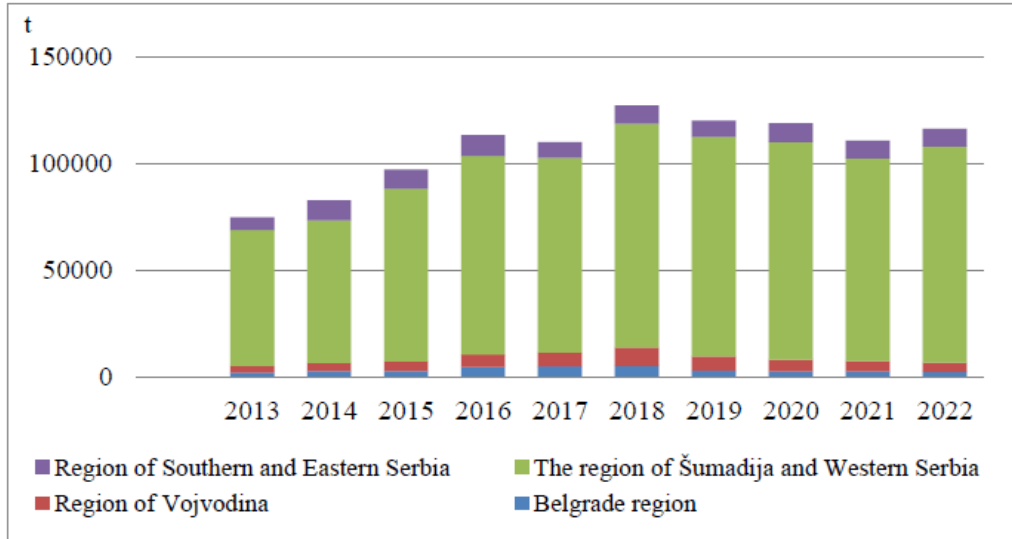
According to Table 3. the largest areas under raspberries in Serbia were in 2020 (24,028 ha), while the least were in 2013 (13,118 ha). The average growing area for the same period was 19,662 ha. The highest total yield of 127,010 t was achieved in 2018, and the lowest of 74,682 t was achieved in 2013. The average value of the total yield for the observed ten-year period was 106,987 t. Regarding the yield expressed in t/ha, the highest achieved yield was in 2015 (6.0 t/ha), and the lowest one in 2020 (4.9 t/ha), while the average value for the overall research period amounted to 5.5 t/ha.

In the observed period 2013-2022, the total area under raspberries increased annually in average by 4.62%, total production increased in average by 5.02%, while the yield in tons per hectare of production area was decreased in average per year by 0.19%.

#### *Raspberries production by regions in the Republic of Serbia*

Dispersion of raspberries production by the regions is shown in next chart (Chart 2.). At the glance it could be seen that raspberries production takes place dominantly in the region of Šumadija and Western Serbia.

**Chart 2.** Raspberries production by regions in the Republic of Serbia (period 2013-2022)



Source: Authors' presentation according to SORS, 2023.

In mentioned region, there are several microregions where raspberries production is concentrated: *Valjevski* - Podgorina and Pocerina (Kolubara district); *Šabački* - Loznica, Krupanj, Bajina Bašta (Mačva district), *Ariljski* - the vicinity of Arilje and Kosjerić (direction Povlen-Varda) Zlatibor district; *Ivanjički* - Ivanjica, Kaona, Kotraž and Guča, and *Čačanski* - Čačak with surroundings (Moravian district); *Kopaonički* - Brus and the foothills of Željina with surroundings (Raška district), and *Kraljevački* - Kraljevo and Dragačevo with surroundings (Raška district), (Tomašević, 2016). For many years, on the world market, "Arilje's raspberry" has been synonym for quality, as the production area around Arilje is the area with the most optimal pedo-microclimatic conditions for the growing of high-quality raspberries. The beginning of the trellis method of growing raspberries is also linked to this area. Due to mentioned, the "Arilje's raspberry" represents the product with a protected designation of origin (Paraušić, Simeunović, 2015). In 2009, the designation of geographical origin „Ariljska malina“ (Raspberry from Arilje) was registered in the Intellectual Property Office of the Republic of Serbia. It refers to raspberries both in fresh or frozen condition (IPORS, 2009).

In average, total production within this region in period 2013-2022 was 87,859 t, which is 84.8% of overall raspberries production in Serbia, while it was done on, in average, harvested area of 15,532 ha, with average yield of 5.7 t/ha.

In average, overall production of raspberries in the region of Southern and Eastern

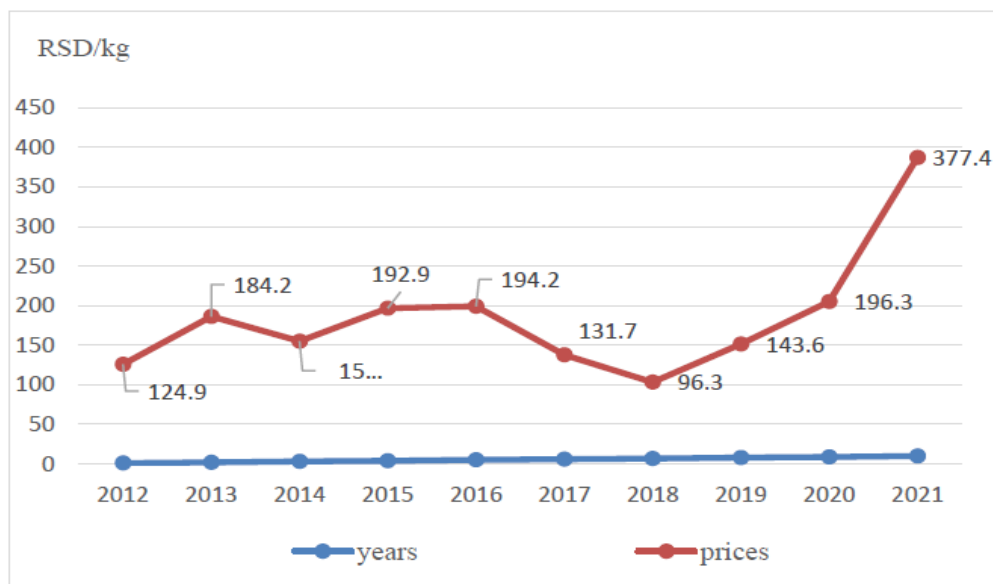


Serbia, for the same period, was 7,855 t, what represents 7.6% of the total production in Serbia. Within the mentioned region, related to raspberries, the most important microregion is *Leskovački* (Leskovac and surroundings), which belongs to the Jablanički district.

In the region of Vojvodina, raspberries are grown, in average, at 937 ha. Realized production (in average) is 5,005 t, with average yield of 5.4 t/ha. In recent years, the raspberries plantations in Vojvodina have been intensively expanding, while remontant raspberry varieties are increasingly involved in production, such are the most famous Polish varieties: Polana and Polka, contrary to dominant variety Willamette (Milić et al., 2020).

In the Belgrade region, raspberries are grown in average on just 547 ha, with a production of 2,945 t and achieved yield of 5.5 t/ha. In this region is realized 2.8% of the total raspberries production in Serbia.

**Chart 3.** Purchase prices of raspberries (in RSD/kg, period 2012-2021)



Source: Authors' presentation according to SORS, 2023.

Raspberries are placed on the market after being classified into 4 categories: 1) *Raspberry "Rolend"* (separate quick-frozen fruits) - if the packaging unit contains at least 80% of the mass of individual, whole, frozen fruits; 2) *Raspberry "Griz"* - if the packaging unit contains parts of frozen crumble raspberry fruits, which are not mutually glued; 3) *Raspberry "Blok"* - if the packaging unit contains frozen berries glued together; and 4) mixture of frozen whole and crumbled fruits - if the packaging

unit contains a mixture of frozen whole and crumbled fruits, which are not glued together (OGRS, 2020/21; Jakšić et al., 2023).

The purchase price of raspberries in 2012 was 124.9 RSD/kg, or 1,07 EUR/kg, while after this comes to significant increase from year to year (with sharp annual decrease in 2018 on 96.3 RSD/kg, or 0,8 EUR/kg). So, since 2019, the purchase price of raspberries has been increasing reaching in 2021 the value of 377.4 RSD/kg, or 3,2 EUR/kg (Chart 3.). This happened during pandemic of corona virus (COVID - 19) mostly based on fact that raspberries have certain medicinal properties that boost the human immunity.

The conversion of RSD into EUR is in line to the official average exchange rate of the National Bank of Serbia.

#### *Foreign trade exchange of raspberries*

Raspberries are in high demand on the world market. According to some authors (Leposavić et al., 2013), over 95% of harvested raspberry fruits from Serbia is directed to global markets. Only small quantities are placed on the local market. As data from Table 4. show, the average export of frozen raspberries from Serbia to worldwide countries during the period 2013-2022 was 89,906 t, with an average value of 272,756 USD. In same period, in average, 76,254 t in value of 224,922 USD was exported from Serbia to the EU states (e.g. about 84.8% of exported frozen raspberries was directed to EU countries). European countries are the most important regional raspberries importers. Worldwide, the largest importer of raspberries is Germany, followed by France, Belgium, UK, Sweden, the Netherlands, Poland, and Austria (Kljajić, 2017b; Kljajić, 2017c).

**Table 4.** Export of no sugar added frozen raspberries (period 2013-2022)

Years	Worldwide		European Union countries (28)	
	Quantity (t)	Value (000 USD)	Quantity (t)	Value (000 USD)
2013	61,416.9	187,357.7	56,821.0	171,539.8
2014	73,252.6	236,517.6	64,933.4	207,713.4
2015	93,731.6	267,566.4	83,400.1	234,569.4
2016	85,956.9	247,883.5	77,009.8	219,853.6
2017	94,000.2	233,233.4	81,689.1	201,121.6
2018	103,275.8	225,763.8	87,884.2	190,062.9
2019	114,354.2	234,343.9	99,145.6	199,705.1
2020	107,745.2	295,896.5	82,582.6	217,716.0
2021	97,961.5	426,143.1	76,275.4	320,042.4
2022	67,364.5	372,850.7	52,802.0	286,897.8
Average	<b>89,905.94</b>	<b>272,755.7</b>	<b>76,254.3</b>	<b>224,922.2</b>

Source: SORS, 2023.

The largest volume of frozen raspberries was exported from Serbia in 2019 (114,354.2 t), while the smallest volume was exported in 2013 (61,416.8 t). The import of raspberries into Serbia is insignificant. The observation period could be divided into two sub-periods according to the exported volume. In the first five-year period (2013-2017), the average export was at 4.225,8 t, while in the second five-year period the average export was at 98,140.2 t, so the trend was to increase the export of frozen raspberries in recent years, with the exception of 2022, when the volume of exports was close to this reached in 2013.

**Table 5.** Export of no sugar added raw raspberries (period 2013-2022)

Years	Worldwide		European Union countries (28)	
	Quantity (t)	Value (000 USD)	Quantity (t)	Value (000 USD)
2013	597.6	1,308.4	591.8	1,298.9
2014	5,056.0	11,936.6	5,047.5	11,926.5
2015	6,422.4	13,013.5	6,411.1	12,982.9
2016	3,389.2	6,695.5	3,377.1	6,660.7
2017	5,663.9	7,932.6	5,634.6	7,844.3
2018	3,858.3	4,448.0	3,739.4	4,200.2
2019	4,922.4	6,721.3	4,917.2	6,709.6
2020	1,563.6	3,056.9	1,563.5	3,056.6
2021	1,900.1	6,802.3	1,878.2	6,753.2
2022	1,386.8	6,317.6	1,386.4	6,313.5
Average	<b>3,476.03</b>	<b>6,823.27</b>	<b>3,454.68</b>	<b>6,774.64</b>

Source: SORS, 2023.

Export of no sugar raw raspberries is presented in the following table (Table 5.), showing that in observed ten-year period in average total export worldwide was 3,476 t with average value of 6,823.3 USD. Within this, in average, 3,454.7 t of no sugar added raw raspberries with value of 6,774.6 USD were exported to the EU countries.

The largest export was realized in 2015 (6,422.4 t), while the smallest quantity was realized in 2013 (597.6 t).

The economic benefits of raspberries production in Serbia are indicated as following (SEEDEV, 2020):

- Continuity in export for last several decades, mainly to the EU market;
- Successful process of association of raspberry producers in well-developed market chain;
- Existence of contracted production;
- Great impact on rural development; and
- Growing competition at the producers' level in purchasing and export.

The economic benefits derived from raspberries export would be much better if raspberries are exported in the form of processed food-products with additional value-added, although the production of processed raspberry products in the form of juices, jams, etc. has upward trend in recent years (MAFWM, 2020).

In order to achieve more significant economic benefits from the production and export, it is necessary to produce raspberries in sufficient (larger) quantities that would satisfy the growing needs at the foreign markets. Along with that, it is important to determine the strategy for international marketing, which would imply more intensive promotion of Serbian raspberries through the media and Internet, and appearance at international fairs (Radosavljević, 2014).

Serbia's the biggest competitor for exports to European countries is Poland. Currently, Polish advantage is reflected in fact that, by joining the EU, it received certain competitive advantages towards the growing and realization. Therefore, some of the leading EU agro-food companies have built their capacities for raspberries processing in Poland, what contributes to increase in raspberries production in mentioned country.

### **Conclusion**

Raspberries are grown in Serbia on large areas, concentrated in several micro-regions within the region of Western Serbia. Micro-regions centers are Arilje, Valjevo, and Ivanjica, being the main area for the production. In analyzed ten-years period, raspberries were grown on area of 19,662 ha (in average), with a total production of 106,987 t and average yield of 5.5 t/ha. Within the fruits export from Serbia, raspberry has a dominant share. Due to its high quality, it achieves a high price on the international market. In observed period in average, 89,906 t of frozen raspberries were exported from Serbia, while approximately 51% were exported to EU. Export of fresh raspberries is much smaller than the export of frozen raspberries, targeting two independent and separate markets. Since 2000, the value of frozen raspberry exports has been increased for three times, while the value of fresh raspberry exports has been increased for 20 times (SEDEDEV, 2020).

Despite the significant results achieved on global market, Serbia lags behind the competition. The countries that represent Serbia's biggest competitors in the export of raspberries are Chile and China globally, or Poland on the European market. Consequently, in order to increase exports and reduce competitiveness, there are certain priorities for development and expansion of raspberry production in Serbia that relate to modernization of entire production process in terms of revitalization of old plantations and introduction or expansion of new ones, with the use of certified,

high-quality planting material, as well as the application of complete agrotechnical measures, introduction of new varieties, which would extend the harvesting season, and thus the export period, the expansion processing, as well as introduction of innovative technical solutions in function of intensifying production. Perspective of raspberry exports from Serbia in upcoming period is very good with appliance of appropriate marketing measures, in which the state plays a significant role. State role is also reflected in subsidizing production, what is of great importance for expanding and modernizing raspberry production and export increase. Besides, producer's education through extension service also has a significant role in raspberry production advancing.

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