ECONOMIC VIABILITY OF PLUM PRODUCTION ON THE FAMILY FARM IN THE REPUBLIC OF SERBIA

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ABSTRACT

The aim of this paper is to determine the economic viability of plum production on an individual agricultural holding located in rural area of the South Banat district of the Republic of Serbia. Several methods were used for this research: content analysis, interview, description method, calculation method, and some static methods for economic evaluation of production. The analysis was carried out on the basis of the data from the family farm. Publications and databases of the Statistical Office of the Republic of Serbia, as well as scientific and professional literature relevant to the research topic were also used as data sources. The analysis showed that the production of plums on an individual agricultural holding could be economically viable and justified.

Key words: economic viability, production, plum, family farm.

INTRODUCTION

Fruit production has an important place in the economy of the Republic of Serbia. A large number of people are employed in the production, processing and trade of fruit, as well as in activities that rely on this branch of agriculture (catering, tourism, chemical industry). In some parts of Serbia, especially in hilly and mountainous areas, fruit production is the main source of income for a large number of farms (Milić et al., 2013).

There were 3.5 million hectares of agricultural land in the Republic of Serbia in 2021. An area of 182,084 hectares was planted with fruit trees, which accounted for only 5.2% of the total agricultural land. This is a relatively small area considering that there are extremely favourable conditions for growing fruit trees (RZS, 2022).

Compared to other fruit crops grown in Serbia, plum ranks first in terms of share of total land under orchards, but not in terms of economic importance. The main reasons for this are low yields, low purchase prices and a low share of exported plums in the total amount of plums produced.

Numerous positive characteristics of the plum as a cultivated crop have contributed to the fact that the areas under cultivation have not decreased significantly over the years, despite the low profit from the sale of this fruit.

Serbia has favourable conditions for fruit production, including plum production. This refers primarily to the presence of favourable natural conditions (land, water, air) and experienced growers. Considering the relatively low market price compared to other fruits, plum is accessible to all categories of consumers. For these reasons, it is important to encourage the development of the production of this fruit, but by using modern technologies in order to achieve the best possible economic effects (Благојевић и Божић, 2012).

MATERIALS AND METHODS

The subject of this study is the production of plums on a family farm in the territory of the municipality of Bela Crkva. The members of this farm are mainly engaged in fruit production, in which the production of plums plays a dominant role.

The aim of this research is to determine the economic viability of plum production on the family farm in the period 2018 - 2021.

Several methods were used for this research: content analysis, interview, description method, calculation method, and some static methods for economic evaluation of production.

Records from interviews conducted with household members and internal documentation of the analysed family farm were used as data sources.

In addition, the databases of the Statistical Office of the Republic of Serbia, United Nations and relevant domestic and foreign scientific and professional literature were also used.

RESULTS AND DISCUSSION

In the structure of fruit production in Serbia, the largest areas are traditionally planted with plum trees (72,116 ha), as the data in Chart 1 show.
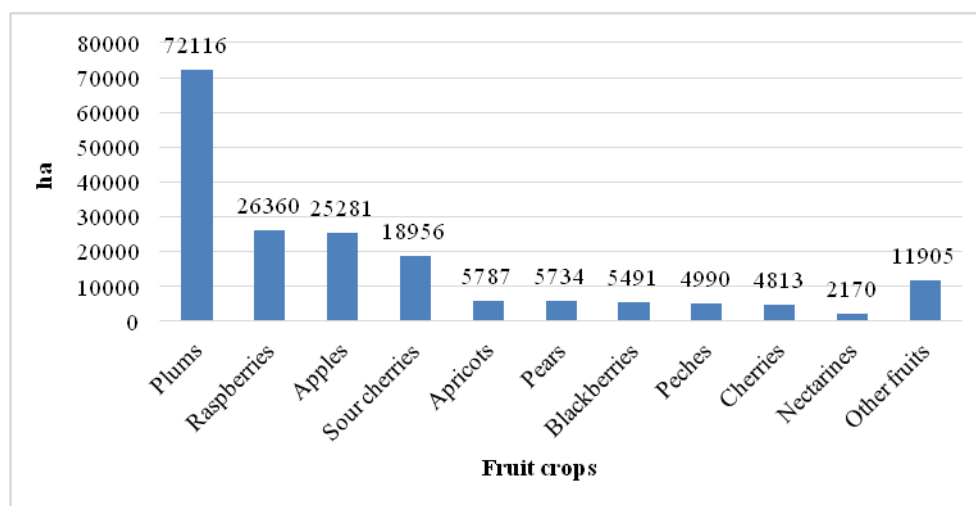

Chart 1: Cultivated areas of certain fruit crops in Serbia in 2017
Source: Authors based on RZS data

Plum production in Serbia has a long tradition and great historical significance. It is believed that the first forms of European plums were brought to the Balkans at the time of Alexander the Great (356 - 323 BC). In the Middle Ages, plums were grown in Serbia mainly on the lands of noblemen and monasteries, especially in the valleys of the rivers: Western Morava, Ibar and Lim. At the end of the 19th and beginning of the 20th century, large quantities of plums were exported from Serbia, the volume of which was up to 40,000 tonnes (Mišić, 2006).

The trend of exporting plums from Serbia (then Yugoslavia) continued between the two world wars and then gradually declined from year to year. It is best evidenced by the fact that only 4,157 tonnes of plums were exported from Serbia in 2020 (Chart 2).

From the data shown in Chart 2, it can be seen that the export of dried plums has slightly decreased in the last 7 years, while the export of fresh plums has shown growth with the highest export in 2020 (27,500 tonnes).

Plums are grown throughout Serbia, but the leading production areas are the areas of Western Serbia, Šumadija and part of Southern Serbia, around Prokuplje. According to the agricultural census conducted in 2012, the largest areas under plum trees were in the

following municipalities: Valjevo (4,006 ha), Kraljevo (2,351 ha), Kragujevac (2,330 ha), Osečina (2,265 ha) and Prokuplje (2,049 ha) (RZS, 2012).
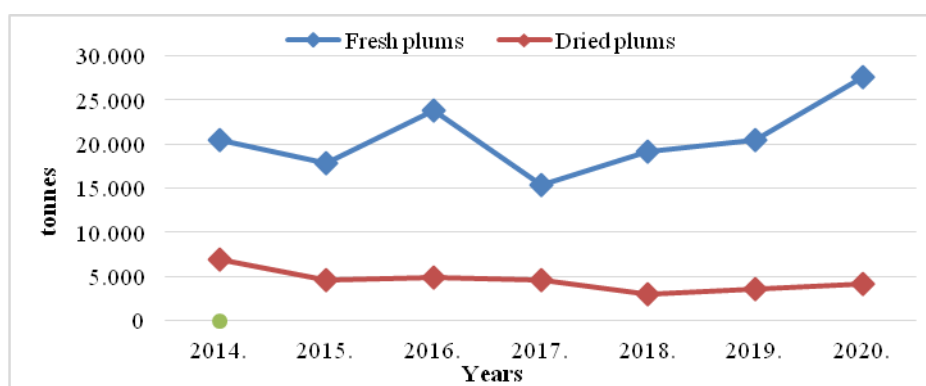

Chart 2: Export of fresh and dried plums from the Republic of Serbia in the period 2014 - 2020.
Source: Authors based on RZS and Comtrade data

Plum production is not as widespread in South Banat as in the above-mentioned regions of Serbia.

For many years, plum trees were grown in Serbia in an extensive manner (planting at low density, no pruning or fertilization, no tillage). Gradually, a new approach was adopted, which provides for the cultivation of plums in semi-intensive and intensive cropping systems (planting in high density, with regular application of all agrotechnical and pomotechnical measures and planting of highly productive varieties such as: Čačanska lepotica, Stanley, Čačanska rodne and Čačanska najbolja). The result of this approach is an increase in the average yield in plum production throughout the country (Table 1).

Table 1. Cultivated area, total production volume and average yield of plums in the Republic of Serbia by years in the period 2014 - 2021.

	2014	2015	2016	2017	2018	2019	2020	2021
Area (ha)	75.626	74.172	73.319	72.024	72.224	72.316	73.010	72.569
Production (t)	421.529	354.890	471.442	330.582	430.158	558.930	582.547	412.778
Average yield (t/ha)	5.6	4.8	6.4	4.6	6	7.7	8.0	5.7

Source: Authors based on RZS data

Table 1 shows the decreasing trend in the total area planted with plum trees for the period 2014 - 2020. In contrast, the total production volume and average yield show an increasing trend, which could be due to an increase in production intensity. An exception is the year 2021, when a large number of plantations suffered fruit damage due to frost and hail.

Organizational - economic conditions
The farm, which is the subject of the analysis, is located in the district of South Banat, on the outskirts of the municipality of Bela Crkva, right on the border with Romania. Despite its peripheral location, the municipality is very well connected in terms of transport with neighboring municipalities and nearby cities such as Vršac, Smederevo and Belgrade. The transport accessibility is reflected in the network of regional and main roads, the international border crossing with Romania, the waterways - the Danube, the Danube-Tisza-Danube water system and the category C airport. The greatest natural wealth and development potential of this region is undoubtedly the Danube, which is the natural connection of this place with Europe. This position is of great importance for the family farm, because the proximity of a

well-organized market, as one of the most important economic factors, enables the placement of better quality agricultural products at a more favorable price.

The farm under study cultivates 18.62 hectares of land. Most of the cultivated land is owned by the farm, while a small part of the land is leased. The farm is mainly engaged in fruit production, with plum production accounting for the largest share, while agriculture and vegetable production appear more as secondary branches.

The farm has all the necessary machinery for the smooth implementation of all steps of plum production, except for harvesting and pruning, which are done manually and with the help of seasonal workers. This is of great importance for the success of production, as it allows the replacement of the laborious physical work of the workers and thus a significant increase in labour productivity. In addition, the execution of some operations is of higher quality and it is easier to meet optimal agrotechnical deadlines (Bugarin et al., 2014).

The farm has long-standing partners with whom it has a good working relationship, such as the agricultural cooperative and companies that deal with the purchase of fruit and vegetable products. The agricultural cooperative supplies the farm with the necessary raw materials and purchases the goods after the production is completed. With one of the companies dealing with the purchase of fruit and vegetables, the farm cooperates commercially and technically in the implementation of a larger integrated project aimed at networking within the market chain, increasing competitiveness and improving the placement of fruit products.

The owner of the farm is a member of the fruit growers association. Together with the agricultural cooperative, the fruit growers association and several other local agricultural producers, the farm has joined forces for a larger integrated project to implement a joint marketing plan, all with the aim of strengthening the links in the market chain.

Plum production process

Taking into account all existing conditions, the American plum variety Stanley, also known as Stenlej or Stenlejka in Serbia, was planted on the farm under study.

The technological process of production of this plum variety in the observed farm is presented by a technological map (Table 2).

Economic analysis of plum production

The main goal of any farm is to generate as much income as possible. Achieving this goal depends on a number of factors that influence the production process. In order to be able to determine the exact amount of income, i.e. profit, which is also a measure of the efficiency of the use of resources in the production of a certain amount of products, it is necessary to conduct an economic analysis of the production results (Gogić, 2014).

The economic indicators for plum production were calculated on the basis of calculations, i.e. records of costs and income in the observed period (Table 3).

From the calculation (Table 3), it can be seen that there are significant differences in the realised profit for the period 2018-2021. The highest profit, compared to the lowest yield in these years (20 t/ha), was realised in 2021. The high profit was influenced by the high purchase price of 0.34 €/kg in 2021. The reason for such a high price is the poor plum harvest in 2021 due to natural disasters (freezing of a large number of plantations and damage to the fruit by hail). The lowest profit was achieved in 2019, and the main reason is the low selling price (0.11 €/kg) and low yield. There are no major fluctuations in the total costs of plum production. Labour costs are generally the same every year, except in 2021. The fluctuations are due to the different daily wages of workers, which are affected by the supply and demand for labour during the plum harvest.

Table 2. Technological map of plum production in a family farm on an area of 1 ha

No.	Work operations	The month in which the work operation is performed	Unit of measure	Daily output per shift	Total scope of work	Required number of working days to perform the work	Composition of the working group		Total required number of working days	
							workers	machines	workers	machines
1	Loading, transportation and unloading of mineral fertilizer	10	tonne	8,00	0,50	0,06	2	1	0,13	0,06
2	Spreading of mineral fertilizer	10	hectare	4,00	1,00	0,25	2	1	0,50	0,25
3	Autumn plating	10	hectare	4,00	1,00	0,25	1	1	0,25	0,25
4	Pruning	2	hectare	0,20	1,00	5,00	1	0	5,00	0,00
5	Taruping	2	hectare	3,00	1,00	0,33	1	1	0,33	0,33
6	Delivery of water and preparation of spray solution	2	tonne	10,00	0,80	0,08	1	0	0,08	0,00
7	Spraying	2	hectare	5,00	1,00	0,20	1	1	0,20	0,20
8	Loading, transportation and unloading of mineral fertilizer	4	tonne	8,00	0,35	0,04	2	1	0,09	0,04
9	Spreading of mineral fertilizer	4	tonne	4,00	1,00	0,25	2	1	0,50	0,25
10	Spring milling	4	hectare	3,00	1,00	0,33	1	1	0,33	0,33
11	Delivery of water and preparation of spray solution (x2)	4 – 5	tonne	8,00	1,60	0,20	1	0	0,20	0,00
12	Spraying (x2)	4 – 5	hectare	5,00	2,00	0,40	1	1	0,40	0,40
13	Cultivation (x2)	4 – 5	hectare	4,00	2,00	0,50	1	1	0,50	0,50
14	Milling (x2)	4 – 5	hectare	3,00	2,00	0,67	1	1	0,67	0,67
15	Fruit thinning	5	hectare	0,30	1,00	3,33	1	0	3,33	0,00
16	Pruning	5	hectare	0,30	1,00	3,33	1	0	3,33	0,00
17	Irrigation	6 – 8	hour	7,00	14,00	2,00	1	0	2,00	0,00
18	Delivery of water and preparation of spray solution (x2)	6 – 7	tonne	8,00	1,60	0,20	1	0	0,20	0,00
19	Spraying (x2)	6 – 7	hectare	5,00	2,00	0,40	1	1	0,40	0,40
20	Loading, transportation and unloading of packaging	7 – 8	pieces	1000	2000	2,00	1	1	2,00	2,00
21	Harvest	7 – 8	tonne	0,40	29,00	72,5	1	0	72,50	0,00
22	Loading, transportation and unloading of fruits	7 – 8	tonne	20,00	29,00	1,45	2	1	2,90	1,45

Source: Authors based on data from the internal documentation of the analyzed farm

Table 3. Calculation of plum production on the family farm per year, on an area of 1 ha, for the period 2018 - 2021.

Elements of calculation	Year			
	2018	2019	2020	2021
1. Yield (kg/ha)	31,000	29,000	35,000	20,000
2. Purchase price (€/kg)	0,13	0,11	0,14	0,34
3. Gross Income (1 x 2) (€/ha)	4.030	3.190	4.900	6.800
4. Cost of materials:	750	800	950	900
- fertilizers,	300	300	350	337
- pesticides,	262	317	429	372
- fuel	188	183	171	191
5. Labor costs	1.386	1.030	1.050	850
6. Storage costs	-	-	-	-
7. Depreciation	100	100	100	100
8. Other expenses	170	130	150	170
9. Total cost (4+5+6+7+8) (€/ha)	2.406	2.060	2.250	2.020
10. Profit (3 - 9) (€/ha)	1.624	1.130	2.650	4.780

Source: Authors based on data from the internal documentation of the analyzed farm

Production economics demands that costs should be as low as possible. In this context, it is therefore necessary to consider the possibility of reducing the cost of production, especially the cost of labour and materials.

For this reason, it is necessary to determine the values of business success indicators in order to assess whether and to what extent production was economically efficient in the observed period. As basic indicators of the degree of economic efficiency of plum production were analyzed: profitability, efficiency ratio, and labor productivity.

Profitability of plum production

The profitability of production can be expressed as the ratio between the financial result (profit) and the value of production, i.e. the rate of profitability of production (Pp) can be determined as follows:

$$P_p = \frac{Profit}{Gross\ Income} \times 100$$

In this way, the degree of realization (participation) of profit in the total value of production is expressed. The profitability rate of plum production in the observed farm was calculated for all four years:

$$P_{p\ (2021)} = (4.780/6.800) \times 100 = 70,30\%$$
$$P_{p\ (2020)} = (2.650/4.900) \times 100 = 54,08\%$$
$$P_{p\ 2019)} = (1.130/3.190) \times 100 = 35,42\%$$
$$P_{p\ (2018)} = (1.624/4.030) \times 100 = 40,30\%$$

Since the production of plums in the farm under study gives a positive financial result, the profitability rate is positive, and therefore the production of plums is profitable in the years observed. The profitability rate is the highest in 2021 (Rp = 70.30%), showing that in this year, for every 100 euros of production value, 70.30 euros of net profit was obtained. In the other years studied, significantly lower profitability rates were achieved, which can be attributed to lower yields and lower purchase prices.

Efficiency ratio

The ambition of every producer is to make production as efficient as possible, i.e. to reduce production costs to a minimum while maintaining the quality of the product at a reasonable level. The profitability of production is usually expressed by the ratio of total revenues to total expenses, i.e. the ratio of production value to production costs. It is expressed by the efficiency ratio (Er):

$$E_r = \frac{\textit{Gross Income}}{\textit{Total cost}}$$

$$E_{r(2021)} = 6.800/2.020 = 3{,}37$$

$$E_{r(2020)} = 4.900/2.250 = 2{,}18$$

$$E_{r(2019)} = 3.190/2.060 = 1{,}55$$

$$E_{r(2018)} = 4.030/2.406 = 1{,}67$$

From the calculated efficiency ratio, it can be seen that plum production was efficient in all observed years (Er > 1). The highest economic efficiency was achieved in 2021, when 1 euro of resources invested in production generated 3.37 euros of revenue.

Labor productivity in plum production

By comparing business results (quantity of products obtained, net profit, gross profit) with the quantity of labor invested, indicators of labor productivity are obtained. Labor productivity is expressed by the labor productivity ratio (Pr). In the mentioned farm, labor productivity in plum production was determined by the ratio between the obtained yield and the labor invested by the workers, expressed by the number of labor hours per hectare.

$$P_r = \frac{\textit{Yield per hectare}}{\textit{Labor hours per hectare}}$$

$$P_{r\,(2021)} = 20.000/507 = 39{,}4 \text{ kg/hr}$$
$$P_{r\,(2020)} = 35.000/780 = 44{,}9 \text{ kg/hr}$$
$$P_{r\,(2019)} = 29.000/670.9 = 43{,}2 \text{ kg/hr}$$
$$P_{r\,(2018)} = 31.000/707.3 = 43{,}8 \text{ kg/hr}$$

The highest labor productivity was achieved in 2020 (Pr=44.9 kg/hr). The main reason for this is the high yield (35 t/ha) in 2020. The productivity coefficient 44.9 kg/hr shows that for 1 hour of labor 44.9 kg of plums are produced.

CONCLUSIONS

The aim of this work was to determine the economic efficiency of plum production on the family farm, since most plum producers in Serbia are characterized as producers with small farms.

The calculation showed that there are significant differences in the revenues and profits obtained in the years studied for the period 2018 - 2021. The highest profit in plum production was achieved in 2021 in the amount of 4,780 €/ha, and the lowest in 2019 (1,130 €/ha). It can be assumed that these differences are primarily due to the different levels of yield and selling price. Total costs in plum production did not vary significantly, except in 2021.

In evaluating the economic efficiency of plum production, the static indicators such as efficiency ratio, profitability rate and labor productivity were used, and all indicators show positive results.

Plum production is efficient as the efficiency ratio is greater than zero in each year of the studied period (from 1.55 in 2019 to 3.37 in 2021). Plum production is profitable, as the percentage of profit in the total production value ranges from 35.42% in 2019 to 70.30% in 2021. When calculating the labor productivity, it was found that the amount of plums produced for one labor hour ranges from 43.2 kg in 2019 to 44.9 kg in 2020.

It can be concluded that the production of plums in a single farm could be economically profitable and justified.

This example of plum production on the family farm may be useful to potential growers when deciding whether to invest in planting new plantations and growing plums.

Satisfactory economic results can be achieved by growing varieties that are in demand on the market and provide good production results, using modern means and technologies for cultivation and modern organization of production.

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REFERENCES

Благојевић, Р., Божић, В. (2012). *Технологија производње шљиве*, Канцеларија за програм подршке у приватном сектору за подршку сектору воћарства и бобичастог воћа у Јужној Србији, Ниш.

Bugarin, R., Bošnjaković, A., Sedlar, A. (2014). *Mašine u voćarstvu i vinogradarstvu*, Poljoprivredni fakultet, Novi Sad.

Gogić, P. (2014). *Teorija troškova sa kalkulacijama*, Poljoprivredni fakultet, Beograd.

Milić, D., Kalanović - Bulatović, B., Veljković, B. (2013). *Menadžment i organizacija voćarsko - vinogradarske proizvodnje*, Agronomski fakultet, Univerzitet u Kragujevcu, Čačak.

Мишић, П. (2006). *Шљива*, Партенон, Београд

Internal documentation of the analyzed farm.

Републички завод за статистику - РЗС (2012). Попис пољопривреде у републици Србији *Воћарство*, Београд.

Републички завод за статистику - РЗС (2018). Анкета о структури пољопривредних газдинстава, *Шта потврђује, шта оповргава и на шта указује*, Београд

https://comtrade.un.org/Data; accessed 5.3.2022.