ECONOMIC EFFECTS OF PLUM PLANTATION ESTABLISHMENT[1]

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Abstract

Plum is the most important fruit species in the Republic of Serbia both in terms of produced quantities and in the areas under plum plantations. In line with importance of this fruit species, the main objective of the paper is to determine the economic effects of investing in establishment of plum plantation at the 10 hectares. The analysis was performed based on the data gained from the farm of individual agricultural producer from the city of Čačak. Establishment of the plum orchard considers the use of the variety "Čačanska lepotica". Assessment of the investment effects has been done based on the use of dynamic methods for investment evaluation, while the analysis of the investment sensitivity under the conditions of risk was also performed. According to the obtained results, it could be concluded that the investment in plum orchard establishment is profitable.

Key words: *plum, plantation establishment, investment, risk.*

Introduction

Currently, the fruit farming is the most competitive agricultural sector in Serbia. According to the Competitiveness Index, within the group of ten the most competitive agricultural products in Serbia, six are the fruits, primarily stone fruits and raspberry. The competitiveness of stone fruit (e.g. sweet and sour cherries, plums, apricots, etc.) derives from the fact that some of countries worldwide are giving up the production of mention fruit species for various reasons, affecting by this the reduction of competition within the observed sub-sector of fruit farming (SEEDEV, 2020).

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According to the SORS data (Table 1.), during the period 2012-2018., there have been came to increase in areas under the fruit production for around 12%, while in same time came to decrease in number of agricultural holdings involved in fruit farming for around 8.2%. The average area under the fruits per agricultural holding is around 0.7 ha. Majority of agricultural holdings that are growing the fruits, by their size, belong to the category of agricultural holdings that cultivate from 2 to 5 ha.

Table 1. Areas under orchards and number of agricultural holdings involved in fruit farming in Serbia (period 2012-2018.)

Descrip-tion	2012.		2018.		Change in areas under orchards, index 2018/2012	Change in number of AH involved in fruit farming, index 2018/2012
	Areas (in ha)	AH (number)	Areas (in ha)	AH (number)		
Orchards	163,310	295,203	182,923	270,890	112.0	91.8

Source: SORS, 2012; SORS, 2018.

The number of agricultural holdings specialized in fruit farming (56,285 holdings) is relatively small (around 10% of the overall number of agricultural holdings in Serbia, or around 20% of agricultural holdings involved in fruit farming).

According to FAOSTAT, Serbia is one of the countries with the largest areas under the plum orchards, as well as among the leaders in plum production within the Europe (during 2018., there were produced 430,199 tons of fresh plums in Serbia), (FAO, 2020).

By many elements, plum is the most represented and leading fruit species in Serbia. It is grown by nearly 200,000 agricultural holdings, on the area of 72,989 ha, what is around 40% of the total area under the orchards at national level (SORS, 2018).

Mentioned fruit specie is grown on the overall territory of Serbia. By the used areas and volume of production especially are known areas of the Western Serbia, Šumadija and part of Southern Serbia around municipality of Prokuplje (Keserović et al., 2014). Favourable conditions for development of plum farming are in hilly and mountainous regions with the altitude of up to 600 m, what fits to faster plant entry into the yielding, and enables higher yields (Trajčevski, 2008). Analysing the plum production in Serbia by regions, it could be noticed that the region Serbia-North is in deficit, while the region Serbia-South is in surplus by produced plums (Stevanović et al., 2018).

A large share of plum farming in Serbia is based on old and neglected orchards, characterized by alternative yielding and poor fruit quality, as well as with a planting density of around 400 seedlings/ha (SEEDEV, 2020). Due to late spring frosts and buds' freezing, or due to occurrence of hail and spring floods, plum yields significantly oscillate from year to year. In average, at national level plum yields are about 7 t/ha, or slightly above 10 t/ha in the best production years (Keserović et al., 2014).

In line to tradition, favourable climate and available natural resources, widespread processing activities (e.g. into the brandy, jams, dried plums, etc.), and other elements that attract the farmers to engage into this line of production, in previous years it has been noticeable that the extensive plum production is rapidly replacing with the semi-intensive and intensive systems of plum farming. There also comes to change in grown and used plums' varieties, where autochthonous varieties that are usually used in brandy production are replaced by the varieties such are "Čačanska lepotica", "Stanley" or "Čačanska rodna". Besides, it has also came to change in farming technology, i.e. it comes to increase in planting density (the number of seedlings increase up to 800-1,200 seedlings per hectare, reaching the overall yield of around 14 t/ha), while previously freely formed treetop is increasingly replaced with the modern growing forms, such as spindle treetop, etc. Nowadays, there are no modern plantations without implemented irrigation system (Keserović et al., 2014; SEEDEV, 2020). Of course, there are also certain problems that have been burdening the plums farming. The most important are the expressed sensitivity of the plant to the plum pox virus, still large share of varieties that are not matching the market requests, or presence of unsuitable shape of the treetop and inappropriate rootstock, as well as highly oscillating size of the fruits of table varieties (Duralija, 2002).

The largest part of produced plum (over 80%) is used in brandy production, while the rest is used for drying, freezing, or in jam and other confectionery productions. Small volume is consumed as a fresh product (MAFWM, 2019a; SEEDEV, 2020).

Prodanović (2015) had been analytically approached to the issue of profitability in growing of many fruit species, that are produced both in organic and conventional production systems. He founded that in conventional plum production it could be reached a profit of 3,174 EUR/ha, while in organic production the realized profit is lower and amounts 2,594 EUR/ha. Vukoje and Milić (2009) were made a comparative analysis of the economic effects derived from apple, pear and plum production. They have been determined that in Serbian conditions the most profitable is the pear production, while the weakest business results could be achieved

in plum production. Similar results and conclusions had Lukac Bulatovic et al. (2017) who had dealt with the profitability of the production of certain fruit species (apples, pears, peaches, sour cherries and plums) in Vojvodina region. Based on the calculation of the contribution margins, they have been determined that the best business results are achieved in the pears farming, then apples growing, while the worst results were derived from plums farming.

Used Methodology

During 2020, at the territory of city of Čačak was conducted the research including the family agricultural holding that owns plum plantation. All for further economic analysis required data are collected through the in-depth interview with farm members.

In paper was analysed the profitability of investing in a new plum orchard, that has been established according to modern standards, with the use of irrigation system and anti-hail net, as well as with the purchased mechanization needed for the realization of activities in the orchard. In line to gained data from the agricultural holding, as well as available data from the local market, the economic effects of investment in plum plantation under the variety "Čačanska lepotica" were assessed by the use of dynamic methods for the investment evaluation. Evaluation includes next methods: Net Present Value (NPV), Internal Rate of Return (IRR) and Dynamic Payback Period (DPP), (Subić, 2010; Subić et al., 2013; Ivanović, Marković, 2018).

Besides, it was conducted the assessment of investment under the conditions of uncertainty by the use of break-even point method (method assumes determination of critical and minimal values of produced volume and sales incomes below which the investment is not economically justified), and margin of safety (it shows for how much percent the volume of sales or production can fall without going to a loss), (Subić, 2010).

Results and discussion

The plum orchard has been established on the area of 10 ha. It will be mostly in function of fresh plums selling at the local market while the smaller part of fruit production will be realized for processing into the brandy. For new orchard establishment was used the variety "Čačanska lepotica", as its fruits perfectly fits market requirements for fresh consumption, while it can be also successfully used for the brandy production. Planting density is 667 trees per hectare. As form of treetop was used the advanced pyramidal shape, that is the most common treetop form for plum in Serbia.

Besides the establishment of plum orchard with implemented irrigation system (with digging of proper draw well) and anti-hail protection, investment also includes the purchase of specialized mechanisation required in fruit production (small tractor, atomizer, roto-tiller, orchard shredder and tractor trailer), as well as establishment of wire fence around the orchard (purchase of concrete pillars and galvanized wire fence).

Investment was partly financed by own assets (49.17%), while the share of borrowed assets was 50.83% (annual interest rate on borrowed assets from the commercial bank is 6%). The loan will be repaid during the five years, while the grace period is two years. On the other hand, the interest rate calculated on invested farms' own assets is 2%.

Investment in plum orchard establishment considers the use of public incentives for the establishment of fruits' plantations, which amounts 50% of the overall investment costs. This incentive is used for the purchasing of certified seedlings, orchards' pillars, as well as for required land preparation activities towards the establishment of plum plantation, chemical analysis of soil related to determining its chemical composition and defining appropriate recommendations for the use of necessary fertilizers (Ordinance on incentives for programs towards the improvement of competitiveness, for investments in physical assets of agricultural holdings through the support of fruit, vine and hop plantations establishment), (MAFWM, 2019b). Previous research related to impact of overall incentives and share of incentives in the total investment in plum orchard establishment on achieved business results in BiH shows the significant impact of subsidies on business results of farms engaged in plum production (average share of incentives in overall investment in plums' plantation establishment was 14.3%), (Karić, Ćejvanović, 2004).

As was planned, a large part of the produced plums will be sold to the key buyer who will realized them later at the local market as fresh, while the certain volume of plums farm will realize in fresh condition through the local retail based on previously signed contracts. Smaller part of produced volumes of plum will be sold to local processors (for brandy production), or to individuals at farm gate.

In orchard will be engaged two farm members, while during the seasonal production peaks it will be additionally employed external labour.

In next table (Table 2.) are presented the total costs incurred over the years of investment implementation.

Table 2. Total expenditures (in RSD)

No.	Type of cost	Year of the investment realization				
		I	II	III	IV	V
I	**Material costs**	**385.043,09**	**687.542,22**	**975.753,78**	**892.840,89**	**924.249,49**
1.	Direct material	229.712,50	446.401,72	674.156,25	589.262,50	618.725,63
2.	Energy and fuel	155.330,59	241.140,50	301.597,53	303.578,39	305.523,87
II	**Non-material costs**	**4.936.842,74**	**4.953.271,24**	**5.613.507,43**	**5.380.922,49**	**5.135.763,68**
1.	Depreciation	1.917.557,26	1.917.557,26	1.917.557,26	1.917.557,26	1.917.557,26
2.	Labour	2.970.000,00	2.970.000,00	2.970.000,00	2.970.000,00	2.970.000,00
3.	Interest on the loan	0,00	0,00	636.340,20	405.355,44	160.196,63
4.	Other non-material costs	49.285,48	65.713,97	89.609,96	88.009,79	88.009,79
	Total (I+II)	**5.321.885,84**	**5.640.813,46**	**6.589.261,21**	**6.273.763,37**	**6.060.013,17**

Source: IAE, Belgrade 2020.

The profit and loss statement (Table 3.) for entire period of investment implementation was presented according to total costs and formation of previously planned overal incomes. Assuming that investment in establishment of perennial plant plantations does not generate the significant incomes in initial years of investment realization, it is consired that in second and third year will be gained the loss (there is no loss in first year of the investment implementation due to received incentives and definied grace period). Over the years, with the increase in yields, due to plants maturing, there comes to growth in achieved profit, where the largest profit will be gained in fifth year of the investment implementation.

Table 3. Profit and loss statement (in RSD)

No.	Description	Year of the investment realization				
		I	II	III	IV	V
I	**Total Incomes**	**7.984.813,37**	**1.184.592,00**	**4.442.220,00**	**8.884.440,00**	**14.807.400,00**
1.	Incomes of products selling	0,00	1.184.592,00	4.442.220,00	8.884.440,00	14.807.400,00
2.	Incomes from incentives (subsidies)	7.984.813,37	0,00	0,00	0,00	0,00
II	**Business expenses**	**5.321.885,84**	**5.640.813,46**	**6.589.261,21**	**6.273.763,37**	**6.060.013,17**
1.	Material costs	5.321.885,84	5.640.813,46	5.952.921,01	5.868.407,93	5.899.816,54
1.1.	Non-material costs without depreciation and interest on the loan	385.043,09	687.542,22	975.753,78	892.840,89	924.249,49
1.2.	Depreciation	3.019.285,48	3.035.713,97	3.059.609,96	3.058.009,79	3.058.009,79
1.3.	Financial expenses	1.917.557,26	1.917.557,26	1.917.557,26	1.917.557,26	1.917.557,26
2.	Interest on the loan	0,00	0,00	636.340,20	405.355,44	160.196,63
2.1.	Business expenses	0,00	0,00	636.340,20	405.355,44	160.196,63
III	**Gross profit (I-II)**	**2.662.927,54**	**- 4.456.221,46**	**- 2.147.041,21**	**2.610.676,63**	**8.747.386,83**

Source: IAE, Belgrade, 2020.

In line to available investment data (investment value and model of financing), overal costs and production value, the net cash flow (Table 4.) and economic flow (Table 5.) were formed.

Table 4. Net cash flow (in RSD)

No.	Element	Initial moment	Year of the investment realization				
			I	II	III	IV	V
I.	**Total cash inflow (1+2+3)**	**21.079.907,31**	**7.984.813,37**	**1.184.592,00**	**4.442.220,00**	**8.884.440,00**	**23.105.595,64**
1.	Total incomes	0,00	7.984.813,37	1.184.592,00	4.442.220,00	8.884.440,00	14.807.400,00
2.	Financial resources	21.079.907,31					
	2.1. Internal resources	10.365.860,02					
	2.2. External resources	10.714.047,28					
3.	Salvage value	0,00	0,00	0,00	0,00	0,00	8.298.195,64
	3.1. Fixed assets	0,00					6.381.840,43
	3.2. PWC	0,00					1.916.355,21
II.	**Total cash outflow (4+5+6+7)**	**21.079.907,31**	**3.404.328,57**	**3.723.256,19**	**8.435.905,34**	**8.351.392,27**	**8.382.800,88**
4.	Value of investment	21.079.907,31					
	4.1. In fixed assets	19.163.552,10					
	4.2. In PWC	1.916.355,21					
5.	Costs without depreciation and interest on the loan	0,00	3.404.328,57	3.723.256,19	4.035.363,74	3.950.850,67	3.982.259,28
6.	Income tax	0,00	0,00	0,00	0,00	0,00	0,00
7.	Annuities	0,00	0,00	0,00	4.400.541,60	4.400.541,60	4.400.541,60
III.	**Net cash flow (I-II)**	**0,00**	**4.580.484,80**	**-2.538.664,19**	**-3.993.685,34**	**533.047,73**	**14.722.794,76**

Source: IAE, Belgrade, 2020.

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Table 5. Economic flow (in RSD)

No.	Element	Initial moment	Year of the investment realization				
			1	2	3	4	5
I.	**Total cash inflow (1+2)**	**0,00**	**7.984.813,37**	**1.184.592,00**	**4.442.220,00**	**8.884.440,00**	**23.105.595,64**
1.	Total income	0,00	7.984.813,37	1.184.592,00	4.442.220,00	8.884.440,00	14.807.400,00
	Salvage value	0,00	0,00	0,00	0,00	0,00	8.298.195,64
2.	2.1. Fixed assets	0,00					6.381.840,43
	2.2. PWC	0,00					1.916.355,21
II.	**Total cash outflow (3+4)**	**21.079.907,31**	**3.404.328,57**	**3.723.256,19**	**4.035.363,74**	**3.950.850,67**	**3.982.259,28**
	Value of investment	21.079.907,31					
3.	3.1. In fixed assets	19.163.552,10					
	3.2. In PWC	1.916.355,21					
4.	Costs without depreciation and interest on the loan	0,00	3.404.328,57	3.723.256,19	4.035.363,74	3.950.850,67	3.982.259,28
5.	Income tax	0,00	0,00	0,00	0,00	0,00	0,00
III.	**Net cash flow (I-II)**	**- 21.079.907,31**	**4.580.484,80**	**- 2.538.664,19**	**406.856,26**	**4.933.589,33**	**19.123.336,36**

Source: IAE, 2020.

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According to available data about investment in plum orchard establishment, it was made the evaluation of the investment profitability by the use of dynamic methods for the assessment of investment effectiveness (calculating of following indicators - Net present value (NPV), Internal rate of return (IRR) and Dynamic payback period (DPP) are given in Tables 6. and 7.). Additionally, for the evaluation of the economic effects of investment in the conditions of uncertainty the break-even point method was used to.

The NPV of the investment is 1,243,655.78 RSD, representing the overall increase in profit gained by the use of realized investment, after the discounting to current moment. Since the NPV is positive, the investment is considered as economically justified.

As the IRR (5.43%) is higher than the used discount rate (4.03%), according to this indicator investment could be also considered economically justified.

The dynamic payback period for the establishment of plum orchards is 4.92 years, i.e. the investment will be returned in 4 years and 11.05 months. As the DPP is shorter than the period of investment exploitation (in line to obtained bank credit on 5 years), the investment could be considered economically justified.

Table 6. Net present value (NPV) and Internal rate of return (IRR), (in RSD, in %)

No.	Element	Initial moment	Year of the investment realization					Cumulative
			I	II	III	IV	V	
0	1	2	3	4	5	6	7	8
1.	Net cash flow from economic flow (columns 3 to 7)	-21.079.907,31	4.580.484,80	-2.538.664,19	406.856,26	4.933.589,33	19.123.336,36	*26.505.602,55*
2.	Discount rate (in %)	4,03	4,03	4,03	4,03	4,03	4,03	-
3.	Discount factor $(1+i)^{-n}$, i = discount rate; n = year of the investment duration	1,0000	0,9612	0,9240	0,8881	0,8537	0,8206	-
4.	Present value of net cash flow from economic flow (columns 3 to 7)	-21.079.907,31	4.402.913,75	-2.345.647,35	361.349,28	4.211.898,75	15.693.048,67	*22.323.563,08*
5.	**NPV (columns 2 to 7)**				**1.243.655,78**			
6.	**Relative NPV [(columns 2 to 7) / | column 2|]* 100 > i**	**0,06** (meaning – relative increase in accumulation above the price of capital, i.e. discount rate (i=4,03%), so by the investment implementation it will come to covering of the price of capital and gaining of certain amount of profit)						
7.	**IRR > i**	**5,43%**						

Source: IAE, 2020.

Table 7. Dynamic payback period (in RSD, DPP < n)

Year of investment realization	Present value of net cash flow from economic flow	Cumulative net cash flow
0	-21.079.907,31	-21.079.907,31
I	4.402.913,75	-16.676.993,56
II	-2.345.647,35	-19.022.640,91
III	361.349,28	-18.661.291,64
IV	4.211.898,75	-14.449.392,89
V	15.693.048,67	1.243.655,78

Source: IAE, 2020.

Table 8. Break-even point (in RSD)

No.	Description	Year of the investment realization				
		I	II	III	IV	V
1.	Incomes (P)	0,00	1.184.592,00	4.442.220,00	8.884.440,00	14.807.400,00
2.	Variable Costs (VT)	3.355.043,09	3.657.542,22	3.945.753,78	3.862.840,89	3.894.249,49
3.	Fixed costs (FT)	49.285,48	65.713,97	89.609,96	88.009,79	88.009,79
4.	Gross margin	-3.355.043,09	-2.472.950,22	496.466,22	5.021.599,11	10.913.150,51
5.	Break-even point (relative), in %	-1,47	-2,66	18,05	1,75	0,81
6.	Break-even point (value), in RSD	0,00	-31.478,29	801.801,12	155.710,89	119.415,20
7.	Margin of safety in %		102,66	81,95	98,25	99,19

Source: IAE, Belgrade, 2020.

Notice: Positions 4; 5; 6 and 7; were calculated according to the following formulas
- Gross margin (MR = P-VT)
- Break-even point (relative), (PTV = (P x PTR) /100),
- Break-even point (value), (PTV = (P x PTR) /100),
- Margin of safety (SS = ((1 - (PTV / P)) x 100)

According to gained break-even point, it could be seen that the investment is also acceptable in cases of significantly large decrease in production volume or incomes (Table 8.), while the observed investment shows a low level of risk.

Conclusion

Plum production is very common in Serbia. Given the long tradition in plum farming, it is necessary to eliminate the certain shortcomings in its production, as well as to widely introduce in current plum production adequate contemporary tech-tech solutions.

According to that, in paper was calculated the posible profit that could be gained in modern plum farming, as well as the economic analysis of the effectiveness of investment in establishment in appropriate plum orchard. It was determined that investing in plum plantation that will be used for the production of table plums is economically justified and associated with relatively low level of risk. In line to potential problems with plums realization at local market, the priority was found in ensuring the stability of market for table (fresh) plums in the long run.

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