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ECONOMIC FEATURES OF PROCESSED FRUIT PRODUCTION IN SERBIA

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Summary

There are various possibilities of fruit processing regarding assortments of both semi-processed and finished fruit products. Within a wide assortment of processed fruit products, there are semi-processed fruit products which can be directly marketed or used as raw materials in further stages of processing, thus causing different economic effects. This paper displays the indicators of economic effects (production value, production costs (especially direct costs), and the difference between production value and total production costs) in all stages of a certain type of fruit processing. The obtained results indicate that advanced stages of fruit processing entail an increase in costs, but these increased costs eventually enable higher revenues.

*Fruit processing is cost-effective due to the fact that fruit processing value is higher than the market value of fruits. The fruit processing value in compote production is on average 48.87% higher than the fruit market value. In semi-processed fruit production (fruit puree and pitted crushed fruits *Rotativa*²), the fruit processing value is on average 14.83% higher than the fruit market value.*

Key words: processed fruit production, production value, production costs, financial results

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2 Unlike fruit puree which is a homogenous fruit mass, pitted crushed fruits (*Rotativa*) contain parts of processed fruits.

Introduction

Nowadays, Serbia possesses considerable fruit processing and cooling capacities. However, during the last decade of its development, the fruit processing industry in Serbia has addressed the issue of facility underutilisation (Milić et al., 2002, 2005). This is a consequence of the discrepancy between primary fruit production, fruit processing industry and low fruit market value. Approximately 10% of the total fruit yield in Serbia is processed, which is rather low in comparison with the USA where approximately 45% of produced apples and 70% of produced plums are processed.

Processed fruit production can be a highly profitable industry provided it meets market demands. However, current industrial processing facilities should be better equipped, modernised and specialised in order to produce high-quality products which would meet the demands of very selective markets. In addition to production capacity and raw materials, product branding is also an important constituent of successful fruit product marketing. The analysis of product assortment has shown that the Serbian processed fruit production does not have a leading market product, as far as both quantity and quality are concerned, unlike Greece where peach compote dominates the market, as well as apricot products in Hungary, apple juice in Switzerland, tomato products in Italy, etc. (Niketić-Aleksić, 1987).

Research Aims, Data Resources and Work Methods

The principal aim of this research is a review of significant production and economic aspects of processed fruit production. The focus of the research is the quantification of economic effects obtainable in primary production and all stages of a certain type of fruit processing. The analysis of main economic production indicators was done in 2011. The obtained production and economic results in processed fruit production were analysed based on the accounting calculations of the production, business reports, and company's recipes for processed fruit production in the Province of Vojvodina. The following products were observed: fruit purees, pitted crushed fruits, industrial marmalade, jam, compote and fruit juices.

During advanced stages of the research, a method of fruit processing value was applied in order to determine cost-effectiveness of using fresh fruits in production. The assessment of raw materials according to processing value is based on economic gains which are obtained as results of their utilisation in production. This value indicates cost-effectiveness of fruit processing and demonstrates how raw materials purchased on the market gain money value during production.

The processing (yield) value of every agricultural product can be determined, and this value basically represents the economic valorisation of products in technological processing. The processing (yield) value is determined in the following manner:

$$Y = \frac{TV - UTP}{X}$$

where Y is the processing (yield) value of an agricultural product (fresh fruits), TV is the market value of obtained processed fruit products, UTP indicates the total processing costs reduced by raw material costs of input agricultural products (fresh fruits), and X is the amount of a used agricultural product in kilograms, which is valorised.

The fruit processing value is calculated on the basis of calculation data of processed fruit production. The quality of raw materials and market price of obtained products greatly affect the processing price.

Research Results

In addition to fresh fruit consumption, fruits can be semi-processed and used in further processing, or fully processed into finished products. Therefore, there are two groups of processed fruit products: semi-processed fruit products and finished fruit products. The group of semi-processed fruit products includes: fruit pulps, purees, fresh (raw) fruit juice, and pasteurised fruits. The group of finished fruit products includes: compotes, purees, jams, marmalades, jellies, candied fruits, fruit preserves, juices, concentrated fruit juices, fruit syrups, and dried fruits.

Although the assortment of processed fruit products (semi-processed and finished products) is very wide, the production of fruit juices and frozen fruits dominates industrial processing (Lukač Bulatović, 2010). Fruit juices and frozen fruits account for 71.95% of the total processed fruit production in Serbia.

Observed as a whole, the fruit processing in Serbia is badly organized and demonstrates significant weaknesses. First and foremost, processing facilities are oversized and lacking production specialisation, which negatively affects the marketing of high-quality and high-quantity processed fruit products. Approximately 10% of produced fruits and vegetables is processed in Serbia, which is rather low in comparison with developed countries where over 70% of the total fruit and vegetable production is processed.

The utilisation of fruit processing capacities in Serbia approximates to 79.2% in almond, hazelnut, and chestnut processing production, 69.7% in fruit concentrate production, 48.0% in fruit juice production, 34.9% in frozen fruit production, and 31.5% in marmalade production. The utilisation of capacities in other types of fruit processing production is under 17.1%.

One of the reasons of capacity underutilisation is low marketability of fruit products. Processed fruit products are still mostly produced by domestic resources as a consequence of consumer's low standard of living, high prices of processed fruit products, and unsatisfactory quality and assortment of products.

The fruit processing at the observed facility operates in two stages. The first processing stage, which occurs as a consequence of seasonal fruit yield, involves semi-processed fruit production. Fruits are processed into purees and pitted crushed fruits (*Rotativa*), which are later (out of season) further processed into finished products (jams, marmalades and fruit juices).

During 2011, the total processed fruit production at the observed facility amounted to 821,039 kg. Fruit puree with the annual production of 382,575 kg accounts for 46.60%, and occupies a leading position in the total amount of processed fruits (Table 1-3). The production volume of other processed fruit products ranges from 15,770 kg (industrial marmalade) to 167,247 kg (fruit juices).

Business results can be expressed by means of various indicators which measure and determine the economic effectiveness of production during a fiscal year (Andrić, 1998). The most important indicators of business results are: the value of production, production costs, and economic (financial) results.

The production value of analysed processed fruit products was calculated based on the attained production volume and unit selling price. The value of production is directly proportional to the volume of production and selling price. An increase in production volume and selling price causes an increase in production value, and vice versa. In the analysed year (2011), the value of processed fruit production amounted to 92.8 million RSD. The lowest production value was recorded in industrial marmalade production (2.6 million RSD), whereas the highest production value was recorded in compote production (24.5 million RSD).

Table 1. Key economic indicators of the semi-processed fruit production in 2011 (in RSD)

Indicators		Semi-processed fruit products		
		Industrial marmalade	Pitted crushed fruits (<i>Rotativa</i>)	Fruit puree
A.	Production value	2,641,475.00	4,108,863.00	31,184,558.00
I	Direct costs	1,744,803.69	2,710,796.35	20,560,035.76
1.	Material costs	1,492,856.92	2,145,390.97	17,816,992.14
1.1.	Raw materials	651,103.78	2,041,908.29	16,336,032.84
1.2.	Additives (sugar, citric acid)	667,755.43	/	/
1.3.	Package	12,307.74	24,370.92	201,819.79
1.4.	Energy (all forms)	161,689.97	79,111.76	1,279,139.51
2.	Gross personal income	93,394.06	319,071.60	875,499.93
3.	Depreciation	158,552.70	246,333.78	1,867,543.69
II	Overhead costs	668,238.09	1,038,201.26	7,870,971.80
III	Total costs	2,413,041.77	3,748,997.61	28,431,007.56
B.	Financial result - profit	228,433.22	359,865.39	2,753,550.44
	Attained production volume (kg)	15,770	49,185	382,575
	Selling price (RSD/kg)	167.50	83.54	81.51
	Total unit costs – RSD/kg	153.01	76.22	74.31
	Production efficiency	1.09	1.10	1.10
	Production profitability rate (%)	9.47	9.60	9.69
	Production performance	2.21	2.65	0.88
	Labour hour requirement – h/100 kg			
	Machine hour requirement – h/100 kg	0.30	0.08	0.10

Source: The calculation was done by the author based on the data calculation of fruit processing

Within the total unit cost structure, the direct costs account for 72.31%, whereas the overhead costs account for 27.69%. The material costs occupy the largest share of direct costs (60.05% on average). The raw material costs occupy the largest share of material costs (37.01% on average). The average share of additive costs (sugar, citric acid) in the total cost structure amounts to 11.93%, followed by the package costs (6.87% on average), depreciation (6.57% on average), gross personal income (5.69% on average), and electricity and mazut (fuel oil) (4.25%).

Table 2. Key economic indicators of the finished fruit production in 2011 (in RSD)

Indicator		Finished fruit products		
		Compote	Jam	Fruit juice
A.	Production value	24,485,100.00	12,873,750.00	17,516,407.00
I	Direct costs	14,435,974.67	7,910,364.74	11,278,519.88
1.	Material costs	11,395,456.15	6,506,727.65	9,670,422.24
1.1.	Raw materials	4,977,027.36	2,418,894.47	5,632,241.08
1.2.	Additives (sugar, citric acid)	1,936,508.84	2,638,793.96	1,569,104.00
1.3.	Package	3,379,906.67	980,795.52	2,097,857.73
1.4.	Energy (all forms)	1,102,013.28	468,243.70	371,219.43
2.	Gross personal income	1,728,883.15	684,861.12	583,344.83
3.	Depreciation	1,311,635.37	718,775.97	1,024,752.81
II	Overhead costs	5,528,034.00	3,029,361.73	4,318,935.35
III	Total costs	19,964,008.67	10,939,726.47	15,597,455.23
B.	Financial result - profit	4,521,091.32	1,934,023.53	1,918,951.78
	Attained production volume(kg)	139,394	66,868	167,247
	Selling price (RSD/kg)	175.65	192.52	104.73
	Total unit costs – RSD/kg	143.22	163.60	93.26
	Production efficiency	1.23	1.18	1.12
	Production profitability rate (%)	22.65	17.68	12.30
	Production performance			
	Labour hour requirement – h/100 kg	3.25	3.75	1.37
	Machine hour requirement –h/100 kg	0.06	0.28	0.04

Source: The calculation was done by the author based on the data calculation of fruit processing

The economic (financial) results were determined as a difference between the production value and total costs. Positive financial results (profit) were obtained in processed fruit production. In the analysed year, the highest profit (4.5 million RSD) was recorded in compote production. The lowest profit (228,433 RSD) was recorded in industrial marmalade production.

In this paper, the efficiency of production is expressed by a ratio based on the relation between the value of production and total costs. Another indicator of production efficiency is the cost price (Gogić, 2005). As long as the cost price of a product or service is lower than the market price, positive financial results (profit) are obtained.

The efficiency ratio of processed fruit production amounted to 1.14, i.e. for every 100 RSD of total costs 114 RSD of production value was obtained. According to the types of processed fruit products, the most efficient production was recorded

in compote production due to the highest efficiency ratio of 1.23. The production efficiency ratio can influence the selection of fruit products in processing provided there are favourable conditions such as a potential for marketing additional amounts of manufactured products.

Table 3. Key economic indicators of the semi-processed and finished fruit production in 2011 (in RSD)

Indicator		Semi-processed fruit products	Finished fruit products	Total
A.	Production value	37,934,896.00	54,875,257.00	92,810,153.00
B.	Total costs	34,593,046.95	46,501,190.37	81,094,237.32
C.	Financial result - profit	3,341,849.05	8,374,066.63	11,715,915.68
	Attained production volume (kg)	447,530	373,509	821,039
	Production efficiency	1.10	1.18	1.14
	Production profitability rate (%)	9.66	18.01	14.45

Source: The calculation was done by the author based on the data calculation of fruit processing

Profitability is a very important indicator of business performance, and a key factor in assessing financial success and further development of any enterprise. Moreover, profitability is an indicator of justification and utility of an industry. There are two types of profitability: the profitability of production and the profitability of production resources. Since accounting calculations do not express data on average resource utilisation, the profitability rate was used in this paper. The profitability rate can be calculated based on the relation between profit and total production costs (Elenov, 2002). Production is profitable only if positive financial results are obtained. Therefore, the profitability rate is often referred to as the rate of profit, and it is expressed as a percentage.

The positive profitability rate was recorded in processed fruit production in the analysed year. According to the types of processed fruit products, the positive profitability rate was 14.45% on average. The highest profitability rate was recorded in compote production (the profitability rate = 22.65%). In other types of processed fruit production, the profitability rate ranged from 9.47% in industrial marmalade production to 17.68% in jam production.

Production performance is expressed by means of quantity and value. The quantity of production performance in processed fruit production is measured by labour hours per unit of product. The highest production performance quantity of 0.0088 h/kg (113.64 kg/h) was recorded in fruit purees, and the lowest in jam production (0.0375 h/kg or 26.67 kg/h).

Processed fruit production enables more favourable production and economic results than the fresh fruit marketing (Rott, 1996). Advanced stages of processing cause an increase in costs, but these increased costs enable higher income and residual income. The economic effect of apple processing into clear apple juice and brandy indicates the increase in income of 26.9% and residual income of 1.7% in comparison with the effect of selling apples as consumable commodities on the domestic market (Lukač-Bulatović, 2006). An apricot semi-processed product, fruit pulp, indicates the increase in income of 28.21% and residual income of 3.63%.

Further processing of fruit pulp into finished fruit products, jam and marmalade, increases the income by 40.83%, and the residual income by 19.94% (Cindrić et al., 1981).

The processing value of basic raw materials indicates the highest potential price in purchasing raw materials on the market in order to meet the lowest margin of processing profitability (Radović, Furundžić, 1997, Gogić, 2005). If the market price of fruits would equal the processing price then business results of processing would amount to zero. Therefore, fruit processing would be on the lowest margin of economic justification because the profit from fruit processing would amount to zero. If the fruit market price is higher than the processing price, fruit processing shows negative financial results (loss), and vice versa; if the fruit market price is lower than the processing price, fruit processing shows positive financial results (profit).

The processing value of fruits is higher than the selling (market) value of fruits as raw materials, thus fruit processing is cost-effective (Table 4-7).

Table 4. Processing value of basic raw materials in the fruit puree production in 2011 (RSD/kg)

Elements	Semi-processed fruit products				
	Apple puree	Apricot puree	Peach puree	Sour Cherry puree	Plum puree
1. Selling price	41.50	101.00	69.00	126.50	58.00
2. Total costs (without basic raw material costs)	19.3800	38.0500	28.0900	46.1100	24.7400
2.1. Package	0.6800	0.6800	0.6800	0.6800	0.6800
2.2. Energy (all forms)	3.4600	3.5700	3.5700	3.5700	3.5700
2.3. Gross personal income	2.3200	2.3200	2.3200	2.3200	2.3200
2.4. Overhead costs	12.9200	31.4800	21.5200	39.5400	18.1700
3. Basic processing raw materials					
3.1. Amount - kg	1.1800	1.3000	1.3090	1.3300	1.4700
3.2. Selling price	15.53	41.40	26.11	52.10	19.24
3.3. Value (3.1. x 3.2.)	18.3254	53.8200	34.1780	69.2930	28.2828
3.4. Processing value	18.7458	48.4231	31.2529	60.4436	22.6259
3.5. Difference	3.2158	7.0231	5.1429	8.3436	3.3859
4. Profit (1. - (2. + 3.3.))	3.7946	9.1300	6.7320	11.0970	4.9772

Source: The calculation was done by the author based on the data calculation of fruit production and processing

In the fruit puree production in 2011, the processing value of fruits amounted to 36.30 RSD/kg on average (Table 4). The highest processing value was recorded in sour cherry and it amounted to 60.44 RSD/kg. The processing value of other analysed fruit species ranged from 18.75 RSD/kg (apples) to 48.42 RSD/kg (apricot).

The fruit processing value in puree production was higher by 15.38% on average in comparison with the market price of fruits as raw materials. According to the fruit species, the difference between processing and market value in puree production was significant in

apples and peaches. The processing value in apple puree production is 17.15% higher than the market value.

The processing value of basic raw materials in pitted crushed fruit (*Rotativa*) production in the analysed year amounted to 43.64 RSD/kg. The highest processing value of 60.60 RSD/kg was recorded in sour cherries (Table 5). In the analysed pitted crushed fruit production, the processing value is on average 14.28% higher than the fruit market value. In plum pitted crushed (*Rotativa*) production, the processing value is 16.32% higher than the fruit market value, whereas in apricot *Rotativa* production the processing value is 12.50% higher than the selling price of basic raw materials.

Table 5. Processing value of basic raw materials in the pitted crushed fruit (*Rotativa*) production in 2011 (RSD/kg)

Elements	Semi-processed fruit products		
	Apricot pitted crushed fruit <i>Rotativa</i>	Sour cherry pitted crushed fruit <i>Rotativa</i>	Plum pitted crushed fruit <i>Rotativa</i>
1. Selling price	98.50	134.50	60.50
2. Total costs (without basic raw material costs)	40.1600	51.4700	28.3100
2.1. Package	0.6800	0.6800	0.6800
2.2. Energy (all forms)	1.7400	1.7400	1.7400
2.3. Gross personal income	6.9600	6.9600	6.9600
2.4. Overhead costs	30.7800	42.0900	18.9300
3. Basic processing raw materials			
3.1. Amount - kg	1.2330	1.3701	1.4000
3.2. Selling price	41.40	52.10	19.24
3.3. Value (3.1. x 3.2.)	51.0462	71.3822	26.9360
3.4. Processing value	47.3155	60.6014	22.9929
3.5. Difference	5.9155	8.5014	3.7529
4. Profit (1. - (2. + 3.3.))	7.2938	11.6478	5.2540

Source: The calculation was done by the author based on the data calculation of fruit production and processing

In the analysed compote production, the fruit processing value was 79.61 RSD/kg on average (Table 6). The highest processing value of approximately 98 RSD/kg was recorded in the sour cherry processing. The processing value of other analysed fruit species ranged from 52.71 RSD/kg (plum) to 83.69 RSD/kg (apricot).

The fruit processing value is on average 48.87% higher than the fruit market value. Therefore, it is economically justified to buy fruits and process them into compote. According to the analysed fruit species, the difference between the processing and market price in compote production is particularly highlighted in peach and plum processing. In the plum compote production, the processing value of basic raw materials is 61.64% higher than the market price.

Table 6. Processing value of basic raw materials in the compote production in 2011 (RSD/kg)

Elements	Product				
	Apricot compote	Peach compote	Plum compote	Sour cherry compote (with pits)	Sour cherry compote (without pits)
1. Selling price	184.50	146.50	104.00	153.00	188.00
2. Total costs (without basic raw material costs)	113.3600	95.3100	71.3200	83.9900	93.8700
2.1. Additives (sugar, citric acid)	14.3900	13.4600	10.9300	8.7300	7.8000
2.2. Package	20.9000	20.9000	20.9000	20.9000	20.9000
2.3. Energy (all forms)	6.8800	6.9800	6.7000	6.6300	6.6300
2.4. Gross personal income	20.2900	13.9100	4.0600	4.0600	5.9500
2.5. Overhead costs	50.9000	40.0600	28.7300	43.6700	52.5900
3. Basic processing raw aterials					
3.1. Amount - kg	0.8500	0.7872	0.6200	0.7000	0.9600
3.2. Selling price	41.40	27.00	20.22	62.10	62.10
3.3. Value (3.1. x 3.2.)	35.1900	21.2544	12.5364	43.4700	59.6160
3.4. Processing value	83.6941	65.0279	52.7097	98.5857	98.0521
3.5. Difference	42.2941	38.0279	32.4897	36.4857	35.9521
4. Profit (1. - (2. + 3.3.))	35.9500	29.9356	20.1436	25.5400	34.5140

Source: The calculation was done by the author based on the data calculation of fruit production and processing

The processing value of fruits processed into compotes, purees, and pitted crushed fruit products (*Rotativa*) is higher than the fruit market value. The fruit processing value is 48.87% higher than the market value in compote production, 14.28% higher in pitted crushed fruit production, and 15.38% higher in fruit puree production.

The highest profit was recorded in the apricot compote production (35.95 RSD/kg), whereas the lowest profit of 5.12 RSD/kg was recorded in the plum semi-processed fruit production (puree and pitted crushed fruit).

Conclusion

Fruit processing industry is an important factor of market stabilisation, fruit production development and fruit industry enhancement. Therefore, current industrial processing facilities ought to be better equipped, modernised and specialised in order to accomplish planned production structures and create new products which require advanced stages of processing. The advancement of fruit processing and the export of processed fruit products ensure more favourable production and economic results in comparison with the export of raw materials (fresh and frozen fruits).

The processing value of fruits is higher than the selling (market) value of fruits as raw materials. The fruit processing value in compote production is on average 37.0 RSD/kg or 48.87% higher than the selling fruit price. In semi-processed fruit production, fruit puree and pitted crushed fruits *Rotativa*, the processing value is 5.7 RSD/kg or 14.83% higher than the fruit market price.

Within the total cost structure, the direct production costs of the analysed fruit products account for 72.31% on average, whereas the indirect costs account for 27.69%. Within the direct costs, the material costs account for the greatest share of 60.05% on average, whereas the raw material costs account for the greatest share of 37.01% within the raw material costs.

In the analysed processed fruit production, positive financial results per unit of product are notable (32.4 RSD/kg), as well as high production efficiency (1.23) in compote production. The calculated efficiency ratio of all the other processed fruit products ranged from 1.09 (industrial marmalade) to 1.18 in jam production. In the analysed processed fruit production, the average profitability rate amounted to 14.45%. The highest profitability rate was recorded in compote production (the profitability rate of 23.00%). The largest quantity of production (work) performance was recorded in fruit puree production and it amounted to 0.0088 h/kg (113.64 kg/h), whereas the smallest was recorded in jam production (0.0375 h/kg or 26.67 kg/h).

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EKONOMSKA OBELEŽJA PROIZVODNJE PRERAĐEVINA OD VOĆA U SRBIJI

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Rezime

Mogućnosti prerade voća su veoma složene, kako po asortimanu poluproizvoda, tako i gotovih proizvoda. U okviru širokog asortimana prerađevina od voća postoje i poluproizvodi koji se mogu plasirati direktno na tržište, ali isto tako mogu poslužiti i kao sirovina za više faze prerade, pri čemu, se ostvaruju i različiti ekonomski efekti. U radu su prikazani pokazatelji ekonomskih efekata (vrednost proizvodnje, troškovi proizvodnje, posebno direktni, kao i razlika između vrednosti proizvodnje i ukupnih troškova) u svim fazama prerade za određenu vrstu prerađevina. Rezultati do kojih se došlo pokazuju da više faze prerade zahtevaju povećanje pojedinačnih troškova, ali povećani troškovi omogućuju postizanje većeg prihoda.

Prerada voća je ekonomski opravdana, jer je preradna vrednost voća veća od njegove prodajne (tržišne) cene. Preradna vrednost voća u proizvodnji kompotata je veća u proseku za 48,87% u odnosu na tržišnu cenu voća. U proizvodnji poluproizvoda - voćne kaše i voćne rotativE, preradna vrednost u odnosu na tržišnu cenu voća je veća u proseku za 14,83%.

Ključne reči: *proizvodnja prerađevina od voća, vrednost proizvodnje, troškovi proizvodnje, finansijski rezultat*

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