

Comparison of carrot production calculations on farms of different sizes

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Summary: In Serbia, carrots are produced on various land areas within agricultural companies and family farms. This study includes detailed analytical calculations of the realized value of production, cost calculation, and the realized financial results of carrot production on three farms of different sizes, as well as comparison of the obtained results. The cost calculation presented in the production calculations is based on the actual costs made during the technological process of carrot production and obtained from the producers. The economic categories were included and calculated for carrot production per hectare at all three farms. Production calculations provide producers with an insight into the costs of production, giving them the opportunity to better manage them. The calculations confirmed that each of the mentioned three farms had a specific production technology. The amount of costs in the surveyed farms was different, while the value of production and the achieved volume of production were at approximately the same level. Land consolidation and farm expansion would result in increased efficiency of agricultural production on smaller farms with a larger number of plots. Profits from carrot production can be increased by association of agricultural producers, for the purpose of a more favourable supply of inputs, more efficient product distribution with joint marketing, higher share of machinery as opposed to using manual labour, as well as careful monitoring of innovations introduced in the production process. All three farms achieved a positive financial result, which indicates that carrot production is profitable on both smaller and larger areas.

Keywords: calculation, carrot, costs, farm, production

Introduction

Carrot is a biennial dicotyledonous plant. It is used fresh in salads or cooked in stews or side dishes, as well as raw material in food and cosmetics industry (Gvozdenović et al., 2007). The most widespread European variety is *Daucus carota* subsp. *sativus*, orange or orange-red in colour (Gvozdenović et al., 2011).

According to the data issued by the Statistical Office of the Republic of Serbia from 2020, carrots were grown on 2,662 ha in Serbia, with a total

production of 52,740 tons and an average yield of 19.8 t / ha (www.stat.gov.rs). Carrots are an important vegetable crop in Europe with a growing area of about 224,772 ha (www.fao.org). The world's largest producer is China with a production of 17 million tons, which represents 45% of the world production (Škatarčić and Vlahović, 2017).

In order to obtain reliable results based on which future production can be planned, the performance indicators - cost structure and obtained income - must be determined (Ivanišević et al., 2018). The income from the production activities, production cost and the ratio of expense elements in total cost should be known in order for the producers to make rational innovation and adaptations (Özkan et al., 2002).

The producers cannot affect the selling prices of their products because they are established on the market under the influence of supply and demand, but they could have influence on the cost price of their products and services. The procedure of the cost determination in production, processing or realization of the products is called making the calculations. Direct costing calculation is a particularly convenient method for monitoring of the costs and benefits at the family farms in Serbia, as they are not obliged to keep the books for the time

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being, so they do not have at disposal the detailed records on their production economic parameters (Vasiljević and Subić, 2010). The use of appropriate methods for regular production calculation has great advantages. Production costs and revenue should be determined in advance so as to enable producers to make short-term and long-term plans for their production (Acar and Gül, 2016). Moreover, data on the product market prices are an important factor of production management because vegetable producers have to form their decisions based on the current market prices (Zaremba, 2017).

The aim of this study was to determine and compare the economic parameters of carrot production, such as total production, production value, total production costs and financial result of three farms of different sizes.

Material and Methods

The study included the comparison of calculations made for carrot production per hectare on three agricultural farms of different sizes. The farms are located in the area of Begeč, Serbia known for carrot production with protected designation of origin. Carrot production area of the first farm is 5 ha, the second 30 ha, and the third 120 ha. The data were collected on the farms by surveying the producers, monitoring the production process and from internal documentation of the producers (field book). Part of the data was taken from the available literature listed in the reference section of the paper. All three farms used carrot seeds of the Nantes type, a Presto hybrid.

Gocan et al. (2011) stated that carrot cultivars Nantes and Flaker are leaders in carrot production due to their economic effectiveness. The total result of the production process of a production line – the total production – is expressed in natural units. Production per unit of capacity is yield or average production. The value of production is the product quantity and its price, or the sum of values of individual line production within the observed farms (Novković and Šomođi, 2016). Labour invested using the means of production (instruments of labour and subjects of labour) creates a good in the process of production. Production costs represent the value of labour, instruments of labour and subjects of labour consumed in a single production process (Marko et al., 1998). Depreciation costs and costs of fuel and lubricants were calculated for individual items of work performed by the farmers' own mechanization. The cost calculation presented in the production calculations is based on the actual

costs made during the technological process of carrot production and obtained from the producers. The study was conducted and the value of production and production costs calculated in 2019. The profit of production lines is the difference between the value of production and total production costs, while the household profit is the difference between total income and total costs (Novković and Šomođi, 2016).

The scheme for the analytical calculation is $p - t = d$. According to this scheme, the value of production (p) is determined first, then costs (t), and their difference is the financial result (d), (Marko et al., 1998).

The economic categories were included and calculated for carrot production per hectare at all three farms. The obtained results were then compared.

Results and discussion

By using their decades-long traditional production and investing great effort, work and knowledge, carrot producers in Begeč have developed the brand "Begečka Šargarepa", renowned for its high quality throughout the region and Europe (Zec, 2021).

Table 1 shows the calculation of carrot production on the farm 1 which produces carrots on approximately 5 hectares of leased plots. The average farm size is 4.5 hectares and it varies significantly across regions (Simonović et al., 2017). The value of the stated production was 1,250,000 dinars/ha, the total production costs were 1,041,749 dinars/ha, and profit of 208,251 dinars/ha was realized.

Material costs on the farm (Table 1) make up the largest part of the total production costs and amount to 463,100 dinars/ha, which is the largest amount of material costs compared to other farms. Material costs include the direct material costs (basic material) and indirect material costs (auxiliary material). The basic material includes the costs of seed material, which amount to 150,000 dinars/ha (Table 1), mainly material costs and fertilizer costs, which amount to 73,500 dinars/ha (Table 1). Fertilization was performed on the basis of chemical soil analysis and carrot nutrient requirement. If the costs of seed material (Table 1) which are the same for all three farms are omitted, indirect material costs immediately follow, amounting to 137,000 dinars/ha (Table 1), as the highest costs compared to others. The auxiliary material includes the costs of pesticides where fungicides have the largest share with 101,000 dinars/ha (Table 1). Comparison of data on pesticides expenditure (Table 1) with the data from Table 2 and

Table 3 results in the difference in costs of auxiliary material per hectare (the highest on Farm 1). Higher purchase price at which Farm 1 procures pesticides is due to smaller pesticide quantity required for a smaller production area. Costs of works with own machines and services amount to 134,849 dinars/ha (Table 1). By comparing the stated costs incurred on Farm 2 (Table 2) we see that they are 28,849 dinars/ha lower, while they are 61,509 dinars/ha lower on Farm 3

(Table 3) in relation to the same costs shown in Table 1. The difference in labour costs for carrot production on Farm 1, as compared to the other two farms, comes from the extra payments for services made by Farm 1 due to a lack of its own mechanization. Considering the above, Farm 1 found an acceptable way to reduce the number of operations while following cultivation practices in carrot production. Vegetable producers strive to reduce the costs of production because of

Table 1. Calculation of carrot production per hectare on the farm of 5 ha

No	Elements	Measurement	Quantity	Price	Amount
	1	2	3	4	5
1.	PRODUCTION VALUE	RSD			1,250,000
1.1.	Extra class	kg/ha	50,000	22	1,100,000
1.2.	II class	kg/ha	15,000	10	150,000
2.	PRODUCTION COSTS	RSD			1,041,749
2.1.	Material costs	RSD			463,100
2.1.1.	Seed	RSD	3 su/ha	50,000	150,000
	Fertilizer (kg/ha)				Total: 73,500
2.1.2.	NPK 10:10:20 KN, KS (3x)	RSD	1,200 kg 25 kg x 3	42.5 RSD/kg 300 RSD/kg	51,000 22,500
	Protection agents (kg/ha. l/ha):				Total:137,000
2.1.3.	Insecticides (1 preparation) Herbicides (2 preparations) Fungicides (4 preparations)	RSD	12 kg 21+21 21+2x2kg+4x1kg	1500 RSD/kg 12000+6,000 RSD/l 7000+50000+44000	18,000 18,000 101,000
2.1.4.	Drip irrigation system	RSD	15,000 m (water hose) 300 l (fuel)	4 RSD/m 142 RSD/l	102,600
2.2.	Services (works)	RSD			163,649
2.2.1.	Plowing	RSD			10,000
2.2.2.	Mineral fertilization	RSD			2,600
2.2.3.	Rotary tillage, mini beds forming	RSD			52,678
2.2.4.	Sowing. Fertilization against insects	RSD			21,071
2.2.5.	Herbicide treatment	RSD	2	3,600	7,200
2.2.6.	Fungicide treatment	RSD	8	3,600	28,800
2.2.7.	Combining-picking	RSD			/
2.2.8.	Transport				41,300
2.3.	Other costs	RSD			50,000
2.3.1.	Land lease	RSD			50,000
2.4.	Gross personal income	RSD			365,000
2.4.1.	Salaries	RSD			/
	Seasonal workers				
2.4.2.	Picking Irrigation	RSD	140 1	2,500 15,000	350,000 15,000
3.	Profit	RSD			208,251

Table 2. Calculation of carrot production per hectare on the farm of 30 ha

No	Elements	Measurement unit	Quantity	Price	Amount
	1	2	3	4	5
1.	PRODUCTION VALUE	RSD			1,220,000
1.1.	Extra class	kg/ha	50,000	22	1,100,000
1.2.	II class	kg/ha	17,000	10	120,000
2.	PRODUCTION COSTS	RSD			816,750
2.1.	Material	RSD			421,950
2.1.1.	Seed (Su/ha)	RSD	3	50,000	150,000
	Fertilization (kg/ha)				Total: 110,250
	NPK 9:12:25			70 RSD/kg	70,000
2.1.2.	Fertilizer: NPK 12:7:11	RSD	1000 kg	85 RSD/kg	21,250
	Microelements with fungicide treatment:		250 kg	Microelements:	
	Bioplex(5x), Trazex(5x), Aminokiseline(2x)		0,5 l/ha; 1 kg/ha; 1 l/ha	3,400.00RSD/l; 1,700.00 RSD/kg; 1,000 RSD/l	8,500
	Protection agents (kg/ha, l/ha):				Total: 59,100
2.1.3.	Insecticides (1 preparation)	RSD	15 kg/ha;	1200RSD/kg;	Ins: 18,000
	Herbicides (3 preparations)		1 l/ha; 1.5 l/ha; 0.9 l/ha	2500RSD/l; 5000 RSD/l; 3000RSD/l;	Herb: 12,700
	Fungicides (3 preparations)		0.8 kg/ha (3x); 0.5 l/ha(2x); 1.5 l/ha (2x)	6000 RSD/kg; 6500 RSD/l; 2500 RSD/l	Fung: 28,400
2.1.4.	Drip irrigation	RSD	15,000 m (irrigation hose) 300 l (fuel)	4 RSD/m 142 RSD/l	102,600
2.2.	Operations	RSD			134,800
2.2.1.	Subsoiling	RSD			5,800
2.2.2.	Plowing	RSD			6,000
2.2.3.	Pre-sowing preparation for mineral fertilization	RSD			4,000
2.2.4.	Mini beds forming	RSD			9,000
2.2.5.	Sowing	RSD			12,000
2.2.6.	Insecticide treatment	RSD			2,000
2.2.7.	Herbicide treatment	RSD	3x	2,000	6,000
2.2.8.	Fungicide treatment	RSD	7x	2,000	14,000
2.2.9.	Interrow cultivation	RSD	2x	2,000	4,000
2.2.10.	Irrigation	RSD			1,000
2.2.12.	Combining	RSD			53,600
2.2.13.	Transport	RSD			17,400
2.3.	Other costs	RSD			52,000
2.3.1.	Land lease	RSD			52,000
2.4.	Gross personal income	RSD			208,000
2.4.1.	Salaries	RSD	2	80,000	160,000 RSD x 12months= 1,920,000 RSD/30ha= 64,000 RSD/ha
2.4.2.	Seasonal workers Weed control Irrigation	RSD	6	2,500 RSD/person	6x2500x24x12= 4,320,000 RSD/30ha= 144,000 RSD/ha
3.	Profit	RSD			403,250

its direct impact on business results (Pavlović et al., 2014). Agricultural machinery, as an important factor of production, plays an important role in the process of agricultural production. Its importance is both of technical and organizational-economic character, as tractors, combine harvesters and other auxiliary agricultural machines allow a more rational use of available natural and other resources, increase production volume and productivity, and enable relative reduction of production costs (Munčan and Božić, 2017). Depreciation costs included in Table 1 and in the other two tables (Table 2 and Table 3) were calculated for each individual operation performed using their own mechanization. The costs of gross personal income on Farm 1 amounted to 365,000 dinars/ha (Table 1) and was elevated compared to the costs on the other two farms (Table 2 and 3). The difference between the stated costs and the surveyed farms is the result of a large share of manual labour at picking of technologically mature carrot root, which was done manually due to a lack of proper mechanization. Mechanized harvesting of carrots can significantly reduce the share of manual labour (Ponjičan et al., 2010). The smallest item in the total costs incurred on Farm 1 is composed of land lease, amounting to 50,000 dinars/ha (Table 1). Stated costs are, also, lowest compared to the other farms (Tables 2 and 3).

As outlined above, the main shortcomings of the production on Farm 1 are higher purchase prices of materials due to their smaller quantity compared to farms 2 and 3, as well as a lack of mechanization. Farm 1 achieved the yield of 65 t/ha (Table 1) at 76.9% of the extra class carrots, which ended in a positive financial result, with the profit of 208,251 dinars/ha. (Table 1).

Table 2 shows the calculation of carrot production on Farm 2 where carrots are produced on an area of 30 ha. Only 3% of farms use an area of over 20 hectares (Đurić et al., 2016). The value of the production amounted to 1,220,000 dinars/ha, the total production costs were 816,750 dinars/ha, and the realized profit was 403,250 dinars/ha.

Material costs of carrot production on Farm 2 amounted to 421,950 dinars/ha (Table 2). They are lower than the material costs on Farm (Table 1) but higher compared to the same costs on Farm 3 (Table 3). Direct material costs comprise the largest part of the total costs of Farm 2. Direct material costs amount to 260,250 dinars/ha, where the costs of seeds are 150,000 dinars/ha, and the costs of fertilizers 110,250 dinars/ha (Table 2). Farm 2 (Table 2) had the highest costs of fertilizers compared to Farm 1 and 3 (Tables 2 and 3). The reason behind this can be

found in the application of microelements with each fungicide treatment. According to Pirahouskaya et al. (2014), the application of complex fertilizers with microelements had a positive effect on improving the quality of carrots.

Microelements were not applied on the other two farms, and it increased the costs of mineral fertilizer on Farm 2 (Table 2). It should be noted that fertilization was performed on the basis of a previous chemical analysis of the soil. Tapki et al. (2020) stated that the correlation between farm sizes and the amount of fertilizers used per hectare was not statistically significant. Indirect material costs on Farm 2 amounted to 59,100 dinars/ha (Table 2) and are the lowest compared to other farms (Table 2 and Table 3). This is the result of a more favourable purchase price of protection agents, as well as the choice of preparations in line with all cultivation practices. The selection of protection products, as well as finding their optimum combination is also difficult because certain products are prohibited by law and withdrawn from the market. Currently, weed control in carrot crops is conducted using the preparations registered in Serbia, based on three active substances: pendimethalin, kletodim, and propaquizafop (Konstantinović et al., 2020).

The costs of work on Farm 2 amounted to 134,800 dinars/ha (Table 2) and are slightly lower in comparison with the costs on Farm 1 (Table 1), or higher in comparison with the same costs on Farm 3 (Table 3). Complete work on Farm 2 was performed with own mechanization. Ownership of machinery is an advantage and should reduce the cost of works compared to payment of certain work operations to third parties, as is the case on Farm 1. The costs of gross personal income on Farm 2 amounted to 208,000 dinars/ha (Table 2) and they are the lowest compared to the same costs incurred in the other two farms (Tables 1 and 3). If the costs shown in Table 2 are compared with the same costs in Table 1, it is noticeable that they are much lower due to the significantly lower participation of human labour, especially at the carrot root extraction phase. On the other hand, the cost of gross personal income per hectare on Farm 3 are higher compared to the same costs on Farm 2 due to a significantly larger area of carrot production and a larger number of permanently employed workers and seasonal workers.

The lowest in the total cost calculation are other costs that include land lease and amount to 52,000 dinars/ha (Table 2). Other costs on Farm 2 (Table 2) are higher compared to the same costs of Farm 1 (Table 1), or lower compared to Farm 3 (Table 3).

Table 3. Calculation of carrot production per hectare on the farm of 120 ha

No	Elements	Measurement unit	Quantity	Price	Amount
	1	2	3	4	5
1.	PRODUCTION VALUE	RSD			1,272,000
1.1.	Extra class	kg/ha	51,000	22	1,122,000
1.2.	II class	kg/ha	15,000	10	150,000
2.	PRODUCTION COSTS	RSD			859,445
2.1.	Material costs	RSD			384,665
2.1.1.	Seed (su/ha)	RSD	3	50,000	150,000
	Fertilizer (kg/ha; l/ha):				Total: 56,350
	NPK 6:12:24		1000 kg/ha	37 RSD/kg	
	KN 15:46		2x25 kg/ha	190 RSD/kg	37,000
2.1.2.	KS	RSD	2x25 kg/ha	150 RSD/kg	9,500
	Vuksal-bor		2x1 l/ha	717 RSD/l	7,500
	Vuksal-cink		1 l/ha	916 RSD/l	1,434
					916
	Protection agents (kg/ha, l/ha):		3 l/ha; 1 l/ha	2040RSD/l;3140 RSD/l	Total: 75,715
	Herbicides (2 preparations)		2x2kg/ha;	600 RSD/kg; 3200 RSD/kg;	
2.1.3.	Fungicides (6 preparations)	RSD	2x2kg/ha; 1 l/ha; 2,5 l/ha; 1 l/ha; 2x2 l/ha	10250 RSD/l; 6468 RSD/l; 7655 RSD/l; 1335 RSD/l	Herb: 9,260
	Insecticides (1 preparation)		8 kg/ha	1480 RSD/kg	Fung: 54,615
					Insect: 11,840
2.1.4.	Drip irrigation	RSD	15,000 m (hose) 300 l (fuel)	4 RSD/m 142 RSD/l	102,600
2.2.	Operations	RSD			102,140
2.2.1.	Plowing	RSD			4,800
2.2.2.	Pre-sowing preparation for mineral fertilization	RSD			3,500
2.2.3.	Subsoiling	RSD	2x		4,640
2.2.4.	Rotary tillage	RSD	2x		6,200
2.2.5.	Mini beds forming	RSD			7,200
2.2.6.	Sowing, insecticide treatment, drip irrigation	RSD			9,600
2.2.7.	Insecticide treatment	RSD	2x	1,600	3,200
2.2.8.	Fungicide treatment	RSD	8x	1,600	12,800
2.2.9.	Interrow cultivation	RSD	2x	1,600	3,200
2.2.10.	Irrigation	RSD			1,000
2.2.11.	Combining	RSD			32,000
2.2.12.	Transport	RSD			14,000
2.3.	Other costs	RSD			60,000
2.3.1.	Land lease	RSD			60,000
2.4.	Gross personal income	RSD			312,640
2.4.1.	Salaries	RSD	40	46,860.075	1,874,403x12 months/120 ha= 187,440 RSD/ha
2.4.2.	Seasonal workers	RSD	600	2,000 RSD/worker 52,000 taxes and insurances	1,252,000*12/120= 125,200 RSD/ha
3.	Profit	RSD			412,555

According to the above, we can conclude that medium-sized farms are suitable for carrot production from the economic perspective. Farm 2 achieved the yield of 67 t/ha (Table 2) with the participation of extra class carrots of 74.6% and a positive financial result, with a profit of 403,250 dinars/ha (Table 2).

Table 3 shows the calculation of carrot production on Farm 3 which produces carrots on an area of 120 ha. The largest portion of farmland with over 100 hectares is used by only 0.2% of the total number of family farms (Đurić et al. 2016). The value of the production amounted to 1,272,000 dinars/ha,

total production costs were 859,445 dinars/ha, while the profit was 412,555 dinars/ha.

Material costs on Farm 3 amounted to 384,665 dinars/ha (Table 3) and they had the highest share in the total production costs. Material costs on Farm 3 were the lowest compared to the same costs incurred on farms 1 and 2 (Tables 1 and 2). Direct materials costs amounted to 206,350 dinars/ha, of which the costs of seeds were 150,000 dinars/ha, while the costs of mineral fertilizers were 56,350 dinars/ha (Table 3). The costs of mineral fertilizers per hectare were lower on Farm 3 compared to the costs on farms 1 and 2 (Tables 1 and 2). The difference in costs arises from the lower purchase price due to larger quantities. Indirect materials cost (pesticides costs) on Farm 3 amounted to 75,715 dinars/ha (Table 3). The costs were lower compared to the costs incurred on Farm 1 (Table 1), but higher in comparison to indirect materials cost on Farm 2 (Table 2). Although Farm 3 procured most of the preparations at lower prices (due to the larger quantity it procures) this was due to a different combination of preparations and a larger number of treatments on Farm 3.

The cost of works on Farm 3 amounted to 102,140 dinars/ha (Table 3) and they are the lowest compared to the costs incurred on farms 1 and 2 (Tables 1 and 2). The difference in the cost of works per hectare on Farm 3 arises from the fact that the entire scope of works during carrot production is performed using their own mechanization, as well as the larger production area. Larger farms are better equipped with mechanization which allows them more efficient implementation of the technology of production of industrial crops and intensive production enables them to realize higher yields (Munćan and Božić 2017).

Gross personal income costs on Farm 3 amounted to 312,640 dinars/ha (Table 3). They are lower in comparison to the same costs on Farm 1 (Table 1) and higher in comparison with the same costs on Farm 2 (Table 2), due a larger number of workers and more arable land. The profitability of such production mostly depends on labour costs, significant manual labour is required during the production year (Bodiroga, 2020).

Other costs on Farm 3 include land lease and amount to 60,000 dinars/ha (Table 3) and they are the highest compared to the same costs on farms 1 and 2 (Table 1 and Table 2).

Total production costs on Farm 3 amounted to 859,445 dinars/ha (Table 3). The costs are lower in comparison to the same costs on Farm 1 (Table 1), and higher in comparison to the total costs of Farm 2, which amounted to 816,750 dinars/ha (Table

2). Although production costs per hectare should be lower on larger production areas, the difference in total production costs between Farm 3 and Farm 2 is a result of higher pesticide costs on Farm 3, as well as higher gross personal income costs.

On Farm 3, the yield was 66 t/ha (Table 3) with a high share of extra class carrots at 77.27%. Acar et al. (2020) stated that if they want more profit from carrot production, producers must make sure to produce more extra class carrots, which in their research accounted for 73.80%. Considering the yield and the realized profit of 403,250 dinars/ha (Table 3), it is concluded that production of carrots on larger areas is very profitable due to lower purchase prices of raw materials on larger farms and machinery ownership, which results in lower production costs per hectare and positive financial result of production.

The average cost of production for one ton of carrots is 13,746.36 dinars on the observed farms, the purchase price of one ton of extra class fresh carrots is 22,000 dinars, while fresh carrots that do not belong to extra class cost 10,000 dinars per ton. Research by Sito et al. (2019) stated that the average cost of producing one ton of carrots was around 80 Euros. The purchase price of carrots before storage ranged from 213 to 240 Euro per ton and after storage from 267 to 333 Euro per ton.

Farms of 5 ha make up about 78% of the total number of family farms and dispose with 30.5% of utilized agricultural land. Farms of over 10 ha make up only 8.1% of farms in Serbia, using 47.7% of utilized agricultural land. The largest farms, with over 50 ha, make up only 0.9% of the total number of family farms and dispose with about 19% of utilized agricultural land (Munćan and Božić, 2017). The small size of farmland per farm prevents the use of the effects of economies of scale, which further leads to high unit production costs and low marketability, reflected in the low performance with modest and uncertain market surpluses. In addition to a relatively small average farm size, an important limitation of more efficient land use is the fragmentation of farms to six plots per farm. Current farms are reduced to backyards. Gardening should not be underestimated in any case, as it can be a very important factor of survival from both personal and general perspectives (Simonović et al., 2017)

Acar et al. (2020) stated that 56.16% of producers find the initiative for carrot production in its profitability. The average farm size examined in their research was 12.62 hectares. The main problems in carrot production that affected the price of the product were high input prices, low product prices, insufficiently developed market,

Table 4. Key production and performance indicators

No	Elements	Measurement unit	Farm 1	Farm 2	Farm 3
	1	2	3	4	5
1.	Yield per ha	kg/ha	65,000	67,000	66,000
2.	Extra class	kg/ha	50,000	50,000	51,000
3.	II class	kg/ha	15,000	17,000	15,000
4.	Price (extra class)	RSD/kg	22	22	22
5.	Price (II class)	RSD/kg	10	10	10
6.	Value of production	RSD/ha	1,250,000	1,220,000	1,272,000
7.	Costs of production	RSD/ha	1,041,749	816,750	859,445
8.	Cost of production per kilo	RSD/ha	16.02	12.19	13.02
9.	Result (profit)	RSD/ha	208,251	403,250	412,555
10.	Profit margin	%	16.66	33.05	32.43

and a lack of organization and cooperation among the producers. Despite these limitations, technological innovations in the production process and associations of farmers with an aim of increasing productivity and input supplies can lead to increased profits. Establishment of producer associations and supply unification can strengthen the bargaining power of producers and increase their sales position on the national and international markets (Bodiroga, 2020). Economic activities of agricultural enterprises can be maintained by careful observation of the changing technological and economic directions and taking the necessary precautions (Acar et al., 2016). Carrot producers should be encouraged to unite in farmers' associations to overcome the emerging production challenges more easily (Tapki et al., 2020). Vegetable production can be very profitable, especially if a level is reached at which, in terms of quantity, quality and continuity of vegetables, a producer can be competitive on the international market (Puškarić et al., 2009).

Conclusion

The three farms had different production costs per hectare, although the value of production remained approximately the same, due to the differences in the applied cultivation practices, the degree of mechanization and the purchase price of inputs.

The analysis and comparison of the obtained economic parameters in carrot production for all three surveyed farms opened the possibility of achieving favourable yield and a positive financial result on both large and small production areas.

Regardless of the high costs of production incurred on the farms in our study, the production resulted in a high profit, pointing to the conclusion

that carrot production is profitable regardless of the size of the production area. Profits from carrot production can be increased by association of agricultural producers, for the purpose of a more favourable supply of inputs, more efficient product distribution with joint marketing, higher share of machinery as opposed to using manual labour, as well as careful monitoring of innovations introduced in the production process.

Land consolidation and farm expansion would result in increased efficiency of agricultural production on smaller farms with a larger number of plots.

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Poređenje kalkulacija proizvodnje mrkve na gazdinstvima različitih veličina

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Sažetak: Mrkva se u Srbiji proizvodi na različitim površinama u okviru poljoprivrednih preduzeća i poljoprivrednih gazdinstava. Istraživanja u ovom radu obuhvataju detaljne analitičke kalkulacije ostvarene vrednosti proizvodnje, obračuna troškova, te ostvarenih finansijskih rezultata proizvodnje mrkve na tri poljoprivredna gazdinstva različite veličine kao i uzajamno poređenje dobijenih rezultata. Obračun troškova prikazan u kalkulacijama proizvodnje baziran je na podacima o stvarnim troškovima, učinjenim tokom tehnološkog procesa proizvodnje mrkve, dobijenim od samih proizvođača. Navedene ekonomske kategorije obuhvaćene su i obračunate u okviru kalkulacija proizvodnje mrkve po hektaru za sva tri gazdinstva. Kalkulacije proizvodnje pružaju proizvođačima uvid u načinjene troškove proizvodnje dajući im mogućnost da na taj način bolje upravljaju njima. Kalkulacijama se potvrdilo da je svako od navedena tri gazdinstva imalo specifičnu tehnologiju proizvodnje. Visina troškova kod ispitivanih gazdinstava bila je različita, dok su vrednost proizvodnje kao i ostvareni prirodni rezultat bili na približno istom nivou. Postupcima komasacije i arondacije potrebno je sprovesti ukрупnjavanje poseda, čime bi se povećala efikasnost poljoprivredne proizvodnje na manjim gazdinstvima sa većim brojem parcela Udruživanje poljoprivrednih proizvođača u cilju povoljnijeg i boljeg snabdevanja inputima, bolje distribucije sa zajedničkim nastupom na tržištu, povećanje učešća mašinskog u odnosu na živi ljudski rad uz praćenje inovacija u procesu proizvodnje, mogu dovesti do povećanja profita u proizvodnji mrkve. Sva tri gazdinstva ostvarila su pozitivan finansijski rezultat, što ukazuje na to da je proizvodnja mrkve isplativa kako na manjim, tako i na većim površinama.

Ključne reči: gazdinstvo, kalkulacija, mrkva, proizvodnja, troškovi

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