

ECONOMIC AND FINANCIAL ASPECTS OF CABBAGE PRODUCTION ON THE FAMILY FARM¹

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Abstract

The paper primarily presents the production results of cabbage production research in the Republic of Serbia and then the research is focused on the economic and financial aspects of production on the selected family farm. Research is based on real data from practice, collected from cabbage producers in Glogonj place, which belongs to the territory of the city of Pančevo in the South Banat district, AP Vojvodina, Serbia. A calculation was made for one production cycle per unit of area and per unit of yield, as well as critical values that follow the production of cabbage in the open field.

The research results showed that the total costs of cabbage production on a representative agricultural farm are relatively high and amount to 6,783.95 Euro/ha. However, with the realized income of 12,758.36 Euro/ha, the annual financial result is favorable and amounts to 5,974.40 Euro/ha. Cabbage yields or prices can drop by 53.2% while production still generates a positive financial result. The economic and financial results of the research are outstanding and show that cabbage production in this part of Serbia is extraordinarily profitable.

Key words: *cabbage, production, economic analysis, financial result.*

Introduction

Vegetable production in Serbia has a long tradition, and this production is carried out in rural areas and rural households. In the past, the production of vegetables

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had an exclusively seasonal character, while in the winter months vegetables were stored either underground and/or processed in the family farm. Nowadays, fresh vegetables are intensively produced throughout the year, either in the open field or in a sheltered area, through the rotation of two to three types of vegetables during the year (Ilin et al., 2019, Kljajić et al., 2014). Despite this fact, the total production of vegetables in Serbia is below realistic possibilities. Reasons are numerous and some of them are: the fragmentation of the land holdings of agricultural producers, the obsolescence of machinery, the lack of capacity for storage and processing of vegetables, errors in cultivation technology that can occur at critical moments of production and that can be related to the preparation of land for planting, quality of planting material, nutrition, plant care, phytosanitary protection, irrigation in terms of watering norms and water quality, etc. (Moravčević et al., 2019, Moravčević et al., 2021). In addition to favorable natural resources (land, water and biodiversity), which our country possesses, the greatest resource is the individual agricultural producers of vegetables who have maintained this production through the various periods of transition that our country has gone through. Considering all of the above, the intensification of vegetable production in Serbia is realistically possible through the application of complex, modern agro technical measures and innovative technologies, as well as the support of the relevant Ministry through various subventions and other incentives, as well as scientific institutions and expert advisory services from this area (Grujić et al., 2014).

According to the agricultural census of the Republic of Serbia (Survey 2018), the production of vegetables in the Republic of Serbia totaled 1,300,347 tons in 2018. In the structure of the total value of vegetable production, vegetable production in AP Vojvodina amounted to 389,447 t, which is approximately 30% (29.95%) in relation to production in the territory of the Republic of Serbia (<https://data.stat.gov.rs/Home/Result/130102?language-Code=sr-Cyrl&displayMode=table&guid=5e42d908-b307-49e4-adb6-47b59f167a3ealink>).

According to the same data source, in the Republic of Serbia, vegetables (vegetables, watermelons and strawberries) are grown on a total of 50,107 ha, on the land of a total of 114,643 family farms. Therefrom, vegetables in greenhouses and plastic greenhouses as protected areas occupy a total area of 3,834 ha on the land of 22,680 family farms. Vegetables for fresh consumption are grown outdoor on a total of 34,190 ha on the land of 98,543 farms, while vegetables for industrial processing are grown on a total of 12,083 ha on the land of 4,326 farms (Table 1).

Table 1. Areas under vegetables and the number of farms in the territory of the Republic of Serbia (2018).

	Type of production	Area (ha)	Number of family farms
Republic of Serbia	Vegetables, watermelons and strawberries (in total)	50,107	114,643
	Vegetables in greenhouses and plastic greenhouses	3,834	22,680
	Outdoor vegetables for fresh consumption	34,190	98,543
	Outdoor vegetables for industrial processing	12,083	4,326
South Banat region	Vegetables, watermelons and strawberries (in total)	2,557	2,261
	Vegetables in greenhouses and plastic greenhouses	36	324
	Outdoor vegetables for fresh consumption	1,667	2,010
	Outdoor vegetables for industrial processing	854	61
The city of Pančevo	Vegetables, watermelons and strawberries (in total)	282	496
	Vegetables in greenhouses and plastic greenhouses	15	91
	Outdoor vegetables for fresh consumption	258	432
	Outdoor vegetables for industrial processing	8	5

Source: <https://data.stat.gov.rs/Home/Result/1300020203?languageCode=sr-Latn&display-Mode=table&guid=90941dad-5472-49d5-b69a-9482d4d4ec06>

Only 5.1% of the total vegetable production in the Republic of Serbia is realized in the South Banat Region. Vegetable production takes place on a total of 2,557 ha, which includes the land of 2,261 family farms. Therefrom, outdoor vegetable production accounts for 98.6% of production, while only 1.4% is produced in protected areas.

In the area of the city of Pančevo, where the Glogonj settlement belongs, vegetables are grown on a total of 282 ha, predominantly outdoors, for fresh consumption and for industrial processing (266 ha on the land of 437 family farms). The production of vegetables in greenhouses and plastic greenhouses accounts for only 5.3% of the total production of vegetables in the area of the city of Pančevo.

The official statistics of the Republic of Serbia monitor the production of 11 types of vegetables (potatoes, tomatoes, peas, cabbage and kale, onions, peppers, beans, melons and watermelons, carrots, cucumbers, garlic). The

research in this paper refers to cabbage, which is intensively produced in the area of the city of Pančevo.

Cabbage is a biennial herbaceous plant that belongs to the Brassicaceae family. It is the leading representative of cruciferous vegetables in our country. It contains on average 6-10% of dry matter, 4-1% of carbohydrates, 1-2% of proteins as well as 3-50 mg of vitamin C, which is especially important in the diet during the winter months. Raw cabbage contains 4.2-5.8% carbohydrates, 1.6-1.9% protein, 0.8-1.3% cellulose, 0.12-0.18% vegetable oils and 0.7 -1.2% mineral substances. The share of vitamin C and vitamin B1 is 38 mg. Mineral substances mainly contain potassium, calcium and sulfur (Moravčević et al., 2005). Cabbage produces vegetative organs in the first year, and a flowering stem and seeds in the second year. It easily adapts to different climatic and soil conditions, but it is best suited to wet areas. Although cabbage tolerates low temperatures, the optimal temperature for its growth and development is 15-20 °C. Both optimal soil moisture and optimal air humidity are necessary for the development of cabbage. The optimal soil moisture is about 80% of the field's water capacity. In the absence of water, cabbage yields are significantly lower and the heads of cabbage are smaller. Cabbage needs the most water at the beginning of the formation of its heads. The optimal air humidity is in the range of 85% to 90%.

Cabbage is most successfully grown on alluvial, medium-heavy, deep soils rich in humus. With earlier varieties of cabbage, slightly lighter sandy-loam soils can be used for cultivation. Soils with a heavy mechanical composition, impermeable to water and with little organic matter are completely unfavorable for growing cabbage. The optimal soil pH value for cabbage is 6.0-6.5. On acidic and heavy soils, production can only succeed with the addition of manure in larger quantities. Cabbage must be grown in a crop rotation due to its high sensitivity to diseases and pests, and it should be only grown to the same surface after 3 years.

The best pre-crops for cabbage from fodder and field crops are perennial legumes such as alfalfa and various types of clover, grasses and cereals (barley, wheat...). Vegetables include beets, celery, lettuce, peas and beans, tomatoes, cucumbers and potatoes. On the other hand, cabbage can be a good starter for most vegetable types. The reason is that behind the cabbage, the soil is not burdened by roots, and at the same time, it is very loose.

Yields of early varieties of cabbage under normal production conditions reach a value of 30-40 t/ha, mid-early varieties around 60 t/ha, and late varieties and hybrids over 80 t/ha.

Cabbage can be used raw, cooked or canned (Moravčević et al., 2005, Moravčević et al., 2011).

Materials and methods of research

The paper first shows the production of vegetables at the level of the Republic of Serbia, AP Vojvodina, then at the level of the South Banat region and within it at the level of the city of Pančevo, because the calculation made refers to the selected family farm in a populated place belonging to the city of Pančevo. The presentation of cabbage export and its purchase price for the last three years is also given.

For the research in this paper, data from the Statistical Office of the Republic of Serbia, Belgrade, data from the Trade Statistics for the Development of International Business (Trade Map), the results of previous research by domestic and foreign authors' on this topic, etc., were used. The research is based on real data from practice, collected from cabbage producers from family farms in the South Banat region.

Based on the collected data, a calculation was made for one production cycle per unit of area and per unit of yield, as well as the critical values that follow the outdoor production of cabbage.

Economic analysis determined more important indicators: income, variable costs, coverage margin and critical production values. The data are presented in tables and in graphs using statistical and calculative methods for solving such tasks and problems in science and practice.

Research results and discussions

Significant areas are covered by cabbage in the vegetable seeding structure. Average harvested area under cabbage was 7,672 ha for the period 2019-2021 in the Republic of Serbia. The areas under cabbage were decreasing by 2.80% on average per year. Average total production was achieved in the value of 181,001 t, which was increasing by 1.96% on average annually. The average cabbage yield of 23.9 t/ha was decreasing by 2.78% on average per year (Table 2).

Table 2. Average values of areas, total production and yield of cabbage and kale in the Republic of Serbia for the period 2019-2021.⁴

Research period	Harvested area, ha /arable land, ha	Index (2019=100)	Total production (t)	Index (2019=100)	Yield, (t/ha)	Index (2019=100)
2019	7,957	100,00	178,308	100,00	25,4	100,00
2020	7,547	94,85	179,377	100,60	22,4	88,19
2021	7,513	94,42	185,317	103,93	23,8	93,70
<i>Average</i>	7,672		181,001		23,9	
<i>Average annual rate of change (%)</i>	-2,80		1,96		-2,78	

Source: <https://data.stat.gov.rs/Home/Result/130102?languageCode=sr-Cyrl&displayMode=table&guid=60471cb4-72eb-4225-920b-61caef71e634>

Only 17.31% of the total vegetable production in the Republic of Serbia is realized in the area of AP Vojvodina. In the area of AP Vojvodina, the average value of the area under vegetables for the same period was 1,080 ha, and that area was decreasing by 2.45% on average per year. The achieved average total production was 31,332 t and it was increasing by 1.75% on average per year. The average yield of 29.0 t/ha was increasing by 4.25% annually (Table 3).

Table 3. Average value of areas and yield of cabbage and kale in the area of AP Vojvodina for the period 2019-2021.

Research period	Harvested area, ha /arable land, ha	Index (2019=100)	Total production (t)	Index (2019=100)	Yield, (t/ha)	Index (2019=100)
2019	1,111	100,00	30,768	100,00	27,7	100,00
2020	1,071	96,40	31,373	101,97	29,3	105,78
2021	1,057	95,14	31,855	103,53	30,1	108,66
<i>Average</i>	1,080		31,332		29,0	
<i>Average annual rate of change (%)</i>	-2,45		1,75		4,25	

Source: <https://data.stat.gov.rs/Home/Result/130102?languageCode=sr-Cyrl&displayMode=table&guid=60471cb4-72eb-4225-920b-61caef71e634>

The average export of cabbage from Serbia to all countries of the world for the three-year period of analysis was 3,511.6 t with an average value of 1,160.3

⁴ In the database of the Republic Institute of Statistics (harvested area in ha, total production in t, and yield in t/ha), cabbage is tracked as a category of cabbage and kale

thousands USD. However, the largest amount of cabbage was exported to the countries of the European Union. For the same period, an average of 2,622.7 t of cabbage was exported to the countries of the European Union, which is 74.7% of the total export of cabbage, in the value of 939.6 thousands USD (Table 4).

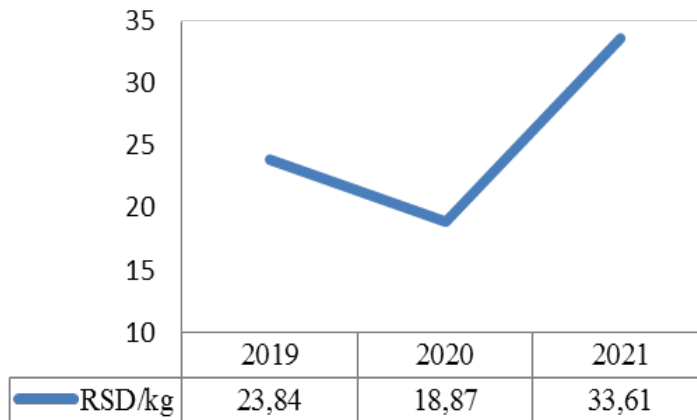
Table 4. *Export of cabbage⁵ from Serbia for the period 2019-2021.*

Years	All countries		The European Union countries (28)	
	Quantity (t)	Value in thousands of USD	Quantity (t)	Value in thousands USD
2019	4,593.5	1,641.8	3,906.8	1,455.7
2020	3,880.9	1,031.1	2,695.4	810.9
2021	2,060.3	807.9	1,266.0	552.2
average		3,511.6 1,160.3		2,622.7 939.6

Source: <https://data.stat.gov.rs/Home/Result/170304?languageCode=sr-Cyrl&displayMode=table&guid=f229f7f6-fce9-48c3-9ff7-cbebc05f01a>

In the previous three years, cabbage was selling at an average purchase price of 25.44 dinars/kg (Graph 2). The lowest price was in 2020. while the highest was in 2021.

Graph 2. *Average annual purchase prices of cabbage in the Republic of Serbia for the period 2019-2021. year*

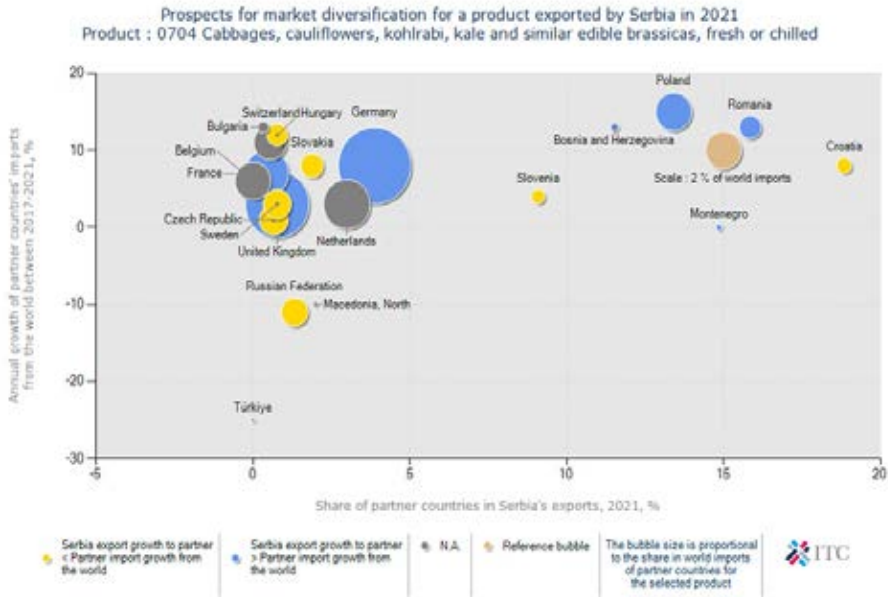


Source: <https://data.stat.gov.rs/Home/Result/0302010302?languageCode=sr-Cyrl&displayMode=table>

5 In the export category of the database of the Republic Institute of Statistics, cabbage follows cabbage, kohlrabi and similar edible vegetables, fresh

The countries to which most cabbage is exported from the Republic of Serbia are Poland, Romania, Croatia, Slovenia, Bosnia and Herzegovina and Montenegro (Figure 1 taken from): https://www.trademap.org/Country_SelProductCountry_Graph.aspx?nvpm=%7c688%7c%7c%7c%7c0704%7c%7c%7c4%7c1%7c1%7c2%7c1%7c1%7c2%7c1%7c%7c2

Figure 1. Export of cabbage from Serbia in 2021 %



A smaller percentage of cabbage is exported from Serbia to other countries of the world: Germany, Great Britain, France, Holland, Belgium, Switzerland, Sweden, Russia and others.

Economic results of cabbage production on the family farm

The economic analysis of cabbage production achieved during 2021 on the family farm in the South Banat region is based on the calculation of production on an area of 1.0 ha (Table 5). The family farm produces cabbage from seedlings, taken from a local certified nursery garden. The family farm has all the necessary machinery and equipment for carrying out work in growing vegetables. Production is carried out in an open field with the application of complete agrotechnics, including drip irrigation. Harvesting is done manually, during the most intensive harvest, additional labor is hired, i.e. pickers

from the local area, and harvesting is carried out in several passes. After harvesting, the heads of cabbage are classified according to weight and health criteria and packed in cardboard boxes. On average, the weight of a head of cabbage is about 2 kg. Produced cabbage is mainly sold on the quantum markets, wholesale or on the farm itself to known customers from the surrounding area. A certain part is processed into cabbage products.

Table 5. *Cabbage production calculation (P= 1.0 ha)*

Description	Quantity	Unit of measure	Price per unit of measure	Total RSD/ha	Total Euro/ha
A Income					
Cabbage	50,000.00	kg	30.00	1,500,000.00	12,758.36
Subventions				0.00	0.00
Total				1,500,000.00	12,758.36
B Variable costs					
Seedlings	50,000.00	struk	3.90	195,000.00	1,658.59
Fertilizers				40,560.00	344.99
Plant protection products				38,480.00	327.29
Packaging (cardboard box)	1,900.00	komad	50.00	95,000.00	808.03
Loading, export and spreading of manure				4,062.50	34.55
Tillage				15,600.00	132.69
Seed preparation				7,800.00	66.34
Scattering of mineral fertilizers				2,600.00	22.11
Spraying				13,000.00	110.57
Costs of planted seedlings - machines				6,500.00	55.29
Costs of planted seedlings - labors				10,000.00	
Hoeing	40.00	sat	300.00	12,000.00	
Harvest costs (with packaging)	400.00	sat	300.00	120,000.00	1,020.67
Drip tapes	14,400.00	m	9.10	131,040.00	1,114.57
Irrigation costs (diesel generator 7.5 KW)	430.00	l			

Description	Quantity	Unit of measure	Price per unit of measure	Total RSD/ha	Total Euro/ha
Maintenance costs of irrigation systems and aggregates				5	
Engaged labour (other)	36.00	sat	250	9,000.00	76.55
Other costs (electricity, small inventory, etc.)				1,370.00	1
Total B				797,589.50	6,783.95
V Profit (A-B)				702,410.50	5,974.40

Source: Authors' calculation based on field research (2021)

* NBS exchange rate per day 31.07.2021 (1 RSD= 117,57 €)

On the family farm in the analyzed year, a yield of 50,000 kg/ha was achieved. Total costs, market value of production and realized profit were obtained based on collected data on costs in the production process and the amount of yield. Costing includes total costs, where material costs are calculated based on market prices. All the necessary materials for production are bought on the territory of the cities of Pančevo and Belgrade. During the calculation, the purchase price of cabbage was used, which was achieved in 2021 and was approximately 30.0 dinars/kg.

The total costs in the regular production of cabbage on the family farm amount to €6,783.95/ha. If this cost were to be translated to a kilogram, it amounts to 0.14 €/kg, which compared to the selling price of cabbage is a lower value and represents a benefit for the producer. When comparing the production costs and the realized income in the production of cabbage in 2021, which amounted to €12,758.36/kg, the realized profit is €5,974.40/ha, i.e. €0.12/kg, at the selling price of cabbage in 2021. , year of 30.0 din/kg, i.e. 0.26 €/kg.

The economics of cabbage production as a ratio of realized production value and total costs in the production process is 2.14. This value is an indicator of how many euros of production value were realized per euro of total production costs (*Jeločnik M., et al., 2021*).

Table 6 shows the critical values in cabbage production. If the yields and prices of cabbage are taken into account, its production can be characterized as moderately risky.

Table 6. *Critical values of cabbage production*

Description	RSD (kg/ha)
Expected yield (EY)	50.000,00
Expected (average) price (EP)	30,00
Subventions (S)	0,00
Variable costs (VC)	797.589,50
Critical price: $CP = (VC - S) / EY$	15,95
Critical yield: $CY = (VC - S) / EP$	26.586,32
Critical variable costs: $CVC = (EY \times EP) + S$	1.500.000,00

Source: Authors' calculation based on field research (2021)

The values at which the profit is equated to zero, that is, the critical values that accompany the production of cabbage show that the yields or the price of cabbage can fall by 53.17%, that is, to 15.95 dinars/kg and to the value of the total production per hectare per year of 26,586.32 t, while production still generates a positive financial result.

Conclusion

Cabbage production on the family farm in the place of Glogonj provides an annual income of €12,758.36/ha. The total costs of regular cabbage production on this family farm are €6,783.95/ha. In the structure of variable costs, the biggest share is the costs related to cabbage seedlings, irrigation and harvesting (67.2%). A positive financial result of €5,974.40/ha was achieved.

It can be concluded that the production of cabbage in this part of Serbia is economically profitable according to the established economic indicators.

Production on the family farm can be completed and thereby the family farm can be strengthen on the market through the association of several producers in specialized cooperatives and associations of vegetable producers, then by processing and packaging a quantity of produced vegetables, as well as by improving production through the introduction of innovations and new scientific knowledge into practice.

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