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VEGETABLE PRODUCTION IN THE REPUBLIC OF SERBIA – PRESENT STATE AND PROBLEMS⁴

Abstract

The aim of the research in this paper is to consider the state and basic trends of vegetable production in the Republic of Serbia for the period from 2012. to 2020. Therefore, the paper indicates which necessary measures should be taken to increase the volume of vegetable crop production in our country and improve the production. In spite of all problems, and owing to significant but insufficiently used local resources (people) and favourable natural conditions (climate features, soil and water resources), vegetable production in the Republic of Serbia has a good opportunity for intensive development. This development has to be accompanied by the appropriate credit and monetary support, investment and incentives.

Keywords: *plant production, vegetable crop production, average annual rate of change, selling prices*

JEL classification: *Q000, Q110, Q150*

ПРОИЗВОДЊА ПОВРЋА У РЕПУБЛИЦИ СРБИЈИ - СТАЊЕ И ПРОБЛЕМИ

Резиме

Циљ истраживања у овом раду је сагледавање стања и основних трендова кретања повртарске производње у Републици Србији за период 2011-2020. година. Сходно томе, указано је на неопходне мере које треба предузети како би се остварило повећање обима производње повртарских култура у нашој земљи и унапредила производња. Упркос свим проблемима, а захваљујући постојању значајних а недовољно искоришћених локалних ресурса (становништво), као и повољних природних услова (климатске карактеристике, земљиште и водни ресурси), повртарска производња у Републици Србији има шансе за даљи

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интензивни развој уз спровођење одговарајуће кредитно-монетарне, инвестиционе и подстицајне подршке.

Кључне речи: биљна производња, повртарство, просечна годишња стопа промене, продајне цене

Introduction

The Republic of Serbia has favourable climatic conditions and good soil and water potential for vegetable crop production. Consequently, it can be defined as a *traditionally vegetable-growing country* with diverse production. Bearers of vegetable growing are rural areas where production is still mainly conducted in open fields. However, there is a constant tendency of increasing the areas with greenhouses and glasshouses as protected areas with controlled production conditions. The possibility of growing vegetable crops both in open fields and in protected areas enables all-year-round production, which leads to significant production and economic differences. Economically speaking, the most significant difference is the fact that faster maturation of vegetables in protected areas results in significantly enhanced production profitability (Kljajić et al., 2013).

If the total agricultural production in our country is taken into account, vegetable production represents one of the most intensive branches of agriculture. This is confirmed by crop yield, generated income, net income, as well as the share of human labour. Open-field vegetable production reaches a 5 to 8 times greater production value in comparison to wheat production, while it is as many as 190 to 250 times greater in protected areas (Ševarlić et al., 2011). The vicinity of the market has a great impact on production. Thus, villages closer to large towns are better positioned, while villages in hilly and mountainous areas which are distant from large towns have a smaller number of vegetable crops at their disposal to be cultivated successfully and transported to large market places.

Grujić et al. (2014) believe that the relevant ministry should be more involved in suggesting appropriate agricultural measures in the field of vegetable production.

The data in Table 1 show that during the observed 9-year period the greatest annual share in the arable land structure was realised by cereals for the production of grain, both at the level of the EU-27 (54.1%) and in the area of Serbia (67.2%). It can be noticed that Serbia also has a greater average annual share of the areas cultivating industrial crops (16.3%) in comparison to the EU-27 (10.6%). However, the areas cultivating strawberries have the lowest average annual share in the total arable land, both at the EU-27 level (0.1%) and in the territory of Serbia (0.2%). When it comes to vegetable production, vegetables are grown on only 2% of the EU 27 area, while this share is slightly greater in Serbia (2.4%).

Table 1. Arable land structure at the level of the EU-27 and Serbia from 2012 to 2020 (in %)

Year	Cereals for the production of grain (% in arable land)		Dry pulses and protein crops (% in arable land)		Root crops (% in arable land)		Industrial crops (% in arable land)		Plants harvested green (% in arable land)		Fresh vegetables (% in arable land)		Strawberries (% in arable land)	
	European Union -27 countries	Serbia	European Union -27 countries	Serbia	European Union -27 countries	Serbia	European Union -27 countries	Serbia	European Union -27 countries	Serbia	European Union -27 countries	Serbia	European Union -27 countries	Serbia
2012	55.2	67.0	1.3	0.5	2.9	4.7	11.2	14.3	0.0	10.7	2.0	2.6	0.1	0.2
2013	55.1	67.9	1.2	0.5	3.2	4.5	11.9	14.1	0.0	9.8	1.8	2.4	0.1	0.2
2014	54.9	69.7	1.4	0.4	3.1	4.5	11.9	13.4	0.0	9.8	1.9	2.4	0.1	0.2
2015	54.5	67.9	2.0	0.5	2.9	3.2	12.0	14.4	19.2	9.7	2.0	2.6	0.1	0.2
2016	54.2	67.7	2.1	0.5	3.1	3.4	12.1	15.7	19.5	9.1	2.1	2.7	0.1	0.2
2017	52.6	65.9	2.4	0.6	3.3	3.6	0.0	17.4	19.7	9.2	2.0	2.8	0.1	0.3
2018	52.9	66.3	2.2	0.4	0.0	3.0	12.6	19.1	0.0	8.9	2.0	2.2	0.1	0.3
2019	53.9	65.9	2.0	0.4	3.2	3.0	11.6	19.0	0.0	9.4	2.0	2.1	0.1	0.3
2020	53.1	66.8	2.1	0.4	3.1	2.6	12.2	19.0	0.0	9.0	2.0	2.0	0.1	0.3
<i>Average per year</i>	<i>54.1</i>	<i>67.2</i>	<i>1.9</i>	<i>0.5</i>	<i>2.8</i>	<i>3.6</i>	<i>10.6</i>	<i>16.3</i>	<i>6.5</i>	<i>9.5</i>	<i>2.0</i>	<i>2.4</i>	<i>0.1</i>	<i>0.2</i>

Source: EUROSTAT database, Crop production in national humidity.

The agricultural sector has a huge political and economic significance for our country. Still, there is an increasing number of problems related to agricultural production. Fragmentation of properties and age structure of agricultural holdings are certainly some of its weakest points (Kljajić et al., 2011). These could be solved by associating agricultural producers in order to facilitate the response to the large and constant offer of foreign buyers. Our country generates a surplus when trading with vegetable products. However, it has far greater possibilities owing to its natural and other resources required for vegetable production. Since Serbia is a signatory of various international trade agreements, the imported goods are also available on the vegetable crop market, which creates competition to domestic producers (Moravčević Đ. et al., 2021). One of the important factors which limit vegetable production is the unregulated market in terms of the presence of a large number of “middlemen”. Middlemen dictate low prices of vegetables and thus prevent producers from gaining the desired income from production. At the same time, this makes them less motivated to deal with vegetable production and/or to broaden their production area (Bodiroga R., 2020).

In addition, old-fashioned production technology, lack of appropriate machinery, inadequate irrigation and drainage systems, insufficient financial incentives and alike are the limitations which prevent this sector from reaching its full potential (Zelenović V. et al., 2018).

Materials and methods

This paper involves the research period from 2012 to 2020 and includes the analysis of the areas and realised yield of selected vegetable crops in the Republic of Serbia. The authors used data of the Statistical Office of the Republic of Serbia in Belgrade, as well as the available scientific and professional literature dealing with this topic in order to understand the state and production results of the vegetable production in Serbia. The EUROSTAT Database was used for calculating the arable land structure at

the level of the EU-27 and Serbia for the period from 2012 to 2020. The methodology of data comprehensiveness according to individual categories was defined in the document named the Integrated Farm Statistics Manual (2020)⁵. For the needs of the paper, and in order to show the structure of the arable land category, the share of the following subcategories was presented: cereals for the production of grain, dry pulses and protein crops, root crops, industrial crops, plants harvested green, fresh vegetables (including melons) and strawberries. The arable land also involves flowers and ornamental plants, seeds and seedlings, other arable land crops and fallow land, but the related data from the EUROSTAT Database were not available at the time of writing this paper.

The authors' aim was to show the yield of the mentioned crops represented in the arable land at the level of the EU-27 and Serbia using the EUROSTAT Database. However, data availability is not at the appropriate level and it is not possible to create an adequate time series. This situation would consequently lead to inadequate interpretation of the data. Therefore, the data on the crop yield are presented only for the Republic of Serbia using the data of the Statistical Office of the Republic of Serbia (SORS) for the analysed period.

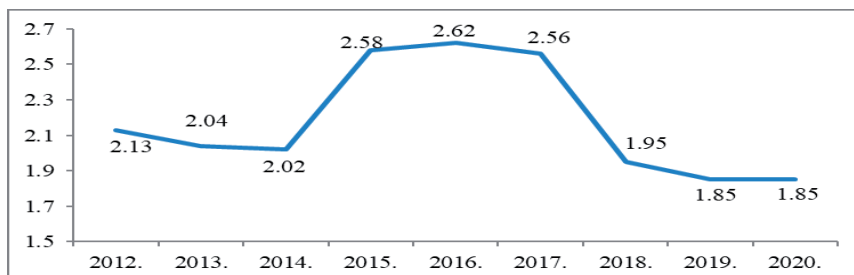
The data are presented in the form of tables and graphs while applying standard mathematical and statistical methods.

Research results

The holdings of vegetable producers mainly consist of several production lines. This involves the production of smaller quantities of vegetables intended for the personal needs of the holdings. This kind of production is mostly conducted in house gardens where a certain level of specialisation is evident. However, modern machinery and technical and technological innovations have to be applied in the market-oriented vegetable production.

According to the data of the Statistical Office of the Republic of Serbia in Belgrade for the 2012-2020 period, the share of the areas cultivating vegetables in the total sown arable land in the Republic of Serbia varied from 1.85% in 2019 and 2020 to 2.62% in 2016 (Graph 1).

Graph 1. Average annual share of the vegetable areas in the arable land in the Republic of Serbia from 2012-2020 (in %)



Source: The authors' calculations according to the SORS data, Belgrade.

⁵According to this source, the utilised agricultural area (UUA) consists of arable land, permanent grassland, permanent crops and kitchen gardens (<https://ec.europa.eu/eurostat/documents/3859598/11495053/KS-GQ-20-009-EN-N.pdf/6f2e2660-9923-4780-a75c-c53651438948?t=1604911800000>).

The official statistics monitors 11 vegetable crops. The area where these vegetable crops were grown in Serbia for the period 2012-2020 is expressed in hectares and presented in Table 2, while their percentage share is presented in Graph 2.

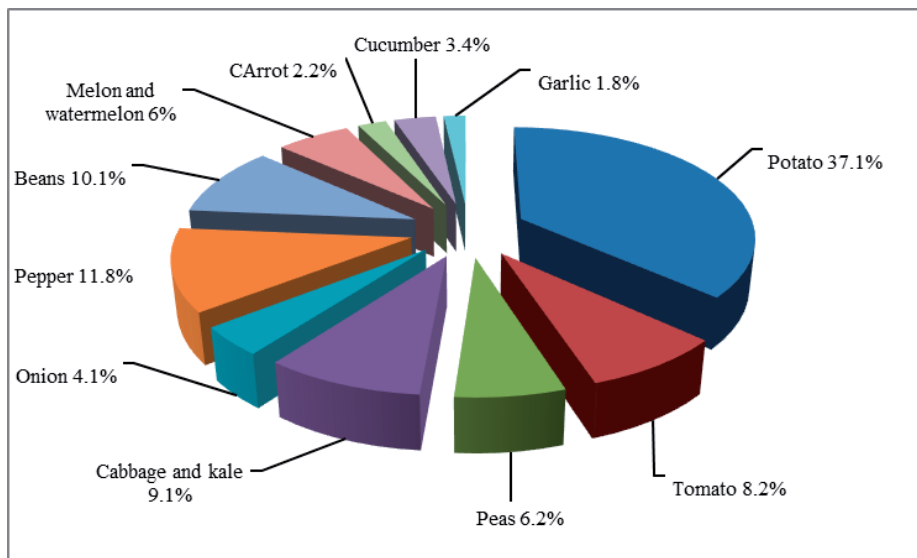
Table 2. Productive area of vegetable crops in the Republic of Serbia for the 2012-2020 period (in ha)

	Potato	Tomato	Peas	Cabbage and kale	Onion	Pepper	Beans	Melon and watermelon	Carrot	Cucumber	Garlic
2012	52,035	9,158	6,045	11,890	4,984	11,906	12,906	7,004	3,144	4,222	2,795
2013	50,740	8,723	5,526	11,246	4,674	11,714	11,931	6,800	3,059	4,048	2,799
2014	51,987	9,162	5,571	11,116	4,979	11,865	10,531	6,396	2,980	4,179	2,808
2015	41,658	8,869	9,872	11,039	5,587	14,845	12,694	6,824	2,696	3,990	1,950
2016	40,105	10,065	7,502	10,804	4,772	16,977	12,404	6,314	2,465	3,843	1,581
2017	38,472	10,917	8,097	10,213	4,145	17,386	13,181	8,372	1,932	4,271	1,820
2018	28,232	8,629	6,736	8,251	3,618	12,016	9,112	6,814	1,385	3,220	1,441
2019	34,110	7,888	6,282	7,957	3,349	10,097	9,091	5,709	1,915	3,020	1,145
2020	29,676	7,347	6,038	7,547	4,080	9,974	8,512	5,237	2,662	2,883	1,313
average	40,779	8,973	6,852	10,007	4,465	12,976	11,151	6,608	2,471	3,742	1,961
Average annual rate of change	-6.8	-2.7	0.0	-5.5	-2.5	-2.2	-5.1	-3.6	-2.1	-4.7	-9.0

Source: *The Statistical Office of the Republic of Serbia, Belgrade* <https://www.stat.gov.rs/>
<https://data.stat.gov.rs/Home/Result/130102?languageCode=sr-Cyrl&displayMode=table&guid=3786c672-5b82-4441-85cb-a1302ae75726>

The data given in Table 2 show that during the analysed 9-year period the largest average area was taken by potato (40,779 ha or 37.1%), while the smallest area was occupied by garlic (1,961 ha or 1.8%). According to the data from this table, it can be noticed that the area under sown vegetable crops decreased on average per year during the analysed period. This decrease was the most expressed in the areas cultivating garlic (-9%) and potato (-6.8%). The areas growing peas showed neither the average growth nor decrease, but they remained the same during the analysed period. The lowest average annual decrease of the sown areas was recorded for carrot (-2.1%) and pepper (-2.2%).

Graph 2. Average annual share of the most important vegetable crops in the Republic of Serbia from 2012 to 2020 (in %)



Source: The Statistical Office of the Republic of Serbia, Belgrade, <https://www.stat.gov.rs/>

The changes of the areas cultivating vegetable crops in Serbia in the analysed period were presented using selected indicators of descriptive statistics (Table 3).

Table 3. Arithmetic mean, standard deviation (in ha) and coefficient of variation (%) of the areas cultivating vegetable crops in Serbia from 2012 to 2020

Vegetable type	Arithmetic mean (ha)	Standard deviation (ha)	Coefficient of variation (%)
Potato	40,779	8,713.12	21.37
Tomato	8,973	1,003.01	11.18
Peas	6,852	1,339.33	19.55
Cabbage and kale	10,007	1,541.68	15.41
Onion	4,465	678.55	15.20
Pepper	12,976	2,606.47	20.09
Beans	11,151	1,748.33	15.68
Melon and watermelon	6,608	830.91	12.57
Carrot	2,471	569.99	23.07
Cucumber	3,742	516.20	13.79
Garlic	1,961	635.59	32.41

Source: The authors' calculation based on the SORS Belgrade data, <https://www.stat.gov.rs/>

The variations of the areas cultivating vegetable crops differ. The largest changes in the areas were registered for carrot, which is confirmed by the greatest coefficient of variation amounting to 23.07%. The smallest changes in the areas were registered for

tomato. Here the coefficient of variation amounted to 11.18%, so they had relatively more stable values of the sown areas.

Table 4 shows the average yield trends of the analysed vegetable types in the Republic of Serbia during the observed period.

Table 4. Realised yield of vegetable crops in the Republic of Serbia for the 2012-2020 period (in t/ha)

	Potato	Tomato	Peas	Cabbage and kale	Onion	Pepper	Beans	Melon and watermelon	Carrot	Cucumber	Garlic
2012	11.1	17.0	5.4	25.6	6.0	7.4	0.8	27.1	15.1	13.1	2.2
2013	15.1	20.0	5.7	27.0	6.8	8.6	1.1	37.4	21.4	15.7	2.6
2014	11.4	13.9	3.8	23.5	8.6	9.6	1.1	35.7	16.8	12.6	3.8
2015	15.3	16.6	4.5	26.2	8.2	11.1	1.0	35.4	23.7	13.2	3.6
2016	17.8	15.9	5.5	26.8	12.1	13.4	1.1	32.9	19.7	14.3	3.0
2017	15.3	15.6	4.7	25.7	8.0	11.4	1.0	29.6	16.3	13.6	2.8
2018	17.3	15.3	4.3	25.4	7.7	11.2	1.2	29.3	16.0	13.2	2.5
2019	20.6	14.2	4.1	22.4	8.8	11.7	1.0	28.6	20.6	9.8	2.7
2020	22.4	14.1	4.6	23.8	8.1	10.7	1.1	27.0	19.8	10.9	2.4
average	16.3	15.8	4.7	25.2	8.3	10.6	1.0	31.4	18.8	12.9	2.8
<i>Average annual rate of change</i>	9.2	-2.3	-2.0	-0.9	3.8	4.7	4.1	0.0	3.4	-2.3	1.1

Source: The Statistical Office of the Republic of Serbia, Belgrade, <https://www.stat.gov.rs/>
<https://data.stat.gov.rs/Home/Result/130102?languageCode=sr-Cyrl&displayMode=table&guid=6e0187fb-dbf7-456c-8dd5-e2b0fff7618b>

It can be noticed in the table above that the greatest average yield was obtained by melons and watermelons (31.4 t/ha), while the smallest yield was recorded in beans (1 t/ha) and garlic (2.8 t/ha). On the basis of the data in this table, it can be seen that during the observed period the greatest average annual increase in the total yield was registered for potato (9.2%) and pepper (4.7%). The largest average annual decrease was recorded for tomato and cucumber (-2.3%). The average annual yield of melons and watermelons remained unaltered during the observed period.

The variations in the yield of the vegetable crops are different. The greatest changes in the yield were registered in potato, which can be confirmed by the greatest coefficient of variation amounting to 21.78%. The smallest changes in the yield were determined for cabbage and kale. Here the coefficient of variation was 5.91%, so they had relatively stable yields (Table 5).

Table 5. Arithmetic mean, standard deviation (t/ha) and coefficient of variation (%) of the vegetable crop yield in Serbia from 2012 to 2020

Vegetable type	Arithmetic mean (t/ha)	Standard deviation (t/ha)	Coefficient of variation (%)
Potato	16.3	3.55	21.78
Tomato	15.8	1.80	11.39
Peas	4.7	0.62	13.19
Cabbage and kale	25.2	1.49	5.91
Onion	8.3	1.59	19.16
Pepper	10.6	1.68	15.85
Beans	1.0	0.12	12.00
Melon and watermelon	31.4	3.74	11.91
Carrot	18.8	2.74	14.57
Cucumber	12.9	1.64	12.71
Garlic	2.8	0.51	18.21

Source: The authors' calculation based on the SORS Belgrade data, <https://www.stat.gov.rs/>

In addition to the realised yield, the production results are also affected by the selling price of vegetables (Table 6).

Table 6. Selling prices of vegetables at some wholesale and green markets in Serbia for the period from December 14 to December 20, 2020

Unit of measure RSD/kg	Market	Subotica	Novi Sad	Beograd	Niš	Leskovac
Potato	Wholesale	30	-	30	35	20
	Green	-	40	80	50	20
Tomato	Wholesale	-	150	100	90	60
	Green	100	170	180	120	-
Cabbage	Wholesale	-	30	20	20	15
	Green	-	40	40	30	20
Onion	Wholesale	40	50	30	35	20
	Green	50	60	100	50	40
Pepper (except pepper Shilja and Babura)*	Wholesale	150	-	200	200	-
	Green	-	-	300	-	-
Beans white	Wholesale	300	250	230	-	-
	Green	300	300	350	-	-
Carrot	Wholesale	50	-	30	40	30
	Green	60	80	100	60	-
Cucumber for salad	Wholesale	-	100	80	90	-
	Green	-	140	150	130	-
Garlic	Wholesale	350	350	500	350	300
	Green	350	500	600	450	650

Source: [stips.minpolj.gov.rs](https://www.stips.minpolj.gov.rs) (<https://www.stips.minpolj.gov.rs/sites/default/files/2020-12/BiltenVP1751.pdf>)

*The Serbian Agricultural Market Information System (SAMIS or STIPS in Serbian) separately provides data for the prices of pepper Shilja and pepper Babura. Table 6 presents data for *pepper – other*.

The data in the Serbian Agricultural Market Information System (SAMIS) do not conform to all the vegetable types monitored by the official statistics of Serbia (SORS). Therefore, the vegetable types observed in the research period (2012-2020) are not completely adjusted to the vegetable types whose selling prices are monitored by the SAMIS database.

The vegetable prices at wholesale markets are lower by a certain percentage than the prices at green markets. In addition to the prices at the markets (wholesale or green), the prices also varied between the towns. For example, the price of tomato at the wholesale market in Belgrade amounted to 100 RSD/kg, while it was 180 RSD/kg at green markets. In Leskovac, the price of garlic at the wholesale market amounted to 300 RSD/kg, while it was 650 RSD/kg at local markets.

The vegetable demand is high in Serbia, which stimulates producers to increase their production volume. There is a significant pressure on the domestic market brought by large quantities of imported vegetables. Nevertheless, domestic users are more inclined to use domestic products. This fact is significant in terms of encouraging producers to intensify their production.

Improvement of vegetable production in the Republic of Serbia

The following measures might improve the vegetable production in our country:

- Increasing the areas where vegetables are grown, particularly increasing the areas cultivating vegetables as the subsequent crop. This would accelerate the shifts in crop rotation, ensure greater productivity and consequently increase the yield;
- Increasing the areas with greenhouses and glasshouses as protected areas with controlled production conditions;
- Creating and introducing new vegetable cultivars, primarily for fresh consumption during the whole year but also for procession, and creating new resistant cultivars and hybrids resistant to pathogens and pests. This would ensure the production of high-quality food;
- Using high-quality seeds and certified planting materials which have a significant impact on the total production, crop yield and profitability;
- The main pre-condition for profitable vegetable production is the appropriate application of irrigation, which will certainly increase the yield (Kljajić et al., 2009.);
- Improving the technology of vegetable growing by using renewable sources of energy (Jeločnik et al., 2021);
- Marketing vegetables by means of tourist demand and consumption;
- Establishing the transfer of scientific results into the direct production by educating agricultural producers at seminars, conferences, etc. (Vlahović et al., 2010; Moravčević et al., 2019.)

Conclusion

Vegetable production represents one of the most intensive branches of plant production. Among other things, it requires more work force than crop production and realises greater yield per unit area.

Although vegetable production in the Republic of Serbia is realised on a very small area (around 2.4% on average a year), under difficult conditions and mostly without irrigation, it can be claimed to have remarkable results. In the following period, further decrease of areas cultivating vegetable crops should be restricted in order to prevent the total disappearance of this important agricultural branch.

In order to increase the area and yield related to vegetable crops in the future period, the authors suggest that the Ministry of Agriculture, competent institutes, faculties, agencies and other institutions proposing agricultural policy measures should pay more attention to small-scale producers in the field of vegetable production. By allocating more incentives to these producers, vegetable production in Serbia would be improved and intensified.

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