
ORGANIC AGRICULTURE PERSPECTIVES IN DEPENDENCE OF SOIL TYPE: COMPARATIVE ANALYSES OF SERBIA, MONTENEGRO, BULGARIA AND CROATIA

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ABSTRACT

Unlike traditional agriculture, which is characterized by the use of large quantities chemicals, the development of organic agriculture helps to conserve natural resources, and influences employment growth and the opening of new jobs in rural areas. For the development of organic farming, one of the main factors is soil type. This article analyzes soil resources, explores prospects for the growth of organic agriculture in Serbia and provides a comparative analysis of the development of organic production in Montenegro, Bulgaria and Croatia. Using official statistics, the situation in the production of organic products in individual countries is analyzed. The results of the growth of organic agricultural land and the share of organic agricultural land in the total volume of agricultural land are presented according to indicators. The comparative analysis carried out in this article is based on available statistical data on the land area and the types of the soils.

Introduction

Organic agriculture is a very specific type of cultivation, basically opposite to conventional agriculture, because it is strongly ecologically oriented, expresses concern for the preservation of the environment, natural resources and biological diversity, emphasizes the use of natural materials and respect for the biological processes of growth and development of plants and animals that are cultivated within agricultural

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activity (Ristić et al., 2023). Water and fertilizer have a high impact on crop yield and greenhouse gas emissions from soil (Kuzman et al., 2021). Authors Latinović et al., point out that important factors that influence the increase in the use of organic agricultural products are awareness, lack of funds, lack of knowledge about health benefits (Latinović et al., 2023).

Organic agriculture represents a system of sustainable agriculture, largely based on local resources, which maintains ecological balance and minimizes the negative impact of agriculture on the environment. It also implies production in accordance with the law and standards with the control of the entire production cycle by an authorized certification organization. Profitable agricultural production is the base of the growth of national agricultural companies and individual producers (Kuzman et al., 2023). The development of organic agriculture: provides assistance in the preservation of the human environment and in this sense leaves an enviable legacy for future generations, it contributes to more proper nutrition of the population and the preservation of human health, it contributes to the development of rural communities and the reduction of negative demographic trends. In current conditions of man-made transformation of nature, the principle adequacy of the materials and technologies used to productivity and resources of the biosphere is of cardinal importance (Ermakov&Jovanović, 2023). Organic food is associated with organic plant production, which directly affects the preservation of a healthy environment (Beslać et al., 2023). In current conditions of man-made transformation of nature, the principle adequacy of the used materials and technologies is of cardinal importance (Jovanović et al., 2023). Challenges facing agriculture and food production look huge (Janković et al., 2023). The key role of the public sector for the future of organic agriculture is emphasized by stakeholders, who suggest that civil society could balance the lack of public support through collective action and increasing awareness of human health and sustainability of the food sector (Moreno-Perez and Blázquez-Soriano, 2023). Contemporary aspirations in agriculture inevitably imply the growth of the organic agriculture share in the total agricultural production, as well as management in a way that will ensure precaution and responsibility in order to protect the health and well-being of current and future generations and the environment (Willer et al., 2023). Solutions are found in the organization of organic agricultural systems with competitive productivity, considering the target of 25% of the agricultural area under organic agriculture set by the European Green Deal (Martín-García et al., 2023). Some authors point out that the expansion of organic agriculture could reduce the potential for soil carbon sequestration unless appropriate agricultural practices are applied (Gaudare et al., 2023), while the future impacts of organic agriculture on soil are unclear.

Materials and methods

Organic agriculture, which provides healthier, cleaner food and the environment, is a topic of great interest for all the countries selected in this study, some are more developed, and some of them are just beginning to develop this type of agriculture.





The starting point of the research is the analytical method, which extracted components such as the number of organic producers, processors, data on regulation and labeling, shares of organic production, etc. through indicators of FiBL & IFOAM – Organics International (2023). The World of Organic Agriculture (Willer et al., 2023), also involved official statistical data and consulted number of scientific and professional articles and studies turned to organic agriculture and soil quality. These data were systematized for each country, and then, using the method of comparative analysis, comparisons of characteristics and mutual relations were made in two parts: in the first - the current status and trends of organic agriculture in the observed countries, and in the second part - soil quality as an important prerequisite for successful organic production. By continuing the research, we used a synthesis. The positions of all analyzed countries to observed fields have been determined.

Research and discussion

Contemporary situation in organic production in selected countries

Organic production is an important sector for all selected countries. While Bulgaria, and Croatia in addition to national regulations on organic agriculture, fully implement mandatory EU regulations – European Union Regulation 848/2018 (EU Reg), Serbia and Montenegro was introduced regulations at the national level which are fully implemented EU regulation on organic agriculture. Agapieva-Aliosman & Dirimanova (2021) emphasizes that clear policy, goals and management strategies are needed in the organic and agricultural sector in Bulgaria. (Table 1).

Table 1. System of regulative in organic production in selected countries

Country	Domestic regulative	Relevant authority	International regulative	Official organic product symbols
Serbia	Law on organic production	Ministry of agriculture, forestry and water management (MAFWM)	-	
Bulgaria	National Plan 2007-2013 (former)	Bulgarian Ministry of Agriculture, Food and Forestry	EU Reg	
Croatia	Law on organic production (former)	Republic of Croatia Ministry of Agriculture	EU Reg Action plan	
Montenegro	Law on Organic Production	Ministry of agriculture, forestry and water management	-	

Source: Author's systematization

Table 2. Control bodies and control authorities in the organic sector in selected countries

<i>Country</i>	<i>Number of bodies and authorities</i>	<i>Relevant authority</i>
Serbia	6	Accreditation Body of Serbia
Bulgaria	17	EC (European Commission)
Croatia	11	EC (European Commission)
Montenegro	1	Accreditation body of Montenegro

Source: Author's research

Control and certification of organic production in Serbia in 2023 is carried out by 6 control organizations. In the European Union, the control bodies are under the supervision of the European Commission, which maintains the data register. Bulgaria has 17 certification bodies, Croatia 11 and Montenegro only one.

In the field of organic types of products, according to the author's research, Serbia is mainly engaged in the production of fruit, where part of the production consists of frozen, deep-frozen, dried and freeze-dried fruit. According to data from 2022, there are 458 producers in Serbia, of which 149 are engaged in processing. Research data show that producers are currently focused on the following types: raspberries (from the Arilje region), strawberries and berry fruits. Producers also export vegetables, grain, pulses and oilseeds, as well as honey and bee products. The production of organic meat is also under development (Vojvodina, Kraljevo, Golija). In Serbia, there are groups of cooperative organization of production. Linked manufacturing is important because it increases market opportunities. Table 3 shows the top 5 producers in cooperative production in 2022.

Table 3. Producers in cooperative organic production with number of cooperates

Associate producer	Number of cooperates	Products
Zadruگار doo	763	Frozen fruits
Fortis doo	742	Fast frozen fruits
Erikos doo	577	Frozen and lyophilized fruit
Midi Organic doo	441	Fruits
Agrofröst doo	395	Raspberry

Source: Author's research

Bulgarian organic production is primarily based on honey and bee products, but Bulgarian rose products are also represented (rose water, rose oil) and other aromatic plants. In addition, organic seeds and cereals are produced.

In Croatia, there are farms that produce several types of grains and vegetables, but the main product is certainly organic olive oil, for which the coast of the Adriatic Sea is known, as well as islands. An interesting example is the "Šoltansko super organic" olive oil, which was awarded worldwide. Olive oil under a unique name is produced by small local producers from the island Šolta.

In Montenegro an important feature of the current organic production is fragmentation. Organic production is quite scattered and diverse and producers of small quantities are characteristic such as individual agricultural holdings that mostly cover local market requirements. There is no good practice of the association of small producers as in

Croatia or Serbia. According to the data of the certification body Monteorganica for 2021 production is based on vegetable with 424 producers, of which 371 produce fruit, 63 agricultural crops and medicinal plants, 10 vegetable crops, a 3 producers collect forest fruits and medicinal herbs. Livestock production is engaged in 64 producers, of which 56 have beehives. 27 deals with the processing of organic products of direct manufacturers. Among them stand out: IN-SPE - producer of organic tea from the wild herbs and HM Durmitor - the largest farm in Montenegro.

Table 4. Comparative analysis of organic products and producers production

Country	Enterprise	Products
Serbia	Minex Kruševac Master food Užice Medino Krnjevo Yugotrejd Arilje	Frozen fruit and forest products Strawberry and other berries Honey and bee products Raspberry, blackberry, strawberry, plum and cherry
Bulgaria	Adan Village Damovitsa Mountin Rose Sofia Amerov Honey Ignatievo Bilbo Varna	Seeds and grains (sunflower, flax, spelt) Rose and aromatic plants Honey products
Croatia	Terra Rossa Sv. Katarina Zrno Eko Imanje Dubrava Šolta group of producers	Olive oil 60 vegetable, arable and spicy crops Šoltansko super premium olive oil
Montenegro	Mugoša Igor Podgorica Božović Vučidar Berane Kolašinac Muhamed Plav Vučetić Miladin Pljevlja IN-SPE HM Durmitor	Potatoes, Cabbage, Beetroot, Carrot, Onion, Oats, Rye, Barley, Spelled, Buckwheat, Rye and flour, Apple Honey Lambs, Sheeps

Source: Author's research

In 2023, Serbia established a digital register of agricultural holdings through the eAgrar platform. The aim of establishing the Register and digital platform is to improve agricultural production in the Republic of Serbia so that it is productive, rich and respected, and competitive on the EU and social markets. All incentives can be realized by registration and request on the eAgrar software platform.

The situation in Bulgaria and Croatia with incentives must be considered within the Eco-schemes a repayment schemes in agriculture aiming at the protection of environment and climate. They are a key element of the [Common agricultural policy \(CAP\)](#). Montenegro grants state incentives (2023) in the field of organic production for the following: Agricultural producers can receive support per hectare (ha) of production area, conditional head of livestock, poultry and number of bee colonies, which are registered in the Register of entities in organic production within the framework of organic production.

In 2020 the number of producers in Serbia was 439 and the latest data shows 651 producers in 2022 (MAFWM, 2023). For Bulgaria, sector of organic production is national priority (Shishkov, Kolev, 2014). The number of producers in Bulgaria was 59942 in 2019. Organic production in Croatia is recognized as an important sector and the number of organic producers is growing. Montenegro shows no progress. (Table 5).

Table 5. Number of producers and other operator types by country 2021

Country	Producers	Processors	Importers	Exporters	Number of producers (2019-20)	Trend
Serbia	458	152	74	82	439	+19
Bulgaria	5942	249	22	2	5942	0
Croatia	6024	378	12	No data	5153	+871
Montenegro	422	25	No data	0	423	-1

Source: Author's systematization based on FiBL&IFOAM survey, 2023

Table 6. Organic farming indicators data in Serbia, Bulgaria, Croatia and Montenegro (2020)

Indicator	Organic agricultural land (including in-conversion areas) in ha	Organic shares of total agricultural land in %	Organic Agricultural land development – 10-years growth in %
Country			
Serbia	19317	0.6	209.7
Bulgaria	116253	2.3	364.6
Croatia	108610	7.2	239.0
Montenegro	4823	1.9	57.2
Italy	2095380	16.0	91.0

Source: Author's systematization based on FiBL&IFOAM survey, 2023

Type of soil in selected countries

Organic shares of agricultural land data shows big achievements of Croatia (7.2%) as 27th world country. Bulgaria takes 52nd place (2.3%), and Serbia with less than 1% (0.6%) takes 92nd place in the world scale. Ten-year development data are encouraging for all three countries. In Bulgaria, the increase in organic agricultural land during the ten-year period is 346.4%, in Croatia 239%, and in Serbia 209.7%. Serbia's notably weaker results can be a consequence that it is not a member of EU, like Bulgaria (member since 2007) and Croatia (member since 2011) and Montenegro 1.9%, and 10-years growth of 57.2%.

For investigation of organic production indicators in selected countries, it is necessary to consider the type and characteristics of the soil (Table 7).

Table 7. Share of WRB referent soil groups based on the analysis and restrictions

WRB name	Serbia	Bulgaria	Croatia	Montenegro - has not yet harmonized to WRB	Restrictions in intensity and type
Cambisol	27,99	15,58	8,80	36,00 (Calcomelanosol 47 – national soil classification)	Severe to very severe restrictions
Chernozem	17,68	20,23	0,93	-	Without restrictions
Fluvisol	7,58	8,97	2,50	2,4	No restrictions to serious restrictions conditionally can be highly productive soils
Leptosol	15,90	3,29	0,60	-	Serious restrictions
Luvisol	2,38	33,15	12,60	-	Moderate to medium restrictions
Solonetz / Solonchak	1,43	0,009	0,22	-	Severe restrictions
Vertisol	8,32	>1,00	5,37	-	Moderate restrictions

Source: Author's systematization based on authors Bašić (2013), Pavlović et al. (2017), Shishkov & Kolev (2014) & Protić et al. (2005)

Serbia has diverse natural resources and soil of different taxonomies. Serbia is close to Bulgaria in terms of the amount of chernozem and fluvisol, while Croatia has less chernozem. Smaller amounts of fluvisol exist in Croatia and Montenegro.

Croatia and Serbia have numerous deposits of lignite, which is used for electricity production and household heating. Combustion of lignite leads to significant pollution of the environment with heavy metals and other phytotoxic elements. That is why significant areas of land in Croatia and Serbia are not suitable for organic production. Damage of land in Bulgaria is the result of coal and ore mining, and the extraction of non-metal mineral resources, like raw materials for the cement industry, facing stone materials and building materials (Kirilov & Banov, 2016). Heating with low-quality coal (lignite) leads to soil pollution. A total of 422 contaminated and potentially contaminated localities have been identified in the Republic of Serbia (Vidojević et al., 2022).

In Montenegro, there exist certain types of soil near polymetallic mines and lignite fields, smelters, fire pit-heating plants and other industrial facilities that can become phytotoxic and unsuitable for organic production. The most common soil types are those formed on carbonate rocks, or Calcomelanosol (national soil classification), covering 660,000 ha. In succession to Calcomelanosol, Calcocambisol appears in lower areas over an area of 30,000 ha and Terra Rossa, formed in the coastal area and in the Skadar Lake basin. The

surface area of Terra Rossa is about 84,000 ha. Montenegro has not yet harmonized its national classification with the WRB. Most of the soils represented in Montenegro have a shallow soil profile and low contents of nutrients (Vidojević et al., 2022). Each country has its own specifics in terms of the use of its resources and the quality of land resources.

Organic production in Serbia is rapidly growing area of agriculture, by the collected data of relevant institutions in Serbia, we can notice necessity of three important steps in organic agriculture improvement: investment to knowledge and education, modern legislative, and conversion of lands from conventional to organic production capable lands.

In 2019, the Ministry of Agriculture of Bulgaria (MinAg) emphasizes that organic production is a national priority (USDA, 2021). When looking at the growth of the organic sector in the previous ten-year period of 364.6%, it is clear that Bulgaria is investing efforts in its development. In particular, Bulgaria has a rich production of organic honey and honey products.

Croatia applies all the regulations regarding organic food production and labelling, including the national label for organic food. Certified organic food production in Croatia is considerably lower than in other EU member countries (Gajdić et al., 2018), thus this research confirms the differences between Croatia and Bulgaria. However, it must be taken into account organic share in total agricultural land with 7.2% in Croatia and 2.3% in Bulgaria. Montenegro has negative trend in number of producers (-1) compared to the previous period, total 422, but the data show that share of 1.9 of total agricultural land is higher than in Serbia (0.6). In general, when it comes to the number of producers, the trend is positive in Serbia (+19) and Croatia (+871), there are no changes in Bulgaria, while the trend is negative in Montenegro.

Organic agriculture depends on the soil quality itself. Serbia has sufficient natural resources for the development of organic agriculture, but has not finance support for acceptable technologies and means of production (Jovanović & Stojkov Pavlović, 2023). The soils of Serbia are extremely heterogeneous as a result of the varied geological base, climate, and vegetation (Vučinić et al., 2022). Some soils are naturally fertile, providing optimal conditions for high, stable and good-quality yields, such as carbonate chernozems on loess, while others have unfavorable characteristics to such an extent that production on them is not economically viable. There are also soil types with exceptionally unfavorable characteristics even for the formation of natural vegetation, such as solontchak and solonetz (Pavlović et al., 2017).

Conclusions

The increase of the area of arable land under organic production, as well as the increase in number of organic producers testify in favor of the fact that the organic production is outlook and long-term profitable activity, with multifunctional advantages. Success of organic farming depends on soil type and permanent improvement of its quality. Disturbance and damage of land brings serious health risks. Choice of suitable soil for organic agriculture is possible by the analysis of soil quality and mapping of the land.

It is necessary to analyze peculiarities of soil (pH, humus content, CaCO₃ content) and evaluate possibility for soil dressing by organic fertilization. Monitoring of soil quality is necessary at any soil species. Improvement of the soil for organic production realize by composting and use of residual organic substances after recycling. Financial support for the development of organic production sector in Serbia is provided for organic producers to do administrative and technical activities through the official platform. This platform is the first interactive database of organic agriculture managed on the authority of the Ministry of Agriculture. The transition from fossil sources to renewable energetic sources is obligatory for organic agriculture development. Besides, the suggestion is that developing countries should make efforts to advance organic practices control, marketing strategies and emphasize a commitment to sustainability. Montenegro, considering its size and development, is not far behind the other countries discussed here. The advantage of Montenegro is represented by almost 30,000 ha of Terra Rossa land of typical quality, but it is necessary to invest additional efforts in the regulatory mechanism of organic production. Bulgaria and Croatia are committed to the Action plan for organic production in the European Union 2021 – 2027.

Conflict of interests

The authors declare no conflict of interest.

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