Zejak D *et al*. (2022)
Notulae Botanicae Horti Agrobotanici Cluj-Napoca
Volume 50, Issue 3, Article number 12815
DOI:10.15835/nbha50312815
Research Article

# State and economical benefit of organic production: fields crops and fruits in the world and Montenegro

Dejan ZEJAK[1], Vera POPOVIĆ[2*], Velibor SPALEVIĆ[3], Dragana POPOVIĆ[4], Vuk RADOJEVIĆ[2,5], Sezai ERCISLI[6], Ivan GLIŠIĆ[7]

[1]*University of Belgrade, Faculty of Agriculture, Nemanjina 6, 11000 Belgrade, Serbia; zejakd@gmail.com*
[2]*Institute of Field and Vegetable Crops, National Institute for the Republic of Serbia, 21000 Novi Sad, Serbia; vera.popovic@ifvcns.ns.ac.rs (*corresponding author)*
[3]*University of Montenegro, Biotechnical Faculty, 81000 Podgorica, Montenegro; velibor.spalevic@gmail.com*
[4]*University of Novi Sad, Faculty of Economics in Subotica, 21000 Novi Sad, Serbia; drvvpopovic@gmail.com*
[5]*University of Novi Sad, Faculty of Agriculture, Dositej Obradovic 8, 21000 Novi Sad, Serbia; radojevicvuk@gmail.com*
[6]*University of Ataturk, Faculty of Horticulture, Erzurum, Turkey; sercisli@atauni.edu.tr*
[7]*University of Kragujevac, Faculty of Agronomy, Čačak, Republic of Serbia; glishoo@yahoo.com*

## Abstract

Organic farming preserve and upgrade the biodiversity of the soil and biodiversity of the entire ecosystem by protecting the environment, plants, and human health. This study analyses organic plant production worldwide and in Montenegro (2000-2020) and discusses the prospects and challenges in developing organic plant production. Geographically, Montenegro has a diverse climate, suitable for the production of more types of fields crops, vegetables and fruits throughout the year. The paper compares the area of organic farms, the number of farmers, and share of organic in the overall agricultural land in the world and Montenegro, Europe, and several European countries similar to Montenegro in terms of relief or area (Switzerland, Slovenia, Slovakia, Estonia, Serbia, and Cyprus). Data were also analysed for a mountainous state, such as Switzerland, and a Mediterranean one, as Cyprus, as by its position and relief, Montenegro is at the same time a mountainous (northern) and a Mediterranean country (southern region). Shows are trends in plant production areas in Montenegro since it gained independence (2006) and comparison with the EU countries. Grassland production prevails in Montenegro with 85.89%, followed by fruit (12.26%) and cereals (1.62%). The total area under organic vegetable covered a small area compared to the production of fodder crops (3951.84 ha), fruit (563.98 ha), medicinal and aromatic plants (232.46 ha) and field crops (74.49 ha). Organic fruit production has the largest share in the northern part of Montenegro. Certified organic production brings benefits because health-safe products are a condition for preserving the environment and health.

***Keywords:*** field crops; fruit; organic plant production; Montenegro; vegetable; world

*Received: 13 Jul 2022. Received in revised form: 16 August 2021. Accepted: 22 Aug 2022. Published online: 25 Aug 2022.*
From Volume 49, Issue 1, 2021, Notulae Botanicae Horti Agrobotanici Cluj-Napoca journal uses article numbers in place of the traditional method of continuous pagination through the volume. The journal will continue to appear quarterly, as before, with four annual numbers.

## Introduction

Production of organic cereals and fruit is synthesis of knowledge and practice with the aim of using the natural potential of the ecosystem, interactions between living organisms and to minimize chemical intervention (New England Tree Fruit Management Guide, 2012). The modern trend in nutrition sets new requirements for the quality and health safety of food, research that has for the goal of determining the economic effects of organic cereals and fruit production is considered very significant. At the end of the 20$^{th}$ century, significant changes occurred in the world: social, economic, and political. The increase in pollution and degradation of the environment resulted in health risks for the humankind of today and the environment. Unlike conventional agriculture, which, due to the application of pesticides and fertilizers, led to the loss of individual plant and animal species, organic farming is based on the principles of protection and preservation of plant and animal species and the environment. Organic production is based on the biological balance of the system land - plant - animal - human. According to the *Codex Alimentarius* definition, it is a "holistic" production system that promotes and strengthens the agroecosystem and health, including biodiversity, biological cycle, and soil. Organic production is one of the world's leading trends in agriculture that is continuing to grow. Organic production of agricultural and other products is based on the application of organic production methods at all stages of production, aims to reduce the use of chemicals, and excludes the use of GMOs and products consisting of or derived from GMOs, as well as the use of ionizing radiation. Organic farming aims to produce safe food, of high quality, in an environmentally sustainable way, maintaining the genetic diversity of agro and ecosystem, preserving the environment, maintaining and improving soil fertility, reducing all forms of pollution, and producing food of high nutritional value, improving health and making a profit (Popović, 2015; Popović *et al*., 2012a; 2012b; 2013; 2014; 2019; Dozet *et al*., 2016; Stevanovic *et al*., 2018; Ikanović and Popović, 2020).

Growers who want to produce organic fields, vegetables, and fruits in semiarid warm and cool climate areas like Serbia and Montenegro need expanded strategies for soil, plant, pest (insect, disease, weed), and environmental management to enhance crop diversity, productivity, market opportunities, and profitability. Practices to be studied include composts, cover crops, biodiversification, ecological weed management, and crop management. Consumer demand for organically produced fields, vegetables, and fruit is increasing due to increased awareness about the health and environmental implications of growing fruit using conventional methods. However, small land holdings, lower yields, widely dispersed farms, long-term investment, low in-hand capital, and lack of national policy for organic fruit farming discourage growers from shifting from conventional plant growing to organic fields, vegetables, and fruit production. The decision of the farmers whether to grow fruits or cereals, organic or conventional agriculture, and sell the fruits as fresh or dry is dependent mainly on the economic, knowledge, and resource availability of each type of practice (Popović *et al*., 2014; Ikanović and Popović, 2020).

Organic production promotes the healing of agroecosystems, including biodiversity and biological cycles, and emphasizes the use of methods that exclude, as much as possible, the use of inputs outside the farm. The production is based on the use of agrotechnical measures, biological and mechanical methods whenever possible rather than agro-chemicals to fulfil specific functions within the agricultural and other systems (Popović *et al*., 2013; Ikanović and Popović, 2020). Considering the fact that agriculture is among the leading causes of environmental pollution, it is extremely important to introduce organic production, which is based on the recycling of agricultural waste, the use of organic nutrients, microbial fertilizers and biopesticides (Stevanović *et al*., 2018).

*Organic production and certification* methods provide a safe product produced in accordance with the legislation governing the field of organic production. An organic product is a product *produced and labelled* in accordance with the law and legislation adopted pursuant to the law (Ikanović and Popović, 2020). Through the concept of multi-functionality and social-cultural heritage of rural areas, organic farming development

should facilitate an increase in exports, preserve human health, reduce depopulation of rural areas, develop rural tourism and link agriculture and protected natural areas. The efficiency of agriculture, including organic farming, cannot be achieved without incentives. The development and growth of organic production require linking all participants in the value chain: producers (farmers), processors, consumers, scientific institutions, and the state. Without cooperation, organic farming improvement cannot be achieved. Unlike conventional agricultural production, safe food produced in organic farming and processing system absolutely excludes the use of synthetic products (fertilizers, pesticides, growth promoters, hormones, etc.) and the use of genetically modified organisms. Safe food production is a global trend resulting from the demand for agricultural products produced in this way. Good agroecological conditions, uncontaminated areas, and water are significant advantages that Montenegro the Republic of Serbia should use as a means to produce safe food (Glamočlija *et al.*, 2015; Stevanovic *et al.*, 2018; Božović *et al.*, 2018; Ikanović and Popović, 2020; Ikanović*et al.*, 2020). All the countries in this region, has significant potential to develop organic production, especially due to favorable climate conditions. This area belongs to wide area which has convenient climate and soil conditions for arable farming (Šarčević-Todosijević 2016; Kolarić *et al*., 2021). The first organized initiatives began in the first decade of the 21$^{st}$ century.

The European Commission stated, in the Organic Action Plan, that the aim is to encourage the production and consumption of organic products and to have a quarter of agricultural land in the EU under organic farming by 2030. Organic production brings numerous benefits: in organic areas, the biodiversity is richer by about 30%; organically-fed animals enjoy greater welfare and receive fewer antibiotics, and organic farmers have higher incomes. Consumers know they are getting a safe product because it has the EU organic product logo (Popović *et al*., 2014; Ikanović and Popović, 2020).

According to the Constitution, Montenegro is an ecological state. Development of the organic agriculture in Montenegro began in the early years of the last decade of the 20$^{th}$ century, with the UNDP project "Moraca", concerning the development of organic food, implemented together with the Ministry of Agriculture, Forestry and Water Management and the Biotechnical Institute in the vicinity of the Moraca Monastery, Kolasin. Then, the association Healthy Food Production in Niksic and the organization Centre for Agriculture Development were formed in 2004 in Bijelo Polje, as the first in this field. The Law on Organic Agriculture was adopted in 2004 when the first producers were certified. More than 50% of organically produced apples come from Italy, and the organic fruit trade reaches 4 to 5% of total trade in some countries (Šebek,2020).

Activities that contributed to organic agriculture development in Montenegro have been developing continuously for the last eighteen years. The first Law on Organic Agriculture was adopted in 2004, with bylaws in 2005-2006. In Montenegro, the Law on Organic Production currently in force was adopted in 2013 and was harmonized with the Council Regulation No. 834/2007. The legal conditions for establishing a certification authority were met with the adoption of the first Law on Organic Agriculture (Mirecki,2014).

The transition from conventional to organic production requires that production go through a period of conversion. Organic food production is economically viable, but it is also expensive. Prices of organic products are high due to the method of production, but also high demand for organic food, which is growing in the world. Certified organic production brings benefits because health-safe products are a condition for preserving the environment and health.

The transition from conventional to organic production requires that production go through a period of conversion. Organic food production is economically viable, but it is expensive. Prices of organic products are high due to the method of production, but also high demand for organic food, which is growing in the world. Positive effects of organic farming are in the environmental, social and economic sense. Organic production of agricultural products has a high level of quality, environmentally is friendly.

Potential benefits from organic production arise from improved: soil fertility, organic matter content and biological activity; better soil structure and reduced susceptibility to erosion; reduced pollution from nutrient leaching and pesticides; and improved plant and animal biodiversity (Kasperczyk and Knickel, 2006).

This study aims to analyse organic production with particular emphasis on organic fruit production in Montenegro, to record the number of organic farms, areas under organic plants and crops, and organic produce types, to indicate the way forward and provide guidance for the improvement of future production.

## Materials and Methods

*Methods*

The research subject of the authors was the analysis of the organic agriculture in the world, Serbia and Montenegro. Used method was desktop study analysis that respects available scientific andprofessional literature and database. Based on the official data from the Research Institute of Organization Agriculture FiBL (www.fibl.org) the National Certification Body Monteorganica Ltd Podgorica and the Government of Montenegro - Ministry of Agriculture, the paper analysed the following for the period 2000-2020: the number of organic producers, the area under organic plants and crops and organic produce types: field crop species, medicinal plants and fruit growing in Montenegro (www.monstat.org, https://orgcg.org). The Research Institute of Organic Agriculture – FiBL data on Montenegro are similar to those of Monteorganica, Podgorica.

The national data were compared with the official data on organic agriculture in the world, the European Union, and a number of European countries that are similar to Montenegro in essential characteristics. By comparing such data, the authors seek to provide a clearer picture of the share of organic agriculture in total agriculture and, through a SWOT analysis, indicate the possibilities for further improvement of organic production in Montenegro.

In this way, we can provide an overview of the current state of play, historical development, future, and possible trends in organic agriculture. The data was processed using descriptive statistics, and the parameters under research were presented in tabular and graphical forms.

*Study area*

*Physical-geographical background.* In terms of landforms, Montenegro shows a great variability, ranging from sand and rock coasts (some corresponding to a ria coast), karst plateaus, large (intra-montane) field, high mountains holding a (peri) glacial imprint, canyons, and more; all of it comprised in only 13 812 km$^2$ and within an elevation range of 2535 m. It is characterized by a Mediterranean climate, with warm and dry summers and autumns, relatively cold winters with heavy snowfall in the continent. The coast is very indented with a narrow coastal belt that is in the hinterland with rugged high limestone mountains and plateaus.

The average altitude is 1,086 m; lowest point: Adriatic Sea 0 m; highest points: Prokletije (Zlakolata, 2534 m.a.s.l., Dobra kolata, 2528 m); Durmitor Kuk (Bobotovkuk, 2522 m).

The territory of Montenegro is administratively divided into 24 (25) municipalities: Andrijevica, Bar, Berane, Bijelo Polje, Budva, Cetinje, Danilovgrad, (Golubovci), Gusinje, Herceg Novi, Kolašin, Kotor, Mojkovac, Nikšić, Petnijica, Plav, Pljevlja, Plužine, Podgorica, Rožaje, Šavnik, Tivat, Tuzi, Ulcinj, Žabljak.

The structure of land use is as follows: agricultural land: 38.2% (estimated in 2018); arable land: 12.9% (estimated in 2018); crops: 1.2% (estimated in 2018); pasture: 24.1% (estimated in 2018); forest: 40.4% (estimated in 2018); other: 21.4% (estimated 2018). Irrigated land 24 km$^2$ (2012) (Spalevic*et al*., 2019*;* 2020; Skataric *et al.,* 2021; Zejak *et al.,* 2021). The Map of Montenegro is presented in the Figure 1.

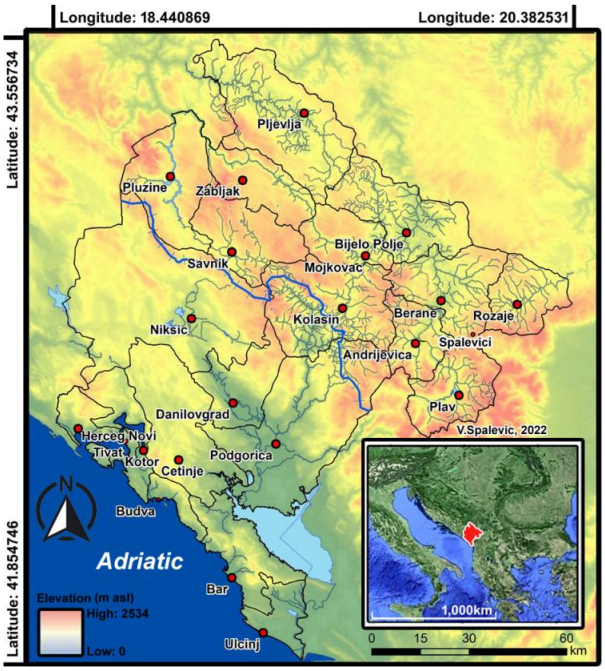



**Figure 1.** Map of Montenegro, Source original, Spalević *et al*., (2020)

From a geographical point of view, Montenegro is generally divided in three regions which share climatic, lithologic, hydrographic and vegetation characteristics: Coastal Montenegro, Central Montenegro North(east)ern Montenegro, Figure 2.

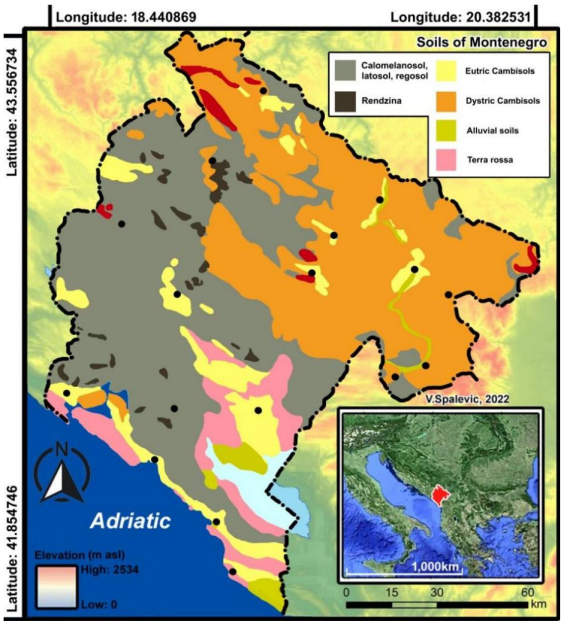



**Figure 2.** Soil types of Montenegro, Source original, based on Fustic and Djuretic (2000)

The Territory of Montenegro is composed of different types of sedimentary, igneous and metamorphic rocks. Most of the terrain of Montenegro is composed of Mesozoic carbonate formations while igneous rocks and clastic silicate rocks are much less common. Paleozoic geological formations belong to the sedimentary and

metamorphic, clastic silicate rocks which are mostly found in the north-eastern part of Montenegro, while the Cenozoic carbonate and clastic rocks occur sporadically in all regions of Montenegro.

Most of the soils in Montenegro are shallow, with low plant and nutritional potential, Figure 2. The lands of Montenegro are classified into five categories of effective fertility. Lands of high production capacity of I and II categories (1.5%) of the total area of Montenegro. Land of medium fertility of III and IV category (3%); lands with limited fertility, which is a quarter of the territory; low fertility, of VII and VIII categories (49%) and infertile land with 23% of the territory. In the specific Montenegrin topographic conditions of with high relief dynamics, under the combined influences of surface and groundwater, precipitation and temperature, vegetation that differently protects land from degradation in different regions of Montenegro, and under anthropogenic influence, many types of soils have developed, of which the most dominant are the following soil types: (1) Litosol and Regosol; (2) Calcomelansol; (3) Rendzina; (4) Humus silicate soil - Ranker; (5) District Cambisol (Brown acid soils); (6) EutricCambisol (Brown Eutric soil); (7) Kalkocambisol (Brown soil on limestone); (8) Terra rossa; (9) Deluvial and alluvial soils (Spalevic *et al*., 2019*;* 2020; Skataric *et al*., 2021; Zejak *et al*., 2021).

Climate of Montenegro. Montenegro, from the aspect of weather and climatic conditions, is located in a zone of pronounced thermal asymmetry, between cold northern Europe and very warm northern Africa. Just above Montenegro, there is an intensive exchange of warm air masses going to the north and cold going from the north to the south. Very often over Montenegro there are collisions and mixing of air masses with extremely different physical and meteorological properties, what is causing high precipitations.

Montenegro's position is such that large action systems such as the Genoa Cyclone, the Adriatic Cyclone, the Icelandic Depression, the Black Sea Depression, the Azores Anticyclone, the Siberian Anticyclone, the Central European Anticyclone, the Cold Front from the North-Arctic Cold Front and the Warm-Tropical Front from south, strongly influence the weather and climate of this area.

Dominant climate types are: maritime type, continental type, mountain type and six climate regions can be distinguished with recognizable climates, but not with clearly defined borders.

The basic climatic regions with recognizable climates are: (1) Maritime (Primorje), which is characterized by long and warm summers and mild winters with large amounts of precipitation; (2) Zeta-Bjelopavlici plain, which is characterized by long, warm and dry summers with high temperatures and warm nights, mild winters with large amounts of precipitation and lower temperatures than the coastal area; (3) The mountainous hinterland of the Adriatic, which is the area with the highest amount of precipitation in Europe, related to the mountainous area above the Bay of Kotor (Krivosije). In that area, on the steep slopes of Orjen in Crkvice (940 m above sea level), an average of about 5000 mm of precipitation falls annually (which represents the European maximum precipitation), and in record years close to 7000 mm. (5) The continental part of the North of the country at an average altitude of up to approximately 700 m with the lowest annual rainfall, which is evenly distributed throughout the year. (6) Continental areas of about 1000 m above sea level, located in mountainous areas in the north Montenegro, are characterized by short and humid summers, and long and harsh winters, with frequent frosts and low temperatures, which decrease sharply with altitude increase. (7) Mountainous areas above 1500 m above sea level are characterized by long cold winters with snow cover recorded in all the months throughout the year (Spalevic *et al*., 2019*;* 2020; Skataric *et al*., 2021; Zejak *et al*., 2021).

## Results and Discussion

*Organic production in the world*

The total area under organic production in the world in 2020 covered 74.93 million hectares. The largest areas in the organic production system are located in the territory of Oceania, 35.91 million hectares, Table 1. By continents, Oceania had the highest share of the total areas (47.92%), followed by Europe (22.82%), South

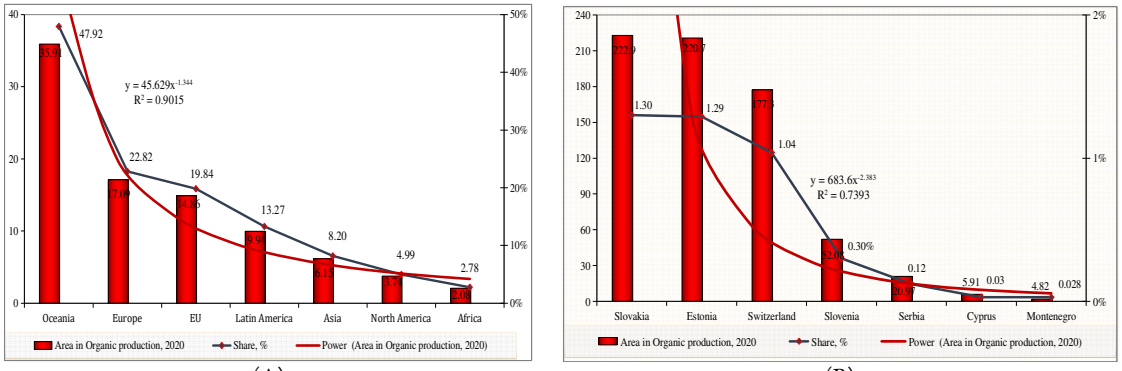
America (13.27%), Asia (8.20%), North America (4.99%), and Africa (2.78%), while the EU is an important producer with a share of 19.84%, Table 1, Figure 3.

**Table 1.** Organic agriculture trends Organic area (farmland) [ha], Organic area share of total farmland [%], Organic producers in the world, 2000, 2010 and 2020

| Country | 2000 | 2010 | 2020 | Share in the world, 2020% | Share in 10 years growth, % |
|---|---|---|---|---|---|
| **Organic area (farmland) [ha]** | | | | | |
| World | 14 980 991.83 | 36 670 679.77 | 74926508.87 | 100.00 | 104.33 |
| Africa | 52 675.50 | 1 072 124.00 | 2086858.72 | 2.78 | 94.65 |
| Asia | 60 532.11 | 2 457 915.00 | 6146235.41 | 8.20 | 1.50 |
| Europa | 4581068.00 | 10028781.00 | 17098134.00 | 22.82 | 70.49 |
| EU | 107359.20 | 175559.50 | 14868779.50 | 19.84 | 83.69 |
| South America | 3805916.00 | 8 374 614.00 | 9949460.57 | 13.27 | 18.80 |
| Northern America | 4581068.00 | 10028781.00 | 3744162.57 | 4.99 | -1.68 |
| Oceania | 3917608.00 | 7 539 643.00 | 35908876.40 | 47.92 | 4.76 |
| **Organic area shares of total farmland [%]** | | | | | |
| World | 1.14 | 12.52 | 21.58 | - | - |
| Africa | 0.35 | 2.92 | 2.78 | - | - |
| Asia | 0.40 | 6.70 | 8.20 | - | - |
| Europe | 0.89 | 2.05 | 3.44 | - | - |
| EU | 0.72 | 0.48 | 19.84 | - | - |
| South America | 25.40 | 22.84 | 13.28 | - | - |
| Northern America | 30.58 | 27.34 | 4.99 | - | - |
| Oceania | 26.15 | 20.56 | 47.92 | - | - |
| **Numbers of organic producers by region** | | | | | |
| World | 373146.00 | 1 763093.00 | 3368478.00 | 100.00 | 91.10 |
| Africa | 9 267.00 | 535 215.00 | 833 986.00 | 24.75 | 55.80 |
| Asia | 5 289.00 | 461 774.00 | 1 808 464.00 | 53.68 | 291.60 |
| Europe | 156666.00 | 273375.00 | 417977.00 | 12.41 | 52.90 |
| EU | 6 710.00 | 8533.00 | 349 499.00 | 10.37 | 3995.80 |
| South America | 132 151.00 | 215 472.00 | 270 473.00 | 8.03 | 25.50 |
| Northern America | 156 666.00 | 273 375.00 | 22 448.00 | 0.87 | -1117.70 |
| Oceania | 69 773.00 | 268 723.90 | 15 930.00 | 0.47 | -1586.90 |

[1]Source: Research Institute of Organic Agriculture FiBL, 2022.

In 2000, this type of agricultural production covered an area of 14.98 million ha worldwide. The largest areas were in Europe (4.58 mill. ha) and North America (4.58 mill. ha), followed by Oceania (3.92 mill. ha) and South America (3.81 mill. ha), with arable land accounting for 15%. Europe produces ¼ of the global organic production, and in 2010-2020, organic production areas increased by 70.49%. During the same period, a significant increase in such areas took place in Africa (94.65%), followed by the EU (83.69%), South America (18.80%), Asia (1.50%), while the decline in the areas was noted in North America (-1.68%). The areas under organic production in the world grew by 104.33%, but the areas remain small compared to the total global plant production and amount to 74.93 mill. ha in 2020, which is 1.5% of the total area, Tables 1 and 2.




(A) (B)

**Figure 3.** Area (mill. ha) and share of the organic area in the world (%), 2020 (A); The area under organic crops (ha) and the share (%) of Slovakia, Estonia, Switzerland, Slovenia, Serbia, Cyprus, and Montenegro, in 2020 and their share in relation to areas in the EU (B)

**Table 2.** The area under organic crops and plants (ha) in the world, the EU, Slovakia, Estonia, Switzerland, Austria, Slovenia, Serbia, Cyprus and Montenegro, 2000-2020

| Parameter | World | Europe | Slovakia | | Switzerland | | Slovenia | Estonia | Serbia* | Cyprus | Montenegro* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | Area under organic crops [ha] | | | | | | | | | | |
| **2000** | 14980991.83 | 4581068.00 | 58458.00 | | 9872.00 | | 82737.22 | 5200.00 | - | 52.00 | - |
| **2001** | 17302299.63 | 5484319.00 | 58706.00 | | 20141.00 | | 93954.88 | 5280.00 | - | 52.00 | - |
| **2002** | 19879439.92 | 5870898.00 | 49999.00 | | 30552.00 | | 102642.10 | 15000.00 | - | 166.00 | - |
| **2003** | 25765459.78 | 6249193.00 | 49992.00 | | 40890.00 | | 109090.10 | 23280.00 | - | 500.00 | - |
| **2004** | 29973069.44 | 6564579.00 | 51186.00 | | 46016.00 | | 114560.70 | 23032.00 | - | 1017.96 | - |
| **2005** | 29246059.99 | 6988448.00 | 90206.00 | | 59742.00 | | 117116.60 | 23499.00 | - | 1698.4 | - |
| **2006** | 30173401.52 | 7313417.00 | 120409.00 | | 72886.00 | | 117816.10 | 26831.00 | 740.00 | 1979.00 | 255.00 |
| **2007** | 31509670.58 | 7792049.00 | 117906.00 | | 79530.00 | | 116640.50 | 29322.00 | 830.00 | 2322.00 | 265.00 |
| **2008** | 34472530.40 | 8296365.00 | 140755.00 | | 87346.00 | | 114133.70 | 29838.00 | 4494.00 | 2322.00 | 1876.00 |
| **2009** | 36270553.59 | 9229231.00 | 145490.00 | | 95167.00 | | 112081.90 | 29388.00 | 8661.00 | 3575.04 | 4603.00 |
| **2010** | 35713927.04 | 10028781.00 | 174471.00 | | 112972.40 | | 111514.50 | 30696.00 | 5855.00 | 3575.04 | 3561.12 |
| **2011** | 36670679.77 | 10548523.00 | 166700.00 | | 133779.00 | | 116188.80 | 32149.00 | 6335.00 | 3575.04 | 3068.07 |
| **2012** | 36832974.50 | 11154985.00 | 166700.00 | | 144149.50 | | 121788.20 | 35101.00 | 6340.00 | 3923.00 | 3068.07 |
| **2013** | 43067952.83 | 11397345.00 | 157848.00 | | 151255.70 | | 128139.90 | 38664.50 | 8278.00 | 4303.39 | 3068.07 |
| **2014** | 48694674.00 | 11757323.00 | 180307.40 | | 155560.30 | | 133972.90 | 41237.19 | 9548.00 | 3887.28 | 3288.60 |
| **2015** | 50304060.09 | 12663904.00 | 181882.00 | | 155806.00 | | 137233.70 | 42188.00 | 15298.00 | 4699.00 | 3212.50 |
| **2016** | 57985178.82 | 13535235.00 | 187024.00 | | 180852.00 | | 142072.60 | 43579.00 | 14358.00 | 5550.00 | 3469.80 |
| **2017** | 69175461.60 | 14349846.00 | 189148.00 | | 196441.00 | | 151403.60 | 46222.35 | 13423.00 | 5615.80 | 2715.30 |
| **2018** | 70904090.71 | 15575002.00 | 188986.00 | | 206590.00 | | 160991.90 | 47848.28 | 19254.00 | 6022.40 | 4454.68 |
| **2019** | 71958042.18 | 16494912.00 | 197565.00 | | 220737.00 | | 172713.20 | 49638.00 | 21266.00 | 6240.00 | 4751.48 |
| **2020** | 74926508.87 | 17098134.00 | 222896.00 | | 220796.00 | | 177346.70 | 52078.00 | 20970.75 | 5918.00 | 4822.77 |
| **Share 2020, %** | 100.00 | 22.82 | 1.30 | | 1.29 | | 1.04 | 0.30 | 0.12 | 0.03 | 0.028 |

[1]*Source:* Research Institute of Organic Agriculture FiBL2022; * data have been recorded in FiBl as of 2006, as Montenegro gained independence in 2006, while previously, it was Serbia and Montenegro.

In 2020, 3.37 million producers were engaged in organic agricultural production in the world on an area of 74.93 million ha, which is 802.72% more than in 2000. The area under organic plant production in the world was 74.93 million ha in 2020, which is 400.14% more than in 2000, Tables 1 and 2.

The total area under organic production in Europe and the EU in 2020 was 17.10 mill. ha and 14.86 mill. ha, respectively, Figure 3a. In 2020, the areas in the organic production system in seven countries covered by the research were: in the territory of Slovakia 222,896.00 hectares, Estonia 220,796.00 ha, Switzerland 177,346.70 ha, Slovenia 52,078.00 ha, Serbia 20,970.75 ha, Cyprus 5918.00 ha, and Montenegro 4822.77 ha, Table 2, Figure 3b.

In 2020, by continent, most organic producers were in Asia (53.68%), followed by Africa (24.75%), Europe (12.41%), South America (8.03%), North America (0.87%) and Oceania (0.47%), Table 1.

Among the countries surveyed, most organic producers were in Switzerland 7561, followed by Serbia 6300, Slovenia 3685, Estonia 2050, Cyprus 1223, Montenegro 423, and Slovakia 200, Table 3.

**Table 3.** Number of organic producers in the world, Europe, Slovakia, Switzerland, Slovenia, Estonia, Serbia, Cyprus and Montenegro, 2000-2020

| Parameter | World | Europe | Slovakia | Switzerland | Slovenia | Estonia | Serbia* | Cyprus | Montenegro* |
|---|---|---|---|---|---|---|---|---|---|
| Year | Organic producers | | | | | | | | |
| **2000** | 252 040 | 156 666 | 200 | 4 902 | 315 | 230 | - | 15 | - |
| **2001** | 380 661 | 171 097 | 82 | 5 441 | 883 | 369 | - | 15 | - |
| **2002** | 437 246 | 167 401 | 84 | 5 897 | 1 150 | 583 | - | 45 | - |
| **2003** | 379 931 | 166 377 | 117 | 6 124 | 1 421 | 764 | - | 45 | - |
| **2004** | 491 166 | 164 652 | 196 | 6 373 | 1 590 | 810 | - | 225 | - |
| **2005** | 678 598 | 187 777 | 265 | 6 420 | 1 718 | 1013 | - | 305 | - |
| **2006** | 909 380 | 203 711 | 280 | 6 299 | 1 953 | 1173 | 78 | 305 | 15 |
| **2007** | 1 239 096 | 212 209 | 350 | 6 199 | 2 000 | 1211 | 90 | 305 | 13 |
| **2008** | 1 391 568 | 222 500 | 363 | 5 996 | 2 067 | 1245 | 110 | 305 | 25 |
| **2009** | 1 806 927 | 254 798 | 363 | 5 782 | 2 096 | 1278 | 130 | 732 | 29 |
| **2010** | 1 564 349 | 273 375 | 365 | 5 659 | 2 218 | 1356 | 137 | 732 | 62 |
| **2011** | 1 766 789 | 289 628 | 365 | 5 757 | 2 363 | 1431 | 323 | 732 | 62 |
| **2012** | 1 906 916 | 320 483 | 365 | 5 895 | 2 682 | 1478 | 1073 | 719 | 62 |
| **2013** | 1 954 034 | 331 075 | 403 | 6 047 | 3 049 | 1553 | 1228 | 719 | 62 |
| **2014** | 2 063 935 | 337 466 | 420 | 6 195 | 3 293 | 1542 | 1866 | 743 | 167 |
| **2015** | 2 233 825 | 348 986 | 431 | 6 244 | 3 412 | 1629 | 2289 | 1 032 | 222 |
| **2016** | 2 539 671 | 373 251 | 655 | 6 348 | 3 513 | 1753 | 2794 | 1 174 | 280 |
| **2017** | 2 925 380 | 391 673 | 802 | 6 638 | 3 627 | 1888 | 6153 | 1 175 | 308 |
| **2018** | 2 778 358 | 416 704 | 802 | 7 032 | 3 738 | 1948 | 6706 | 1 249 | 328 |
| **2019** | 3 129 897 | 428 677 | 716 | 7 284 | 3 823 | 2060 | 6261 | 1 252 | 393 |
| **2020** | 3 368 478 | 417 977 | 200 | 7 561 | 3 685 | 2050 | 6300 | 1 223 | 423 |

[1]*Source:* Research Institute of Organic Agriculture FiBL2022; * data have been recorded in FiBl as of 2006, as Montenegro gained independence in 2006, while previously, it was Serbia and Montenegro.

Research by Popović *et al.* (2019) is in accordance with our research. The authors note that more than 3.13 million producers in 181 countries were engaged in organic plant production on 71.95 million ha, which accounts for 1.4% of the total agricultural land, while its value amounted to USD 97 billion.

In recent years, in many countries worldwide, the areas under organic plant production have been showing an upward trend. The share of organic areas in the world, compared to total arable land, was 0.89% in 2000 and 3.44% in 2020. In Europe, areas under organic plant production had an upward trend. In 2000, such areas covered 4,581,068 ha, and in 2020 17,098,134 ha, which is an increase of 273.23%. The number of organic producers in Europe in 2000 was 156,666.00, and in 2020 were 417,977.00, which is an increase of 166.79%. The share of areas in 2020 in European countries compared to the total agricultural area was as follows: 22.41% in Estonia, 17.71% in Switzerland, 11.67% in Slovakia, 10.76% in Slovenia, 4.37% in Cyprus, 0.60% in Serbia, and 1.86% in Montenegro, Table 4. Research by Popović *et al.* (2019), is in accordance with our research. The authors note that many countries worldwide are recording growth in organic production. Globally, 2.98 million producers in 181 countries are engaged in organic farming on an area of 69.8 million ha, which accounts for 1.4% of the total agricultural land, with a value of USD 97 billion. Organic plant production in Serbia in 2019 covered an area of 21,265 ha or 10.44% more than the total area in 2018. Of these areas, arable land was 15,915 ha, while meadows and pastures covered 5.350 ha. Most producers are from Vojvodina (39.83%), South and Eastern Serbia (39.7%), Sumadija and Western Serbia (20.26%), while areas in Belgrade are far smaller, with a share of 0.21%. Cereals prevail (2182.89 ha). Given the great potential for organic production in Serbia, according to forecasts, the areas will increase by 20% (Ikanović and Popović, 2020).

**Table 4.** Share of organic crops and plants compared to total agricultural land in Europe, Switzerland, Austria, Slovenia, Slovakia, Estonia, Serbia, Cyprus and Montenegro, 2000-2020

| Parameter | Europe | Slovakia | Switzerland | Slovenia | Estonia | Serbia* | Cyprus | Montenegro* |
|---|---|---|---|---|---|---|---|---|
| Year | Organic area shares of total farmland [%] | | | | | | | |
| **2000** | 0.89 | 1.00 | 7.71 | 2.71 | 1.07 | - | 0.04 | - |
| **2001** | 1.06 | 2.26 | 8.77 | 2.72 | 1.09 | - | 0.04 | - |
| **2002** | 1.14 | 4.38 | 9.59 | 2.31 | 3.09 | - | 0.12 | - |
| **2003** | 1.23 | 4.93 | 10.22 | 2.34 | 4.79 | - | 0.32 | - |
| **2004** | 1.29 | 5.98 | 10.76 | 2.39 | 4.73 | - | 0.65 | - |
| **2005** | 1.38 | 6.77 | 11.00 | 4.80 | 4.84 | - | 1.12 | - |
| **2006** | 1.49 | 8.11 | 11.06 | 5.71 | 5.53 | - | 1.31 | - |
| **2007** | 1.60 | 8.70 | 11.00 | 6.09 | 6.00 | - | 1.59 | - |
| **2008** | 1.70 | 9.63 | 10.79 | 7.27 | 6.10 | 0.09 | 1.59 | 0.37 |
| **2009** | 1.89 | 10.22 | 10.62 | 7.51 | 6.01 | 0.10 | 2.45 | 0.90 |
| **2010** | 2.05 | 11.9 | 10.60 | 9.01 | 6.36 | 0.11 | 3.02 | 0.69 |
| **2011** | 2.16 | 14.16 | 11.05 | 8.79 | 6.66 | 0.18 | 3.07 | 0.60 |
| **2012** | 2.28 | 15.25 | 11.59 | 8.79 | 7.27 | 0.18 | 3.36 | 0.60 |
| **2013** | 2.34 | 15.8 | 12.20 | 8.33 | 7.96 | 0.23 | 3.95 | 0.60 |
| **2014** | 2.35 | 16.25 | 12.74 | 9.51 | 8.49 | 0.28 | 3.57 | 1.43 |
| **2015** | 2.82 | 15.68 | 13.08 | 9.47 | 8.85 | 0.44 | 3.72 | 1.36 |
| **2016** | 2.73 | 18.02 | 14.48 | 9.75 | 9.12 | 0.41 | 4.94 | 1.06 |
| **2017** | 2.88 | 20.01 | 15.39 | 9.90 | 9.6 | 0.38 | 4.61 | 1.73 |
| **2018** | 3.13 | 20.98 | 16.51 | 9.85 | 10.01 | 0.55 | 4.55 | 1.85 |
| **2019** | 3.31 | 22.33 | 16.99 | 10.31 | 10.35 | 0.61 | 4.98 | 1.87 |
| **2020** | 3.44 | 22.41 | 17.71 | 11.67 | 10.76 | 0.60 | 4.37 | 1.86 |

[1]*Source:* Research Institute of Organic Agriculture -FiBL2022. *Montenegro gained independence in 2006, and the data in FiBl have been recorded since than

*Organic production in Montenegro*

Agricultural production in Montenegro refers to a process of production of plant and animal products on agricultural soil. Within the MNE classification of economic activities, agriculture comprises the cultivation of crops and plants, animal husbandry, and organic production. Montenegro was FRY until 2006, then Serbia and Montenegro, and in 2006 it was recognized as an independent state. With the adoption of the legislation governing organic farming, appropriate conditions for the transition to organic production methods were met, and for that reason, the first year covered by the analysis is 2008. The starting point for the transition to organic plant production is soil quality, which was the initial advantage. The utilized agricultural land by categories in Montenegro in 2010 was 222890.6 ha and 257949.80 ha in 2020, which is an increase of 35059.20 ha or 15.73%, Table 5, Figure 4.

**Table 5.** Agricultural soil (ha) by use category in Montenegro for the period 2010, 2015 and 2020

| Year | Total agro-utilized soil | Utilized kitchen gardens | Utilized arable soil | Vineyards | Orchards[1] plantations | Orchards[1] extensive | Nurseries | Perennial meadows and pastures |
|---|---|---|---|---|---|---|---|---|
| **2010** | 222890.60 | 2 028.8 | 5 716.1 | 2 697.0 | 999.6 | 966.2 | 32.1 | 210 450.8 |
| **2015** | 231405.40 | 1 861.1 | 6 853.3 | 2 708.0 | 1 144.8 | 1 147.2 | 57.9 | 217 633.1 |
| **2020** | 257949.80 | 2038.8 | 7055.3 | 2888.0 | 1390.7 | 1204.1 | 68.5 | 243304.4 |

[1]Source: Monstat, 2021. [1)] Olives included

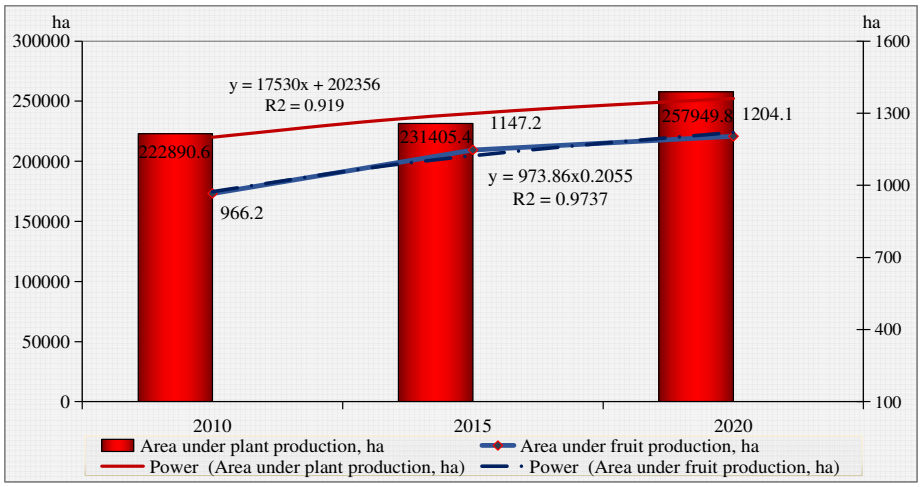



**Figure 4.** Share of fruit in total agricultural utilized land in Montenegro, 2010, 2015 and 2020

Regardless of the organization, agriculture consists of conventional and organic production. Organic production is "friendly" towards natural resources and the environment, thus becoming a general interest of the economy and social community. Under such conditions, the state's role is of utmost importance, which has the task to create a stimulating, stable, yielding, sustainable and equal business environment for all market participants (Ristić, 1991).

The areas under organic farming in Montenegro record an upward trend, from 1876.00 ha in 2008 to 4882.77 ha in 2020. The share of organic areas compared to agricultural areas varied from 0.37% in 2008 to 1.87% in 2020. Also, the number of organic producers has been growing and varied from 25 in 2008 to 432 in 2020. All these data indicate significant growth both in terms of areas (160.28%) and the number of producers (1628.00%), Figure 5.

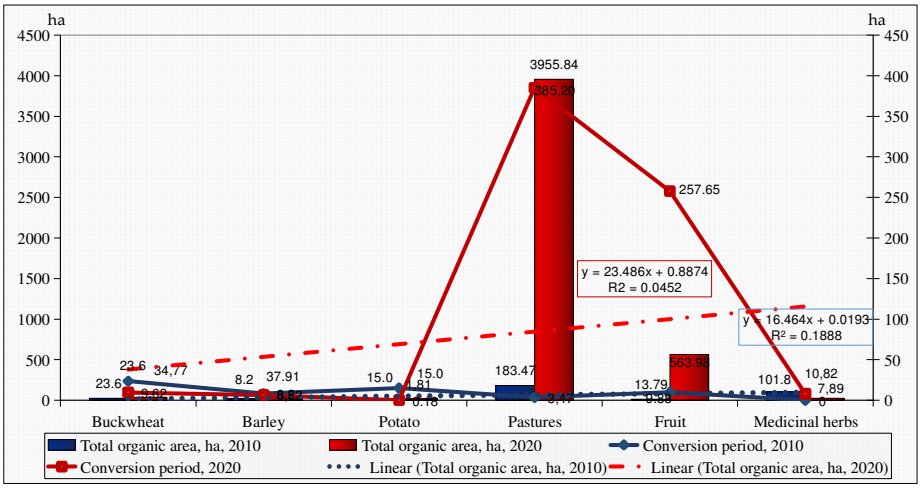



**Figure 5.** Structure of organic plant areas by crop, for Montenegro, 2010 and 2020

The areas under organic farming in Montenegro record an upward trend, from 1876.00 ha in 2008 to 4882.77 ha in 2020. The share of organic areas compared to agricultural areas varied from 0.37% in 2008 to 1.87% in 2020. Also, the number of organic producers has been growing and varied from 25 in 2008 to 432 in 2020. All these data indicate significant growth both in terms of areas (160.28%) and the number of producers (1628.00%), Figures 5, 6 and 7.

Grassland production prevails in Montenegro's organic production with 85.89%, followed by fruit (12.26%), cereals (1.62%), etc., Table 6, Figure 5. Fruit growing has a large share in organic production, especially in northern Montenegro. The organic sector has been showing a continuous growth trend; hence, fruit production in the country grew by 2.3% compared to 2008. The total trade in fruit in Montenegro originates from large-scale production and plantations. Most of the organic fruit production takes place in the northern and southern regions of Montenegro. Organic vegetables in Montenegro in 2020 were cultivated on 1.00 ha. The total area under vegetable covered a small area compared to the production of fodder crops (3951.84ha), fruit (563.98ha), medicinal and aromatic plants (232.46 ha), field crops (74.49ha), etc., Table 6.

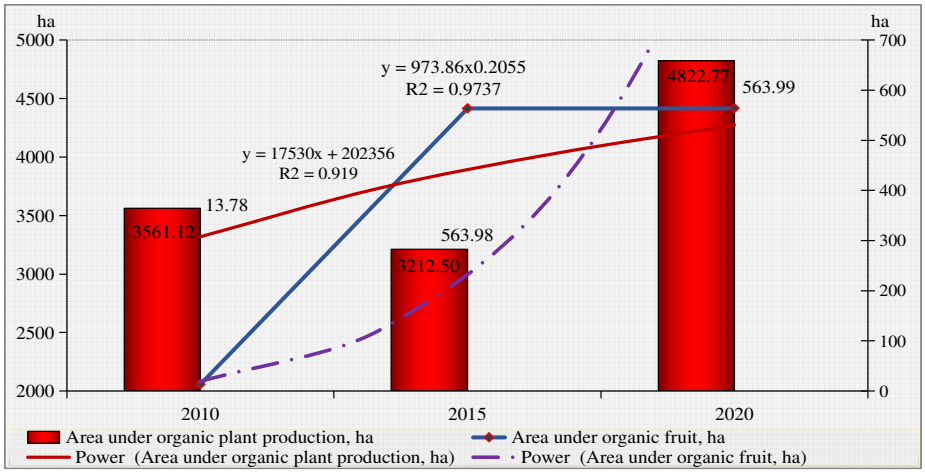



**Figure 6.** Share of fruit in total organic areas in Montenegro, 2010, 2015 and 2020

**Table 6.** Number of organic producers in the Montenegro, 2010, 2015 and 2020

| Parameters / Year | IC | 2010 C | T | IC | 2015 C | T | IC | 2020 C | T |
|---|---|---|---|---|---|---|---|---|---|
| Crops | Areas under organic production in Montenegro (ha) | | | | | | | | |
| Buckwheat | 23.6 | - | 23.6 | 9.62 | 25.15 | 34.77 | 9.62 | 25.15 | 34.77 |
| Barley | 8.20 | - | 8.20 | 6.52 | 31.39 | 37.91 | 6.52 | 31.39 | 37.91 |
| Potato | 15.0 | - | 15.0 | 0.18 | 1.63 | 1.81 | 0.18 | 1.63 | 1.81 |
| Industrial crops | 2.3 | - | 2.3 | - | - | - | - | - | - |
| Cabbage | 6.0 | - | 6.0 | - | - | - | 1.0 | - | 1.0 |
| Pastures - Temporary and permanent | 3.47 | 3451.10 | 3451.10 | 27.87 | 2512.16 | 2540.03 | 385.2 | 3565.64 | 3950.84 |
| Stone fruit | 8.03 | 3.90 | 11.93 | 257.65 | 306.33 | 563.98 | 257.65 | 306.33 | 563.98 |
| Berries | 1.06 | - | 1.06 | - | - | - | - | - | - |
| Fruit-citruses | 0.79 | - | 0.79 | - | - | - | - | - | . |
| Medicinal plants | - | 41.14 | 41.14 | 7.89 | 26.11 | 34.00 | 0.61 | 231.85 | 232.46 |
| **Total** | **64.98** | **3496.14** | **3561.12** | **309.73** | **2902.77** | **3212.50** | **659.78** | **4162.99** | **4822.77** |
| **Number of producers** | | **67** | | | **222** | | | **437** | |

[1]Source: MAFWM, OADP Project-Biotechnical Faculty, 2009, and Monteorganica 2022, Podgorica; IC - in conversion; C-certified, T - Total

Golijan (2016) points out that the entire organic sector tends to grow continuously, and therefore plant production in the country rose by 10.01 ha compared to the previous year, 2014. Total turnover in medicinal plants in Serbia originates from large-scale production (50%), and the rest (50%) comes from spontaneous flora collection. Southern and Eastern Serbia has the largest share in organic farming of medicinal and aromatic plants, with a mid-point of 40.31 ha in 2015.

The number of organic producers and areas in conversion and organic production for Montenegro is shown in Table 7. In 2008, there were 25 agricultural producers, of which 15 were plant producers, three were livestock producers, three were mixed farms, and four were medicinal plant collectors. There were 67 agricultural producers in 2020, 222 in 2015, and 437 in 2020 from 25 towns, Table 7, Figure 7.

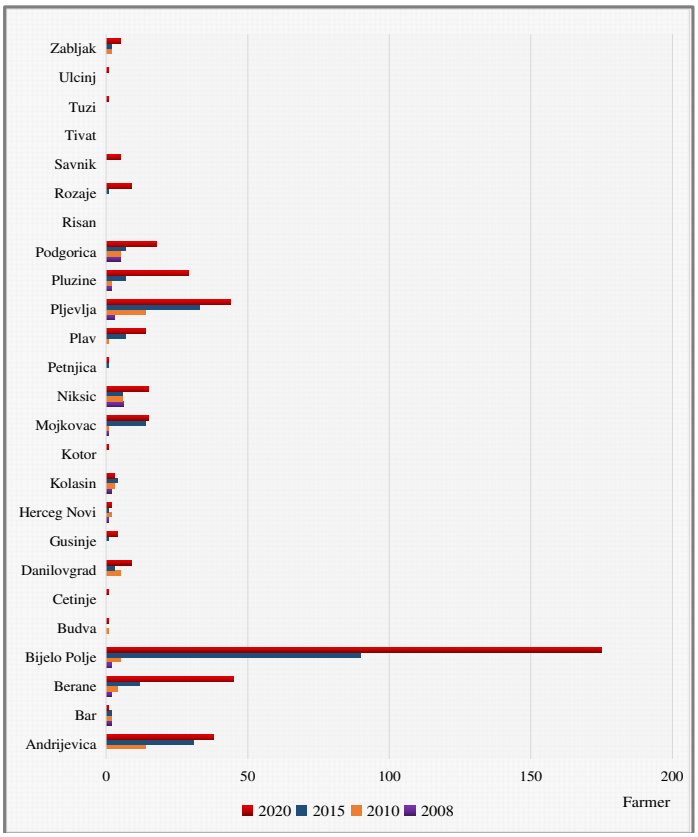



**Figure 7.** Registered organic producers CB Monteorganica, by towns in Montenegro, for the period from 2008; 2010; 2015and 2020

**Table 7.** Overview of the number of registered organic producers CB Monteorganica, by municipalities in Montenegro for the period from 2008 - 2020

| Municipality | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Andrijevica | 0 | 0 | 14 | 14 | 21 | 21 | 24 | 21 | 37 | 36 | 36 | 38 | 38 |
| Bar | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 |
| Berane | 2 | 3 | 4 | 4 | 10 | 14 | 12 | 12 | 24 | 29 | 31 | 34 | 45 |
| Bijelo Polje | 2 | 3 | 5 | 9 | 2 | 8 | 52 | 90 | 121 | 137 | 150 | 165 | 175 |
| Budva | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 |
| Cetinje | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| Danilovgrad | 0 | 0 | 5 | 6 | 5 | 4 | 2 | 3 | 3 | 5 | 6 | 8 | 9 |
| Gusinje | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 2 | 2 | 4 | 4 |
| Herceg Novi | 1 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 |
| Kolašin | 2 | 2 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 3 |
| Kotor | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| Mojkovac | 1 | 1 | 1 | 9 | 6 | 6 | 2 | 4 | 3 | 14 | 15 | 14 | 15 |
| Nikšić | 5 | 7 | 6 | 9 | 7 | 5 | 5 | 6 | 7 | 7 | 10 | 15 | 15 |
| Petnjica | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Plav | 0 | 0 | 1 | 4 | 8 | 8 | 7 | 7 | 8 | 2 | 14 | 13 | 14 |
| Pljevlja | 3 | 4 | 14 | 28 | 35 | 34 | 31 | 33 | 36 | 39 | 44 | 45 | 44 |
| Plužine | 2 | 3 | 2 | 1 | 3 | 3 | 4 | 7 | 6 | 7 | 11 | 21 | 29 |
| Podgorica | 5 | 6 | 5 | 5 | 6 | 7 | 6 | 7 | 8 | 12 | 14 | 18 | 18 |
| Risan | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Rožaje | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 2 | 2 | 4 | 6 | 9 |
| Šavnik | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 5 |
| Tivat | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Tuzi | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| Ulcinj | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| Žabljak | 0 | 1 | 2 | 3 | 3 | 2 | 2 | 2 | 4 | 5 | 5 | 5 | 5 |
| **Total:** | **25** | | **67** | **100** | **152** | **160** | **167** | **222** | **280** | **317** | **351** | **397** | **437** |

[1]Source: Monteorganica and the Government of Montenegro, Podgorica, 2022

The organic agriculture share of 0.4% in the total agriculture of Montenegro is low. Several authors highlighted the importance of organic food production in Montenegro (Lazic and Babović, 2002; Despotović, 2002; Zejak, 2010; 2011; 2012; 2020). Food production and agriculture still play an important role in the economic development of Montenegro. The prevailing existence of extensive agriculture in Montenegro provides a good basis for development of organic agriculture. Development of the organic sector is therefore considered as an important and contributing factor for the overall economic development and rural poverty alleviation. Montenegro possesses favourable natural conditions for development of organic agriculture. There is a huge potential space in which one can organize organic production with a very short transitional period. Montenegro has relatively large areas that could be used for organic agriculture (Lazic and Babović, 2002; Zejak, 2010; 2011; 2012; 2020; Simonović *et al.,* 2013). Demand for organic food is a steadily increasing trend, together with the increased knowledge of consumers about the necessity of rich diversity of high-quality food that is chemically and micro-biologically safe (Lazic and Babović, 2002).

Agriculture carries an imperative of economy sector with strategic importance (Manon and Lünzer, 2000; Rajović, 2009a, 2009b; Milošević *et al*., 2020). Data on organic agriculture, its importance as Montenegro's development opportunity, its position within the overall regional development, as well as its export orientation are also seen through the following theses: organic agriculture as part of Montenegro's overall regional development is a condition for the survival of already rather depopulated villages; the transformation of agricultural production into bio-production and its export orientation, or its establishment on the economy of demand instead of the economy of supply, is an essential condition for its further development. The role of the state in all these activities is exceptional, which will be implemented through credit policy, appropriate tax policy, and production and export incentives. Organic farming can be a driver for sustainable rural development, as well as a factor of integration in the region in the areas of forging business alliances, research, and education (Zejak, 2011; 2012; 2014). Agriculture carries an imperative of economy

sector with strategic importance (Simonović *et al.,* 2013). Climate conditions for the agriculture development in Montenegro, in the examples of municipalities of Berane, Andrijevica, and Plav, favor organic farming. The study area has moderate continental and mountain climate. In organic agriculture, the envisaged implementation can be achieved if the objectives are reasonably harmonized through: the establishment of institutions for the certification of agricultural produce, setting up of plants for the primary processing of fruit, vegetables, medicinal plants, wild medicinal plants, forest fruits and through the revitalization of neglected estates and the consolidation of agricultural holdings (Manon *et al*., 2000; Despotović *et al*., 2015; Rajović, 2009; Zejak, 2011; 2012; Milošević *et al*., 2020).

Tables 8 and 9 show the number of organic producers in Montenegro by area of production for the period from 2010 to 2020. It is evident that plant production prevails over livestock production. Fruit production has the highest share. In 2010, the number of fruit producers was 36 out of a total of 80 organic food producers. In 2015, there were 169 fruit producers of 249 producers at the level of Montenegro. In 2020, there were 341 fruit producers of 463 organic producers in Montenegro.

In the period 2007-2012, the national certification body Monteorganica issued 70 certificates. In 2021, there were 152 organic producers in Montenegro. The data for 2018 show that 363 producers were registered in Montenegro, of which 158 in the Municipality of Bijelo Polje, mainly organic producers engaged in plant production.

The organic producers' growth trend continues in 2019, with a total of 349 producers, and most of them were registered in Bijelo Polje (149), and the least in Petnjica, Bar, Budva, and Šavnik - one each.

**Table 8.** Number of organic producers in Montenegro, by area of production, 2010-2020

| Year | Fruit growing | Viticulture | Field crop farming | Vegetable growing | Wild plants | Bee keeping | Livestock farming | Total |
|---|---|---|---|---|---|---|---|---|
| **2010** | 36 | 2 | 24 | 7 | 3 | 4 | 4 | 80 |
| **2011** | 50 | 3 | 39 | 8 | 6 | 6 | 5 | 117 |
| **2012** | 97 | 1 | 47 | 10 | 1 | 9 | 3 | 168 |
| **2013** | 112 | 3 | 49 | 12 | 2 | 11 | 4 | 193 |
| **2014** | 123 | 2 | 47 | 9 | 2 | 14 | 4 | 201 |
| **2015** | 169 | 2 | 42 | 9 | 3 | 18 | 6 | 249 |
| **2016** | 218 | 2 | 52 | 7 | 3 | 24 | 6 | 312 |
| **2017** | 243 | 2 | 52 | 7 | 5 | 30 | 8 | 347 |
| **2018** | 273 | 2 | 62 | 7 | 4 | 31 | 9 | 388 |
| **2019** | 307 | 2 | 65 | 10 | 4 | 41 | 9 | 438 |
| **2020** | 341 | 1 | 51 | 7 | 4 | 48 | 11 | 463 |

[1]Source: Monteorganica and the Government of Montenegro, Podgorica, 2022

**Table 9.** Number of organic producers in the Montenegro, 2010, 2015 and 2020

| Parameters | IC | 2010 C | T | IC | 2015 C | T | IC | 2020 C | T |
|---|---|---|---|---|---|---|---|---|---|
| Area, ha | 68.45 | 103.6 | 172.05 | 392.35 | 157.35 | 549.7 | 316.34 | 554.58 | 870.92 |
| Producer | 57 | 10 | 67 | 51 | 71 | 222 | 260 | 177 | 437 |
| Plant production | 47 | 9 | 56 | 47 | 42 | 189 | 210 | 149 | 359 |
| Livestock production | 4 | 4 | 8 | 7 | 7 | 15 | 26 | 12 | 38 |
| Mixed farms | 3 | - | 3 | 10 | 8 | 18 | 28 | 12 | 40 |
| Processing and sale, t | - | 40,2 | 40,2 | 0,2 | - | 40,2 | - | - | - |
| Medicinal plants and forest fruit | - | 103,6 | 103,6 | 103,6 | - | 103,6 | 1.0 | 232,0 | 233.0 |

[1]Source: Monteorganica 2022; IC - in conversion; C- certified, T - total

Organic, or bio-dynamic farming, began in the 1940s with the work of scientists Pfeiffer and Kolisko. Müller put their ideas into practice, and in 1949 he introduced the term "organisch-biologischerlandbau". Germany, Austria, and Switzerland can be considered the countries of the initial development of organic farming in Europe, as they were the countries where the pioneers of organic and biological-dynamic agriculture worked: Rudolf Steiner, Hans Müller, Hans Peter Rusch. The origins of the development of organic farming in Germany are in the field of biodynamic agriculture, founded by scientist and philosopher Dr. Rudolf Steiner (1861-1925). In 1924, he introduced this term into agriculture in his lectures in Koberwitz near Breslav in Schlesien. Organic production is labelled by a mark unique to each country, Figure 8A, B and C.

(A) (B)

**Figure 8.** EU organic farming logo(A); Serbia organic farming logo (B). Montenegro organic farming logo (C)

In Montenegro, for the period 2006/2007 to 2020, the most significant rise in the number of organic farms was registered in the northern part; in the Municipality of Bijelo Polje, the number rose from one in 2006/2007 to 188 in 2021. In southern Montenegro, Municipality of Bar, the number of farms fell from two in 2006/2007 to one in 2021. The growing trend in organic fruit production is evident: walnut, apple, pear (Figures 9 and 10), walnut, plum, chokeberry, raspberry, blueberry, and blackberry in northern Montenegro. Production of apples dominates fruit growing, while blackberry has the lowest share.

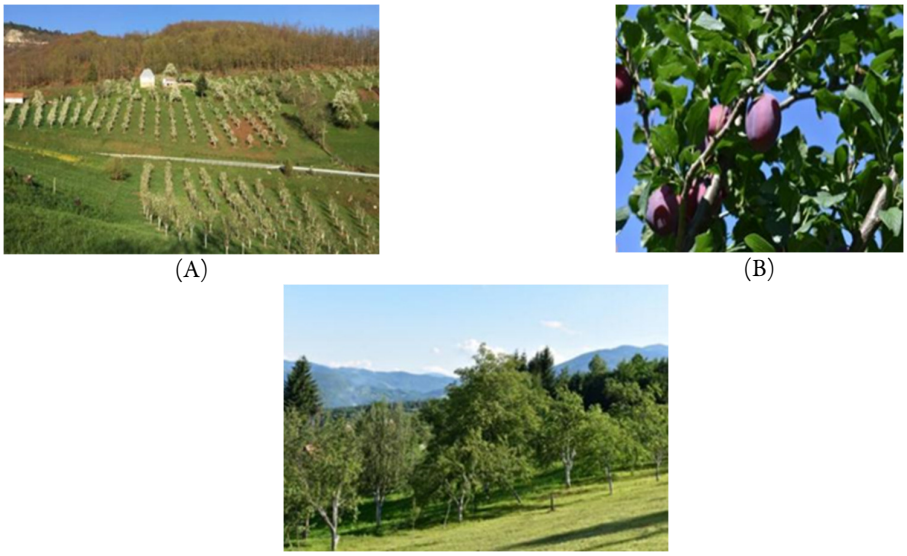
(A) (B)

(C) (D)

**Figure 9.** Organic apple; (A, B); organic pear (C); orchards, agricultural holding Mašulović, Praga village, Niksic (D)
(Source: *https://www.organicmarket.me/organski-proizvodjac/asanin-ivan/me)*

According to the data of Monteorganica Ltd - Podgorica, the number of organic producers in 2020 increased by about 30% compared to 2019, or 435 farmers in total. Again, most of them are in the Municipality of Bijelo Polje (175) and the least in the municipalities of Tuzi, Budva, and Bar. In 2021, there were 511 organic

producers. The fact that there were 7 registered producers in 2007, 100 in 2011, and 511 in 2021 shows a significant increase in the number of organic farms (73 times), which is probably a result of the interest of the rural population in this form of agriculture, as well as significant support funds allocated to this sector by international donors, local self-governance and the Government of Montenegro.



(A) (B)

(C)

**Figure 10.** Organic apple; (A); organic plum orchard, agricultural holding Kljajević, Đurđevića Tara village, Pljevlja; (B); agricultural holding Ašanin, Krstac village, Mojkovac (C)

In the coming period, Montenegro has to implement measures that will contribute to the growth of productivity, quality of products, marketing activity, etc., which will provide an overall contribution to growth in price competitiveness. From Montenegro's perspective, agricultural production is an important factor in economic development. Its development and importance have been especially intensified in recent years through the development of an institutional framework for organic production. Organic agriculture developed in reaction to the increasing environmental degradation, deterioration of food quality, and the growing threat to the health of the human population (Zejak, 2011; 2012).

Organic agriculture aims to produce high-quality food while developing sustainable agriculture by conserving the ecosystem and increasing soil fertility. This implies legal regulation with the fulfilment of precisely defined conditions, as follows: isolation of land parcels, livestock farms, and processing facilities from possible pollution sources; the adequate quality of irrigation water; coordinated development of plant and livestock production; and qualification of experts and producers for organic agriculture with the obligation of permanent innovation of knowledge (Zejak, 2011; 2012; 2014; 2020; Milošević *et al*., 2020).

Organic agriculture implies using natural fertilizers in the production process, with the exclusion of pesticides, herbicides, and artificial fertilizers. Protection in organic plant production is based on preventive agro-technical and hygiene measures. When diseases and pests cannot be suppressed preventively, biological protection agents are used. The SWOT analysis is shown in Table 10.

The first two sections of the SWOT analysis (Strengths and Weaknesses) are internal factors. The other two sections (Opportunities, Threats) are external factors, from the environment. The SWOT analysis should bring about concrete actions or strategies.

During Nazism, the government even banned organic farming, both in theory and practice. For that reason, its supporters, but also scientists, emigrated to Switzerland and the USA. In the 1970s, together with the visible adverse effects on the environment, the first associations of organic farming were formed from

industrialized-commercial agriculture. More intensive work began in the 1980s (Manon *et al.,* 2000) when the first production standards were set.

Organic agricultural production today is set as one of the priorities for the development of agriculture and is an integral part of our rural and agricultural development strategy. The SWOT analysis is a sound tool and can also be very useful in a slightly less formal strategy formulation, Table 10.

**Table 10.** The SWOT analysis

| STRENGTHS | WEAKNESSES |
|---|---|
| Safe product<br>Large supply<br>Market position | Insufficient state support in the form of subsidies<br>Large workforce |
| Customer base | More investments |
| Brand recognition | Insufficient funds for crop protection |
| Growing production<br>Profitable production | Insufficient product supply<br>More investments |
| Internet on-line booking | Small farms |
| Rich biodiversity | Insufficient education of producers |
| **OPPORTUNITIES** | **THREATS** |
| Increased demand<br>Producers have higher income<br>Customer satisfaction<br>Preservation of ecosystem and human health.<br>Market growth<br>Use of European funds | Insufficient education of producers<br>Lack of development strategic documents<br>Insufficient market capacity<br>Natural disasters<br>Economic recession<br>Fuel price growth<br>Change in legislation |

Organic products are becoming increasingly important goods on a global scale, and the share of these products in world trade is increasing. It is obvious that the presence of organic food in the diet of an increasing number of consumers around the world is not trendiness but a continuous desire to consume quality products and thus contribute to the preservation of health and the environment. Organic products provide a great opportunity to affirm small and medium-sized enterprises in the domestic market, but even more so in the international market.

Organic production of food is based on ecological practice, a high degree of biodiversity, and the conservation of natural resources (Despotović, 2004; Rajović *et al.,* 2009; Čengić – Džomba*et al.*, 2014; Popović *et al.,* 2017). Plants' yield is largely dependent on the genetic potential, which could be defined as the yield of a variety that was grown in conditions it had adapted to, with adequate amounts of water and nutrients and efficient control of pests, diseases, weeds, and other stresses (Ikanović*et al.*, 2014; Popović *et al*., 2020a; 2021a; 2021b; Lakić *et al*., 2020; Kolarić *et al*., 2021; Filipović *et al.*, 2021; Ljubičić *et al.*, 2021; Rajičić *et al.,* 2021). Yields vary considerably primarily as a result of agroecological conditions during the growing season (Popović *et al.,* 2020a). New perspective varieties have more and better-filled grain, higher yield, grain mass, and farinaceous content, while proteins and lysine were lower than in older varieties (Glamočlija*et al.,* 2015; Popović *et al.,* 2020a). Many studies state that food items from products from organic farms had way more nutrients than those sourced from commercial or conventional farms.

Legume sowing is of great importance in organic production (Ikanović and Popović, 2020). Two-year alfalfa utilization is the recommended time in this research because of the following benefits. In crop rotation, alfalfa field is provided with nitrogen by symbiotic nitrogen fixation, and the alfalfa is cultivated every five years in the same field. In contrast, in the middle of that period, the field is fertilized with compost produced on the farm. Thanks to alfalfa biomass and seed and also nitrogen fixation, maintaining soil fertility is resolved in a

sustainable and natural way (Božović *et al.,* 2022). The outcomes of this study will help organic farmers extend their seasons, improve their ecosystem services, and diversify their production and market potential.

Social and ecological diversity are basic elements to build resilience. Diverse perennial agricultural systems produce certain services more efficiently than systems based on annual crops (Gliessman, 2007; Jordan *et al.,* 2017). Diversity of adaptive institutions is particularly important to foster sustainable development (Ostrom, 2005). Diversity also includes variety of plausible hypothesis about the world and possible strategies (Leach *et al*., 2010) an essential basis for building agricultural governance approaches that contribute to equity and social justice (Ludwig*et al*., 1993). The intersubjective nature of knowledge needs to be better integrated into the study and management of agricultural systems. In terms of management, the adoption of some basic principles, such as learning, flexibility, adaptation, scale-matching, participation, diversity and precaution, may significantly improve the current standard procedures (Rivera-Ferre*et al*., 2013; Ugrenović *et al*., 2021).

Calculations show that fruit growing in the Republic of Serbia is economically profitable, as well as the fact that it can be a propulsive economic activity. With modern technology and the application of innovative knowledge, farmers will achieve good economic results (Prodanović and Babović, 2014).

## Conclusions

Organic production is a controlled way of production from farm to fork, preventing possible distortions of ecosystems but also adverse effects on human health. Its pronounced growing trend in the world and our country is due to its great importance. The trend of organic farming growth in the world and in our country confirms that the prospects of this production are good and that such a trend will continue in the future. Organic production is successfully organized in Montenegro. The organic agriculture share of 0.4% in the total agriculture of Montenegro is low. Organic vegetables in Montenegro in 2020 were cultivated on 1.00 ha. The total area under vegetable covered a small area compared to the production of fodder crops (3951.84ha), fruit (563.98ha), medicinal and aromatic plants (232.46 ha) and field crops (74.49ha).

Organic fruit production growth trend stands out in particular: walnut, apple, pear, plum, chokeberry, raspberry, blueberry, and blackberry, in northern Montenegro. Production of apples dominates fruit growing, while blackberry has the lowest share. The agroecological conditions of this region of Montenegro are excellent for organic production. Most organic producers are located in the northern part of Montenegro. The Municipality of Bijelo Polje has the largest number of organic food producers in Montenegro and the largest number of organic fruit growers. The number of organic producers in Montenegro was 25 in 2008, while 341 producers were registered in 2020. The number of organic producers recorded an increase of 1364%. The future is in organic production because products from organic production they have much more nutrients than those sourced from commercial or conventional farms. Organic agriculture contributes to the health and wellbeing of soil, plants, animals and humans. The production of organic plant production, cereals and fruit has economic justification, which inspires optimism that it will develop. It is necessary to apply modern technology with the application of innovative knowledge in order for farmers to achieve good economic results. The organic production system is friendly to resources and the environment, and the products are of the highest quality, so there is a general interest to opportunities to improve the economy of this production are found.

## Authors' Contributions

Conceptualization, D.Z., VS, SE, D.P.; methodology, V.P., D.Z., VS; software, D.P.; validation, V.R., D.Z.; formal analysis, V.S., S.E.; investigation, D.Z., V.R.; resources, D.Z.; data curation, V.S.; writing—original draft preparation, D.P; V.P.; D.Z.; S.E., V.R.; writing—review and editing, V.S.; I.G., D.P, S.E.; visualization,

V.S.; supervision, V.P.; V.S., S.E.; project administration, V.P.; funding acquisition, D.Z. All authors read and approved the final manuscript.

**Ethical approval** (for researches involving animals or humans)

Not applicable.

## Acknowledgements

We would like to express our gratitude to the national certification body Monteorganica, Podgorica, and the Ministry of Agriculture of the Government of Montenegro for the data provided for this study. This research was supported by the Ministry of Science, Education, and Development of the Republic of Serbia (Grant No. 451-03-68/2022-14/200032) and APV Project 2022-2023: Analysis of the impact of nitrogen on the productivity of maize hybrids of different FAO maturity groups using classical and modern technology.

## Conflict of Interests

The authors declare that there are no conflicts of interest related to this article.

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