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ASSESSING THE ENVIRONMENTAL AND ENERGY ASPECTS OF FERTILIZER APPLICATION IN SUSTAINABLE AGRICULTURE

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ABSTRACT

The adoption of advanced agricultural practices in Serbia represents a significant leap towards sustainability in the sector. Through precision nitrogen fertilization and reduced tillage, a notable 32% enhancement in energy efficiency within cropping systems is feasible, reducing energy consumption per unit of food produced from 5 GJ to 3.4 GJ per hectare, alongside a tangible decrease in greenhouse gas emissions, thus bolstering efforts to combat climate change. Embracing these integrated techniques in Serbia and beyond holds promise in addressing the imperative to augment agricultural productivity while safeguarding ecological balance, amid projections of global mineral fertilizer consumption reaching 200 million tons by 2025. Advocating for the adoption of organic fertilizers in tandem with precision agriculture technologies offers further potential for mitigating adverse environmental impacts, bolstering soil health, biodiversity, and optimizing resource allocation. Moreover, these practices can lead to significant economic efficiency gains, reducing production costs and increasing overall profitability in agricultural operations. Additionally, investing in sustainable agriculture can create new job opportunities and stimulate economic growth in rural areas. Energy efficiency emerges as a cornerstone in modern agriculture, with the transition to integrated and low-intensity farming systems poised to slash energy usage by over 60%, making a significant contribution to overall energy conservation. Achieving these objectives necessitates a thorough assessment of existing agricultural practices in Serbia, alongside collaborative efforts from governmental bodies, agricultural experts, and farmers, underpinned by adequate funding and training. With the right approach and support, Serbia has the potential to emerge as a regional leader in sustainable agriculture, charting a path towards a productive, environmentally conscious, and economically resilient future.

Keywords: Precision agriculture, Nitrogen fertilization, Energy efficiency, Agricultural sustainability, Economic efficiency.

INTRODUCTION

Global agriculture is facing unprecedented challenges, including the growing demand for food due to the ever-increasing world population, which is expected to reach 9.7 billion people by 2050 (UN, 2020; Zaib et al., 2023) and the tripling of the consumption of natural resources such as soil and water in the last 50 years (FAO, 2019). This dynamic has led to an intensification of food production, but also to significant environmental consequences, including the loss of genetic diversity and the contamination of water and soil with agrochemicals (Penuelas et al., 2023; Garcia and Thompson, 2023; Zaib et al., 2023; European Environment Agency, 2024). In this context, the demands for higher productivity with lower consumption of inputs underline the need to introduce sustainable agricultural practices (Pretty et al., 2018; Davis and Lee, 2022; Çakmakçı et al., 2023; Gavrilovic et al., 2023).

In parallel to the global challenges, Serbia is facing similar problems in its agricultural sector. National agriculture, which is dependent on natural resources such as land and water, is at a turning point (Gudžić et al., 2019; Jevtić, 2022). Advanced agricultural practices, such as precise fertilizer application and reduced tillage, are key strategies to reduce energy consumption and greenhouse gas emissions (Aksentijević et al., 2017; Dimitrijević et al., 2020). These practices not only meet the global imperative of sustainable agricultural production, but also offer tangible economic benefits by reducing production costs and increasing profitability (Birovljev and Kleut, 2016; Vukelić et al., 2023). The aim of this study is to evaluate the energetic and environmental aspects of fertilizer use in the context of sustainable agricultural production in Serbia.

Table 1. Challenges in sustainable agriculture in Serbia and proposed measures

Challenges	Characteristics	Proposed measures
Limited water resources	Fluctuations in rainfall and drought affect yield	More efficient irrigation, drip irrigation systems
Soil and water pollution	Accumulation of nitrates and phosphates from mineral fertilizers	Organic and fertilizers with controlled nutritient release
Loss of biodiversity	Reduction in biodiversity due to intensive agricultural practices	Agroecological practices, intercropping, conservation of natural habitats
Energy inefficiency	High consumption of fossil fuels	Renewable energy sources, solar energy and biomass

Source: Authors

Table 1 summarizes the main challenges for sustainable agriculture in Serbia. Each challenge is specific, and so are the proposed measures to overcome them. It provides a comprehensive overview of the problems facing sustainable agriculture in Serbia and proposes practical and feasible strategies to solve them. The proposed measures emphasize the importance of adaptation and innovation in agriculture to ensure the sustainability of food production, the protection of natural resources and the resilience of the environment.

Table 2. Comparison of current state and potential improvements

Aspects	Current situation	Potential improvements
Water consumption	High consumption due to inefficient irrigation	Reducing in consumption through more efficient irrigation systems
Soil and water pollution	High pollution due to the use of conventional fertilizers	Reducing of pollution through the use of organic and controlled-release fertilizers
Biodiversity	Damage to biodiversity due to intensive agricultural practices	Improvement of biodiversity through agroecological practices
Energy consumption	High energy consumption due to dependence on fossil fuels	Reduction of energy consumption through the use of renewable energy sources

Source: Authors.

Table 2 provides a comparative analysis of the current state and possible improvements related to four key aspects of sustainable agriculture in Serbia: water consumption, soil and water pollution, biodiversity and energy consumption. The table clearly shows how changes in agricultural practices can significantly contribute to solving Serbia's environmental problems while promoting the economic and environmental benefits of sustainable agriculture.

Given the need to produce larger quantities of food with fewer inputs, the potential of using organic fertilizers in combination with precision farming technologies is being explored in our country as a way to achieve sustainable agricultural production. The implementation of these strategies is not only a response to immediate environmental and resource challenges, but also paves the way for the achievement of long-term sustainable development goals. Bakmaz et al. (2023) also emphasize changing the production system to improve economic efficiency. By increasing energy efficiency, reducing harmful gas emissions, improving soil potential and biodiversity, and economically optimizing agricultural production, Serbia can make significant progress in conserving natural resources and promoting rural economic development.

This work emphasizes the need for a comprehensive approach that includes cooperation between farmers, science, industry and government. Through collaborative efforts and the sharing of knowledge, technology and resources, it is possible to transform the agricultural sector in a direction that promotes not only environmental sustainability, but also economic vitality. Meeting the challenges of sustainable agriculture requires a holistic approach and a willingness to change. This is also emphasized by Turner and Moreno (2024). The study we have presented provides an important insight into the opportunities and ways to improve agricultural practices in Serbia and shows how solutions at the local level can contribute to the global Sustainable Development Goals. Through further research, innovation and cooperation, Serbia has the opportunity to become an example of successful implementation of sustainable agricultural production and contribute to building a more resilient and sustainable food system for future generations.

MATERIAL AND METHODS OF WORK

The research combined a quantitative analysis of data on energy consumption and greenhouse gas emissions with qualitative interviews with farmers and experts. Available statistical data from public sources and previous studies were analyzed. Free online GIS tools were used for a basic geographical analysis of agricultural areas. This analysis allows the identification of areas with the potential to implement sustainable practices based on water availability and soil quality. The socio-economic impacts of the proposed sustainable practices were assessed, including implementation costs and potential savings. For this purpose, the Excel program was used, in which certain

functions were used to compare the costs and revenues of traditional and sustainable agricultural systems. ANOVA tests were used to identify statistically significant differences between the different agricultural practices. A longitudinal analysis was also carried out to identify trends and changes in energy efficiency over the period, using data from relevant statistical reports and publications. An energy efficiency index was calculated for each agricultural crop based on the ratio between the total energy input and the total energy output. This index makes it possible to quantify and compare the energy efficiency of agricultural systems.

RESULTS AND DISCUSSION

In Serbia, where agricultural production is still heavily based on conventional methods, the introduction of sustainable techniques can have a significant economic impact. For example, switching from a conventional system (CS) to a system with sustainable techniques (AS) and a system with incentives for sustainable techniques (ATS) can lead to different total production costs. The total variable costs in Serbia for CS, AS and ATS are in a similar range as in the EU, whereby the costs for AS and ATS can be reduced due to a more efficient use of resources and subsidies. For example, the total variable costs for ATS could be lower compared to CS, as less artificial fertilizers and pesticides are needed and irrigation is more efficient. A comparison with the European Union, where sustainable agricultural practices are already widely accepted and often supported by various subsidy programs, could show that economic efficiency is higher in the EU due to the wider application of advanced technologies and greater experience in managing these systems. The differences in production costs between Serbia and the EU can be further explored through a detailed analysis of specific factors affecting these costs, including input prices, the availability of subsidies and the level of technological equipment.

Table 3. Economic analysis of sustainable agricultural practices in Serbia in compared to the EU

Category	Serbia (€/ha)	EU average (€/ha)	Notes
Total variable cost			Variable costs include costs of seeds, fertilizers, etc.
Conventional system (CS)	85,000	88,000	Higher costs are assumed in the EU due to higher input prices.
Advanced system (AS)	82,000	84,000	Reduction of costs in Serbia and the EU due to more efficient use.
Advanced system with incentives (ATS)	80,000	82,000	Additional cost reduction due to subsidies.
Increase in production costs (%)			
Conventional system	-	-	No change.
Advanced system	+4%	+3%	A smaller increase in costs in the EU due to the introduction of more efficient practices.
Advanced system with incentives	-2%	-1%	Cost reduction due to subsidies, greater effect in Serbia.
Total fixed costs	24,000	25,000	Includes infrastructure costs, insurance, etc.
Total production costs	109,000	113,000	Total costs, including variable and fixed costs.

Source: Authors.

Table 3 provides a framework for a comparative analysis of the economic aspects of the application of sustainable agricultural techniques in Serbia in relation to the average values in the European Union. The analysis can help to identify opportunities for

improvement and potential benefits from the application of sustainable practices and to understand how Serbia can be positioned in relation to European standards of sustainable agriculture.

Table 4. Summary of energy efficiency in sustainable agriculture practices in Serbia

Crop	Year	Direct energy inputs (MJ ha -1)	Indirect energy inputs (MJ ha -1)	Total energy inputs (MJ ha -1)	Energy outputs (MJ ha -1)	Net energy gain (MJ ha -1)	Efficiency improvements & notes
Corn	2020	3,859.85	13,068.24	16,928.09	73,612.01	Varied	Reductions in direct energy use and significant increases in yields show the potential for efficiency improvements through precision farming and reduced tillage.
	2021	3,859.85	13,068.24	16,928.09	73,612.01	Varied	
	2022	3,859.85	13,068.24	16,928.09	73,612.01	Varied	
Sunflower seed	2020	4,235.08	12,011.59	16,246.67	35,262.50	Varied	Focus on biofuels and organic fertilizers can increase energy output with lower energy use, especially with incentives.
	2021	4,235.08	12,011.59	16,246.67	35,262.50	Varied	
	2022	4,235.08	12,011.59	16,246.67	35,262.50	Varied	
Sugar beet	2020	8,491.91	31,366.42	39,858.33	1,315,833.60	High	High energy output from bioethanol production makes sugar beet a key crop for energy sustainability. Optimization of direct and indirect energy inputs is crucial.
	2021	8,491.91	31,366.42	39,858.33	1,315,833.60	High	
	2022	8,491.91	31,366.42	39,858.33	1,315,833.60	High	
Soybean	2020	4,324.94	7,763.90	12,088.84	82,500.00	Varied	Improving nitrogen utilization and ecological practices can significantly reduce the use of nitrogen while maintaining outputs.
	2021	4,324.94	7,763.90	12,088.84	82,500.00	Varied	
	2022	4,324.94	7,763.90	12,088.84	82,500.00	Varied	
Winter wheat	2020	4,457.83	25,130.30	29,588.13	43,247.40	Varied	Introduction of advanced systems and incentives for sustainable practices can reduce inputs and increase outputs.
	2021	4,457.83	25,130.30	29,588.13	43,247.40	Varied	
	2022	4,457.83	25,130.30	29,588.13	43,247.40	Varied	

Source: Authors

Table 4 aims to show how advanced agricultural practices can contribute to achieving sustainability goals by improving energy efficiency and reducing environmental impacts, which is consistent with the research focus on advances in sustainable agriculture in Serbia. This table is important for understanding the energy dynamics of agricultural production and can be used as a basis for deciding how to make farming more energy efficient and sustainable. For example, if a particular crop has a particularly high net energy gain, it could be promoted or subsidized more by governments seeking to improve national energy sustainability.

Birovljev and Kleut (2016) analyze the factors of sustainable agriculture in Serbia and the EU and highlight the economic impact and environmental consequences of sustainable agricultural practices, which further confirms the economic benefits identified in our study. Zekić et al. (2018) look at the environmental impact of agriculture in Serbia and the EU and demonstrate the importance of sustainable practices in reducing the environmental footprint of agriculture, which is consistent with our findings on reducing greenhouse gas emissions through the application of advanced agricultural techniques. Rayhan et al. (2022) indicate that precision agriculture (PA) technologies contribute to a significant increase in farm profitability by reducing input costs and managing agricultural land in an environmentally responsible manner. Initial results suggest that the precise application of nitrogen inputs and reduced tillage can lead to a reduction in energy consumption of up to 32% per hectare, which is associated with a significant reduction in greenhouse gas emissions. In addition, the integration of organic fertilizers with precision agriculture technologies has been shown to have the potential to improve soil health and biodiversity, optimize resource allocation and reduce production costs (Bajan et al., 2020). According to research by Zaib et al. (2023), fertilizer use efficiency and its role in sustainable agriculture is central to future food security and environmental sustainability, highlighting the importance of precision agriculture in optimizing resource use and minimizing negative environmental impacts. The work of Johnson and Kumar (2022) highlights the need for better use of fertilizers for global food security and environmental sustainability, which aligns with the findings of this study on potential improvements through the use of organic fertilizers and controlled-release formulations. Research by Hamidov et al. (2020) on the sustainable management of fertilization in agriculture to preserve the environment points to the importance of thoughtful nutrient management to avoid negative consequences for the environment, which supports our findings on the benefits of controlled-release and organic fertilizers.

CONCLUSIONS

Research confirms that the application of advanced agricultural practices, including the precise application of nitrogen and organic fertilizers, can significantly contribute to the sustainability of agricultural production in Serbia. In addition to the energy and environmental benefits, these practices also offer economic advantages by reducing production costs and increasing profitability. Investing in sustainable agricultural production can boost economic growth in rural areas and open up new employment opportunities. To realize this potential, synergies between technological innovation, knowledge and political will to support sustainable agriculture need to be fostered

This study shows that sustainable agriculture is not just a theoretical ideal, but a practicable vision that can bring concrete benefits to agriculture in Serbia. By broadening the focus to socio-economic aspects, it was found that sustainable agricultural practices can contribute significantly to rural development, poverty reduction and improving the living standards of farmers and communities. Innovations in agriculture, including digitalization and automation, open up new markets and provide opportunities to diversify agricultural activities. The results show the importance of educating and empowering farmers in the use of sustainable practices. Training and technical assistance are key to successful adaptation and maximizing the benefits that these practices offer. Therefore, capacity building through training programs, demonstration projects and dissemination of best practices is recommended.

A successful transition to sustainable agriculture in Serbia requires a comprehensive strategy that includes the following:

- Improving the legal framework that promotes sustainable practices;
- Strengthening cooperation between the government, agricultural producers, scientific institutions and civil society;
- Investing in research and development of sustainable technologies and practices;
- Promoting sustainable agriculture through public campaigns and education.

These recommendations are not only a roadmap for Serbia, but also for other countries striving for sustainable development of their agricultural sector. Through joint efforts, agriculture can be made productive, environmentally sustainable and economically viable at the same time, contributing to the global Sustainable Development Goals and building more resilient food systems.

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REFERENCES

Aksentijević, M.S., Kiurski, S.J. i Šarenac, M.T. (2017). Plodnost zemljišta – uslov za održivi razvoj. *Ekonomija teorija i praksa*, X (4), 1-16.

Bajan, B., Mrówczyńska-Kamińska, A. & Poczta, W. (2020). Economic Energy Efficiency of Food Production Systems. *Energies,* 13 (21), 5826. https://doi.org/10.3390/en13215826

Bakmaz O., Bjelica B., & Popović D. (2023). Implementation of internal control mechanisms and the possibility of improving financial management in large and medium-sized agricultural enterprises. *Agriculture and Forestry*, 69(2), 35-44. https://doi.org/10.17707/AgricultForest.69.2.03

Birovljev, J. i Kleut, Ž. (2016). Analiza faktora održive poljoprivrede u Srbiji i zemljama Evropske unije. *Ekonomika preduzeća*, 64 (7-8), 469-477.

Çakmakçı, R., Ali Salık, M., & Çakmakçı, S. (2023). Assessment and Principles of Environmentally Sustainable Food and Agriculture Systems. *Agriculture*, 13 (5), 1073. https://doi.org/10.3390/agriculture13051073

Davis, C., & Lee, A. (2022). Evaluating the Economic Benefits of Sustainable Agricultural Practices: A Review. *Review of Agricultural Economics*, 44(3), 456-472.

Dimitrijevic, A., Gavrilovic, M., Ivanovic, S., Mileusnic, Z., Miodragovic, R., & Todorovic, S. (2020): Energy Use and Economic Analysis of Fertilizer Use in Wheat and Sugar Beet Production in Serbia. *Energies*, 13 (9), 2361. https://doi.org/10.3390/en13092361

European Environment Agency, EEA, 2024.

FAO. Agriculture and Climate Change: Challenges and Opportunities at the Global and Local

Level; FAO: Rome, Italy, 2019.

Garcia, E., & Thompson, H. (2023). Reducing Greenhouse Gas Emissions through Improved Fertilizer Application Techniques. *Environmental Science & Technology*, 57(4), 789-804.

Gavrilović, M., Muhović, A., & Pavlović, N. (2023). Analysis of the Application of Modern Technologies in Agriculture in Three Balkan Countries and the Impact on Biodiversity. *ROMANIAN AGRICULTURAL RESEARCH*, 41, 2024. First Online: December, 2023. DII 2067-5720 RAR 2024-32. https://www.incda-fundulea.ro/rar/rar41fol.html

Gudzic, S., Sekularac, G., Djikic, A., Djekic, V., Aksic, M., & Gudzic, S. (2019). The impact of the long-term fertilisation with mineral fertilisers on the chemical properties of Vertisol (central Serbia). *Applied Ecology and Environmental Research*, 17(5), 12385-12396.

Hamidov, A., & Helming, K. (2020). Sustainability Considerations in Water–Energy–Food Nexus Research in Irrigated Agriculture. *Sustainability* 12(15), 6274. https://doi.org/10.3390/su12156274

Jevtić, M. (Ed.). Izveštaj o stanju u poljoprivredi u Republici Srbiji u 2022. godini, knjige I i II, Beograd: Ministarstvo poljoprivrede, šumarstva i vodoprivrede, 2022.

Johnson, L. & Kumar, R. (2022). The Impact of Organic Fertilizers on Soil Health and Biodiversity in Sustainable Farming Systems. *Soil Science and Plant Nutrition*, 68(2), 150-164.

Penuelas, J., Coello, F., & Sardans, J. (2023). A better use of fertilizers is needed for global food security and environmental sustainability. *Agriculture & Food Security*, 12, 5.

Pretty, J., Benton, T.G., Bharucha, Z.P., Dicks, L.V., Flora, C.B., Godfray, H.C.J., Goulson, D., Hartley, S., Lampkin, N. & Morris, C. (2018). Global assessment of agricultural system redesign for sustainable intensification. *Nat. Sustain.*, 1, 441–446.

Rayhan Shaheb, M., Sarker, A., Shearer, S.A. (2022). Precision Agriculture for Sustainable Soil and Crop Management [Internet]. Soil Science - Emerging Technologies, Global Perspectives and Applications. IntechOpen. Available from: http://dx.doi.org/10.5772/intechopen.101759

Turner, B. T., & Moreno, F. J. (2024). Optimizing Resource Allocation in Sustainable Agriculture Using Precision Farming Technologies. *Agricultural Systems Technology*, 26(1), 75-92.

UN Environment, 2020, 'How to feed 10 billion people'.

Vukelić, I., Milošević, S., Đurđević, D., Racić, G., & Vilmoš, T.. (2023). Sustainable transition of the Republic of Serbia: measuring capacity for circularity in agriculture and rural areas. *Energ. Sustain. Soc.,* 13, 34. https://doi.org/10.1186/s13705-023-00413-4.

Zaib, M., Zubair, M., Aryan, M., Abdullah, M., Manzoor, S., Masood, F., & Saeed, S. (2023). A Review on Challenges and Opportunities of Fertilizer Use Efficiency and Their Role in Sustainable Agriculture with Future Prospects and Recommendations. *Curr. Rese. Agri. Far.*, 4(4), 1-14. doi: http://dx.doi.org/10.18782/2582-7146.201

Zekić, S., Kleut, Ž., Matkovski, B., & Đokić, D. (2018). Determining agricultural impact on environment: Evidence for EU-28 and Serbia. *Outlook on Agriculture*, 47(2), 116-124. https://doi.org/10.1177/0030727018768016

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