PRELIMINARIES TO PROMOTING SUSTAINABLE VEGETABLE FARMING

PREMISE PENTRU PROMOVAREA AGRICULTURII SUSTENABILE ÎN LEGUMICULTURĂ

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Abstract.
The paper presents a theoretical analysis of the premises, strategies, and principles that can support the development of sustainable vegetable farming in Romania. The study highlights existing advantages, such as soil fertility, pedoclimatic diversity, labor availability, and tradition in vegetable farming. The necessary strategic directions are analyzed, including innovation, investments oriented towards sustainable practices, access to financing, and the role of associative forms. The fundamental principles of sustainability - environmental protection, economic viability, and social stability, along with maintaining productivity, form the basis of a resilient vegetable growing system adapted to current challenges.
Key words: sustainable vegetable farming, development premises; sustainable strategies; principles of sustainability

Rezumat.
Lucrarea prezintă o analiză teoretică asupra premiselor, strategiilor și principiilor care pot susține dezvoltarea legumiculturii sustenabile din România. Studiul evidențiază avantajele existente, precum fertilitatea solurilor, diversitatea pedoclimatică, disponibilitatea forței de muncă și tradiția în cultura legumelor. Sunt analizate direcțiile strategice necesare, incluzând inovația, investițiile orientate către practici sustenabile, accesul la finanțare și rolul formelor asociative. Principiile fundamentale ale sustenabilității - protecția mediului, viabilitatea economică și stabilitatea socială, alături de menținerea productivității - constituie baza unui sistem legumicol rezilient adaptat provocărilor actuale.
Cuvinte cheie: legumicultură sustenabilă, premise de dezvoltare; strategii sustenabile; principii ale sustenabilității

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INTRODUCTION

Sustainable agriculture is, in the current context, one of the key strategic directions for ensuring a balance between the need to increase agri-food production and the conservation of natural resources. The concept has evolved in response to increasing environmental pressures and the challenges posed by climate change, and is defined as a system capable of maintaining productivity without compromising resources for future generations [Velten et al., 2015; Reganold and Wachter, 2016].

Due to its intensive nature, vegetable farming is sensitive to climate change, soil degradation, and economic pressure on farmers. Therefore, the transition to sustainable production systems is no longer just an option, but a fundamental condition for maintaining the sector's viability in the medium and long term [Pretty et al., 2018; Lal, 2015].

In Romania, vegetable growing has a number of natural and traditional advantages that can facilitate the implementation of sustainability principles: fertile soils, favorable pedoclimatic diversity, and a wealth of knowledge passed down from generation to generation. However, the development of sustainable vegetable growing is influenced by multiple constraints, such as climate variability, limited access to financial and technological resources, and labor migration [Gadanakis et al., 2015].

At European level, common agricultural policies promote the adoption of resource-efficient, resilient and environmentally friendly production systems, objectives that are also integrated into recent strategies such as "Farm to Fork". In this context, the Romanian vegetable sector must identify ways in which it can correlate these directions with local realities in order to ensure long-term competitiveness [European Commission(a)].

Although the literature offers numerous perspectives on the principles of sustainable agriculture, there is still a need for an integrated synthesis that highlights the premises, strategic directions, and fundamental principles applicable to the national context. Such an analysis allows for a better understanding of the current opportunities and challenges in Romanian vegetable farming.

The purpose of this paper is to conduct a conceptual analysis of the opportunities and directions for the development of sustainable agriculture in vegetable growing, based on the favorable premises identified in Romania, the strategies necessary to consolidate this system, and the principles that define its functionality. By structuring these elements into a unified framework, the paper contributes to informing decisions for farmers, researchers, and decision-makers, supporting the transition to a more competitive vegetable sector that is adapted to future challenges [Khoury et al., 2014].

MATERIAL AND METHOD

This paper is a synthesis and theoretical analysis based on relevant literature on sustainable agriculture and its application in the vegetable sector. The documentation

process aimed to identify and select scientific sources published between 1990 and 2024, including scientific articles, specialized volumes, technical guides, institutional reports, and European strategic documents.

The sources consulted came from international scientific databases (Google Scholar, Scopus, Web of Science), national specialist literature, and official European Union documents, in line with the practice used in assessments of sustainable agricultural systems [FAO, 2019].

The selection of materials was based on the following criteria: relevance to the field of vegetable growing, applicability of the information in the context of sustainable agriculture, timeliness of the data, and credibility of the source. European policy documents such as the Farm to Fork strategy, which set the current directions for agri-food systems, were also integrated [European Commission(a)].

The information was analyzed using a narrative approach, structuring the key concepts into three major directions: the premises for the development of sustainable agriculture in the national context, the strategies needed to strengthen this system, and the fundamental principles that define the functionality of sustainable agriculture in vegetable growing. This approach is consistent with the methodology used in conceptual studies on sustainable agriculture, which aim to integrate ecological, economic, and social elements in a coherent manner [Munteanu et al., 2008].

RESULTS AND DISCUSSIONS

The premises for the development of sustainable agriculture in Romania

The development of sustainable agriculture in Romanian vegetable farming is supported by favorable natural and structural factors. A first essential element is the high agroecological potential, characterized by fertile soils, varied hydro-pedological resources, and a pedoclimatic diversity favorable to vegetable crops. These conditions allow the use of technologies with low environmental impact, while maintaining productivity and offering a competitive advantage over other European regions [Lal, 2015; Munteanu et al., 2008].

A second major aspect is the availability of labor in rural areas, which is particularly relevant for organic or low-input systems, where a significant part of agricultural work requires manual intervention. The relatively low cost of labor can contribute to increasing the profitability of small and medium-sized farms and facilitate the adoption of sustainable technologies that require greater physical input [Gadanakis et al., 2015; Stoleru, 2008].

In addition, Romania has a strong tradition in vegetable cultivation, reflected in practical knowledge accumulated over generations and adapted to local conditions. This cultural background provides valuable support for the implementation of sustainable technologies, as many traditional practices coincide with the principles of sustainable agriculture - the use of manure, crop rotation, and the maintenance of biodiversity at the household level [Stoian, 2005].

Taken together, these premises indicate that the vegetable sector has a favorable foundation for integrating sustainability principles. However, turning these advantages into concrete results depends on the ability of farmers and institutions in the agricultural sector to capitalize on existing resources through

technological investments, training, and the adaptation of public policies to national specificities [European Commission(b); FAO, 2019].

Strategies for strengthening sustainable agriculture in vegetable growing

The development of a sustainable vegetable growing system in Romania requires the implementation of integrated strategies aimed at improving resource efficiency, increasing farm competitiveness, and reducing pressure on the environment. A first strategic element is the promotion and transfer of innovation through the introduction of modern cultivation technologies, the use of ecological plant protection methods, and the adoption of computerized resource monitoring systems. Expanding vocational training programs and access to up-to-date information facilitates the adoption of these solutions at the level of small and medium-sized farms [Pretty et al., 2018; Stoleru, 2013].

A second strategic direction is the mobilization and targeting of capital towards sustainable investments. The development of rural infrastructure, the modernization of protected areas, the installation of efficient irrigation systems, and the creation of collection and processing centers contribute to increasing the added value of vegetable production [Gadanakis et al., 2015; Munteanu et al., 2008].

Another fundamental element is facilitating access to finance and strengthening marketing mechanisms. Currently, limited access to credit and tailored forms of financial support constrains farmers' ability to implement sustainable practices. The development of agricultural cooperatives, producer associations, and their integration into supply chains enable competitive prices, reduce risks, and increase economic stability [European Commission(b); FAO, 2019].

At the same time, harnessing rural human resources is essential for a sustainable system. Reducing migration and revitalizing rural communities depend on recognizing the strategic role of the local workforce [Stoleru, 2008; Teliban, 2011].

Finally, planning and regulating the use of natural resources is a mandatory component of sustainability. Responsible management of soil, water, and biodiversity, together with the implementation of clear regulations on the use of inputs and environmental protection, ensures the long-term stability of vegetable agroecosystems [Lal, 2015; Munteanu et al., 2008].

By integrating these strategies, the vegetable sector can evolve towards a sustainable model capable of simultaneously meeting production, environmental protection, and rural community development objectives, in line with European guidelines on the transition to a green economy [European Commission(a)].

Principles of sustainable agriculture in vegetable growing

Sustainable agriculture in the vegetable sector is based on a set of fundamental principles that aim to strike a balance between environmental protection, economic performance, social stability, and productive continuity [Velten et al., 2015; Reganold and Wachter, 2016].

The first principle, which is highly relevant to vegetable production, is the reduction of environmental degradation. Limiting the use of pesticides and chemical fertilizers, adopting minimum tillage, using green crops, and increasing

biodiversity contribute to reducing pollution, maintaining soil fertility, and strengthening the resilience of agroecosystems. These practices reduce dependence on external inputs and promote more efficient management of natural resources [Munteanu et al., 2008; Stoian, 2005].

A second central principle is economic viability, a prerequisite for the functioning and perpetuation of sustainable systems. In vegetable farming, where economic risks are amplified by market volatility and climate vulnerability, the adoption of low-cost technologies, the use of local resources, and the diversification of production can ensure a stable income for farmers [Pretty et al., 2018; Gadanakis et al., 2015].

A third principle, social stability, is closely linked to the role of rural communities in supporting vegetable farming. Sustainable agriculture contributes to the preservation of family farms, the maintenance of the active population in rural areas, and the conservation of agricultural traditions, which are an important part of Romanian cultural heritage [Stoleru, 2008; Teliban, 2011]. By creating jobs and supporting a functional local economy, sustainable systems become a factor of social stability and development.

Finally, ensuring consistent productivity is essential for sustainability. Achieving stable harvests without compromising soil fertility or production capacity for future generations requires the use of agrotechnical practices adapted to local conditions, resource conservation, and careful monitoring of climate developments [Lal, 2015; FAO, 2019].

By integrating these principles, sustainable vegetable farming becomes a production model capable of simultaneously meeting ecological, economic, and social requirements, providing a solid framework for the sustainable development of this sector [Velten et al., 2015; Pretty et al., 2018].

CONCLUSIONS

The sustainability of the vegetable sector is essential for the development of Romanian agriculture, and this analysis highlights the main elements that justify and reinforce this perspective:

1. Romania has favorable conditions for the development of sustainable vegetable farming, thanks to its valuable natural resources, available rural labor force, and tradition of vegetable cultivation. These elements provide a solid foundation for the implementation of sustainable practices.

2. Strategies to strengthen sustainable agriculture must integrate innovation, investments in environmentally friendly technologies, and improved access to finance, especially for small and medium-sized farms. Developing rural infrastructure and strengthening cooperatives are key factors in increasing competitiveness.

3. The principles of sustainable agriculture - environmental protection, economic viability, and social stability, along with consistent productivity, form the foundation of a resilient vegetable farming system capable of responding to

current climatic and economic challenges.

4. The adoption of sustainable practices contributes both to maintaining soil fertility and conserving biodiversity, and to creating stable socio-economic conditions for rural communities, strengthening the role of vegetable growing as a strategic sector.

5. Integrating these directions into a unified vision is essential for aligning the Romanian vegetable sector with European objectives regarding the transition to green agriculture, highlighting the need for public policies adapted to national specificities.

Overall, the analysis highlights that the development of sustainable vegetable farming requires a complex, interdisciplinary, and collaborative approach that leverages existing resources and supports farmers' adaptation to the new requirements of the green economy.

REFERENCES

1. **Food and Agriculture Organization of the United Nations (FAO), 2019** – *The State of Food and Agriculture. Moving forward on food loss and waste reduction.* Rome.
2. **Gadanakis Y., Bennett R., Park J., Areal F.J., 2015** - *Evaluating the sustainable intensification of arable farms*. Journal of Environmental Management, 150.
3. **Khoury C.K., Bjorkman A.D., Dempewolf H., Ramirez-Villegas J., Guarino L., Jarvis A., Rieseberg L.H., Struik P.C., 2014** – *Increasing homogeneity in global food supplies and the implications for food security*. Proceedings of the National Academy of Sciences, 111(11).
4. **Lal R, 2015** – *Restoring soil quality to mitigate soil degradation*. Sustainability, 7(5).
5. **Munteanu N., Stoleru V., Stoian L., Fălticeanu M., 2008** – *Technological bases of organic vegetable growing*. Ed. "Ion Ionescu de la Brad", Iasi.
6. **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., Pierzynski G., Prasad P.V.V., Reganold J., Rockström J., Smith P., Thorne P., Wratten S., 2018** – *Global assessment of agricultural system redesign for sustainable intensification*. Nature Sustainability, 1(8).
7. **Reganold J.P., Wachter J.M., 2016** – *Organic agriculture in the twenty-first century*. Nature Plants, 2, 15221.
8. **Stoian L., 2005** – *Practical guide to organic vegetable growing*. Ed. TipoActiv, Bacau.
9. **Stoleru V., 2008** – *Studies of the opportunity of vegetable growing in a sustainable agricultural system.* Doctoral thesis*, U.S.A.M.V. Iasi.*
10. **Stoleru V., 2013** – *Management of organic vegetable systems*. Ed. "Ion Ionescu de la Brad" Iasi.
11. **Teliban G.C., 2011** – *Researches regarding the technical opportunities for the implementation of ecologic agriculture system in the vegetable enterprises from Iasi County.* Doctoral thesis, U.S.A.M.V. Iasi.
12. **Velten S., Leventon J., Jäger N., Newig J., 2015** – *What is sustainable agriculture? A systematic review*. Sustainability, 7(6).
13. ******* European Commission(a). Farm to Fork Strategy for a fair, healthy and environmentally-friendly food system. https://food.ec.europa.eu/horizontal-topics/farm-fork-strategy_en
14. ******* European Commission(b). Common agricultural policy. https://agriculture.ec.europa.eu/cap_en