

Statistical Analysis of Cultivated Areas with Major Crops in Buzau County

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ARTICLE INFO	ABSTRACT
<p><i>Article history:</i> Received: March 19, 2025 Accepted: March 30, 2025 Published: March 30, 2025</p> <p><i>Keywords:</i> horticulture, cultivated areas, statistical analysis, Buzau County, Romania</p>	<p>Horticulture represents a crucial sector of Romanian agriculture, contributing to both rural and national economic development. This study analyzes the variations in the cultivated areas of major horticultural crops in Buzau County during the period 2019–2023, based on data provided by the National Institute of Statistics (INS). The results highlight differences and disparities in the evolution of cultivated areas, reflecting changes in the structure of horticultural crops and their adaptation to climatic and economic conditions. These shifts suggest a reconfiguration of agricultural priorities, influenced by factors such as crop resilience to climate change and market demands. The study underscores the impact of climatic, economic, and infrastructural factors on the dynamics of the horticultural sector and emphasizes the need for investments in agricultural infrastructure and advanced technologies to strengthen and diversify horticultural production in Buzau County.</p>

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1. Introduction

Horticulture is a fundamental pillar of modern agriculture, significantly impacting both rural and national economies. Beyond its role in diversifying agricultural production, this sector plays a crucial part in ensuring food security by providing high-quality products for both domestic consumption and export. Moreover, horticulture supports agricultural biodiversity and promotes the sustainable management of natural resources, facilitating the transition to a more efficient agricultural model better adapted to current challenges. In Romania, horticulture holds a central position within the agricultural sector, encompassing specialized branches such as pomology, viticulture, vegetable growing, and floriculture. This field plays a strategic role in the national economy by offering high-quality products and generating economic opportunities through increased exports. The development of horticulture is supported by favorable pedoclimatic conditions and Romania's long-standing tradition in plant cultivation, which provides the country with a competitive advantage in this sector.

This study aims to analyze and evaluate the dynamics of cultivated areas for major horticultural crops in Buzau County using statistical data provided by the National Institute of Statistics (INS). The research focuses on determining the distribution of horticultural areas, including vegetable crops, floriculture, fruit-bearing orchards, and greenhouse surfaces, thus offering a detailed perspective on the structure of this sector. Statistical analysis is an essential tool for interpreting current trends and the factors influencing the development of horticulture at both county and regional levels.

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Furthermore, the study contributes to a deeper understanding of Buzau County's position within the Southeast region, providing relevant insights for agricultural strategy development. Identifying the factors that either stimulate or hinder the growth of this sector is crucial for formulating effective measures to support the expansion and diversification of horticultural production. Additionally, assessing cultivated areas allows for a better appreciation of the region's agricultural potential, highlighting the adaptability of crops to local conditions, the efficiency of resource utilization, and the impact of infrastructure on horticultural development. Thus, this study provides a scientific foundation for formulating sustainable agricultural policies and for supporting a competitive and resilient agricultural sector in Buzau County.

2. Literature review

Horticulture in Romania holds a central position within the agricultural sector, boasting a long-standing tradition and a diverse range of crops, including vegetables, fruit trees, grapevines, flowers, and ornamental plants. This field integrates scientific knowledge from disciplines such as biology, plant physiology, genetics, pedology, and agrochemistry to develop modern and efficient production systems (Ciobanu, 2015). Food security requires that all individuals consistently access sufficient, safe, and nutritious food to meet their dietary needs and maintain a healthy lifestyle.

Horticulture plays a crucial role in enhancing food security by contributing to food self-sufficiency, diversifying diets through the supply of essential nutrients, and fostering economic development by creating jobs and generating income in agricultural communities (Jaskani & Khan, 2021). Due to its essential role in ensuring food security and promoting sustainable urban development, numerous studies have explored the expansion of urban horticulture and its integration into existing built environments. Although urban areas offer significant potential for horticultural production, challenges remain regarding the availability of suitable land and the sustainable implementation of horticultural activities within cities (Edmondson et al., 2020). Over the years, horticultural practices in Romania have evolved significantly, transitioning from traditional subsistence farming techniques to advanced technologies integrated into European commercial supply chains (Marinescu & Popescu, 2018). Adapting to climate change necessitates the development of resilient crop varieties capable of maintaining both stable yields and high-quality harvests. A practical approach to mitigating adverse climatic effects involves implementing modern cultivation techniques that are accessible and easily applicable to farmers. Additionally, agroecological strategies are becoming increasingly relevant, enhancing the resilience of horticultural crops and ensuring long-term sustainable production (Bisbis et al., 2019). The hilly regions of the country, such as the Subcarpathian and the Transylvanian Plateau, are renowned for their ideal pedoclimatic conditions, which favor the production of high-quality fruits and grapes (Marinescu & Popescu, 2018). Studies indicate that the diverse terrain of Buzau County, combined with fertile soils and a temperate-continental climate, provides a favorable environment for various horticultural crops, including vegetables, fruits, and ornamental plants. However, climatic variability, manifesting as droughts or excessive precipitation, can negatively impact agricultural production (Boboc, 2022). Research institutions like the Plant Genetic Resources Bank in Buzau are crucial in conserving and improving local plant varieties. These efforts contribute to preserving biodiversity and developing crops adapted to local conditions, a key factor for the long-term sustainability of horticulture in the region (BRGV Buzau, 2024).

Useful background on regional horticultural practices was retrieved from institutional sources (University of Agronomic Sciences and Veterinary Medicine of Bucharest – Faculty of Horticulture, 2025).

3. Results

Main horticultural crops in Romania and regional analysis of cultivated areas

The total national cultivated area for major crops includes land allocated to cereal crops (wheat, maize, barley, etc.), flowers and ornamental plants, grain legumes, industrial crops, orchards, and field-grown vegetables. This cultivated area reflects the dynamics of agricultural land use and serves as a key indicator for analyzing trends in agricultural production, the impact of climate change, agricultural policies, and the sector's sustainability.

An analysis of the evolution of cultivated areas in Romania highlights significant changes in the national agricultural structure. The graph in Figure 1 illustrates the dynamics of cultivated areas between 2019 and 2023, revealing an overall declining trend. In 2019, the cultivated area reached its highest level within the analyzed period, recording 8,737 thousand hectares. Over the following two years, 2020 and 2021, the cultivated areas remained relatively stable, at approximately 8,263 thousand hectares. However, 2022 marked a significant decrease, with the cultivated area dropping to 8,006 thousand hectares. In 2023, a slight recovery was observed, with the area increasing to 8,211 thousand hectares, although it remained below the 2019 level. These variations can be correlated with the influence of climatic, economic, or structural factors that have shaped the evolution of agricultural land use at the national level.

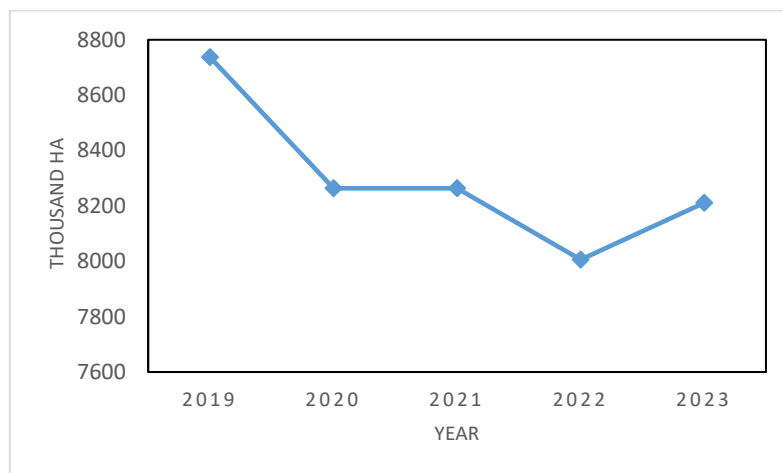


Figure 1. Total national cultivated area for major crops (thousand ha)

Source: author, data processing based on INS, 2025

The statistical analysis of cultivated areas in Romania during the 2019–2023 period, as presented in Table 1, highlights significant differences between the main crop categories, with a particular focus on areas allocated to horticulture. The data suggest a distinct dynamic between horticultural crops (vegetables, flowers, orchards, greenhouse areas) and grain cereals, which continue to dominate the national agricultural structure.

Table 1. Detailed area of major crops at the national level

Crop Category-Ha/ year	2019	2020	2021	2022	2023
Cereals for grain	5569.1	5338.1	5351.5	5183.8	5168.5
Leguminous crops for grain	116.0	107.4	84.9	76.1	101.7
Vegetables - total	227.7	200.5	197.7	177.6	179.7
Flowers and ornamental plants	0.317	0.278	0.345	0.311	0.313
Bearing orchards	135.1	136.0	137.6	138.1	141.9
Greenhouse area	0.206	0.207	0.242	0.181	0.234

Source: author, data processing based on INS, 2025

The cultivated area for vegetables has steadily declined, from 228 thousand hectares in 2019 to 178 thousand hectares in 2022, marking a 22% reduction. In 2023, a slight recovery was recorded, reaching 180 thousand hectares, though this value remains below the 2019 level. This decline may be attributed to factors such as lack of investment, climate change, or a shift toward other crop types. Regarding fruit-bearing orchards, a continuous increase was observed over the analyzed period, from 135 thousand hectares in 2019 to 142 thousand hectares in 2023, suggesting a sustained focus on pomology, a sector with high added value. This trend reflects a possible prioritization of perennial crops, which offer greater resilience to climate change and increased attractiveness for export markets.

Flowers and ornamental plants represent a marginal sector in terms of cultivated area, fluctuating from 0.317 thousand hectares in 2019 to 0.313 thousand hectares in 2023. This segment indicates a niche market with development potential, especially given the growing demand for decorative horticultural products. The greenhouse area, although relatively small compared to other categories, reflects a positive trend. After a decline in 2022, the area increased significantly in 2023 (0.234 thousand hectares), suggesting a rising interest in intensive horticultural production, adapted to the needs of both domestic and foreign markets.

In contrast, extensive agricultural crops, such as grain cereals, continue to occupy the largest share of cultivated land. In 2019, these crops covered 5,569 thousand hectares, but the area declined steadily until 2022 (5,184 thousand hectares), followed by a slight increase in 2023 (5,168 thousand hectares). This relative decrease may be correlated with the adaptation of agricultural production to market demands and the diversification of cultivated crops.

From a broader perspective, horticultural areas (vegetables, orchards, flowers, greenhouses) represent a small fraction of the total agricultural land, yet they hold high economic value and have a significant impact on food security and biodiversity. In this context, increased investment and the promotion of these sectors are essential for strengthening horticulture within Romania's agricultural economy.

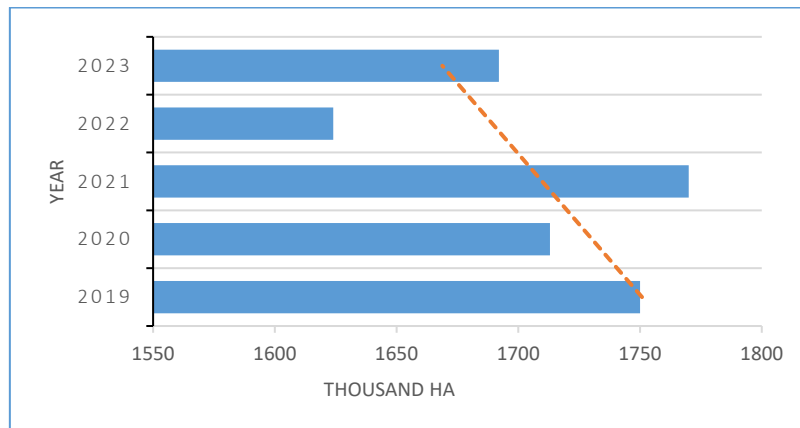


Figure 2. Total Area in the South-East Region

Source: author, data processing based on INS, 2025

Figure 2 illustrates the evolution of cultivated areas in the Southeast region of Romania during the 2019–2023 period, highlighting their dynamics in the national agricultural context. This region holds a significant position in Romania’s agriculture due to its extensive areas dedicated to agricultural and horticultural crops.

Over this period, the analysis of cultivated areas reveals regional fluctuations and a general trend that reflects broader changes in the national agricultural sector. In 2019, the total cultivated area in the Southeast region was 1,745.8 thousand hectares, making it one of the most productive years within the analyzed period. In the following years, the cultivated area gradually decreased, reaching 1,712.2 thousand hectares in 2020, a relatively stable value compared to the previous year but indicative of a slight decline in agricultural activity. These variations reflect the regional agricultural sector’s vulnerability to external factors such as climate change, agricultural policies, and economic conditions. Throughout the 2019–2023 period, the South-East Region significantly contributed significantly to Romania’s total cultivated area, accounting for 19.98% in 2019 and increasing to 21.43% in 2021. These percentages underscore the region’s consistent and vital role in national agriculture, highlighting its essential contribution to the country’s agricultural production.

According to available data, Buzau County accounts for approximately 2.7% of Romania’s total agricultural area, featuring a diversified agricultural structure with a significant role in both viticulture and fruit growing. In hilly areas, viticulture holds a central position, with the county being renowned for its vineyards in the Dealu Mare wine region. Key viticultural centers, such as Pietroasele and Dealul Câlnău, specialize in producing high-quality red wines, benefiting from favorable pedoclimatic conditions. This region is known for noble grape varieties and is highly appreciated nationally and internationally, reinforcing Buzau County’s status as an important viticultural hub in Romania.

In floodplain areas, along the Buzau, Slănic, and Râmnic rivers, apple, plum, sour cherry, and apricot orchards dominate, representing essential sectors of local fruit production. These plantations benefit from fertile soils and a favorable climate, allowing for competitive yields for domestic consumption and processing. The development of these sectors is supported by the county’s strong agricultural tradition and its potential to adapt to the modern agri-food market’s demands.

Table 2. Cultivated Areas in Buzau County by Major Crops

Crop Category-Ha/Year	2019	2020	2021	2022	2023
Cereals for grain	175633	191286	186545	173382	166313
Leguminous crops for grain	2452	6115	5802	2768	4069
Vegetables - total	5867	4197	5792	5737	5409
Flowers and ornamental plants	24	25	20	20	0
Bearing orchards	8553	8600	6371	6351	6480
Greenhouse area	2	2	:	:	4

Source: author, data processing based on INS, 2025

The analysis of cultivated areas in Buzau County during the 2019–2023 period, as presented in Table 2, highlights distinct trends for the main categories of agricultural and horticultural crops, marked by both increases and significant declines. Grain cereals represent the county's most extensive crop category, reflecting this sector's importance within the local agricultural structure. The cultivated area increased significantly in 2020, reaching 191,286 hectares, compared to 175,633 hectares in 2019. However, a gradual decline was recorded in the following years, with the area decreasing to 166,313 hectares in 2023. This trend may indicate an adaptation to economic and climatic conditions and a potential shift by farmers towards alternative crops.

Regarding grain legumes, the cultivated area fluctuated significantly over the period analyzed. In 2020, the area more than doubled compared to 2019, expanding from 2,452 hectares to 6,115 hectares. However, in 2022, it dropped sharply to 2,768 hectares, followed by a partial recovery in 2023, when the cultivated area increased to 4,069 hectares. These variations highlight the instability of this sector, which may be influenced by factors such as market demand, crop profitability, or climate change. The vegetable crop sector experienced fluctuations throughout the analyzed period, with a notable decline in 2020, when the cultivated area dropped to 4,197 hectares, compared to 5,867 hectares in 2019. Although there were modest increases in subsequent years, the cultivated area declined again in 2023 to 5,409 hectares. These fluctuations suggest difficulties in maintaining a stable production level, possibly due to high maintenance costs, limited resource access, or changing market demands.

Flowers and ornamental plants occupy an insignificant area in Buzau County, with this sector remaining underdeveloped. Between 2019 and 2022, the cultivated area remained relatively constant, fluctuating between 20 and 25 hectares. In 2023, these crops were no longer reported, indicating a possible shift by producers toward more profitable agricultural sectors. Regarding fruit-bearing orchards, the cultivated area remained relatively stable over the period analyzed. In 2020, it peaked at 8,600 hectares but later declined to 6,351 hectares in 2022. However, 2023 saw a slight recovery, with the cultivated area rising to 6,480 hectares. These figures suggest a stability trend in this perennial sector, which holds significant potential for agricultural diversification and for leveraging the favorable pedoclimatic conditions of the county.

The greenhouse area in Buzau County remains one of the smallest among the analyzed categories, reflecting limited development of controlled-environment agriculture. In 2019 and 2020, it covered only 2 hectares, with no significant changes. In 2023, an increase to 4 hectares was recorded, potentially indicating a modest expansion of this sector, possibly driven by growing interest in intensive

horticultural production. The dynamics of cultivated areas in Buzau County between 2019 and 2023 reflect a series of changes influenced by climatic conditions, market demand, and the availability of agricultural resources. Although grain cereals dominate the county’s agricultural structure, horticultural crops such as vegetables and orchards continue to play an important role in economic diversification and in maximizing the region’s agricultural potential. However, instability in specific sectors, such as grain legumes and vegetables, underscores the need for investments and support policies to ensure the sustainable development of the county’s agriculture.

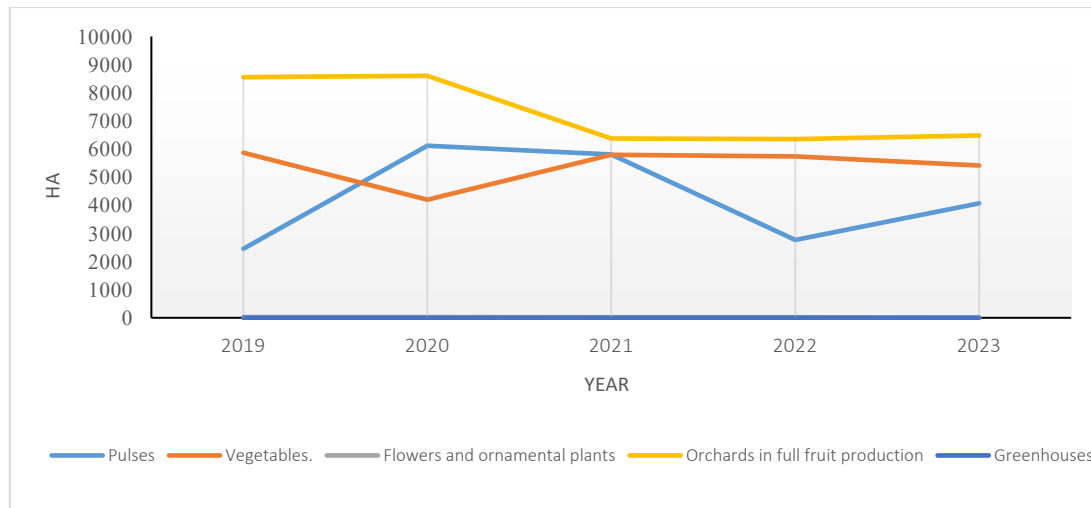


Figure 3. Dynamics of Cultivated Areas in Buzau County

Source: author, data processing based on INS, 2025

The graph in Figure 3 illustrates the fluctuations in cultivated areas in Buzau County during the 2019–2023 period, highlighting the dynamics of different horticultural crop categories. The Y-axis represents the cultivated area values, expressed in hectares, while the X-axis, labeled with the analyzed years, reflects trends and interannual variations. Graphical analysis allows for identifying agricultural sectors in continuous decline, such as floriculture, and segments that have shown slight recovery, such as orchards and grain legumes. The dynamics of cultivated areas in Buzau County have significant implications for agricultural production, local economic stability, and the competitiveness of the horticultural sector. Reducing cultivated areas for specific categories, such as vegetables or ornamental plants, may indicate structural challenges, including high production costs, infrastructure deficiencies, or unfavorable climatic factors. These issues affect the local market supply capacity and farmers' incomes, exerting pressure on the sector's economic sustainability. On the other hand, the increase in cultivated areas for orchards and grain legumes suggests a progressive adaptation of producers to market demands and a shift toward high-value-added crops. These fluctuations can influence future investment strategies in the agricultural sector, creating opportunities for infrastructure modernization, the introduction of advanced technologies, and production diversification. The stabilization and development of this sector depend on implementing effective support measures to enhance farmers' resilience and improve agricultural performance in Buzau County.

Factors Influencing Horticulture in Buzau County

Horticulture in Buzau County is shaped by a complex interaction of natural, infrastructural, and technological factors, which influence both the sector's dynamics and its overall performance. Research

highlights the significant impact of various technological and climatic factors on the productivity of varieties cultivated in similar agricultural areas, emphasizing the continuous need to adapt agricultural practices to local and regional conditions" (Băcanu et al., 2019). Natural conditions provide Buzau County with a significant competitive advantage. Its varied topography, which includes plains, hills, and rolling terrains, creates diverse microclimates favorable for a wide range of horticultural crops. The county benefits from fertile soils, particularly alluvial soils found along the valleys of the Buzau, Slănic, and Râmnic rivers, which offer optimal support for fruit growing and vegetable cultivation. The temperate-continental climate, characterized by hot summers and moderate precipitation, supports the development of economically important crops such as grapevines, fruit trees, and field-grown vegetables. However, recent climate change phenomena, including severe droughts and extreme precipitation events, necessitate technological adaptations and restructuring of crop selection to maintain productivity. The available agricultural infrastructure strongly influences the development of local horticulture. Although the county has an extensive road network that facilitates the distribution of horticultural products, its irrigation infrastructure remains underdeveloped, directly affecting productivity during drought periods. Additionally, the limited number of collection and processing centers restricts farmers' ability to market their produce efficiently, often forcing them to sell at lower prices or depend on intermediaries. Nevertheless, recent investments in modern greenhouses and solariums help offset these deficiencies by providing alternative solutions for intensive production. The technological level in Buzau's horticultural sector varies depending on farm size and available resources. Large farms show a clear tendency towards modernization, incorporating advanced drip irrigation systems, specialized orchard maintenance equipment, and digital solutions for crop monitoring. In contrast, small farmers continue to rely on traditional methods, which reduces production efficiency and market competitiveness. However, programs supported by the Buzau Vegetable Research and Development Station and the Plant Genetic Resources Bank are gradually facilitating the introduction of innovative technologies into small and medium-sized farms.

The interaction of these factors determines the performance of Buzau County's horticultural sector, and its future development depends on the implementation of strategic measures. Investments in modernizing agricultural infrastructure, adapting to climate challenges, and adopting advanced technologies are essential for increasing the sustainability and competitiveness of local horticulture.

Strengthening this sector will allow for better utilization of the county's agricultural potential, thereby contributing to the region's economic development.

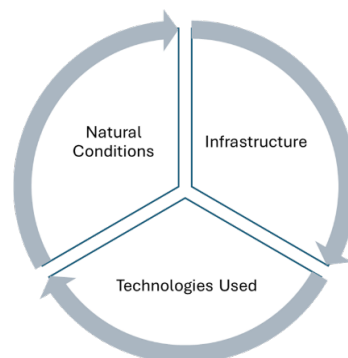


Figure 4. Interaction of influencing factors

Source: the author, using AI software.

Interaction of Influencing Factors in Horticulture in Buzau County

The interaction between natural conditions, agricultural infrastructure, and applied technologies is crucial in determining the performance and sustainability of horticulture in Buzau County. How these factors influence one another generate different effects on productivity and competitiveness, depending on their degree of integration and complementarity. Favorable natural conditions, characterized by fertile soils and a temperate continental climate, can significantly contribute to the development of the horticultural sector when supported by adequate infrastructure. The availability of efficient irrigation networks and collection and processing centers ensures better production valorization, particularly for orchards and vegetable crops. Natural advantages cannot be fully exploited without proper infrastructure, leading to significant production losses and increased yield volatility. Adopting modern technologies considerably impacts horticultural efficiency, especially when integrated within a favorable natural environment. Drip irrigation systems, specialized orchard maintenance equipment, and digital crop monitoring solutions enhance productivity and reduce risks associated with climatic variability. However, the lack of access to such technologies limits farmers' ability to fully capitalize on the region's agricultural potential fully, keeping the horticultural sector in a fragile state of development. A well-developed agrarian infrastructure facilitates market access, ensures optimal logistical conditions, and becomes even more effective when correlated with advanced technologies. The development of modern greenhouses equipped with automated climate control and lighting systems requires stable electrical networks and well-maintained transport routes to rapidly distribute products. Without adequate infrastructure, even the most innovative technologies lose a significant portion of their impact, limiting local producers' competitiveness. Maximizing the performance of horticulture in Buzau County is possible only when all these factors act synergistically. Combining favorable natural conditions with developed infrastructure and cutting-edge technologies can generate a dynamic agricultural sector capable of attracting investment and adapting to market demands. Modern orchards, equipped with irrigation and frost protection systems located in fertile soil areas, are clear examples of such an efficient interaction, enabling the production of high-quality, competitive products for both domestic and international markets. In contrast, the lack of integration of these factors can lead to stagnation or decline in regional horticulture. Infrastructure deficiencies and limited access to modern technologies can diminish the positive impact of natural conditions, resulting in reduced cultivated areas and lower farmer incomes. Such a situation may lead to agricultural workforce migration, further weakening local horticulture's development capacity. Recent analyses of the agricultural labor market indicate significant regional differences in job vacancy rates, suggesting that the development of specialized agricultural sectors, such as horticulture, may be directly influenced by workforce availability and access to qualified personnel (Manolache et al., 2023).

To ensure the sustainability and growth of the horticultural sector in Buzau County, an integrated approach is required. This approach should focus on infrastructure modernization, stimulate investments in innovative technologies, and optimize the use of available natural resources. Such a strategy would improve the productivity and competitiveness of local horticulture and strengthen the county's position within the national agricultural economy.

5. Conclusions

The analysis of cultivated areas during 2019–2023 highlights a slight reduction in the land used for vegetable cultivation and other horticultural crops, alongside a stabilization trend and even a modest increase in orchard areas. This dynamic suggests a progressive shift towards perennial crops characterized by higher economic value and greater adaptability to climate change.

In this context, horticulture in Buzau County stands out due to its long-standing tradition and considerable potential, supported by favorable pedoclimatic conditions, the gradual development of infrastructure, and the increasing integration of modern technologies. The analysis of cultivated areas in recent years reveals both opportunities and significant challenges. The evolution of horticultural land use reflects fluctuating trends, with declines in specific segments, such as vegetables and flowers, and a slight increase in orchard areas. These changes highlight the need for adaptive measures to effectively address challenges related to climate change, underdeveloped agricultural infrastructure, and unequal access to advanced technologies. Comparing the cultivated area in Buzau County with that of the Southeast region reveals a significant regional contribution, although there is still untapped growth potential. The county's natural conditions, characterized by fertile soils and diverse microclimates, provide an optimal foundation for horticultural development. However, capitalizing on these advantages depends on modern agricultural infrastructure, including efficient irrigation systems, collection and processing centers for horticultural products, and better integration of local markets into national and international distribution chains. Investments in these areas are essential for stabilizing production, reducing post-harvest losses, and increasing the competitiveness of the horticultural sector.

The adoption of modern technologies is another crucial factor in enhancing agricultural performance. Drip irrigation systems, drones for crop monitoring, and digital farm management solutions can improve efficiency and optimize production processes. In this regard, research institutions such as the Buzau Vegetable Research and Development Station and the Plant Genetic Resources Bank are key in facilitating farmers' access to innovation and professional training programs. The sustainable development of horticulture in Buzau County depends on integrating natural, infrastructural, and technological factors into a coherent modernization strategy. Collaboration between local authorities, the private sector, and academic institutions is essential for implementing effective policies that support agricultural infrastructure modernization, facilitate farmers' access to innovative technologies, and promote local horticultural products on domestic and international markets. By adopting an integrated approach and making strategic investments, horticulture in Buzau County has the potential to become a benchmark for the entire South-East Region and the Romanian horticultural sector. The growth of this industry would not only stimulate local economic development and job creation and contribute to establishing a more sustainable and competitive agricultural system.

The results of this analysis provide a solid foundation for developing regional and national strategies to support the growth of the horticultural sector. Authorities can use these data to direct investments into agricultural infrastructure, irrigation systems, and modern technologies, thereby maximizing the efficiency of European and national funds in the most promising agricultural sectors. Farmers can benefit from these insights to better understand market dynamics, identify opportunities for crop diversification, and adopt more efficient agricultural practices.

At the same time, agribusiness entrepreneurs can capitalize on high-potential niche segments, such as floriculture and perennial crops, thereby contributing to the county's economic diversification. For investors in the agricultural sector, this analysis serves as a valuable tool for identifying the most profitable areas and production segments. Additionally, financial institutions can use these findings to develop tailored credit products for farmers, facilitating their access to economic resources for farm modernization. Academic and research institutions like the Buzau Vegetable Research and Development Station can leverage these data to identify research priorities and technological development needs. Moreover, universities can adapt educational programs to train specialists in line with the horticultural sector's identified needs. From a consumer perspective, this analysis can help raise awareness about the importance of local horticultural products and sustainable agriculture. Non-governmental organizations can utilize these findings to promote initiatives supporting organic farming and environmental protection, thereby facilitating the transition toward a more responsible and efficient agricultural system.

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