

## SUSTAINABLE DEVELOPMENT OF APPLE PRODUCTION IN ROMANIA: ECONOMIC TRENDS AND STRUCTURAL CHALLENGES

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### REVIEW, RESEARCH ARTICLE

#### Abstract

*Apple production represents a significant component of the agri-food sector in Romania, contributing to rural employment, food supply, and economic stability. This study aims to analyze the economic performance and recent evolution of apple production in Romania over the period 2019–2023, with a focus on cultivated area, total production, yield, and market dynamics. The research is based on statistical and comparative analysis using data collected from national and European sources.*

*The results indicate that while the cultivated area remained relatively stable, production levels and yields fluctuated significantly due to climatic variability and structural constraints. The year 2021 recorded the highest productivity, whereas 2023 was characterized by adverse climatic conditions. At the same time, farm-gate prices showed an increasing trend, influenced by rising production costs and market imbalances.*

*The study also highlights several structural weaknesses, including low productivity compared to European standards, insufficient storage infrastructure, and strong competition from imports, particularly from major producing countries within the European Union. Despite these challenges, the sector presents considerable development potential through modernization, adoption of intensive production systems, and improved market organization.*

*In conclusion, enhancing the economic performance of apple production in Romania requires integrated strategies that combine technological innovation, investment in infrastructure, and better alignment with market demands, contributing to the sustainable development of the rural economy.*

**Keywords:** (max. 5) apple production; rural economy; economic performance; agricultural productivity; yield variability; market dynamics;

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#### INTRODUCTION

Apple production represents one of the most important branches of fruit growing in Romania, playing a significant role in both the agri-food sector and the rural economy. Apples are widely consumed both fresh and processed, being used in a variety of products such as juices, jams, and bakery goods. Due to its versatility and high demand, apple production contributes substantially to ensuring food security and generating income for rural households.

From an economic perspective, the apple sector supports a large number of small and medium-sized farms, contributing to employment and income stability in rural areas. As highlighted in recent analyses, apple production has the potential to increase added value through processing, branding, and export development. Despite this potential, Romania continues to face structural challenges, including lower productivity compared to Western European countries and insufficient modernization of orchards.

Over the period 2019–2023, the Romanian apple sector has been influenced by multiple external and internal factors. Climatic

variability, including late spring frosts, droughts, and extreme weather events, has significantly affected production levels and yield stability. At the same time, increasing input costs, such as energy, labor, and agricultural materials, have placed additional pressure on producers. Market dynamics have also evolved, particularly under the influence of the COVID-19 pandemic and broader European economic changes, affecting both supply chains and price formation.

Although the cultivated area remained relatively stable at approximately 54,000 hectares, production and yields fluctuated considerably from year to year. This variability reflects the strong dependence of apple production on climatic conditions and the limited adoption of intensive and super-intensive production systems. Moreover, structural imbalances persist in the sector, including fragmented farm structures, insufficient storage capacity, and strong competition from imports, especially from major European producers.

Despite these challenges, the Romanian apple sector also presents important opportunities for development. The

modernization of orchards, the adoption of improved varieties, the expansion of storage infrastructure, and the strengthening of producer organizations and cooperatives can significantly enhance competitiveness. Furthermore, increasing consumer demand for local and sustainable products creates new market opportunities for Romanian apple producers.

In this context, the objective of the present study is to analyze the economic performance and recent evolution of apple production in Romania, focusing on key indicators such as cultivated area, production, yield, and price dynamics. The study also aims to identify the main structural challenges and development opportunities, contributing to a better understanding of the sector and supporting decision-making in the field of rural economy.

### MATERIAL AND METHODS

The research is based on the statistical analysis method, which is widely used in the study of agricultural production and rural economy.

This method was applied to analyze the evolution of apple production in Romania over the period 2019–2023, using key indicators such as cultivated area, total production, average yield, and farm-gate prices. The data

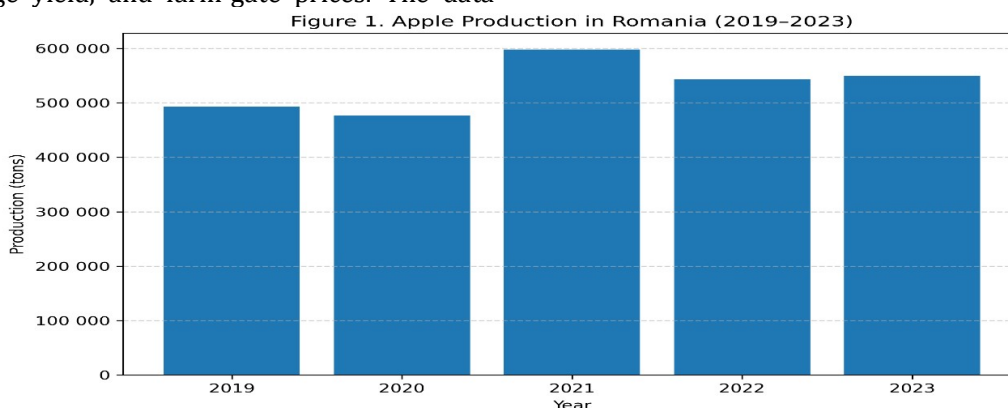
were processed to identify trends, variations, and patterns in the development of the sector.

Statistical analysis included descriptive statistics and dynamic analysis, allowing the comparison of data across different years and the identification of favorable and unfavorable agricultural periods. This approach made it possible to highlight the influence of climatic conditions and economic factors on production levels and market performance.

The method also supported the interpretation of fluctuations in productivity and prices, providing a clear understanding of the economic performance of apple production in Romania.

### RESULTS AND DISCUSSION

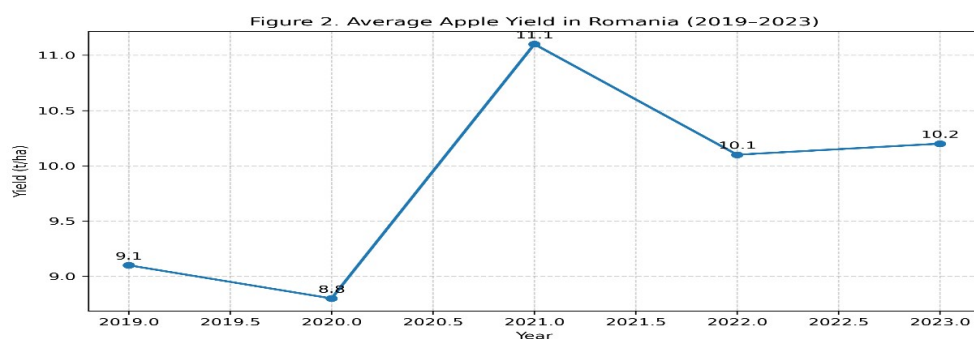
The analysis of apple production in Romania over the period 2019–2023 reveals a relatively stable cultivated area, maintained at approximately 54,000 hectares. This stability reflects the perennial nature of orchards and the slow structural changes specific to the fruit-growing sector. However, despite the constant cultivated area, significant fluctuations were observed in total production and yield, highlighting the strong influence of climatic conditions and technological factors.



Source: Own processing based on data from the National Institute of Statistics and Eurostat.

Total production varied considerably throughout the analyzed period. The year 2021 recorded the highest production level, reaching approximately 598,000 tons, which can be attributed to favorable climatic conditions, including adequate rainfall and moderate temperatures. In contrast, 2020 and 2019

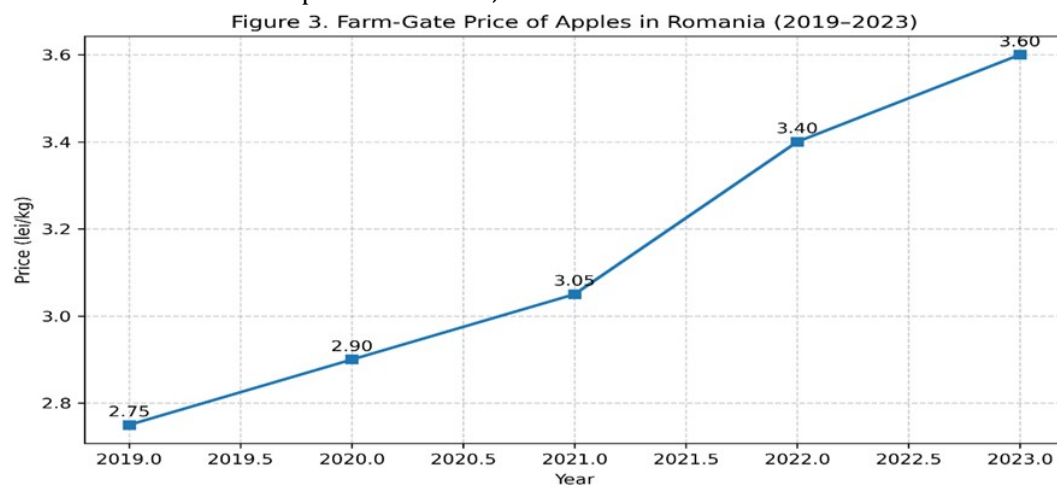
showed lower production levels, while 2023 was characterized as a difficult agricultural year due to extreme weather conditions, which negatively affected both yield and fruit quality.



Source: Own processing based on data from the National Institute of Statistics and Eurostat.

The average yield followed a similar pattern, ranging from approximately 8.8 t/ha in 2020 to a peak of 11.1 t/ha in 2021. These variations indicate that productivity in the Romanian apple sector remains highly dependent on external environmental factors. Compared to Western European countries,

where yields are significantly higher due to intensive and super-intensive production systems, Romania still exhibits a productivity gap, suggesting the need for technological modernization and improved orchard management practices.



Source: Own processing based on data from the National Institute of Statistics and Eurostat.

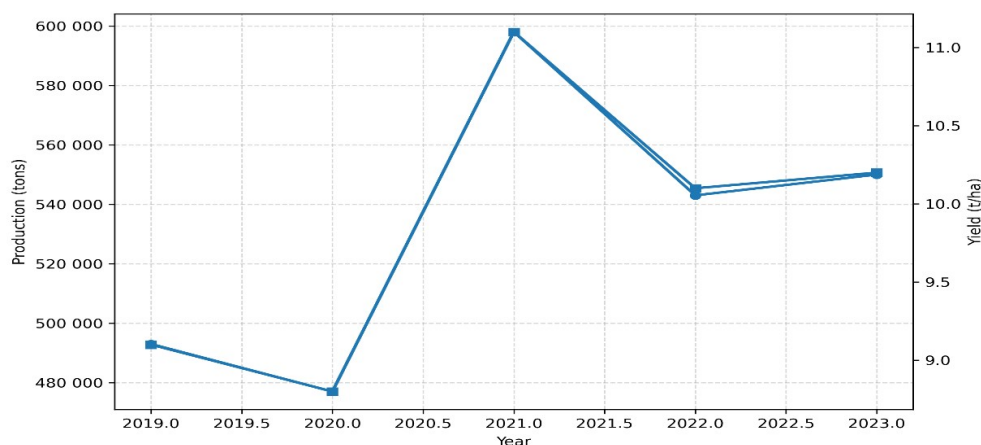
From an economic perspective, farm-gate prices showed an increasing trend during the analyzed period, rising from approximately 2.5–3.0 lei/kg in 2019 to 3.2–4.0 lei/kg in 2023. This upward trend can be explained by rising production costs, inflationary pressures, and fluctuations in supply caused by variable production levels. Although higher prices may benefit producers in the short term, they also reflect underlying inefficiencies and market imbalances within the sector.

A significant issue identified in the analysis is the structural imbalance between domestic production and market demand. Despite being one of the main apple producers in the European Union, Romania remains a net

importer of apples, particularly from countries such as Poland, Italy, and Hungary. This situation highlights weaknesses in storage infrastructure, product standardization, and market organization, which limit the competitiveness of local producers.

Furthermore, the fragmentation of agricultural holdings and the limited adoption of modern technologies contribute to lower efficiency and reduced capacity to compete on international markets. The lack of controlled atmosphere storage facilities leads to seasonal supply imbalances, forcing producers to sell at lower prices immediately after harvest while imports dominate the market during the off-season.

Figure 4. Production and Yield Dynamics of Apples in Romania (2019–2023)



Source: Own processing based on data from the National Institute of Statistics and Eurostat.

Despite these challenges, the sector also presents important development opportunities. The adoption of intensive production systems, the use of improved varieties, and investments in storage and processing infrastructure can significantly increase productivity and value added. Additionally, the organization of producers into cooperatives could improve bargaining power and facilitate access to markets.

Overall, the results indicate that while the Romanian apple sector has a strong production base, its economic performance is constrained by structural and technological limitations. Addressing these issues is essential for enhancing competitiveness and ensuring sustainable development in the rural economy.

### CONCLUSIONS

The analysis of apple production in Romania over the period 2019–2023 highlights both the strengths and the structural weaknesses of this important agri-food sector. The results indicate that although the cultivated area remained relatively stable, production and yield showed significant fluctuations, mainly due to climatic variability and technological limitations. The year 2021 was identified as a peak production year, while 2023 reflected the vulnerability of the sector to adverse weather conditions.

From an economic perspective, the increasing trend in farm-gate prices suggests a partial compensation for rising production costs; however, it also reflects market imbalances and inefficiencies within the supply chain. Despite being one of the main apple producers in the European Union, Romania continues to rely on imports, which indicates structural deficiencies such as insufficient

storage capacity, low product standardization, and weak market organization.

The study confirms that the Romanian apple sector has considerable development potential, but its economic performance is constrained by fragmentation of farms, limited adoption of modern technologies, and insufficient integration into value chains. These findings emphasize the need for strategic interventions aimed at improving productivity, competitiveness, and sustainability.

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