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TRANSFORMĂRI ȘI TENDINȚE ÎN PATRIMONIUL POMICOL AL ROMÂNIEI ÎN ULTIMUL DECENIU: ÎNTRE TRADIȚIE ȘI ADAPTARE LA SCHIMBĂRILE CLIMATICE ȘI PIEȚELE GLOBALE

TRANSFORMATIONS AND TRENDS IN ROMANIA'S FRUIT TREE HERITAGE IN THE LAST DECADE: BETWEEN TRADITION AND ADAPTATION TO CLIMATE CHANGE AND GLOBAL MARKETS

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Abstract

In the context of European and global trends regarding agricultural policies, climate change, domestic and foreign market demand dynamics, labor migration, and progress in horticultural research, Romania is aligning its fruit-growing development strategies, adapting to these transformations by modernizing plantations and diversifying cultivated species. This study analyzes the evolution of Romania's fruit tree heritage in the last decade, from 2013 to 2023, focusing on changes in total cultivated areas, agricultural holdings total number, fruit trees total number and total production by species, and the distribution of fruit tree species and cultivars. The case of Argeș County is examined as a regional example of both the challenges and opportunities in preserving fruit tree heritage. The conclusions emphasize the need for a balance between modernization and conservation of local fruit biodiversity as part of the sustainable agricultural development strategy in Romania.

Cuvinte cheie: sector pomicol, soiuri, suprafețe cultivate, producții, județul Argeș.
Key words: fruit growing sector, cultivars, cultivated areas, yields, Argeș County.

1. Introduction

Romania has a long-standing tradition in the fruit-growing sector, characterized by a large number of cultivated species and cultivar diversity adapted to the country's differing climate zones (Asănică & Hoza, 2013; Antofie et al., 2016; Ștefan et al., 2018 a, b; Coman et al., 2025). Due to the numerous orchards that have been established, the country became a significant fruit producer, improving both local consumption and the national economy (Coman et al., 2020). The Romanian fruit-growing heritage, which includes both traditional cultivars created by Romanian breeders and those introduced from other countries, is fundamental for food availability and safety, genetic diversity, and the preservation of local cultural identity also (Cociu et al., 1999; Madoşă, 2004; Ardelean et al., 2006; Leonte, 2011; Muntean, 2012; Cordea, 2014; Asănică, 2017; Butac et al., 2017; Sturzeanu et al., 2022).

According with the Law No. 348 (2003) regarding fruit growing sector, Romania cultivates 28 different fruit species (Figure 1), including three pomes' species - apple (*Malus domestica*), pear (*Pyrus communis*) and quince (*Cydonia oblonga*), six drupes' ones - plum (*Prunus domestica*), cherry (*Prunus avium*), sour cherry (*Prunus cerasus*), apricot (*Prunus armeniaca*), peach (*Prunus persica*) and nectarine (*Prunus persica var. nucipersica*), four nuts - walnut (*Juglans regia*), almond (*Prunus amygdalus*), hazelnut (*Corylus avellana*) and chestnut (*Castanea sativa*), two mulberries - *Morus alba*, *Morus nigra*, and thirteen shrubs and berries - currant (*Ribes sp.*), gooseberry (*Ribes uva-crispa*), raspberry (*Rubus idaeus*), blueberry (*Vaccinium corymbosum*), blackberry (*Rubus fruticosus*), rosehip (*Rosa canina*), elderberry (*Sambucus nigra*), Damask rose (*Rosa damascena*), honeysuckle (*Lonicera caerulea*), corn (*Cornus mas*), sea buckthorn (*Hippophae rhamnoides*), goji (*Lycium barbarum*), strawberry (*Fragaria* × *ananassa*).

Fruit cultivation in Romania is closely related to natural vegetation zones and their geographic characteristics (Law No. 348, 2003; Coman et al., 2014). Figure 2 illustrates the territorial organization of Romania's counties by macro-regions and development regions, according to INS, while Figure 3 presents the spatial distribution of fruit-growing basins by county, highlighting the regional fruit-growing areas across the country (Coman et al., 2014). In the beech forest subzone, orchards of currants, gooseberries, blueberries, and some apple cultivars are established on hills at 500–800 m altitude. In the gorun forest subzone, raspberries, apples, plums, and cherries are cultivated at 300–800 m in middle and lower altitude hill areas (Law No. 348, 2003; Coman et al., 2014). Apples, pears, plums, quinces,

cherries, almonds, and strawberries can be cultivated in the oak forest's subzone, which covers the northern part of the Romanian Plain, the Getic Piedmont, and the western hill ranges at altitudes of 50 to 500 meters (Law No. 348, 2003; Coman et al., 2014). Nearly all fruit species are produced in silvosteppe zones (50–500 m altitude) in different regions, especially under irrigation systems (Law No. 348, 2003; Coman et al., 2014). Apricots, peaches, almonds, plums, cherries, apples, pears, and nuts are favored by irrigated cultivation in the Danubian steppe zone, which includes the eastern and southern lowlands, Dobrogea, the Bârlad Plateau, and the Siret Plain (0–200 m altitude) (Law No. 348, 2003; Coman et al., 2014).

In the past decade, the Romanian fruit-growing sector has undergone significant changes due to agricultural policies, climate change, domestic and foreign market demand dynamics, labor migration and progress in horticultural research (Coman et al., 2020; Coman et al., 2025). By modernizing plantations and management technology, enhancing the varietal conveyor, and introducing new species into cultivation, Romania is adjusting its fruit-growing development strategies to these changes (Coman et al., 2020; Sturzeanu et al., 2022).

This study analyzes the evolution of Romania's fruit tree heritage in the last decade, focusing on changes in total cultivated areas, agricultural holdings total number, fruit trees total number and, total production by species, and the distribution of fruit tree species and cultivars also. As a regional example of the challenges and opportunities in preserving fruit tree heritage, the situation of Argeş County is reviewed.

2. Material and methods

In order to identify trends and strategic directions, this research uses a mixed-methods approach that combines quantitative data analysis with qualitative case studies. Based on official data regarding the distribution of fruit-growing heritage in Romania between 2013-2023, and analysing the primary national and international sources such as INS (National Institute of Statistics), APIA (Agricultural Payments and Intervention Agency), MADR (Ministry of Agriculture and Rural Development), ISTIS (the State Institute for Testing and Registration of Varieties), FAOSTAT Database (Food and Agriculture Organization of the United Nations), Eurostat, European funding program reports, statistics from the European Agricultural Fund for Rural Development (EAFRD), specifically Submeasure 4.1a. (NRDP 2014–2020), transition period (NRDP 2020–2023) and DR-15 (CAP Strategic Plan 2023-2027), as well as relevant scientific papers and articles, the information's were centralized as follows: total cultivated areas, agricultural holdings total number, fruit trees total number and total production for every cultivated species. Argeș County has been examined as a regional example regarding the challenges and opportunities in preserving fruit tree heritage.

3. Results and discussions

Fruit cultivation continues to be essential to Romania's agricultural landscape, influencing cultural identity, supporting rural development, and encouraging agritourism (Vîntu et al., 2016; Zlati & Paşcu, 2021; Călina et al., 2022; Marin & Voicilă, 2024; Coman et al., 2025). Simultaneously, integration into international markets presents opportunities for export growth, while requiring technological adaptation and competitiveness (Chereji et al., 2022; Coman et al., 2025). In 2013, Romania's total cultivated agricultural area was 8,166,824 hectares, including productive orchards that cover 147,435 ha (INS, 2025). Although INS reported an increase in the total agricultural cultivated area in 2023 to 8,211,163 ha, the orchard area decreased by approximately 5,500 ha, reaching 141,860 ha (INS, 2025). Despite this decline in total orchard surface, sustained investments through national and European financing programs have supported the modernization of fruit farms (Coman et al., 2025; INS, 2025; Prigoreanu et al., 2025). As a result, the number of plantations using advanced technology for establishment and maintenance has increased significantly (Coman et al., 2025). The total number of fruit trees increased slightly, from 78.24 million in 2013 to 80.71 million in 2023, according to the National Institute of Statistics (INS, 2025). This rise is attributed to the planting of new orchards and the ongoing implementation of new projects. The total fruit production varied considerably from one year to another (Chițu et al., 2015), depending on the climatic conditions and the phytosanitary state of the plantations (Chițu et al., 2016 b). In general, a trend of increasing production was registered due to the growth of high-density plantations, the use of superior cultivars, and improved orchard management. These were the key reasons for the minor increase in total production from 1,299,972 to 1,466,008 tons despite these decreases (INS, 2025). At the same time, the widespread introduction of modern, high-yielding cultivars has accelerated, frequently to the disadvantage of local and traditional ones (Coman et al., 2025). For example, in locations such as Argeș County, long-established local apple cultivars such 'Frumos de Voineşti' have been largely replaced by commercial varieties such as 'Gala' and 'Idared', reflecting both market preferences and growers' efforts to improve production and profitability.

European global trends regarding agricultural policies

The fruit-growing sector has been significantly impacted by the current trend in agricultural policies at the European and worldwide levels toward sustainability, climate resilience, biodiversity protection, and digital advancement (Chereji et al., 2022; Prigoreanu et al., 2025). The Common Agricultural Policy (CAP) 2014–2020 and the current CAP 2023–2027 of the European Union place an increased focus on ecological systems, climate-smart agriculture, environmental constraints, and support for high-value perennial crops. EU member states are encouraged by these policy strategies to reconsider orchard systems in order to make them more efficient, competitive, and ecologically sustainable (Chereji et al., 2022; Prigoreanu et al., 2025). As part of long-term food security measures, FAO agricultural development recommendations promote increased diversity and resilience, and improve resource-use efficiency in perennial crops on a worldwide scale. These policy frameworks provide Romanian fruit-growing sector the conceptual basis that allows it to adapt its cultivation technology (European Commission, 2022).

The modernization of Romania's fruit-growing sector has been increased through European funding, especially through Sub-measure 4.1a implemented under the 2014-2020 National Rural Development Programme (NRDP), the Transition Period between 2021 and 2023, and the current DR-15 intervention under the European Union's Common Agricultural Policy (CAP) Strategic Plan. Between 2015 and 2022, a total of 509 orchard farms received financing through Sub-measure 4.1a, supporting both the establishment of new orchards and the restructuring of older ones (AFIR, 2023 a, b; Chereji et al., 2022). Overall, PNDR 2014–2020 financed 66,709 agricultural investment projects, of which approximately 2.60 billion EUR were contracted and 1.86 billion EUR were effectively paid to beneficiaries (AFIR, 2023 a, b). According to AFIR, 2022, 44 more projects totalling 20.33 million EUR for orchard establishment, modernization, and machinery acquisition were chosen during the final fruit-growing session in 2022. High-density planting systems, drip irrigation, anti-hail protection, and modern conditioning and storage facilities have all been made easier to implement due to these investments, which have increased productivity and improved market competitiveness (AFIR, 2020). Overall, EU and state rural development initiatives continue to operate as the main drivers of technological modernization in Romanian fruit growing (MADR, 2021; MADR, 2023).

Impact of climate change on orchard productivity and durability

One of the most significant factors impacting fruit production systems all across Europe is climate change (Khoch et al., 2007; Rosenzweig et al., 2007; Busuioc et al., 2015; Muluneh, 2021; Antala et al., 2022). Numerous temperate fruit species are suffering changes in phenological plant stages, pest pressure, and production due to rising temperatures, increased climatic variability, late spring frost incidents, modified patterns of precipitation, extended summer droughts, and the frequency of extreme weather conditions (Coman et al., 2014; Gullino et al., 2021; Chițu et al., 2022; Opriță et al., 2022; Butcaru et al., 2023; Moale et al., 2023; Septar, 2024; Chiorean et al., 2025). The IPCC (2022) reports that while Eastern Europe, including Romania, is more at risk of hydric stress and temperature extremes that damage orchard viability, mean temperature rises in Europe have been quicker than the global average (Chițu et al., 2015; Chițu et al., 2016 a; Septar et al., 2024). Because of this, farmers are being forced to use more drought-tolerant species or rootstocks, use irrigation technologies, and modify orchard planning and zoning, among other adaptive management measures (Asănică, 2019; Butcaru et al., 2023).

Domestic and foreign market demand dynamics

Orchard systems and species distribution are significantly impacted by changes in consumer demand, global trade, and supply chain integration (Asănică, 2017). Fruit quality, food safety, local origin, high nutritional content, and products from environmentally friendly practices are becoming even more important to European customers (Asănică, 2017; Butac et al., 2017). Additionally, local producers are under pressure due to the imports from non-EU nations, as global market competitiveness has increased (Eurostat, 2023). In order to satisfy both local tastes and export possibilities, Romania's fruit industry has needed to adapt by modernizing plantations, developing post-harvest technologies, and diversifying species (Asănică, 2017; Butac et al., 2017; Chițu et al., 2022). Export-oriented competition is becoming a major factor in species and cultivars selection and orchard modernization also (Sturzeanu et al., 2022; Chițu et al., 2023).

The impact of labor migration on orchard management and performance

The availability of agricultural labor in Romania has been greatly impacted by both internal and external labor migration (Camară, 2019). The agriculture sector is experiencing structural shortages as a result of the long-term migration of trained and seasonal workers to Western European nations. This is especially true for labor-intensive products such as fruits. Romania has one of the highest rates of emigration in the EU, according to OECD (2020), with seasonal labor mobility being especially noticeable in horticulture. In order to make up for the smaller workforce, home growers have been under pressure to implement more mechanized orchard systems, switch to species that require less manual labor, and invest in training and technical innovation. As a result, labor migration is now a crucial but indirect component in changing orchard management practices.

Research advancements in horticulture

New cultivars, improved rootstocks, precision horticulture technology, and orchard designs customized to market demands and climate constraints have all been enabled through advances in horticultural science (Butac et al., 2021; Mazilu et al., 2022). In Europe, current breeding programmes and research facilities focus on developing cultivars that are more resistant to disease, have longer shelf lives, and are more resilient to drought and high temperatures (Pio et al., 2018; Sturzeanu et al., 2022; Chivu et al., 2023). At the national level, Romanian research organizations such as USAMV Bucharest and RIFG Pitești have improved technical recommendations, supported sustainable management practices, and contributed to introducing new fruit species (such as kiwi, jujube, asimina, fig, or kaki) into local production systems (Sumedrea et al., 2014; Iliescu et al., 2019 a; Iliescu et al., 2020; Stan et al., 2021; Ciceoi et al., 2022; Iliescu et al., 2022 b; Stănică 2022 a; Asănică, 2024). These scientific advancements support Romania's progress towards more resilient and competitive fruit-growing technology.

Dynamics of fruit-growing structures in Romania over the last decade (2013–2023)

Malus species were introduced in Romania at the end of the 14th century, and true the time, over 70 valuable native cultivars were bred (Grădinariu et al., 2003; Braniște et al., 2007; Gavrilă & Petre, 2022; Militaru et al., 2024). Romania's apple industry were structural changes between 2013 and 2023 (Figure 4). Due to continued fragmentation and the coexistence of small farms with a few modern large-scale producers, the number of agricultural holdings with apple orchards increased from 117,444 to 133,562. As a result of orchard ageing and partial abandonment of marginal lands, the total cultivated area decreased by almost 9% (from 55,138 to 50,035 ha), and the number of trees decreased from 27.06 to 25.02 million. The growth of high-density plantations, the use of superior cultivars, and improved orchard management were the key reasons for the minor increase in total production from 513,580 to 542,183 tons despite these decreases. Overall, these trends indicate a structural shift toward smaller but more technologically advanced and productive apple orchards, which reflects both modernization initiatives and adaptability to market and climatic challenges. Among the most valuable Romanian apple cultivars are 'Romus 3', 'Rustic' and 'Delicios de Voinești', the most appreciated fruit attributes by the consumers being firmness, juiciness, and balance between acidity and soluble solids content (Braniște et al., 2007; Manolache, 2024; Militaru et al., 2024).

Pyrus communis has been cultivated in Romania for over six centuries, and Romanian researchers developed more than 40 cultivars (Sturzeanu et al., 2022; Erculescu, 2024). Romania’s pear sector between 2013 and 2023, highlighting notable structural changes (Figure 5). The total number of agricultural holdings cultivating pears increased significantly, from 24,004 to 29,622, suggesting a gradual consolidation or diversification of farms. Similarly, the total area planted with pears expanded from 3,680.91 ha to 4,241.57 ha, indicating renewed interest in this crop. Despite these expansions, the total number of pear trees shows only a slight decline, from almost 3.48 million to less than 3.26 million, which may reflect orchard restructuring or ageing plantations. Most striking is the sharp decrease in total production - from 66,849 tons in 2013 to 44,408 tons in 2023 - revealing a substantial drop in yield performance. This reduction may be attributed to climatic stress, disease pressure, limited technological modernization, or insufficient orchard rejuvenation. Among the most valuable Romanian pear cultivars are 'Monica' and 'Isadora', the most appreciated fruit attributes by the consumers being size, firmness, and taste.

Cydonia oblonga orchards are increasing in Romania between 2013 and 2023 (Figure 6), the total number of agricultural holdings cultivating quince increased significantly, from 1,814 to 2,975, and the total area planted with quince doubled from 147.72 ha to 346.95 ha. 'Adonia' and 'Cedonia' are two of the most important Romanian quince cultivars, consumers especially appreciated the fruit's overall appearance, flavor, and balance between acidity and soluble solid content.

Plum (*Prunus domestica*) has been cultivated in Romania for centuries and represents one of the country’s most important fruit crops (Butac et al., 2017). According to breeding records, over 40 Romanian plum cultivars have been developed by national research organizations since the 1950s (Botu et al., 2010; Butac et al., 2017). Romania’s plum sector between 2013 and 2023, revealing a generally positive dynamic across all key indicators (Figure 7). The number of agricultural holdings cultivating plums increased markedly, indicating a sustained interest in this traditional species. Likewise, the total area dedicated to plum cultivation expanded from 68,480.79 ha to 83,276.04 ha, confirming the species’ economic importance. Although the total number of plum trees shows a slight decrease, this may reflect orchard restructuring, replacement of old plantations, or the adoption of more intensive systems. Despite this modest decline, total production increased significantly - from 512,459 tons to 655,872 tons - demonstrating improved productivity. This suggests better orchard management, the use of more productive cultivars, or favorable agro-climatic conditions during certain seasons. Overall, the data indicate a strengthening of the plum sector, characterized by expanded cultivated area and higher production, even amid structural adjustments to orchard density and composition. Through the most

valuable Romanian plum cultivars are 'Romanța' and 'Milenium', the majority of consumers especially appreciated the fruits' attributes, such as overall appearance, color, and taste.

Romanian cherry cultivation (*Prunus avium* and *Prunus cerasus*) has a long tradition, and breeding programs started before the 1970s generated a rich domestic germplasm, over 60 cultivars to this moment (Soare & Dobre, 2018; Corneanu et al., 2021; Stan et al., 2024). In the last five decades, Romanian fruit-breeding researchers have officially registered over 19 new sour-cherry cultivars and 28 sweet-cherry cultivars (Soare & Dobre, 2018; Stan et al., 2024). Regarding the evolution of sweet and sour cherry cultivation in Romania between 2013 and 2023, it highlights a generally upward trajectory in structural indicators, accompanied by a contrasting decline in production (Figure 8). The number of agricultural holdings increased substantially, from 16,661 to 25,517, indicating a growing interest in cherry cultivation at the national level. Similarly, the cultivated area expanded from 5,782.81 ha to 6,380.01 ha, reflecting a moderate but steady enlargement of orchards. The total number of cherry trees also increased, from 5.65 million to 6.10 million, suggesting orchard renewal and investment in new plantations. Despite these structural improvements, total production decreased from 80,477 tons in 2013 to 68,694 tons in 2023. This decline may be linked to climate-related challenges (spring frost, drought), fluctuations in bearing cycles, or the fact that the newly established plantations have not yet reached maximum productivity potential, the trees being still young (Chițu et al., 2016 b; Perju et al., 2022). Despite improvements in cultivation practices and the establishment of protected environments, such as tunnels or solariums, which ensure fruit quality and mitigate climatic influences, total cherry production remains lower than potential (Obada et al., 2023).

Apricot (*Prunus armeniaca*) production indicators in Romania (2013–2023), presented in Figure 9, display a moderate expansion of apricot cultivation at the national level over the last decade. The number of agricultural holdings growing apricots increased from 7,178 in 2013 to 9,965 in 2023, reflecting a broader diversification trend in fruit farming. Despite this, the total cultivated area decreased slightly, from 2,667.69 ha to 2,384.48 ha, suggesting a shift towards smaller or more intensively managed orchards. The total number of apricot trees remained relatively stable, with a marginal increase from 2.20 million to 2.24 million trees. However, total production declined from 28,310 tons in 2013 to 25,626 tons in 2023, indicating potential productivity constraints linked to climatic variability, crop sensitivity, or orchard age structure. Overall, the apricot sector shows increasing farm participation but declining production, pointing to the need for improved orchard renewal, climate-resilient cultivars, and enhanced technological inputs. 'Elmar' and 'De Valu' are two of the most popular local apricot cultivars among consumers.

Romanian peach (*Prunus persica*) and nectarine cultivation began in ancient times with Greek introduction in Dobrogea and was widely cultivated from the late 19th to the early 20th century (Bucur et al., 2025). During 1970–1989, more than 40 new cultivars were developed, through a valuable national breeding program (Bucur et al., 2025). More than 30 locally bred cultivars, which are well suited to the country's soil and climatic conditions, were released beginning in 2020. Between 2013 and 2023, the peach and nectarine sector in Romania experienced a notable restructuring (Figure 10). The number of agricultural holdings increased from 3,515 to 5,350, indicating a broader adoption of these crops. However, the total cultivated area declined substantially, from 1,900.70 ha to 1,256.83 ha. A similar decrease was observed in the total number of trees, which dropped from 1,327,337 to 1,138,116. As a result, total production fell from 19,130 tons to 12,962 tons. These trends suggest a reduction in orchard surface and productivity despite a rising number of producers. While the nectarine breeding program has generated cultivars such as 'Cora' and 'Liana', famous autochthonous peach cultivars include 'Filip' and 'Regenta' (Dumitru et al., 2007; Dumitru et al., 2013). Firmness, juiciness, and flavor are the most valued attributes, according to consumer-oriented quality evaluations, making them important objectives in current breeding and cultivar selection.

Walnut (*Juglans regia*) cultivation in Romania has a centuries-old tradition, historically based on the selection of valuable biotypes from the spontaneous flora, while the commercial hazelnut (*Corylus avellana*) plantations began only after 1970 (Botu et al., 2018). The efforts of national breeding programs have resulted in the release of numerous native walnut varieties (e.g. 'Jupânești', 'Geoagiu') and approximately 9 Romanian hazelnut cultivars, adapted to local conditions (Botu et al., 2018). Between 2013 and 2023, the walnut and hazelnut sector recorded substantial structural expansion (Figure 11). The number of agricultural holdings almost doubled (from 5,660 in 2013, to 13,438 in 2023), while the total cultivated area increased more than fivefold (from 2,816.06 ha in 2013, to 14,765.14 ha in 2023), indicating an accelerated consolidation and diversification of tree nut production. The total number of trees also increased markedly, reflecting sustained orchard establishment. Consequently, production nearly doubled, highlighting both improved orchard performance and the sector's increasing contribution to national nut output. Several autochthonous walnut cultivars, such as 'Jupânești', and hazelnut cultivars, including 'Romavel' and 'Uriașe de Vâlcea', have been developed in Romania through dedicated breeding programs aimed at improving adaptation, yield, and nut quality (Vasilescu & Botu, 1997; Botu et al., 2005). Consumer-oriented quality assessment criteria for these nut species typically emphasize the ease

of detaching the epicarp and endocarp, as well as the kernel-to-shell ratio, which are key determinants of processing efficiency and market value.

Berries also registered an increase regarding the number of agricultural holdings, from 1,535 in 2013, to 6,120 in 2023, and the total cultivated area also, from 861.28 ha in 2013, to 5,420.22 ha in 2023 (Figure 12). According to Sturzeanu et al. (2022), over 15 strawberry cultivars, 10 blueberry ones, and 24 sea buckthorns were developed through Romanian breeding programs.

Varietal structure between tradition and modernization

According with Butac et al. (2021), Romania's rich cultivars assortment (Table 1) is chosen based on several important factors, including compatibility with the rootstock (for balanced development and efficient production), adaptability to local soil and climatic conditions (such as resistance to frost, drought, and diseases), and the final destination of the fruit production (fresh consumption, processing, or industrialization).

Farmers' preferences for species such as blueberries, walnuts, hazelnuts, and sweet cherries for their new plantations have been seen in the analysis of the National Rural Development Program 2014-2020 during the implementation period (Coman et al., 2020).

Recently, species such as *Asimina triloba*, *Ziziphus jujuba*, *Diospyros virginiana*, *Diospyros kaki*, *Actinidia deliciosa*, *Actinidia arguta,* and *Ficus carica* have been introduced in the Romanian fruit-growing program, reflecting the ongoing diversification of fruit species and the modernization of Romania's horticultural sector through the introduction of novel, climatically adaptable cultivars (Iliescu et al., 2019 b; Iliescu et al., 2021; Iliescu & Stănică, 2022; Iliescu et al., 2022 a; Stănică 2022 b; Chițu et al., 2023; Tabacu et al., 2025). In 2023, twenty-four cultivars of various exotic or tropical species were officially registered in Romania's Official Catalogue of Cultivated Plant Species, nineteen of which were created by Romanian breeders (Table 2).

In Romania, the shift toward high-yielding, commercially competitive fruit cultivars has intensified due to economic pressures and changing market demands, often at the expense of traditional, locally adapted ones. In counties like Argeș, where growers are increasingly adopting imported cultivars from the Netherlands, Italy, or Poland that are chosen for improved marketability, uniformity, and storage performance, local varieties have significantly decreased. Despite the strong adaptability and disease resistance of recently developed Romanian cultivars, such as 'Rustic', 'Real' and 'Romus' apples, their adoption remains limited due to insufficient promotion, limited availability of certified planting material, and growers' preference for internationally recognized cultivars. Concerns regarding long-term sustainability are raised by the shift toward high-yielding commercial cultivars, which have increased productivity and improved economic returns while also hastening the depletion of regional genetic resources and reducing the fruit industry's cultural and agro-biodiversity heritage.

Case study - the evolution of the fruit-growing sector in Argeș County between 2013 and 2023

Argeș County, one of Romania's oldest and most representative fruit-growing regions, is characterized by an optimal climate for most of the fruit's species, diverse geological structure, and a longstanding pomological heritage (Coman et al., 2014; Chițu et al., 2016 a). Historically recognized for apple and plum cultivation, the region has undergone substantial structural, technological, and varietal changes over the last decade, reflecting broader national transformations influenced by climate changes, labor migration, market pressures, and modernization driven by European agricultural policy (European Commission, 2025; INS, 2025).

Between 2013 and 2023, the fruit-growing area in Argeș remained relatively stable - declining only slightly from 20,370 ha to 20,280 ha. The number of orchards in production decreased from 22,154 to 20,421 in 2023, while the total number of fruit trees dropped from 6.63 million to 5.07 million (INS, 2025). These reductions indicate the ongoing abandonment of ageing traditional orchards and the consolidation of farms. This structural decline is consistent with decreasing total fruit production, from 139,234 t in 2013 to 115,451 t in 2023, an outcome intensified by climatic stressors such as spring frost, drought, and increasing pest pressure. Table 3 illustrates how orchards in Argeş County changed between 2013 and 2023 based on the INS, APIA, and MADR data.

Modernization has been strongly associated with EU funding, particularly Sub-measure 4.1a under the National Rural Development Programme 2014–2020 (NRDP), which supported high-density orchard establishment, drip irrigation, anti-hail systems, and orchard mechanization (AFIR, 2022; AFIR, 2023 a, b; European Commission, 2022 a, b). These investments significantly increased the share of modernized orchards. Nevertheless, smallholders continue to face barriers in accessing funding due to co-financing constraints and administrative burdens (ENRD, 2020).

Regarding varietal composition, this has also changed. Traditional Romanian apple cultivars such as 'Frumos de Voinești', 'Jonathan', and 'Florina', have declined due to limited market appeal, variable fruit size, and reduced storage potential. Their place has been taken largely by commercial cultivars such as 'Gala', 'Fuji', 'Idared', and 'Granny Smith', which are preferred in retail chains for their uniformity, color,

and long postharvest storage capacity. Similar shifts occur in plum, cherry, and walnut cultivation, driven by market opportunities and resilience to climate change.

Farmers in Argeș face multiple challenges, including orchard ageing, rural depopulation and labor migration, climate-related risks (late frosts, droughts), and unequal access to modernization funds. Nevertheless, local initiatives, such as replanting programs, ecological fruit production, and small-scale processing, illustrate the potential for sustainable revitalization of the sector. The county's nine main fruit-growing basins (Curtea de Argeș, Tigveni, Domnești, Pitești, Stâlpeni, Săpata, Topoloveni, Vedea, and Câmpulung) demonstrate both the persistence of tradition and the ongoing adaptation to technological and environmental change (Coman et al., 2014). Emerging initiatives such as organic fruit production, local processing (juices, jams, dried fruits), and rural tourism underscore the potential for sustainable revitalization. However, the absence of a coordinated strategy for conserving genetic resources, combined with the ageing farming population, poses risks for the preservation of local pomological heritage. Overall, the fruit-growing sector in Argeș County exemplifies Romania's broader movement from traditional, biodiversity-rich orchards toward modern, competitive systems. While modernization has enhanced productivity and market integration, safeguarding local cultivars, supporting smallholders, and enhancing climate resilience remain essential priorities for long-term sustainability (Chițu et al., 2016 a).

In Romania, including Argeș County, the introduction and gradual expansion of new fruit species such as kiwi (*Actinidia* species), kaki (*Diospyros kaki*), pawpaw (*Asimina triloba*), and serviceberry (*Amelanchier* spp.) reflect growers' increasing interest in climate-resilient and high-value alternative crops. In recent years, kiwi fruit (*Actinidia* species) cultivation has begun to expand in several localities of Argeș County, particularly in Cocu, Mărăcineni and Stănești (Figure 13), marking a notable shift toward the introduction of alternative fruit species adapted to Romania's changing climatic conditions. Warmer winters, longer frost-free periods, and increasing interest in high-value niche crops have encouraged local growers to experiment with kiwi orchards, often starting with small demonstration plots that have gradually evolved into commercially viable plantations (Chițu et al., 2023). The species' positive performance in these areas, combined with growing domestic demand for exotic fruits and the availability of EU and national diversification funding, has further stimulated adoption. These emerging plantations illustrate both growers' adaptability and the broader trend toward species diversification within the Romanian fruit sector.

4. Conclusions

The evolution of Romania's fruit tree heritage between 2013 and 2023 indicates a significant structural and functional transformation of the sector, driven by technological, economic, and climatic challenges. The modernization of orchards, supported by European funding and advances in horticultural technology, has improved productivity and efficiency but has also accelerated the decline of traditional cultivars and reduced genetic diversity. This dual reality is best illustrated in Argeș County, where intensive and super-intensive systems tailored to market and climate demands coexist with traditional orchards. A balanced strategy is needed to ensure the long-term viability of Romania's fruit-growing industry, one that protects the nation's rich pomological heritage while encouraging innovation. Financial assistance for farm modernization and species diversity, the preservation and promotion of traditional cultivars, the construction of processing and marketing infrastructure, and the promotion of research, innovation, and sustainable resource use should be the main goals of future initiatives. Effective communication and collaboration among academics, farmers, distributors, processors, and consumers is essential for sustaining Romanian fruit production, fostering resilience, and preserving biodiversity.

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Tables and Figures

Table 1. Overview of the principal cultivars of fruit tree species cultivated in Romania

Species	Cultivars
Apples *(Malus domestica)*	Amalia [2], Ardelean [2], Aromat de vară [1, 2], Aura [2], Auriu de Bistrița [1, 2], Brumar [2], Cezar [2], Ciprian [1, 2], Crimson Crisp [3], Dacian [2], Delia [1], Delicios de Voineşti [1, 2], Elstar [3], Fălticeni [1, 2], Florina [1, 2, 3], Frumos de Voineşti [1, 2], Fuji [3], Gala [3], Generos [1, 3], George [2], Golden Delicious [1, 2, 3], Goldrush [3], Goldspur [1, 2], Granny Smith [1], Idared [1, 2, 3], Inedit [2], Iris [2], Jonagold [1, 2, 3], Jonathan [1, 2, 3], Kaltherer Böhmer [2], Luca [2], Mutzu/Mutsu [1, 2], Parmen auriu [1], Pionier [1, 2], Prima [1, 3], Rădăşeni [1], Real [2], Red delicious [3], Red Melba [1], Remar [2], Revidar [2], Rinarei [2], Romus 1 [1], Romus 2 [1], Romus 3 [2, 3], Romus 4 [3], Rumina [2], Starkrimson [1, 2], T120 [1], T195 [1], Topaz [3], Valery [2], Voinea [2], Wagener premiat [1, 2]
Pears *(Pyrus communis)*	Abatele Fetel [1], Aniversare [1, 2], Andrei [2], Argessis [1, 2], Aroma [2], Aromat de Bistrița [2], Beurré Bosc [3], Beurré Hardy [3], Carpica [1, 2], Conference [1, 2, 3], Contesa de Paris [2, 3], Corina [2], Cristal [2], Curé [1, 2, 3], Daciana [3], Euras [2], Favorita lui Clapp [1, 2], Haydeea [2, 3], Highland [1], Isadora [2], Monica [1, 2, 3], Napoca [1, 2], Nicolas [2], Olivier de Serres [2], Pandora [2], Passe Crassane [3], Republica [2], Romcor [2], Rubys [2], Silvia [2], Timpurii de Dâmboviţa [1, 2], Triumf [1], Tudor [2], Untoasă Bosc [1, 2], Untoasă de Geoagiu [2], Untoasă Hardy [2], Williams [1, 2, 3], Williams roşu [1, 2, 3]
Quince *(Cydonia oblonga)*	Adonia [2, 3], Aromate [2, 3], Aurii [2, 3], Bereczki [2, 3], Campion [2, 3], De Constantinopol [2, 3], De Huşi [2, 3], De Portugalia [2], Moldoveneşti [2, 3]
Plum (*Prunus domestica*)	Agent [2, 3], Alina [2], Alutus [2], Andreea [2, 3], Anna Späth [2, 3], Cacanska Lepotica [3], Cacanska Rodna [3], Carpatin [1, 2], Celia [2], Centenar [1, 2, 3], D'Agen [1, 2, 3], Dâmboviţa [1], Gras ameliorat [2], Gras românesc [1, 2, 3], Ialomiţa [2], Iulia [2], Milenium [2], Minerva [1], Pescăruş [1, 2], Piteştean [2], Record [1, 3], Renclod Althan [1, 2, 3], Renclod de Caransebeş [1], Rivers timpuriu [1, 2, 3], Romanța [2, 3], Silvia [1], Stanley [1, 2, 3], Tita [1, 2], Topval [2], Tuleu gras [1], Tuleu gras [2, 3], Tuleu timpuriu [1], Vâlcean [1, 2], Vinete de Italia [1], Vinete românești [1, 3]
Cherry (*Prunus avium*)	Alexus [2], Amar Galata [1, 3], Amar Maxut [1, 2], Amara [3], Andante [2], Andreiaş [2], Bigarreau Burlat [1, 3], Bing [1], Bigarreau Dönissen [3], Boambe de Cotnari [1, 2, 3], Bucium [2], Cătălina [2], Cetăţuia [2], Cociuvaş [2], Croma [2], Daria [2, 3], Elaiaşi [2], Ferrovia [3], Galata [2], George [2], Germersdorf [1, 2, 3], Golia [2], Hedelfinger [2, 3], Iaşirom [2], Iosifan [2], Izverna [2, 3], Jubileu [2], Kordia [3], Ludovan [2], Margonia [2], Maria [3], Mihailiş [2], Mioriţa [2], Miris [2], Muşatini [2], Negre de Bistriţa [1], Nicolrei [2], Paulică [2], Pietroase Donissen [1], Ponoare [2, 3], Radu [2], Rivan [3], Romaria [2], Roşii de Bistriţa [1, 2], Rubin [2, 3], Sam [1, 2, 3], Skeena [3], Silva (amar) [2, 3], Special [3], Ştefan [2], Stella [1], Van [1, 3]
Sour cherry (*Prunus cerasus*)	Bucovina [1, 2], Botoşani [1, 2], Crişana [1, 2, 3], Engleze timpurii [2], Iva/Ilva [1, 2], Meteor [1], Mocăneşti [1, 2, 3], Nana [1, 3], Oblacinska [1, 3], Pitic [2, 3], Rival [2, 3], Schattenmorelle [1, 2, 3], Stelar [2], Timpuriu de Cluj [2], Timpurii de Osoi [2], Timpurii de Piteşti [2], Ţarina [2, 3], Van [2], Vrâncean [2]
Apricot (*Prunus armeniaca*)	Adina [3], Amiral [1, 3], Andrei [3], Augustin [3], Auraş [1, 3], Bucovina [1], Bucur [1], Callatis [1, 2], Carmela [3], Cea mai bună de Ungaria [1, 2], Comandor [1, 2], Dacia [1, 3], Dana [1], De Valu [1], Elmar [2, 3], Excelsior [1, 2], Favorit [1], Goldrich [2, 3], Ilinca [2], Litoral [1, 2], Mamaia [2, 3], Neptun [2, 3], Olimp [1, 2, 3], Ovidius [3], Rareş [3], Rekord [2], Roşii de Băneasa [1, 2], Selena [1, 2], Silvana [2], Sirena [2, 3], Sulina [2], Sulmona [2, 3],Tudor [1, 2, 3], Umberto [1, 2], Viorica [3]
Peach (*Prunus persica*) and Nectarine (*Prunus persica* var. *nucipersica*)	- Alexia [3], Amalia [3], Antonia [3], Catherine sel I [3], Cardinal [1, 2], Collins [1, 2], Cora [3], Cecilia [3], Congres [1, 2, 3], Costin [3], Creola [3], Delta [3], Filip [3], Flacăra [1, 2, 3], Florica [2], Filip [2], Florin [2], Herăstrău [3], Iustin [2], Jerseyglo [2], Jerseyland [1, 2], Liana [3], Liviu [3], Marina [3], Melania [3], Mimi [2], Minodora [2], Monica [2], Năică [3], NJC 108 [1], Raluca [2, 3], Redhaven [1, 2], Redskin [2], Regenta [2], Romamer 2 [3], Southland [2], Splendid [2, 3], Springcrest [1, 2, 3], Springold [2], Suncrest [2], Superbă de toamnă [1, 2, 3], Triumf [2, 3], Vesuvio [1, 2], Veteran [2], Victoria [2, 3]; Anemona [2], Cora [1, 2], Costin [2], Crimsongold [1, 2], Delta [1], Fantasia [1, 2], Flavortop [2], Independence [2], Liana [2], Marina [2], Nectared [1], Romamer 2 [1, 2], Valerica [2]
Walnut (*Juglans regia*)	Anica [2], Argeşan [1, 3], Carpatica [2], Cogălniceanu [2], Geoagiu 65 [1, 2, 3], Germisara [2, 3], Grădinar [2], Jupâneşti [1, 2, 3], Miroslava [1, 2], Muscelean [1], Novaci [1, 2], Orăştie [1], Ovata[2], Ovidiu [2], Pescianski [2], Redval [2], Regent [2], Ronutex [2], Rubin [2], Sarmis [1], Sibişel 44 [1, 2], Susița [2, 3], Timval [2], Unival [2], Valcor [2, 3], Valcris [2, 3], Valmit [3], Valrex [2, 3], Valstar [2], Velniţa [1, 2], Vernisal [2]
Almond (*Prunus amygdalus*)	Adeluţa [2, 3], Ana [3], April [3], Cristi [2, 3], Ferragnes [1], Mărculeşti [1, 3], Mirela [2], Nicoleta [2, 3], Nikitski [1], Pomorae [1, 3], Primorski [3], Retsou [3], Sabina [3], Sanda [3], Texas [1, 3], Veronica [2], Viola [3]
Hazelnut (*Corylus avellana*)	Arutela [3], Cozia [1, 2, 3], Ennis [3], Romantela [2], Romavel [1, 3], Romnut [2], Tonda delle Langhe [2, 3], Uriaşe de Halle [1, 2, 3], Uriaşe de Vâlcea [3], Vâlcea 22 [1, 2, 3]
Chestnut (*Castanea sativa*)	Casval [3], Gureni [1], Hobiţa [1], Iza [1], Mara [1], Maraval [3], Marsol [3], Migoule [3], Polovraci [1], Precoce [3], Romval [2, 3], Tismana [1, 3]

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Species	Cultivars
Currant ***(Ribes sp)***	black currant: Abanos [1, 2, 3], Abundent [3], Amurg [1, 3], Blackdown [1], Bogatar [1], Deea [3], Houghton Castle [3], Jonkheer van Tets [3], Joseni 27 [1], Perla neagră [1, 2, 3], Poli 52 [2, 3], Record [1, 2], Record 35 [3], Ronix [3], Roșu Timpuriu [3], Tsema [2, 3]; red currant: Abundent [1], Jonkheer van Tets [2], Red Lake [1, 2], Roşu timpuriu [1, 2]; white currant: Mărgăritar [2]
Gooseberry (*Ribes uva-crispa*)	Careless [1, 3], Cernomor [3], Jubiliar [3], Rezistent de Cluj [1, 3], Sirius [3], Someş [1, 3], Verda [3], Virens [3], White Smith [1, 3], Zenit [1, 3]
Raspberry (*Rubus idaeus*)	Cayuga [1, 2, 3], Citria [1, 2], Heritage [3], Latham [3], Opal [2, 3], Ruvi [1, 2, 3], Englezesc Exploit [1], Newburg [1], Star [1]
Blackberry (*R. fruticosus*)	Dar 8 [3], Dar 24 [3], Darrow [1, 2, 3], Felix [3], Loch Ness [3], Orest [3], Smoothstem [1], Thornfree [2, 3]
Blueberry (*Vaccinium corymbosum*)	Augusta [1, 3], Azur [1, 3], Coville [1, 2, 3], Ivanhoe [1], Pemberton [1, 2, 3], Blueray [2, 3], Pastel [2], Simultan [2, 3], Ruben [2], Weymouth [2], Blue crop [3], Duke [3], Delicia [3], Elliott [3], Lax [3], Prod [3], Safir [3], Vital [3]
Rosehip (*Rosa canina*)	Braşov [1], Can [1, 2, 3], Moldova [2]
Elderberry (*Sambucus nigra*)	Brădet [1, 3], Elrom [2], Flora [1], Ina [1, 2, 3], Nero [1], Nora [2, 3]
Damask rose (*R.damascena*)	Argeş 2 [2, 3]
Honeysuckle (*Lonicera caerulea*)	Cera [3], Loni [3], Kami [2, 3]
Corn ***(Cornus mas)***	Bordo [2, 3], Săuceşti [2], Şerbăneşti [2]
Sea buckthorn (*Hippophae rhamnoides*)	Andrei [2], Andros [2], Auraș [2, 3], Carina [2], Carmen [2], Clara [2], Colosal [2], Cora [2], Cristina [2], Diana [2], Dora [2], Golden abundant [2], Mara [2], Ovidiu [2], Pitești 2 [2, 3], Pontus [2], Serpenta [2], Silvia [2], Star [2], Șerpeni [1, 2], Șerpeni 22 [3],Tiberiu [2], Victoria [2]
Goji (*Lycium barbarum*)	Anto [2], Bucur [2], Erma [2], Kronstadt [2], Sara [2], Transilvania [2]
Aronia melanocarpa	Melrom [2, 3], Nero [2, 3]
Strawberry (*Fragaria × ananassa*)	Alba [3], Benton [2], Clery [3], Coral [1], Elsanta [1], Gorella [1, 2], Ireal [2], Magic [1, 2], Marmolada (Onebor) [3], Mira [3], Premial [1, 2], Răzvan [1], Red Gauntlet [1], Sarom [2], Sătmărean [1], Senga Sengana [1, 2]
[1] Government Decision No. 156/2004; [2] Official Catalogue of Cultivated Plants for 2024;[3] Sumedrea et al., 2014	

Table 2. Fruit species that have recently been introduced into Romania's fruit-growing sector

Species		Cultivars introduced in Romania's Official Catalogue of Cultivated Plants for 2023	
		from other growing countries	Romanian creations
Pawpaw (Northern Banana) (*Asimina triloba*)		-	Artemis, Asirius, Asteria, Simina
Chinese Jujube ***(Ziziphus jujuba)***		Silk Road, Great Wall, Rain Queen, Winter Queen	Ziprim
American Persimmon (*Diospyros virginiana*)		-	Abanos, Indiana, James C, Jerry L, Virginia
Japanese Persimmon (Kaki) (*Diospyros kaki*)		-	Katim
Kiwi ***(Actinidia deliciosa)***		-	Kiball, Kigiant, Kisweet, Kiflor
Kiwi Berry ***(Actinidia arguta)***		-	Ariana, Andros
Fig ***(Ficus carica)***		-	Ada Kaleh, Nectar, Tri Kule

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Table 3. Argeș County orchards transformation for each species, between 2013 and 2023, according to the INS, APIA and MADR data

Species	Total cultivated area (hectares)		Fruit trees/plants total number		Total production (tons)	
	2013	2023	2013	2023	2013	2023
Apples ***(Malus domestica)***	5,471	5,368	1,438,041	1,244,617	139,234	115,451
Pears ***(Pyrus communis)***	1,030	902	282,085	277,600	48,531	38,821
Plum (***Prunus domestica***)	13,557	12,750	4,587,977	3,218,572	73,806	63,104
Sweet and sour cherry (***Prunus avium and Prunus cerasus***)	194	148.5	144,370	143,204	2,804	2,114
Apricot (***Prunus armeniaca***)	-	-	59,500	58,414	1,062	1,024
Peach and nectarine (***Prunus persica***)	1	4	5,101	6,529	106	87
Walnut and hazelnut (***Juglans regia*** and ***Corylus avellana***)	97	152	76,769	47,900	1,595	2,473
Berries (***Vaccinium corymbosum, Hippophae rhamnoides, Aronia melanocarpa, Rubus idaeus, R. fruticosus etc.)***	20	177	38,095	31,440	1,084	760
Strawberry (***Fragaria × ananassa***)	-	6	-	-	1,361	1,285
Other species	-	772.5	-	-	-	-
TOTAL	**20,370**	**20,280**	**6,631,938**	**5,028,276**	**269,583**	**225,119**

Fig. 1. Diversity of fruit species cultivated in Romania

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Source: https://insse.ro/cms/sites/default/files/field/publicatii/anuarul_statistic_al_romaniei_carte_ed_2024_ro.pdf

Fig. 2. Romanian counties grouped by macro-regions and development regions, according to INS

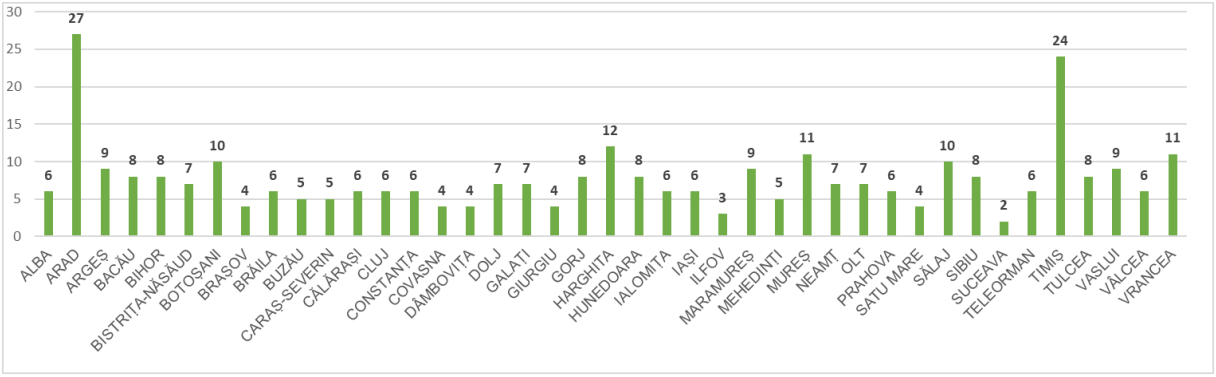

Fig. 3. Romania's fruit-growing basin numbers by county

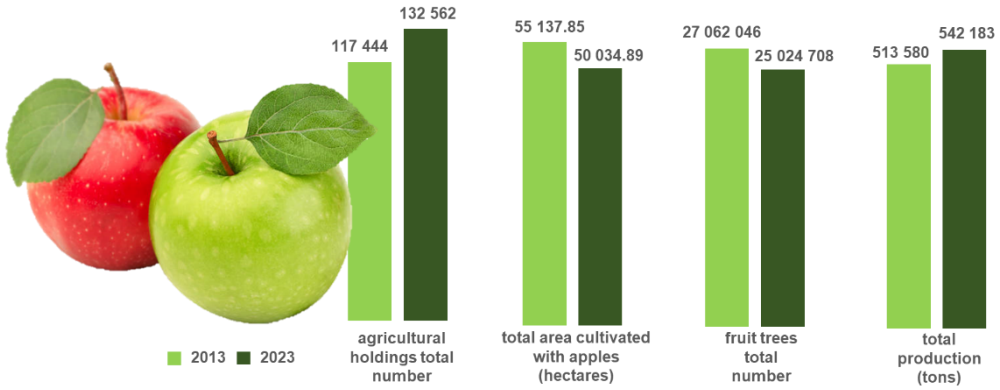

Fig. 4. Apple orchards development trends in Romania between 2013 and 2023, according to the INS and FAO data

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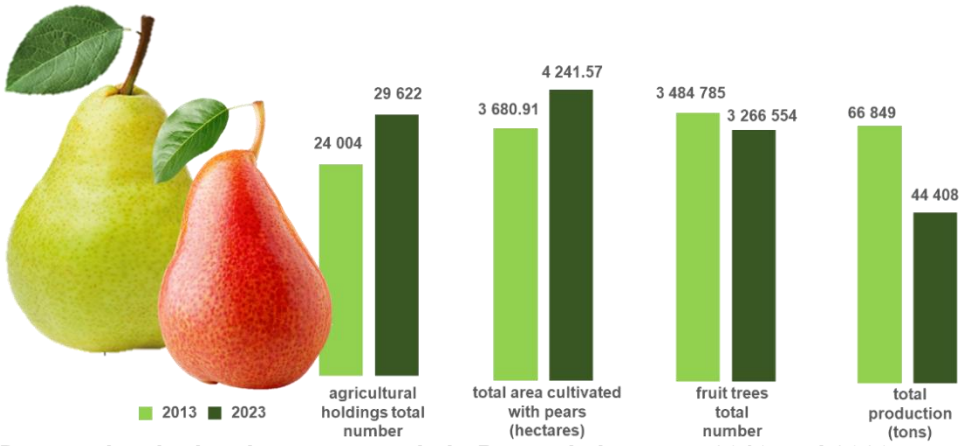

Fig. 5. Pear orchards development trends in Romania between 2013 and 2023, according to the INS and FAO data

Fig. 6. Quince orchards development trends in Romania between 2013 and 2023, according to the INS and FAO data

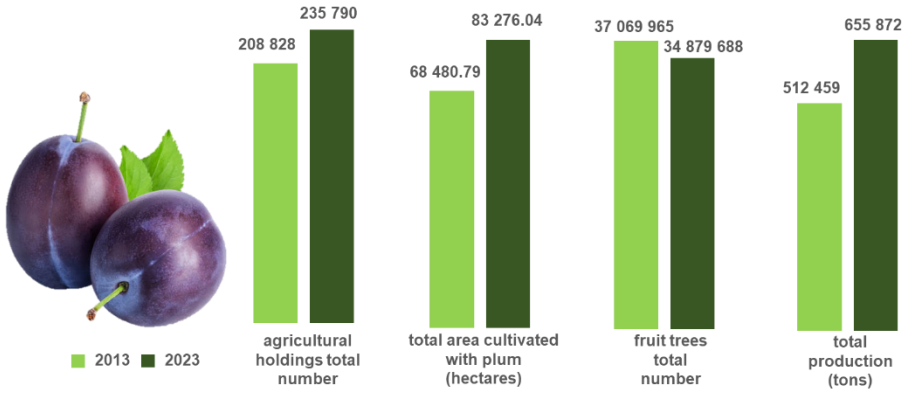

Fig. 7. Plum orchards development trends in Romania between 2013 and 2023, according to the INS and FAO data

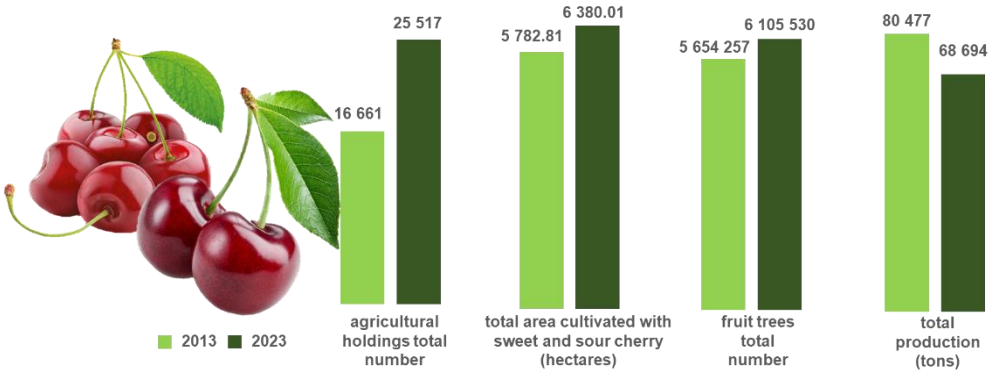

Fig. 8. Sweet and sour cherry orchards development trends in Romania between 2013 and 2023, according to the INS and FAO data

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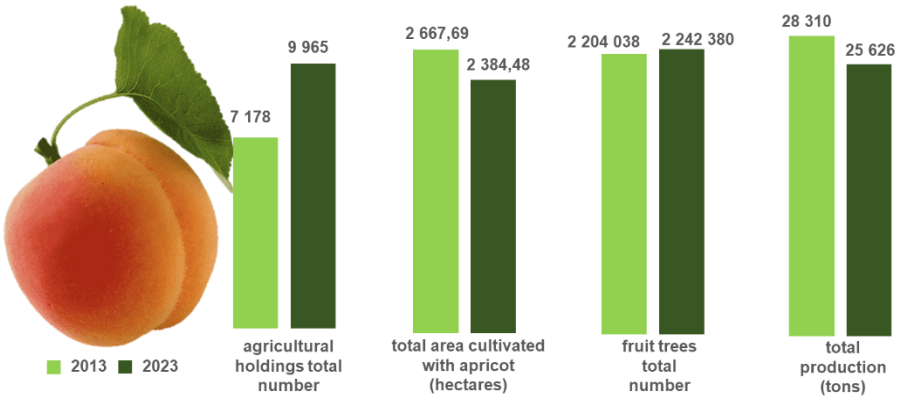

Fig. 9. Apricot orchards development trends in Romania between 2013 and 2023, according to the INS and FAO data

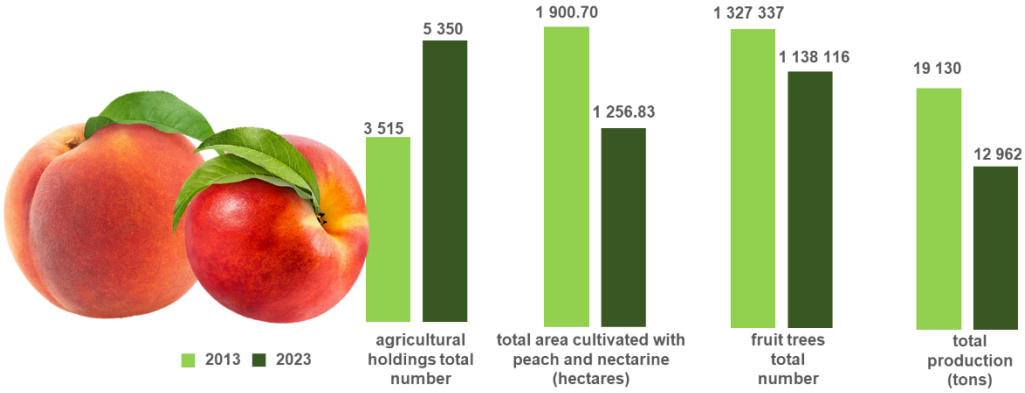

Fig. 10. Peach and nectarine orchards development trends in Romania between 2013 and 2023, according to the INS and FAO data

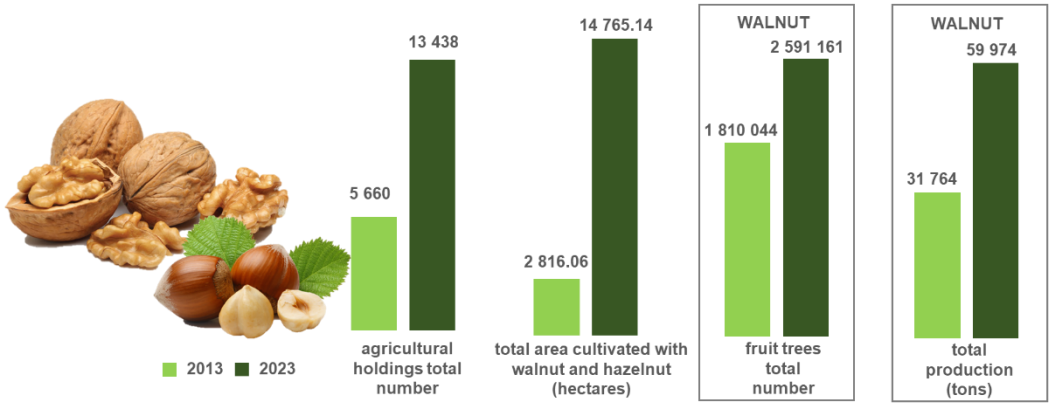

Fig. 11. Walnut and hazelnut orchards development trends in Romania between 2013 and 2023, according to the INS and FAO data

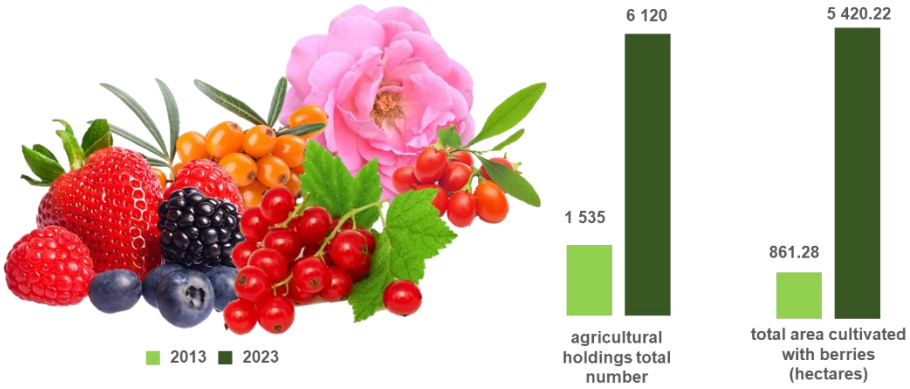

Fig. 12. Berries orchards development trends in Romania between 2013 and 2023, according to the INS and FAO data

 DOI 10.33045/fgr.v41.2025.01

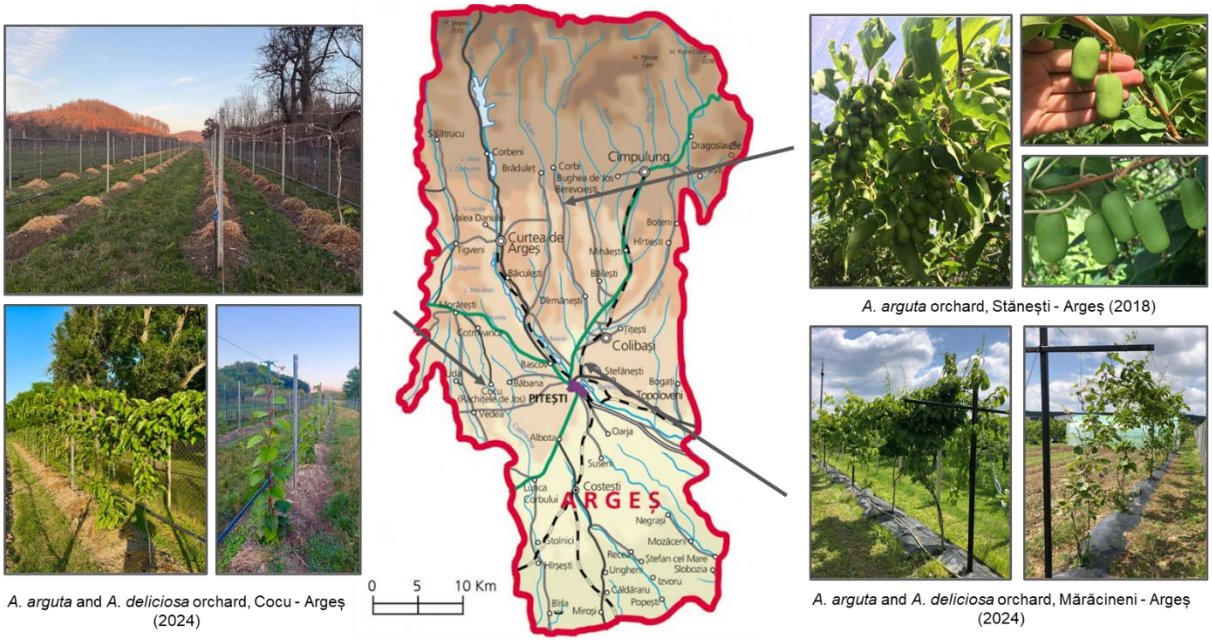

Fig. 13. Emergence and expansion of kiwi (*Actinidia* species) cultivation in Argeș County, Romania (Cocu, Mărăcineni, Stănești communes)