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Studies on the planting dynamics of native grape varieties for winemaking

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Abstract
The wine market has recently become increasingly dynamic, characterized by heightened competition. Alongside well-established producers, new competitors have emerged - not only from Romania and traditional wine-producing countries but also from the so-called "New World of Wine" (China, India, Sweden and Uruguay). This research focused on vineyards areas with Protected Designation of Origin (PDO) status and the varietal structure of grape cultivation in Romania. Special attention was given to the land area planted with native varieties and the ratio between native and noble cultivars. In recent years, motivated by the desire to attract consumer segments seeking authentic, traditional wines, a growing number of wineries have expanded their cultivation of Romanian grape varieties. Consequently, the gap between native and noble cultivars has gradually narrowed. Particularly, several native varieties—such as 'Fetească Neagră', 'Fetească Regală', 'Fetească Albă', and 'Tămâioasă Românească'— have shown consistent expansion in vineyards area in last decades.

Keywords: adaptability, quality, native varieties, wine market

Introduction

The composition and dynamics of grapevine varietal structure represent a fundamental component of national wine identity, shaping both the technological potential of vineyards and the distinctiveness of the resulting wines [2,4]. In Romania, one of Europe's oldest viticultural regions, the diversity of cultivated red grape varieties reflects a complex combination between historical heritage, market pressures, and evolving consumer preferences [16]. The country has a rich pool of indigenous *Vitis vinifera L.* germplasm, including 'Fetească Neagră', 'Băbească Neagră', 'Roșioara', 'Busuioacă de Bohotin', and Negru de Drăgășani, which have been recognized for their oenological potential and adaptability to local environment [17]. However, the current distribution of vineyard areas includes allochthonous cultivars, showing a purposeful attitude that prioritizes global market integration over the value of indigenous genetic resources [7]. According to recent national statistics, allochthonous cultivars cover around two-thirds of the more than 30,000 hectares grown with red grape varieties, while Romanian varietals account for less than one-third [15]. Cultivars like 'Merlot', 'Cabernet Sauvignon', 'Pinot Noir', 'Syrah', and 'Burgund Mare' continue to be popular for their global recognition and consistent consumer demand [18]. 'Merlot' and 'Cabernet Sauvignon', particularly, contribute significantly to varietal standard and Romania's integration with the demands of competitive wine markets. Local cultivars, on the contrary, continue to be significantly underrepresented, while being distributed rather evenly throughout viticultural areas. Important local cultivars including 'Fetească Neagră', 'Băbească Neagră', and 'Roșioara' account for a small rate of overall production, although high-typicity grapes like 'Negru de Drăgășani' are still grown in extremely limited regions [6].

Comparable to the processes described for red cultivars, the distribution of white grape varietals in Romania indicates a complex interaction of tradition, adaptation, and market strategy [14]. White varietals account for the majority of the vineyards, which is historically developed through local consumption patterns and the strong tradition of fragrant, slightly aromatic, and dry white wines that are unique to Romanian oenology [12]. Allochthonous cultivars such as 'Italian Riesling', 'Sauvignon Blanc', 'Aligoté', 'Muscat Ottonel', and 'Chardonnay' are still commonly grown due to their proven technological adaptability and high acceptance in

both local and abroad markets [13]. In addition, Romania has an exceptionally rich portfolio of indigenous white varieties, such as 'Fetească Regală', 'Fetească Albă', 'Tămâioasă Românească', 'Grasă de Cotnari', and 'Galbenă de Odobești'— grapes that play an important role in the country's traditional wine styles and terroir expressions [12]. These local cultivars have significant ecological tolerance, consistent yields, and distinct aromatic characteristics, making them essential to preserving regional typicity and supporting the identity of major appellations like Cotnari, Dealu Mare, Târnave, and Murfatlar [14, 8]. The coexistence of both international and indigenous white cultivars thus reflects, although in different proportions, the structural challenges identified for red cultivars: a persistent conflict between globalization-driven planting choices and the preservation of Romania's unique viticultural heritage [6].

This structural imbalance reveals a strategic paradox: Romania has valuable native grapevine diversity with high potential for identity, terroir expression, and competitive advantage, but these resources are underutilized to influence the marketplace at the national or international level. Strengthening the importance of indigenous cultivars is increasingly regarded as critical for promoting wine authenticity, enhancing climatic resilience, and protecting Romania's position in the global wine business. Therefore, understanding the dynamics, trends, and factors shaping the current varietal structure becomes crucial for designing sustainable viticultural strategies that harmonize economic competitiveness with cultural value.

The study objective was to analyze the existing structure, distribution, and trends in red grapevine cultivars grown in Romania, with a special emphasis on the balance of indigenous and international cultivar. The methodological strategy was designed to (i) quantify the extent to which local and international cultivars contribute to the national vineyard structure, (ii) identify spatial patterns of varietal distribution across major viticultural regions, and (iii) assess the degree to which current planting trends are influenced by economic, historical, or market trends.

Materials and Method

The study used a combination of national statistical datasets, international viticultural reports, and scientific literature. The main statistical source was the Romanian Ministry of Agriculture and Rural Development [(MADR, 2023)], which offers vineyard surface area, varietal composition, and annual updates to the national grapevine registry. Supplementary data was collected from OIV Statistical Reports (2024), regional viticultural databases, and published monographs on the distribution of autochthonous cultivars like 'Fetească Neagră', 'Băbească Neagră', 'Roșioara', 'Busuioacă de Bohotin', 'Negru de Drăgășani' as red cultivars and 'Fetească regală', 'Fetească albă', 'Tămâioasă românească', 'Grasă de Cotnari', 'Galbenă de Odobești' as white cultivars. All documents and datasets were evaluated for completeness, consistency of terminology, and methodological accuracy.

Cultivars were divided into two categories: native Romanian varieties of *Vitis vinifera L*., and allochthonous varietals which include well-known cultivars like 'Merlot', 'Cabernet Sauvignon', 'Pinot Noir', 'Syrah', and 'Burgund Mare' as red cultivars and 'Italian Riesling', 'Sauvignon Blanc', 'Aligoté', 'Muscat Ottonel' and 'Chardonnay' as white cultivars. Surface areas were measured in hectares and then proportionally represented (% of total red grape area). Data were standardized to prevent variations in appellation or regional classification.

Viticultural regions were classified using the national distribution system. Red grape surfaces from each location were pooled and plotted using descriptive statistics to reveal concentration levels and regional variations. Particular emphasis was placed on identifying regions where indigenous cultivars preserve continuity vs areas where multinational cultivars predominate.

Trends in planting and uprooting rates were investigated to determine: expansion or decline in indigenous cultivar areas; market preference for allochthonous cultivars and growers' strategies for meeting export needs and adapting to climate change. Quantitative indicators were complemented with qualitative evaluations based on published expert papers that analyzed socioeconomic and historical factors that influence varietal selection. The study is mostly based on collected national statistics, which might not adequately represent micro-regional heterogeneity or small-scale vineyard vineyards. Furthermore, differences in geographical reporting frequency may cause minor errors in temporal comparisons. However, cross-referencing many independent sources reduces these limitations and assures reliable analysis.

Results and Discussion

The analysis of vineyard area distribution for red grape cultivars in Romania suggests a significant structural imbalance between indigenous cultivars and the larger category of red cultivars planted (Figure 1). From of a total of 30,578.15 hectares planted with red grapes, the top five Romanian cultivars account for only 9,521.06 ha, or 31% of the total area, with the remaining 69% occupied by other cultivars, mostly

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allochthonous. ‘Fetească Neagră’ is the dominant native grape (3,373.43 hectares; 11%), followed by ‘Roșioara’ (2,586.04 ha; 9%) and ‘Băbească Neagră’ (2,568.83 ha; 8%). ‘Busuioacă de Bohotin’, despite its significant typicity and market brand, covers only 923.83 ha (3%), while ‘Negru de Drăgășani’ appears to be significantly underrepresented, with only 68.92 ha cultivated—effectively 0% of the national red grape area. These findings reveal a clear dominance of allochthonous cultivars in Romanian vineyards and highlight the limited spatial presence of high-value native germplasm, raising concerns about the erosion of local varietal identity and the long-term viability of Romanian wine typicity.

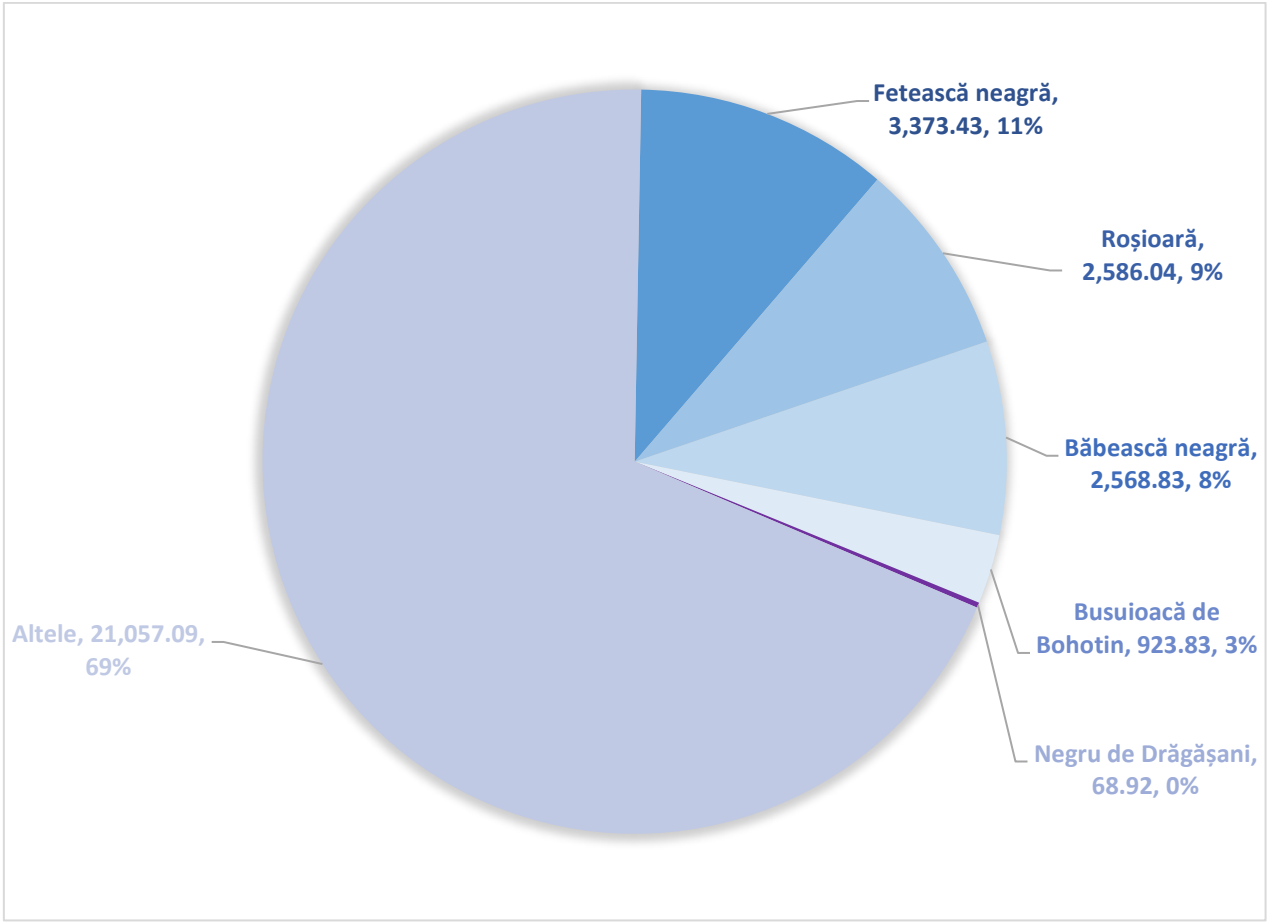

Figure 1. Total area – red grapes – 30,578.15 ha; top five Romanian varieties (9,521.06 ha)

Continuing the analysis of varietal distribution, the structure of allochthonous red grape cultivars reveals an even higher concentration, underscoring Romania's strategic dependence on globally known cultivars. ‘Merlot’ dominates the cultivars classification, covering 10,842.03 hectares, or 36% of total allochthonous red grape areas. A similar proportion (36%) is attributed to the category "others" (11,005.27 hectares), indicating a wide mix of imported cultivars grown on moderate to small plots (Figure 2).

‘Cabernet Sauvignon’, another renowned cultivar, accounts for 5,271.51 ha (17%), confirming its place as a significant varietal for premium and export-oriented wine production. In contrast, cultivars like ‘Pinot Noir’ (2,055.20 ha; 7%), ‘Syrah’ (737.80 ha; 2%), and ‘Burgund Mare’ (666.33 ha; 2%) have significantly lower representation, indicating more specialized or limited regional popularity.

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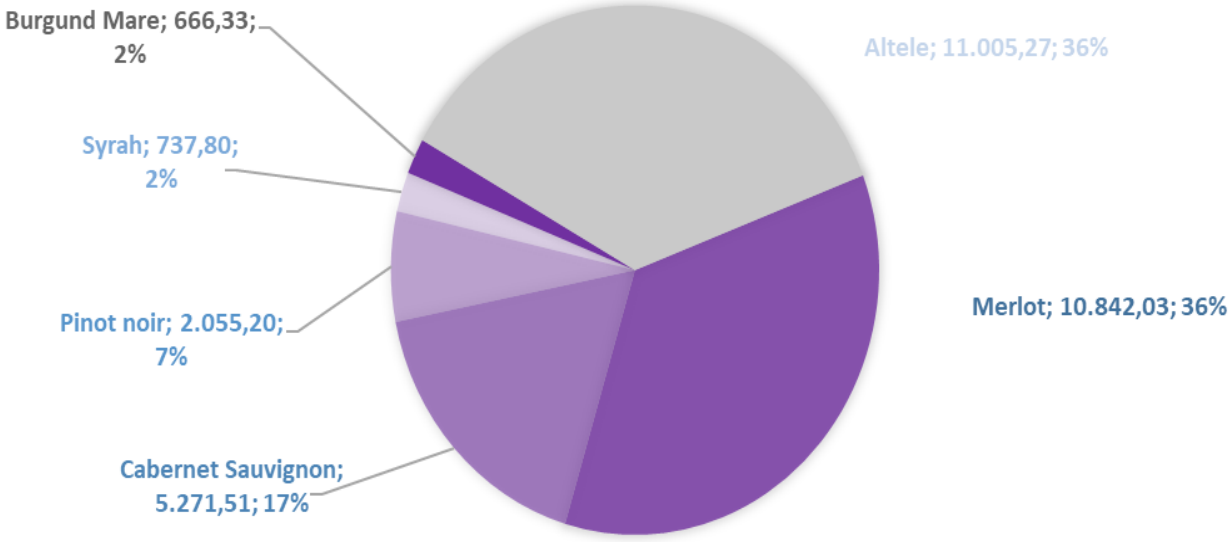

Figure 2. Total area - red grapes - 30,578.15 ha; top five international varieties (19,572.88 ha)

The clear dominance of 'Merlot' and 'Cabernet Sauvignon' demonstrates the substantial influence of global market demand and consumer familiarity on local planting choices. At the same time, the widely distribution of other allochthonous cultivars demonstrates the continuous process of diversification in Romanian vineyards, although within a structure that is still heavily influenced by global varietal trends rather than local oenological identities.

The third diagram (Figure 3) shows the distribution of red grape cultivars, given in total and percentage shares. The findings clearly demonstrate a highly uneven varietal structure, dominated by a small number of allochthonous cultivars. 'Merlot' is the most dominant cultivar, accounting for 10,842.03 units, or 36% of total red wine grape production.

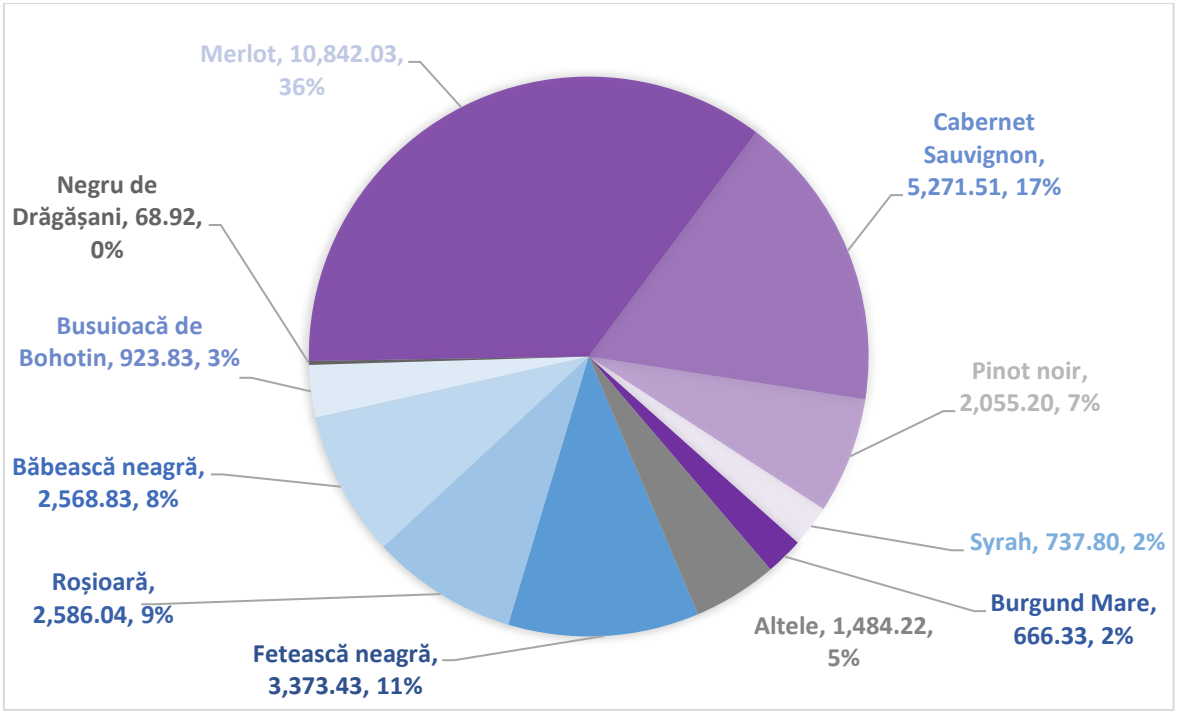

Figure 3. Total area cultivated with red grapes -30,578.15 ha; top five local and allochthonous cultivars (29,093.93 ha)

This dominant position implies that 'Merlot' remains an essential component of wine production in Romania, most likely due to its adaptability, consistent yields, and high market demand. 'Cabernet Sauvignon' (5,271.51 units, 17%) is the second most popular allochthonous varietal, complementing 'Merlot' in terms of blending potential and commercial value.

'Merlot' and 'Cabernet Sauvignon' account for more than 50% of overall production, confirming a strong reliance on allochthonous grape varietals. This tendency may reflect both financial variables and customer preferences for internationally known wine profiles. 'Fetească Neagră' is the most popular native cultivar, accounting for 3,373.43 units (11%), proving its growing relevance and recovery in the current wine sector. Other indigenous cultivars, such as 'Rară Neagră' ('Băbească Neagră') and 'Roșioară', provide a moderate contribution, accounting for 8% and 9% respectively. Their presence demonstrates a continued interest in traditional cultivars; however, they remain less important in comparison to allochthonous varieties. 'Pinot Noir' (7%), 'Busuioacă de Bohotin' (3%), 'Syrah' (2%), and 'Burgund Mare' (2%) are cultivated on smaller areas but contribute significantly to the wine industry's structure. These cultivars broaden the autochthonous wine offering and propose focused production strategies for niche markets or unique oenological attributes. 'Negru de Drăgășani' accounts for less than 1% of the distribution, which could be due to a small agricultural area. The category labeled 'Others', representing 5%, indicates the presence of additional minor cultivars that contribute to biodiversity but do not individually reach substantial grape yields.

White cultivars, both autochthonous and allochthonous, are critical in determining the stylistic diversity and financial value of modern winemaking. Autochthonous white cultivars are often well suited to local climates and soils, demonstrating substantial ecological resilience and constant production in local conditions [19]. Their characteristics frequently include distinct fragrance fingerprints ranging from floral and honeyed notes to mineral and spicy nuances, indicating long-term coevolution with the local terroir [9]. Therefore, they are critical for making wines with a distinct local identity, as well as preserving traditional viticulture's genetic and cultural history. Allochthonous white cultivars, on the other hand, are desired for their global recognition, oenological versatility and predictable behavior. Varieties like 'Chardonnay', 'Sauvignon Blanc', and 'Riesling' provide winemakers with a wide range of tasting options, from fresh, fragrant wines to rich, oak-aged expressions, which boosts wine areas' international competitiveness. Together, these two groups of cultivars contribute to maintain a balance between tradition and innovation, allowing producers to meet diverse consumer preferences while preserving local authenticity and commercial relevance.

Table 1 provides an accurate representation of the Romanian vineyards structure for white wine cultivars and emphasizes the dominant position of the five major autochthonous cultivars in the national vineyard landscape.

Table 1. Area cultivated with the five well-known Romanian white wine grape cultivars

Cultivar	Total vineyard area (ha)	Wine type
'Fetească regală'	11,992.51	White
'Fetească albă'	11,775.10	White
'Tămâioasă românească'	1,697.87	White
'Grasă de Cotnari'	543.07	White
'Galbenă de Odobești'	375,70	White
Top five Romanian local cultivars	**26,384.25**	**-**
% from total white cultivars	47.56%	-
Total area cultivated with white grapes cultivars (ha)	**55,471.16**	-

'Fetească Regală', 'Fetească Albă', 'Tămâioasă Românească', 'Grasă de Cotnari', and 'Galbenă de Odobești' cover 26,384.25 ha, accounting for nearly half (47.56%) of the total area (55,471.16 ha) cultivated with white cultivars in Romania. This ratio classifies the five types as essential components of Romanian white wines, reflecting the historical preferences of winemakers and consumers, as well as the suitability of these cultivars to the national terroir.

The two dominant cultivars, 'Feteasca Regală' (11,992.51 ha) and 'Feteasca Albă' (11,775.10 ha), together cover almost 23,700 ha, representing a significant share from the total white grape vineyard area. Their extensive distribution underscores the traditional and commercial significance of the 'Fetească' group in shaping the aromatic profile and sensory identity of Romanian white wines. Both cultivars are characterized by strong ecological adaptability, consistently high yields, and the capacity to produce wines with diverse typicity, factors that contribute to their sustained cultivation and the preservation of extensive vineyard surfaces

[5]. 'Tămâioasa Românească', cultivated on approximately 1,697.87 ha, completes this valuable group as an emblematic aromatic variety which, despite its relatively limited surface, holds significant cultural importance and is increasingly gaining international recognition, particularly within the semi-sweet and sweet wine categories.

'Grasă de Cotnari' (543.07 ha) and 'Galbenă de Odobești' (375.70 ha) occupy considerably smaller vineyard areas, yet they remain important identity cultivars closely linked to Romania's historic wine regions. Their reduced presence, especially when contrasted with the dominance of the 'Fetească' varieties, can be attributed to evolving consumer preferences, a market shift toward drier or more versatile wine styles, and, in some cases, specific technological challenges associated with these traditional cultivars.

White wine sector strongly anchored in indigenous cultivars, with the top five Romanian cultivars accounting for nearly half of the total vineyard area. This concentration reflects both the continuity of longstanding winemaking traditions and a substantial strategic opportunity to strengthen the identity of Romanian white wines on the international market. The predominance of local varieties may serve as a competitive advantage in a global context increasingly oriented toward wines with authentic origins and pronounced regional character. However, the noticeable imbalance between primary and secondary cultivars underscores the need for coherent policies aimed at preserving viticultural diversity and revitalizing heritage varieties, ensuring that the structural configuration of Romanian vineyards supports not only commercial competitiveness but also the safeguarding of national oenological identity.

The table below (Table 2) provides a representative overview of the Romania white wine vineyards composition, showing the important role of allochthonous cultivars in the Romanian viticultural environment. The five major cultivars— 'Italian Riesling', 'Sauvignon Blanc', 'Aligoté', 'Muscat Ottonel', and 'Chardonnay'— account for 24,230.05 hectares, or around 43.68% of the total surface area cultivated with white wine grapes (55,471.16 ha). This considerable proportion demonstrates that nearly half of Romania's white wine production relies on globally recognized cultivars, reflecting a clear alignment of Romanian viticulture with international market trends and prevailing consumer preferences.

Table 2. Area cultivated with the five allochthonous white wine grape cultivars

Cultivar	Total vineyard area (ha)	Wine type
'Italian Riesling'	6,687.89	White
'Sauvignon Blanc'	5,516.06	White
'Aligoté'	5,053.81	White
'Muscat Ottonel'	4,905.97	White
'Chardonnay'	2,066.32	White
Top five allochthonous cultivars	24,230.05	-
% from total white cultivars	43.68%	-
Total area cultivated with white grapes cultivars (ha)	55,471.16	-

The predominance of 'Italian Riesling', which occupies 6,687.89 hectares, underscores its status as a preferred white cultivar due to its complex aromatic profile, adaptability to diverse pedoclimatic conditions, and strong commercial potential. Also, the substantial areas planted with 'Sauvignon Blanc' and 'Aligoté'— approximately 5,500 ha and 5,000 ha, respectively—reflect producers' strategic orientation toward cultivars with stable demand and well-established recognition on both European and global markets, valued for their versatility in winemaking.

The notable presence of 'Muscat Ottonel' (around 4,900 ha) further illustrates the sustained interest in aromatic cultivars capable of meeting consumer preferences for wines with pronounced floral and fruity characteristics. Although 'Chardonnay' represents the smallest area among the top five allochthonous varieties (2,066.32 ha), it remains a key cultivar for the production of premium white wines and is frequently associated with higher-quality bottlings, including those destined for sparkling wine production.

The data presented reveal a clear differentiation in the allocation of vineyard areas to local versus allochthonous cultivars within Romania's white wine sector. In this case, indigenous cultivars display a slight predominance, reflecting an orientation of Romanian viticulture toward preserving tradition and valorizing its native oenological heritage. Although the total area planted with allochthonous cultivars is comparable to that of local varieties, their internal distribution highlights notable economic and agronomic distinctions.

This configuration suggests a relative equilibrium between tradition and modernization in the structure of Romanian white wine production. The modest predominance of indigenous cultivars indicates that Romania

continues to draw substantially on its viticultural heritage, thereby maintaining an important identity-based competitive advantage on the international market. Simultaneously, the nearly equivalent presence of international varieties reflects a strategic alignment with global demands, ensuring access to well-established and economically advantageous markets. In this context, Romanian viticulture succeeds in integrating traditional continuity with participation in international trade dynamics, with the balance between indigenous and allochthonous cultivars serving as an indicator of a deliberate strategy aimed at diversification and long-term competitiveness [10].

From an international perspective, the balance between autochthonous and allochthonous cultivars differs not only among countries but also between red and white grapevine cultivars. In traditional European wine-producing countries such as Italy and Portugal, indigenous varieties dominate both red and white vineyards; however, this dominance is more pronounced among red cultivars, where autochthonous grapes account for over 70% of planted areas, while white cultivars show slightly higher levels of international cultivar integration due to market demand for globally recognized wines [1]. France presents a distinct case in which historically native cultivars—such as 'Cabernet Sauvignon', 'Merlot', 'Pinot Noir', 'Chardonnay', and 'Sauvignon Blanc'— have become global benchmarks; nevertheless, they remain classified as autochthonous within the national context for both red and white wines, resulting in a structurally balanced but identity-driven varietal composition [11]. By contrast, New World wine-producing countries, including Australia, Chile, and the United States, display a strong predominance of allochthonous cultivars in both red and white cultivars, often exceeding 80% of vineyard area. This tendency is particularly evident in red wines, where cultivars such as 'Cabernet Sauvignon', 'Merlot', and 'Syrah' dominate, while white vineyards are similarly concentrated around 'Chardonnay' and 'Sauvignon Blanc' [3].

Conclusions

This study highlights the structural dynamics of Romania's red and white grapevine varietal composition, revealing a complex interplay between historical legacy, market-driven choices, and emerging trends in global wine consumption. The analysis demonstrates that, despite Romania's rich ampelographic heritage, allochtonous cultivars—particularly 'Merlot', 'Cabernet Sauvignon', 'Italian Riesling', and 'Sauvignon Blanc'— continue to occupy substantial vineyard areas, reflecting the sustained influence of global market integration and consumer familiarity. At the same time, indigenous cultivars retain a decisive role in defining Romania's viticultural identity. Native red varieties such as 'Fetească Neagră', 'Băbească Neagră', and 'Roșioara', along with emblematic white cultivars including 'Fetească Regală', 'Fetească Albă', and 'Tămâioasă Românească', contribute significantly to the preservation of local typicity and represent a valuable resource for enhancing the country's oenological distinctiveness. However, the limited surfaces occupied by high-typicity varieties such as 'Negru de Drăgășani' or 'Grasă de Cotnari' indicate persistent vulnerabilities in the conservation and valorization of Romania's genetic patrimony. The coexistence of both allochthonous and indigenous varieties reveals a sector positioned between tradition and modernization. While allochthonous cultivars support Romania's competitiveness and export potential, the strong presence of local varieties — particularly in white wine — demonstrates a continued commitment to cultural continuity and terroir expression. utilize native cultivars for superior quality and identity-based marketing, while keep internationally known varieties for stability and market competitiveness.

To consolidate Romania's long-term viticultural sustainability, coherent policies are needed to encourage the preservation, revitalization, and promotion of indigenous varieties with demonstrated climatic resilience and distinct sensory potential. Strengthening research, clonal selection programs, and regional branding strategies will be essential for enhancing visibility and economic value on global markets.

In conclusion, Romanian viticulture possesses a unique combination of biodiversity, tradition, and market adaptability. Harnessing these assets through balanced strategic planning can enhance both national and international recognition, ensuring a resilient and competitive wine sector capable of responding to future climatic, economic, and consumer-driven challenges.

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