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I-CRAFT AGRICULTURAL and FOOD TECHNOLOGIES

Table, Dried and Wine Grape Production and Potential in Southeastern Anatolia

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Abstract. In this study, structural changes in grape production in the Southeastern Anatolia Region and throughout Türkiye were analyzed based on data from 2004, 2014, and 2024. All grape varieties commercially cultivated in Southeastern Anatolia were considered in the study. A significant decline in vineyard areas has been observed across the Southeastern Anatolia Region between 2004 and 2024. For example, vineyards for seedless raisins decreased from 6,250 decares in 2004 to 150 decares in 2024, while production decreased from 4,750 tons to 90 tons. Similarly, table grape vineyards decreased from 12,830 decares to 4,300 decares, and production volume peaked at 7,644 tons in 2014 before declining to 4,850 tons in 2024. Despite the decline in vineyard areas in the region, there have been significant increases in productivity. The yield per decare for wine grapes rose from 184 kg in 2004 to 560 kg in 2024, more than tripling. Similarly, productivity for dried seedless grapes increased from 345 kg/da to 569 kg/da. When evaluated at the provincial level, there has been a notable increase in wine grape production in Adıyaman. The production area, which was 100 decares in 2014, increased to 1,500 decares in 2024, while the production volume increased from 75 tons to 750 tons. In Gaziantep, the area dedicated to dried seedless grapes has undergone a substantial decline, from 121,830 decares to 48,081 decares. However, it has been determined that the production amount has undergone an increase from 28,920 tons to 42,307 tons, a development that can be attributed to the enhancement of grape yield per unit area. In contrast, it is observed that a significant proportion of the total vineyard areas in Şanlıurfa (95%), Siirt (50%), and Gaziantep (44%) have been lost. In particular, the production of dried seedless grapes in Şanlıurfa fell from 31,054 tons in 2004 to only 815 tons in 2024. A similar trend is observed across Türkiye. The area under dried seedless grapes decreased from 750,000 decares in 2004 to 491,612 decares in 2024, while production fell from 350,000 tons to 317,053 tons. Although there has been a partial increase in yield (from 529 kg/da to 682 kg/da) in the cultivation of wine grape varieties across the country, the decline in vineyard areas has negatively affected the production of wine grape varieties. In this context, the aim of the study is to determine the potential for grape production for different commercial purposes in the region, identify structural changes in regional viticulture, and establish future production strategies. In conclusion, it has been determined that vineyard cultivation in the Southeastern Anatolia Region is undergoing a complex transformation process in which the decline in production areas and partial increases in productivity are intertwined. In this situation, the need to restructure regional agricultural policies and revise production strategies with a focus on productivity is considered to be of paramount importance.

Keywords: Grape production trends, Agricultural productivity analysis, Southeastern Anatolia agriculture, Cultivation area reduction, Turkish viticulture sector

1 Introduction

Viticulture in Anatolia has a deep-rooted history dating back to prehistoric times. Findings from the Hittite period, such as a solid gold wine jug and goblet dating to around 3000 B.C. and exhibited in the

Museum of Anatolian Civilizations (Deliorman et al., 2011), provide strong evidence of the ancient presence of the grapevine in Anatolia. For example, the Hittite hieroglyphs on the rock reliefs of Konya Ereğli İvriz, dating back to the 8th century BC, contain the following words: "I am Warpalawas, the ruler and hero King of Tuwana. When I was a prince in the palace, I planted these vines. May Tarhunzas grant them abundance and prosperity." (Dilay, 2018) reveal the ancient history of viticulture in the region. While depictions of vines, grapes, and wine are frequently seen in Hittite works, the texts also mention the words vine (tuwarsa), grape (geštın), dried grape (geštın hád.du.a), and wine (wiyana) (Kiracı et al., 2024). According to the provisions of the law, viticulture was one of the fundamental sources of the Hittite economy (Ünar, 2019). Furthermore, ancient historians accept that Dionysus, the protector of vineyards in Greek mythology, came to Greece from Anatolia. In this context, the geography of Anatolia stands out as one of the oldest agricultural centers in human history due to its historical and economic importance in terms of viticulture (Sağlam and Çalkan Sağlam, 2018). Similarly, the Southeastern Anatolia Region, located in northern Mesopotamia, is one of the places where agriculture first began and has a long history of viticulture. Archaeological excavations indicate that viticulture in the region (Nevali Çori, Çayönü Höyüğü, Titriş Höyük, etc.) dates back to as early as 7000 BCE (Öz, 2011; Mertol and Keskin, 2022). Grape seeds, industrial wine production facilities, and wine storage containers have been found in ancient settlements, particularly around Şanlıurfa, Diyarbakır, Mardin, Adıyaman, and Gaziantep. In ancient times, during the Assyrian, Sumerian, and Hittite periods, grapes were consumed as fresh fruit and also used to make wine, vinegar, and dried fruit. During the Roman and Byzantine periods, viticulture became more systematic and developed into a commercial activity. So much so that coins with grapevine motifs were minted during the Byzantine period. During the Ottoman period, viticulture became one of the primary sources of income for the rural population in southeastern Anatolia. Small vineyards were established in the courtyards of homes, and traditional food products such as grape molasses, pestil, bastık, and sucuk were produced from grapes (Oraman, 1965). The Southeastern Anatolia Region's climate, in terms of geographic and climatic suitability, is highly suitable for viticulture. Hot, dry summers and mild winters allow vineyards to produce high yields. The region's soil structure, low humidity, and long sunshine hours enhance both the quality and longevity of the grapes. The provinces of Gaziantep, Şanlıurfa, Mardin, Adıyaman, Diyarbakır, and Batman, in particular, are still areas where viticulture is intensively practiced. Gaziantep, Diyarbakır, and Mardin are among the top ten grape-producing provinces in Türkiye (Metin and Gündüz, 2024). Various researchers have identified numerous local grape varieties in the region (Kısakürek, 1950; Gürsöz, 1993; Kaplan, 1994; Karataş, 2005; Karataş et al., 2016a). Some of these are; Abderi, Ağek, Asuri, Azezi,

Bağılti, Bakari, Balma, Bastık Kabcığı, Belbezık, Belülük, Benitaht, Besni, Bizdok, Boğazkere, Cibin, Çiloreş, Deyvani, Dımışkı, Dökülgen, Eşgar, Habo, Hasani, Hatun Parmağı, Hazirani, Horoz Karası, Hönüsü, Karakurutma, Karfoki, Karik, Kızıl Banki, Kilis Karası, Kohar, Mazrone, Mevji, Mikeri, Muhammedi, Tahannebi, Tayfi, Tilgören, Tümbo, Vanki, Reşek, and Zeyti. Many synonyms and different types of these varieties are frequently encountered in the region (Polat, 2016; Yalçın, 2021; Koyuncu, 2025). On the other hand, some of these varieties have been registered as standard grape varieties (Çelik, 2002). While some of these varieties are suitable for multi-purpose commercial use, others are only suitable for one type of commercial use (Karataş et al., 2010). However, some varieties are also used in small family businesses for the production of various food products and wine using traditional methods. Considering its economic and social contributions, viticulture is more than just an agricultural activity in the Southeastern Anatolia Region; it is one of the cornerstones of rural development. Grape production provides income to thousands of families, both directly and indirectly. In particular, small family businesses secure their livelihoods by selling grape products in local markets. Value-added products such as grape molasses, dried fruit rolls, grape paste, and walnut-stuffed sausage occupy an important place in both the domestic market and exports. In recent years, with the establishment of cooperatives and support for women producers, viticulture has become more organized and sustainable. The active participation of women in the production process has had a positive impact on the region both economically and socially. In addition, grapes and grape products play an important role in cultural promotion through gastronomic tourism and local festivals.

In terms of the current state of viticulture and future prospects, viticulture in Southeastern Anatolia is being modernized with the support of modern agricultural techniques in an effort to make it more efficient (Odabaşıoğlu, 2020). Innovations such as drip irrigation systems, organic farming practices, and methods of combating diseases and pests are increasing the productivity of producers. In addition, the increase in the number of geographically indicated products obtained through the processing of grapes and raisins (Adıyaman Besni Grapes, Antep Karası Dry Grapes, Gaziantep Koruk Ekşisi, Diyarbakır Boğazkere Grapes, Ömerli Karfoki Grapes, Midyat Zeynebi Grapes, etc.) is raising the brand value of the region's grape varieties. Thanks to projects supported by the Ministry of Agriculture and Forestry and local administrations, young farmers are encouraged to take up viticulture, thereby helping to prevent rural migration. Collaborations with universities and research institutes are of great importance for the preservation and development of grape varieties unique to the region. Considering the diversity and uses of seeded grape varieties, the Southeastern Anatolia Region has unique potential

for the cultivation of seeded grape varieties due to its climatic and soil characteristics. On the other hand, despite having some local seedless grape varieties such as Hönüsü, the region does not have the same potential for seedless grape production. The grape varieties cultivated for table use in the region are generally characterized by their large, sweet berries and sparse clusters. Among table grapes with seeds, varieties such as Horoz Karası, Tahannebi, and Hatun Parmağı, which are unique to the region, are popular among consumers for their distinctive flavors. These grapes are consumed fresh, used in breakfast dishes, or incorporated into various desserts. Seedless table grapes, on the other hand, offer significant convenience for families with children and consumers who prefer not to remove seeds. These varieties are preferred in salads, fruit platters, and light snacks. Dried grape cultivation also plays an important role in the region's economy. The hot and dry summers of Southeastern Anatolia provide ideal conditions for grapes to dry naturally. Indeed, Besni, one of Türkiye's most important seedless dried grape varieties, is grown in Adıyaman and dried in the same location, marketed as a geographically indicated product. The Boğazkere grape variety, renowned worldwide and valued for winemaking, originates from the province of Diyarbakır in the region and is widely cultivated in the province's vineyards. Varieties such as Şire (Bastık Kabarcığı), Mazrone, and Azezi are grape varieties with high sugar content that are preferred especially in the production of pestil and pekmez. Dried grapes occupy an important place in both local markets and international trade thanks to their long shelf life and nutritional value. Indeed, Türkiye is one of the world's leading producers of both seedless and seeded dried grapes. Nearly all of Türkiye's grape export revenue comes from dried grape exports, and the seeded dried grapes produced in the region hold an important place in this market. Wine grape cultivation is another important area that increases the region's potential. These ancient lands of Anatolia, which have been the center of wine production since ancient times, enable the production of high-quality wines with grapes that have different terroir characteristics (Anlı, 2006; Atilla, 2006; Çelik et al., 2000; Doğer, 2004). Some local grape varieties in the region, such as Antep Karası and Mazrone, produce distinctive and aromatic wines when used in winemaking. Çelik et al. (2005), reported that the region's arid areas, with their cool nights during the hot and dry summer growing season, provide sufficient sugar accumulation in the grapes (20–23% in white varieties, 22–25% in black varieties), high acidity, and aromatic and tannin content for the production of quality wine. The province of Mardin has great potential for marketing traditional Syrian wines (Demiray, 2022). In recent years, boutique wine producers have also become increasingly interested in the region, and the potential of local varieties has begun to be explored using modern winemaking techniques. This situation also contributes to the development of the region in terms of wine tourism. The aim of this study is to determine the current

status and potential of viticulture in the Southeastern Anatolia Region and to establish a future grape production strategy for the region. Research and genetic resource studies conducted to preserve and develop the grape diversity of the Southeastern Anatolia Region are of critical importance for passing on the region's rich viticultural heritage to future generations. Adapting farmers in the region to modern production techniques and diversifying value-added products will further enhance the Southeast Anatolia Region's grape cultivation potential. With this diversity and historical legacy, the region will continue to strengthen its position as one of Türkiye's key viticulture centers.

2 Material and Method

The study was conducted using data from the Turkish Statistical Institute (TÜİK), data from the Provincial and District Directorates of the Ministry of Agriculture and Forestry, Annual Reports of the Ministry of Agriculture and Forestry, reports from producer associations and development agencies, scientific research on grape varieties grown in the Southeastern Anatolia Region, results reports from various symposiums, conferences, and workshops, as well as scientific articles and papers. The metadata obtained from production data has been collected and presented in tables. All these data have been evaluated and interpreted in line with current literature. In addition, stakeholder, peer, and producer opinions were also considered within the scope of the study, and assessments and recommendations were made by revealing the potential and structural characteristics of viticulture in the Southeastern Anatolia region.

3 Result and Discussion

Table 1 presents a comparative analysis of table grape cultivation in the Southeastern Anatolia Region between 2004, 2014, and 2024, compared to the rest of Türkiye. Upon examining the data in Table 1, it is evident that there has been a significant decline in the vineyard areas dedicated to table grape cultivation across Türkiye. The total area, which was 2,650,000 decares in 2004, decreased to 2,298,938 decares in 2014 and further to 1,601,920 decares in 2024. This situation shows that there have been fundamental changes in Türkiye 's agricultural policies and farmers' production preferences. A similar trend has been observed in vineyards where table grape varieties are grown in the Southeastern Anatolia Region. The total planting area of grapes cultivated for this purpose in the region decreased from 708,390 decares in 2004 to 621,608 decares in 2014 and further to 559,706 decares in 2024. However, despite this decline, it has been determined that the region's share of vineyards producing table grapes

in Türkiye has increased from 27% to 35%. This situation stems from a 40% decrease in the area of vineyards producing table grapes with seeds across the country over the last 20 years. On the other hand, vineyard areas where table grape varieties are cultivated in the provinces of Kilis, Şanlıurfa, Adıyaman, and Siirt have decreased by 95%, 89%, 46%, and 52%, respectively, between 2004 and 2024. In the region, where gardens are mostly planted with pistachios, olives, and similar fruit types, producers plant vines between rows until the main fruit type reaches maturity. This allows producers to earn a modest income from their gardens during the few unproductive years, as well as to produce the grapes and grape products necessary for their family consumption. When fruit trees reach their productive age, however, the care practices applied to the main crop are not applied to the vines, so the vines often become neglected, lose their productivity, and are subsequently uprooted. Additionally, vines are among the first plants to be affected by rapid urbanization. Unlike other cultivated fruit types, vines require more frequent monitoring and care, so vineyards have traditionally been established near residential areas. Due to population growth and economic development, vineyard areas in expanding cities are prioritized for urbanization and construction, leading to the removal of vineyards. On the other hand, there are also examples of an increase in vineyards where table grape varieties such as Mardin and Şırnak are grown. The planting area in Mardin province increased from 114,450 decares in 2004 to 173,768 decares in 2024, representing a 51% increase, which also reveals that different provinces in the region have adopted different agricultural strategies and have different cultivation conditions. Indeed, in Şırnak, the planting area for table grape varieties increased significantly from 2,530 decares to 24,623 decares. Despite the decline in agricultural land due to urban sprawl and investments in industrial development in the Southeastern Anatolia region and throughout Türkiye, the improvement in grape yield per unit area has led to a 24% increase in the production of table grape varieties in the Southeastern Anatolia region and only a 6% decrease in Türkiye. As shown in Table 1, the average yield of table grapes in Türkiye increased from 566 kg/da in 2004 to 688 kg/da in 2014 and 880 kg/da in 2024. This situation indicates that modern viticulture techniques have begun to be applied across the country, priority has been given to cultivating more productive grape varieties with high adaptability to viticulture regions, and the amount of product obtained per unit area has increased due to seasonal changes in climatic conditions. A similar conclusion can be drawn for the Southeastern Anatolia Region. Indeed, both nationwide and in the region, there has been an approximately 56% increase in yield per unit area in areas where table grape varieties are grown. However, the decline in productivity in some provinces may be due to producers adopting innovations more slowly than other producers in the country, continuing to produce mainly with local varieties, not viewing viticulture as their primary source of income, or the region's

ecology being more negatively affected by global climate change in recent years compared to other production regions. Indeed, some survey studies conducted in the region (Uyak et al., 2011; Yıldırım and Onay, 2012; Çakır et al., 2014a; Çakır et al., 2014b; Çakır et al., 2015; Çakır et al., 2017a; Çakır et al., 2017b; Gazioğlu Şensoy et al., 2020; Ünal, 2019; Anonymous, 2021; Yalçın et al., 2021) have yielded findings consistent with our observations. When the region is evaluated on a provincial basis, the first striking finding is the increase in yield in Siirt province. In Siirt province, the yield of table grapes was 119 kg/da in 2004, while in 2024, this figure reached 1,819 kg/da. In Gaziantep province, grape yield increased more than threefold, from 294 kg/da in 2004 to 987 kg/da in 2024. Another province where a steady increase (22%) in the amount of table grapes with seeds obtained per unit area was observed is Diyarbakır. However, there are also some issues in Diyarbakır viticulture. According to Karataş et al. (2016b), producers do not engage in conscious and effective control of diseases and pests in their vineyards, there is no standardization in terms of planting density and training methods, irrigation is not practiced, soil cultivation and fertilization are carried out at a very limited level, summer pruning and canopy management are unknown and therefore not practiced, and producers lack sufficient information about grants and support programs, making it difficult for them to access these resources. Despite the decline in planting areas across Türkiye, total production volumes have been largely maintained thanks to increases in yield. Indeed, grape production, which was 1,500,000 tons in 2004, rose to 1,580,585 tons in 2014, but fell to 1,409,156 tons in 2024. Semerci et al. (2015) reported that between 1990 and 2013, vineyard areas in Türkiye decreased by 19.2%, but grape production increased by 14.6%. The researchers listed the problems they identified in Turkish viticulture as follows: low yields, the lack of an effective role played by producer cooperatives in the marketing of grapes and the absence of market regulation, the lack of organization among producers, the absence of a support system specific to viticulture, quality and standardization problems in grape products, and a lack of product diversity. Çelik (2018) states that, according to official statistics, Türkiye 's total vineyard area decreased by 10.3% between 2007 and 2016, while grape production increased by 11%. The researcher also reported that, despite significant declines in some years, total fresh grape production in Türkiye has remained above 4 million tons since 2009. The researcher reported that during the same period, table grape production increased by 4.1%, while raisin production saw a significant increase of 26.2%, and wine/grape juice production decreased by 2%. In addition, it is stated that, according to the average for the past ten years, 52.1% of the grapes produced in Türkiye are consumed as table grapes, 36.6% as dried grapes, and 11.3% as wine/grape juice grapes. In 2024, the shares of table, raisin, and wine/grape juice grapes in total grape production were 52.7%, 36.4%, and 10.9%, respectively (TÜİK, 2025). This

situation shows that grape variety selection in Türkiye is still being carried out for the same commercial purposes.

Table1. Changes in Production Areas and Quantities of Table Grapes (TÜİK, 2025)

Provinces	Production area (da)			Yield (kg/da)			Production Quantity (ton)		
	2004	2014	2024	2004	2014	2024	2004	2014	2024
Adıyaman	83.200	76.975	45.262	220	692	581	18.273	53.256	26.316
Batman	28.550	47.068	32.938	628	344	400	17.925	16.181	13.176
Diyarbakır	176.730	148.540	143.607	541	564	658	95.568	83.747	94.544
Gaziantep	99.850	103.042	101.043	294	544	987	29.359	56.021	99.721
Kilis	67.040	3.769	3.550	125	330	500	8.375	1.243	1.776
Mardin	114.450	134.708	173.768	660	458	455	75.560	61.644	79.115
Siirt	54.000	25.575	25.811	119	577	1.819	6.440	14.755	46.948
Şanlıurfa	82.040	65.826	9.104	648	591	688	53.163	38.898	6.267
Şırnak	2.530	16.105	24.623	596	766	422	1.509	12.341	10.391
Güneydoğu	708.390	621.608	559.706	432	544	676	306.172	338.086	378.254
Türkiye	2.650.000	2.298.938	1.601.920	566	688	880	1.500.000	1.580.585	1.409.156

As a result, despite a decline in the area planted with table grape varieties, the Southeastern Anatolia Region has managed to increase its total production volume, particularly due to increased productivity. Indeed, total table grape production in the Southeastern Anatolia Region increased from 306,172 tons in 2004 to 338,086 tons in 2014 and 378,254 tons in 2024. This situation may indicate a transition to more intensive and efficient methods in grape cultivation in the region. However, when evaluating this aspect, the differences between provinces are quite striking. While some provinces have experienced significant losses in terms of area and production, others have stood out with increases in productivity and production volume. Despite the continuous decline in planting area across Türkiye, the relative preservation of total production thanks to increased productivity reflects technological advances and adaptability in the agricultural sector. In the future, the sustainability of these trends will depend on factors such as climate change, water resource management, and farmer support. Therefore, it is crucial to continue detailed analyses of regional ecological conditions (Alsancak Sırlı et al., 2015) and for each province to develop its own unique strategies and implement appropriate policies (Baykul et al., 2018). In the Southeastern Anatolia region, between 2004 and 2024, the area under cultivation for seedless table grape production decreased by approximately 66%, and production volume decreased by 9.5% (Table 2). Additionally, the region's share of national production has also declined over the years. There

are many reasons why the production of seedless table grape varieties is not widespread in the region. The most important of these is that temperatures can occasionally exceed 40°C during the summer months, which negatively affects berry development, thereby reducing yield and grape quality. Large-scale dry viticulture is practiced in the Southeastern Anatolia region, meaning that the vineyards are not irrigated. It is quite difficult to successfully produce seedless grape varieties, which are less tolerant to high temperatures and drought than seeded grape varieties, in this ecology and under these cultivation conditions. In particular, hot winds blowing during the early stages of berry formation cause a significant portion of the berries on the clusters to dry out. The lack of widespread adoption of high-stem training systems that keep the clusters in the shade in the region, coupled with the continued preference for local training methods in vineyards, is another factor negatively impacting the success of seedless grape cultivation. For this reason, the cultivation of seedless table grape varieties is almost non-existent in provinces such as Kilis, Mardin, Siirt, and Şanlıurfa, located in the Southeastern Anatolia region. A similar situation applies to seedless raisin grape varieties. When examining the total table seedless grape production in the Southeastern Anatolia region (4,850 tons), it is seen that the main contribution to the region comes from production in the province of Gaziantep. On the other hand, as of 2024, table seedless grape production is also carried out on a small scale in the provinces of Adıyaman and Batman. However, in terms of grape yield per unit area, only Gaziantep province (1,180 kg/da) achieves a value close to the Turkish average (1,343 kg/da), while productivity in the other two provinces where production takes place remains at very low levels. In Gaziantep province, the productivity of seedless table grape production was 400 kg/da in 2004, reached 1,000 kg/da in 2014, and reached 1,180 kg/da in 2024. This situation indicates that production continues in smaller areas using modern techniques and efficient methods, rather than in large vineyards where traditional methods are used. On the other hand, thanks to the increasing number of irrigation projects in the region in recent years and the support and grants provided for the installation of high-stem training systems, it is likely that there will be a partial increase in the cultivation of seedless table grape varieties in the near future. In contrast, in the production of seedless table grape varieties across Türkiye, it can be seen that the yield per unit area increased from 2004 to 2014, rising from 1,143 kg/da to 1,724 kg/da. This upward trend later reversed, and by 2024, yields had decreased to 1,343 kg/da, marking a significant decline. This situation indicates that there have been some fluctuations in productivity in the cultivation of seedless table grape varieties across Türkiye. On the other hand, unlike in the Southeast, it can be said that production has increased in some regions where viticulture is practiced, relative to the total area.

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Table2. Changes in Production Areas and Quantities of Seedless Table Grapes (TÜİK, 2025)

	Production area (da)			Yield (kg/da)			Production Quantity (ton)		
	2004	2014	2024	2004	2014	2024	2004	2014	2024
Adıyaman	-	302	200	-	712	445	-	215	89
Batman	-	80	100	-	550	400	-	44	40
Diyarbakır	-	5.650	-	-	599	-	-	3.385	-
Gaziantep	12.000	4.000	4.000	400	1.000	1.180	4.800	4.000	4.721
Kilis	-	-	-	-	-	-	-	-	-
Mardin	-	-	-	-	-	-	-	-	-
Siirt	-	-	-	-	-	-	-	-	-
Şanlıurfa	-	-	-	-	-	-	-	-	-
Şırnak	830	-	-	677	-	-	562	-	-
Güneydoğu	12.830	10.032	4.300	418	762	1128	5.362	7.644	4.850
Türkiye	350.000	340.077	310.314	1.143	1.724	1.343	400.000	586.164	416.759

As a result, it can be said that a strategic change has taken place in the cultivation of seedless table grape varieties in the Southeastern Anatolia Region. While moving away from large areas and old production models, productivity has increased in small areas. However, this increase in productivity has not been sufficient to compensate for the decrease in area, resulting in a significant decline in the total production volume of table grape varieties in the region. This situation suggests that farmers in the region are attempting to adapt to factors such as economic conditions, water resources, climate change, or market demand, but these efforts have not yet sufficiently reflected in the total production. In Türkiye, although the vineyard area covered by grape varieties cultivated for this type of consumption has decreased by 11%, production volumes have remained stable. This shows that the change in the Southeast is based on regional and specific reasons. Previous researchers have emphasized that within the important provinces for vineyard area and grape production in the Southeast Anatolia region, Mardin, Gaziantep, Kilis, and Adıyaman are important provinces for dried grape production (Söylemezoğlu et al., 2025), while Gaziantep, Mardin, and Diyarbakır are important provinces for table grape production (Anonymous, 2021; Gürsöz, 1993; Kiracı et al., 2024). Across Türkiye, the provinces that stand out in wine grape production are Denizli, Tokat, Nevşehir, Elâzığ, Kilis, Çanakkale, and Tekirdağ (Kiracı et al., 2024). On the other hand, the provinces of Siirt, Diyarbakır, and Adıyaman hold an important position in organic grape production within the country (Söylemezoğlu et al., 2025). Table 3 presents data on the cultivation of wine grape varieties in the Southeastern Anatolia Region between 2004, 2014, and 2024, broken down by province and for Türkiye. Based on these data, it can be seen that no wine grapes were produced in Batman province in any of the three years under review. Among the reasons for this are the lack of demand for wine consumption due to the socio-cultural behaviors and religious beliefs of the people living in Batman Province, the absence of wine production facilities, and similar factors. In

Adıyaman province, the area planted with wine grape varieties increased significantly from 100 decares in 2014 to 1,500 decares in 2024. However, the yield per unit area of wine grape varieties in the province decreased from 750 kg/da in 2014 to 500 kg/da in 2024. However, thanks to the increase in cultivated areas, production has increased tenfold. In recent years, Mardin province has emerged as a rapidly growing player in wine grape production. Although there has been development in this area in the provinces of Diyarbakır, Adıyaman, and Siirt, Mardin is ahead of other provinces in terms of marketing thanks to its long-standing Syriac wine culture. However, the grape yield per unit of vineyard area is quite low, not only compared to the world average but also compared to the national average. The reasons for this include the continued cultivation of local varieties, the insufficient spread of advanced training systems in the province, the use of traditional methods during pruning, ongoing issues in technical areas such as fertilization and irrigation, inadequate and improper measures against diseases and pests, and the lack of knowledge and implementation of practices such as canopy management and summer pruning. Despite high temperatures and droughts during the later stages of the vegetation period, the lack of use of shade covers, the failure to select rootstocks suitable for the variety, and similar issues can be listed as reasons. In the provinces of Diyarbakır and Kilis, it has been observed that the area of vineyards planted with wine grape varieties has fluctuated over the years. Today, Kilis is the province with the highest wine grape production in the region, yielding 11,730 tons of grapes from 73,980 decares of land in 2004. Although the area of vineyards cultivated with wine grapes in the province reached 130,114 decares and the production amount reached 49,859 tons in 2014, the vineyard area later decreased to 62,258 decares and the production amount decreased to 36,217 tons. Nevertheless, the increase in yield in the wine grape vineyards of Kilis province over the last 20 years (364%) is quite remarkable. Kilis province was home to wineries in the early years of the republic (Tokuçoğlu, 2012). Local and standard grape varieties suitable for wine production are frequently found in the vineyards of the province. However, the wine grapes produced in this province today are sold and processed in wineries in different provinces. Diyarbakır province is still home to small-scale wineries today. Wine grape production in Diyarbakır has followed a similar trend to that in Kilis province. From 2004 to 2024, vineyard areas were determined to be 8,000 da, 18,620 da, and 9,280 da, respectively. In parallel, wine grape production in the province was recorded as 700 tons, 13,052 tons, and 6,526 tons. However, the grape yield per unit area in Diyarbakır has seen a significant increase, nearly eightfold over the past 20 years. The increase in production volume and yield in Diyarbakır province is largely related to the compatibility of the locally grown wine grape varieties Boğazkere and Öküzgözü, which are internationally recognized and in increasing demand, with the regional climate and their widespread

cultivation in the region's vineyards. However, Çelik and colleagues (2005) emphasized that the unplanned spread of the Boğazkere variety in the province's vineyards, using outdated techniques and mostly unvaccinated saplings, is cause for concern for the future of viticulture in the region. In the provinces of Gaziantep and Şanlıurfa, wine grape vineyards are gradually decreasing. In particular, wine grape production in Şanlıurfa has almost come to a complete halt. Among the reasons for this situation are: the preference for alternative crops that generate more income, increasingly frequent and prolonged periods of extreme heat, the lack of sufficient market and demand, and similar factors. On the other hand, wine grape vineyards still exist to a significant extent in Gaziantep, but the downward trend is a cause for concern. Nevertheless, in 2024, the amount of wine grapes produced per unit area increased by 3.45 times compared to 2004, suggesting that both new and established producers are applying cultural practices correctly and on time, as well as adopting new techniques that enhance productivity. While there was no wine grape cultivation in Siirt province in 2004 and 2014, by 2024, it was observed that products were obtained from the newly established vineyards. Indeed, today in Siirt Province, 2,630 tons of wine grapes are produced annually from 1,461 decares of vineyard area. With a yield of 1,800 kg/da per decare, Siirt Province has a productivity that is well above the regional and even national average. This situation may be attributed to the establishment of new wine grape vineyards in Siirt Province in accordance with modern viticulture practices, the careful approach to cultivation, adherence to terroir rules, the selection of grape varieties with high adaptability to the region, or similar factors. The production method in this province should be closely monitored, and successful practices should be disseminated to other provinces in the region.

The Southeastern Anatolia Region accounts for 27% of Türkiye's total vineyard area and approximately 18% of total grape production. When considering only vineyards where wine grape varieties are cultivated, the Southeastern Anatolia Region accounts for 25% of the country's vineyard area and 21% of production volume. In this regard, the region holds a significant position within Turkish viticulture (Turkish Statistical Institute, 2025). On the other hand, wine grape production accounts for approximately 11% of total grape production in Türkiye. However, not all of these grapes are used for wine production; a significant portion is used in the production of fruit juice, vinegar, fruit leather, grape molasses, walnut sausage, köfter, and similar food products. Some sources report that only 2-3% of the grapes produced in Türkiye are used in wine production. This situation is also clearly evident when comparing Türkiye 's position in the global grape production rankings and its grape production volume with its position in wine production and wine production values (OIV, 2025). Although wine grape areas

have decreased across Türkiye over the past 20 years, grape yields per unit area have continued to increase. On the other hand, the production dynamics of wine grapes differ greatly from those of table and raisin grapes, both across Türkiye and in the Southeastern Anatolia region (Polat et al., 2018). When considering the entire Southeast Anatolia region in terms of wine grape cultivation, it has been observed that, despite fluctuations in vineyard areas and production volumes over the past 20 years, grape yields per unit area have increased. This increase in yield has offset the decline in vineyard areas, and by 2024, wine grape production in the region has reached 2.4 times the level of 2004. However, the yield obtained from vineyards where wine grape varieties are grown in the region (560 kg/da) is still below the Turkish average (682 kg/da).

Table3. Changes in Wine Grape Production Areas and Quantities (TÜİK, 2025)

	Production area (da)			Yield (kg/da)			Production Quantity (ton)		
	2004	2014	2024	2004	2014	2024	2004	2014	2024
Adıyaman	-	100	1.500	-	750	500	-	75	750
Batman	-	-	-	-	-	-	-	-	-
Diyarbakır	8.000	18.620	9.280	88	701	703	700	13.052	6.526
Gaziantep	53.480	9.560	9.535	217	566	749	11.594	5.414	7.140
Kilis	73.980	130.114	62.528	159	383	579	11.730	49.859	36.217
Mardin	2.060	63.757	55.820	485	428	451	1.000	27.264	25.184
Siirt	-	-	1.461	-	-	1.800	-	-	2.630
Şanlıurfa	40.920	1.827	30	191	883	500	7.835	1.613	15
Şırnak	50	-	70	720	-	400	36	-	28
Güneydoğu	178.490	223.978	140.224	184	434	560	32.895	97.277	78.490
Türkiye	700.000	687.512	558.243	529	647	682	370.000	445.127	380.738

Table 4 provides detailed data on the cultivation of “dried seedless grape” varieties in the provinces of the Southeastern Anatolia region. In Siirt province, it is observed that no enclosed vineyard areas have been established for the cultivation of dried seedless grape varieties since 2004, and that vineyard activities for this commercial purpose have not been continued in the province. In Adıyaman province, both the vineyard areas (from 15,100 da in 2004 to 39,939 da in 2024) and the production quantities (from 4,830 tons in 2004 to 25,668 tons in 2024) have shown a steady and significant increase over the years. In the vineyards where dried seedless grape varieties are cultivated in the province, productivity has doubled by 2024 compared to 2004. Particularly, consumer demand for the Besni grape variety, which has been granted a geographical indication, ensures that production in the province is maintained and even increased. As of 2024, Mardin province is the province with the highest production of dried seedless grape varieties in Southeastern Anatolia. It has maintained its leadership in this field since 2004. The Karfoki grape variety, which is grown in Mardin province and has a geographical indication, has a very special place in this production. Between 2004 and 2024, the vineyard area where dried grape

varieties are grown in Mardin province increased by 1.8 times, while the production volume increased by 1.4 times. However, the grape yield per unit vineyard area has decreased from 558 kg/da to 450 kg/da over the years. When considering data on grape cultivation for other commercial purposes in Mardin Province, a general decline in yield is evident across the province's vineyards. The most likely reason for this situation is that the local grape varieties grown in the province are struggling to cope with the stress caused by the temperature increases resulting from climate change. Gaziantep, which ranked first in the region in terms of vineyard area for dried seedless grape varieties in 2004 (121,830 da), lost a significant portion of these vineyards by 2014 (48,399 da). In subsequent years, vineyards growing dried grape varieties have been largely preserved. On the other hand, productivity increased 2.4 times between 2004 and 2014, and 1.4 times between 2014 and 2024. It has been determined that this increase in yield has compensated for the decline in vineyard area, enabling production to exceed the 2004 level of 28,920 tons and reach 42,307 tons in 2024. Accordingly, Gaziantep serves as a successful example of increasing production through productivity despite a decline in vineyard area. Between 2004 and 2024, Kilis province has set an important example by steadily increasing both its vineyard area (1.7 times), productivity (3.7 times), and total production volume (6.3 times) in terms of the cultivation of raisin grape varieties. It can be said that Kilis is an important and growing player in the cultivation of raisin grapes. Batman province, despite becoming an important producer in 2014 in terms of vineyard area and production volume for dried seedless grape varieties (25,785 da and 14,420 tons), has been unable to maintain this production model. In 2024, due to both the reduction in vineyard areas and the decline in productivity, the province's grape production fell to 7,141 tons per year. Between 2004 and 2014, Diyarbakır largely preserved the vineyard areas where dried seedless grape varieties were grown and even increased grape production from 2,973 tons to 17,663 tons thanks to increased productivity during this period. However, between 2014 and 2024, production was abandoned in nearly all of the vineyards where these varieties were grown, resulting in a decline in production volume to 841 tons. This change means that producers in Diyarbakır have largely abandoned the production of dried grape varieties with seeds. The reason for this may be that producers prefer alternative product patterns. Despite being one of the top three provinces in southeastern Anatolia for raisin grape cultivation between 2004 and 2014, Şanlıurfa has lost nearly all (97.5%) of its vineyard areas by 2024. There are several reasons for this change in Şanlıurfa. These include: the dismantling of vineyards due to urbanization; the end of vineyard cultivation, which was carried out as intercropping, due to the fruiting of trees in orchards of higher-income fruit types such as pistachios and olives; the shift toward crops that generate higher income, and the decline in vineyard productivity due to bureaucratic issues related to irrigation, in addition to rising

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temperatures and drought (Bekişli et al., 2015; Polat et al., 2018; Özel and Eser, 2021). Eser (2019) found that in areas where viticulture is practiced as intercropping among other fruit trees, different training systems are not used, and production continues with traditional training methods. On the other hand, the decline of vineyards in Şanlıurfa province has also led to the complete loss of a portion of the province's local grapevine genetic resources. Some grape varieties identified by Gürsöz (1993) are no longer found in vineyards today. In Şırnak province, the production of dried seedless grape varieties has shown sharp declines and increases over the past 20 years, with an annual production of 2,922 tons on 5,955 hectares as of 2024.

Table4. Changes in Production Areas and Quantities of Dried Grapes with Seeds (TÜİK, 2025)

	Production area (da)			Yield (kg/da)			Production Quantity (ton)		
	2004	2014	2024	2004	2014	2024	2004	2014	2024
Adıyaman	15.100	29.296	39.939	320	693	643	4.830	20.297	25.668
Batman	2.200	25.785	17.850	220	559	400	485	14.420	7.141
Diyarbakır	26.800	23.285	1.028	111	759	818	2.973	17.663	841
Gaziantep	121.830	48.399	48.081	237	621	880	28.920	30.073	42.307
Kilis	31.520	33.405	53.908	159	330	585	5.020	11.013	31.552
Mardin	72.260	145.800	128.104	558	477	450	40.305	69.534	57.605
Siirt	-	-	-	-	-	-	-	-	-
Şanlıurfa	69.420	47.885	1.747	447	707	467	31.054	33.869	815
Şırnak	8.500	92	5.955	758	304	491	6.439	28	2.922
Güneydoğu	347.630	353.947	296.612	345	556	569	120.026	196.897	168.851
Türkiye	750.000	628.137	491.612	467	681	645	350.000	427.533	317.053

The Southeastern Anatolia Region is Türkiye's most important region in terms of the area and production volume of raisin grape cultivation (Ünal and Soltekin, 2018). Indeed, as of 2024, the region accounts for 60% of the vineyards where dried seedless grape varieties are cultivated in Türkiye, and 53% of the total harvest comes from this region. The total vineyard area dedicated to this purpose in the region was 347,630 hectares in 2004, but this area has decreased to 296,612 hectares by 2024. The major losses of vineyards, particularly in Diyarbakır, Gaziantep, and Şanlıurfa, are the main reasons for this situation. On the other hand, the average grape yield obtained from vineyards where dried grape varieties are grown in the region has steadily increased from 345 kg/da to 569 kg/da over the past 20 years. The continuous upward trend in vineyard productivity in the region is largely attributed to productivity increases in Gaziantep, Kilis, Adıyaman, and Diyarbakır. However, the average productivity value in the region remains below the national average (645 kg/da). The amount of dried seedless grape varieties grown in vineyards in the region was 120,026 tons in 2004, but it jumped significantly to 196,897 tons

in 2014, only to decline to 168,851 tons in 2024. Across Türkiye, the area of vineyards where dried seedless grape varieties are cultivated decreased significantly and continuously from 750,000 da in 2004 to 628,137 da in 2014 and 491,612 da in 2024. The grape yield per unit vineyard area has increased from 467 kg/da (2004) to 645 kg/da (2024). However, the increase in yield has not been able to compensate for the decline in vineyard areas dedicated to dried seedless grape varieties across the country, resulting in a production decrease of approximately 10% over the past 20 years, dropping to 317,053 tons. Nevertheless, the increase in grape yield per unit vineyard area is encouraging both at the regional and national levels. This situation indicates that more modern agricultural techniques are beginning to be adopted, that there is an increasing trend toward grape varieties that are highly adaptable to the ecological conditions of the regions where they are grown and are highly productive, and that the varieties most suitable for the commercial purposes of the region are being selected. When examining the data in Table 5, it is observed that in the last 20 years (from 2004 to 2024), no vineyards for drying seedless grape varieties have been established in the provinces of Adıyaman, Gaziantep, Kilis, Mardin, Siirt, and Şanlıurfa, nor were any previously present. The primary reasons for this situation include: the fact that viticulture in these provinces is primarily carried out without irrigation, the absence of ecological conditions suitable for the cultivation of seedless raisin grape varieties in these provinces, the lack of productive and high-quality varieties among local varieties that could be cultivated for this purpose, and similar factors. In addition, the fact that the Aegean Region, where the production of seedless raisin varieties is widespread in Türkiye, has a global brand value also causes other regions to avoid competition. Indeed, Türkiye is the most important player in the global raisin market with a 31.6% share of exports thanks to the export of seedless raisins produced in the Aegean Region. Although vineyards for the cultivation of these varieties have been established from time to time in the provinces of Şırnak, Batman, and Diyarbakır, as of 2024, the total amount of grapes obtained from seedless raisin grape varieties in Southeastern Anatolia is only 90 tons. The total vineyard area where seedless raisin grapes are grown across Türkiye has remained almost the same over the past 20 years, despite some declines. Production volume, however, has increased due to the rise in the amount of grapes produced per unit of vineyard area. As of 2024, Türkiye produces a total of 944,294 tons of seedless raisin grapes annually across 760,761 hectares of vineyards. This production volume represents the amount of fresh grapes obtained from these varieties. Türkiye has a higher productivity in the cultivation of both table seedless and dried seedless grape varieties compared to other varieties. This situation stems from the productivity of these varieties, the ecological advantages of the regions where they are intensively cultivated, the high level of awareness among producers, and the application of modern viticulture

techniques in these regions. The Southeastern Anatolia Region, however, does not possess these advantages. This situation indicates that the trend in Southeastern Anatolia is based on regional and specific reasons, while the importance of seedless raisin grape varieties is maintained throughout Türkiye.

Table5. Changes in Production Areas and Quantities of Seedless Grapes for Drying (TÜİK, 2025)

	Production area (da)			Yield (kg/da)			Production Quantity (ton)		
	2004	2014	2024	2004	2014	2024	2004	2014	2024
Adıyaman	-	-	-	-	-	-	-	-	-
Batman	-	250	30	-	308	400	-	77	12
Diyarbakır	-	1.700	-	-	154	-	-	261	-
Gaziantep	-	-	-	-	-	-	-	-	-
Kilis	-	-	-	-	-	-	-	-	-
Mardin	-	-	-	-	-	-	-	-	-
Siirt	-	-	-	-	-	-	-	-	-
Şanlıurfa	-	-	-	-	-	-	-	-	-
Şırnak	6.250	-	120	760	-	650	4.750	-	78
Güneydoğu	6.250	1.950	150	760	173	600	4.750	338	90
Türkiye	750.000	716.265	760.761	1.173	1.586	1.241	880.000	1.135.947	944.294

4 Conclusion

In this study, the dynamics of grape production in the Southeastern Anatolia Region and Türkiye between 2004, 2014, and 2024 were analyzed based on the principle of grouping grapes according to their commercial evaluation classes. The findings clearly show that a significant transformation has taken place in the viticulture sector at the regional and national levels. During this transformation process, a sharp decline in vineyard areas was observed in the Southeastern Anatolia Region, while there was an increase in the amount of product obtained from unit vineyard areas. Indeed, the total area under viticulture in the region decreased from 1,235,590 da in 2004 to 1,000,992 da in 2024. On the other hand, the production amount increased from 469,205 tons in 2004 to 630,535 tons in 2024. The increase in grape production in the region was achieved through increased yields in vineyards. A similar situation has occurred throughout Türkiye. While the total vineyard area in Türkiye was 5,200,000 da in 2004, it decreased to 3,722,850 da in 2024. Although the production volume fluctuates according to seasonal climatic changes, it is largely maintained. The decline in vineyard areas both across Türkiye and in the

Southeastern Anatolia Region indicates that producers have shifted toward the cultivation of different, high-yield crops. The findings suggest that producers continuing cultivation in the remaining vineyard areas have adopted more modern agricultural techniques, appropriate variety/rootstock selection, and likely improved water management. It is evident that a multidimensional transformation has taken place in grape production in the Southeastern Anatolia Region. The transformation in viticulture in the Southeastern Anatolia Region has not been limited to a reduction in area and an increase in yield, but has also resulted in the purpose of grape production being shaped in line with market demands and, possibly, the varieties grown changing accordingly.

In this regard, it can be said that the provinces in the region have begun to develop their own viticulture strategies. Indeed, in provinces where viticulture is practiced, production for certain commercial purposes has been discontinued, but there has been a focus on the production of grape varieties that have increased yields and generated satisfactory income. Among the most prominent examples of this situation are: Diyarbakır and Şanlıurfa's withdrawal from the production of dried seedless grape varieties, Adıyaman and Kilis's increase in the production of wine and dried seedless grape varieties, Şırnak's increase in the production of table seedless grape varieties, and Siirt's shift toward wine grape cultivation in addition to its existing table grape vineyards. A more in-depth examination of the driving forces behind this transformation and its future potential is necessary. As a result, it is evident that structural changes are taking place in the viticulture sector across Türkiye and that new strategies are needed for viticulture regions in terms of sustainability. Grape production in the Southeastern Anatolia Region is undergoing a complex transformation process characterized by a significant increase in yield per unit area, accompanied by a serious decline in acreage. This situation suggests that farmers are reevaluating their production preferences and shifting toward more efficient but often smaller-scale production due to various factors such as climate change, limited water resources, changes in market demands, and agricultural policies. While some provinces in the region are withdrawing from grape production, provinces such as Gaziantep, Adıyaman, and Kilis are emerging as models focused on efficiency or growth in grape production for specific commercial purposes. Similar trends across Türkiye underscore the importance of strategic planning, technological adaptation, and policies that take regional differences into account across the entire viticulture sector.

5 Suggestions

5.1 Promoting Efficiency-Focused Agricultural Policies

Despite the decline in fruit-growing areas in the Southeastern Anatolia Region, the increase in efficiency demonstrates the effectiveness of modern agricultural techniques. Therefore, efficiency-focused production models should be promoted by increasing training programs, technical support, and incentives for farmers in the region.

Promotion of Drought- and Climate-Resistant Varieties and Rootstocks: Considering that climatic factors are behind the reduction in acreage, the development and dissemination of drought-resistant grape varieties and rootstocks is of great importance.

Focus on Value-Added Products: The increase in wine grape production demonstrates that value-added products can contribute to the regional economy. In this regard, investments should be encouraged in areas such as wine production, organic dried products, and geographically indicated table grapes.

Strategic Planning that Takes Regional Differences into Account: The success stories of provinces such as Gaziantep, Adıyaman, and Kilis demonstrate the need to develop different strategies according to each province's potential. Therefore, province-based agricultural policies should be created, and support should be tailored to these differences.

Strengthening Producer Cooperatives: In order to increase productivity and marketing power in shrinking production areas, producer unions and cooperatives should be supported, and financing, training, and marketing support should be provided to farmers through these structures.

Data-Driven Agriculture and Digitalization: Agricultural data collection systems, satellite-supported monitoring, and digital agriculture applications should be widespread to ensure more informed production decisions. This will increase both productivity and sustainability.

Development of a National Grape Strategy: Since similar structural transformations are taking place throughout Türkiye, a comprehensive national grape strategy should be developed; this strategy should cover production, processing, marketing, and export dimensions.

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