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THE STRATEGIC ROLE OF MUĞLA PROVINCE IN OLIVE AND OLIVE OIL PRODUCTION IN TÜRKIYE

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Abstract: Muğla is one of Türkiye's most important olive-producing regions and has preserved its value from past to present through olive and olive oil production. The region's Mediterranean climate and fertile soils have supported the development of olive cultivation in Muğla. The historical relationship between Muğla and olives dates back to ancient times, during which olives have served both as a livelihood for the local population and as a cultural heritage element. Muğla's significance in olive production can be understood from its position as one of the leading provinces in Türkiye's overall olive output. In particular, districts such as Milas, Menteşe, Yatağan, Bodrum, and Fethiye contribute greatly to olive production. The region's olive oils are in demand in both national and international markets due to their high quality. When production data is examined, Muğla holds a significant share within Türkiye's total olive production, a contribution that reinforces the country's standing in global olive production. While Türkiye ranks among the top countries in the world in terms of olive output, Muğla's role in this success is undeniable. The olive oils produced in Muğla are registered as geographically indicated products and stand out as high value-added goods. Beyond olive oil, by-products of olives are also utilized in various industries, contributing to the regional economy. However, olive producers face several challenges, including climate change, rising costs, marketing difficulties, and the transition to sustainable production techniques. In this context, providing technical support to producers, developing more efficient marketing strategies, and minimizing environmental impacts are of great importance to ensure the sustainability of olive farming. In conclusion, Muğla's olive production stands out due to its significant contribution to Türkiye's olive sector and the value its olive oil brings to the global market. Nevertheless, considering the challenges faced by producers, a transition toward more sustainable and efficient production systems is essential.

Keywords: Muğla, Olive, Olive oil, Value added product

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1. Introduction

The history of Muğla province, which is an important part of the Caria region located in the southwest of Anatolia, dates back to 3000 BC. It is stated that the province played an important role in maritime trade during this period. Throughout history, Muğla has been under the rule of various civilizations; it was first called Alinda and Mobella, and then came under the control of great states such as Byzantium, Seljuks, Menteşe Principality and Ottoman Empire (Niray, 2002; Oktik et al., 2004).

Olive oil trade has a historical importance within the boundaries of Muğla province. The Mediterranean production tradition has been widespread in Anatolia since antiquity and Muğla has been a part of this production network. Records from the 16th century indicate the existence of olive mills in the Menteşe Sanjak (Taşkıran, 2004). The rich forested areas, mines and arable lands in the region have led to invasions throughout history. However, the modern development process progressed rather slowly. Although Muğla gained commercial importance in the 16th century with the conquests of Rhodes, the economy remained largely based on agriculture (Tekeli, 1993).

Muğla's economy in the 19th century was largely based on timber and forest products. In the early 20th century, the Italian occupation of Rhodes caused Muğla's economic structure to become dependent on the northern regions. During this period, agricultural products such as sweetgum (*Liquidambar orientalis*) oil and tobacco became important sources of income. At the same time, tobacco production increased with mechanization and olive cultivation started to develop in this period (Aktüre, 1993). Records kept after the proclamation of the Republic clearly show that the number of olive trees in Türkiye increased gradually (Çakar et al., 2011). In the early 1970s, as a result of the developments in olive cultivation in Türkiye and around the world, olive cultivation gained acceleration in Muğla. In order to contribute to this process and to identify the problems related to olive cultivation in the region, the Ministry of Agriculture of the Republic of Türkiye established the Olive Growing Application and Research Center in Milas district. As of 2024, the research center continues to be managed by Muğla Sıtkı Koçman University.

Within the scope of this study, the historical and economic importance of Muğla olive cultivation, its contribution to regional production, the development of value-added products derived from olives and olive oil, and the challenges faced in production and marketing processes are discussed. Furthermore, this study aims to highlight the strategic role of Muğla in Türkiye's olive sector and provide forward-looking recommendations to support sustainable development and competitiveness in the future.

2. Türkiye's Position in World Olive Production and Muğla's Contribution to Olive Production

The olive tree is an evergreen and long-lived plant with the potential to be cultivated in both the northern and southern hemispheres between 30-45 degrees latitude (Russo et al., 2016). However, 97% of olive production worldwide is realized in the Mediterranean Basin. According to FAO 2022 data, Türkiye accounts for 14% of world olive production. In Türkiye, the total production of table and oil olives was recorded as 2 976 000 tons as of 2022. Of this production, 938 217 tons are table olives and 2 037 783 tons are oil olives (Anonymous, 2024a) (Figure 1). However, since the data for Greece for 2022 is not available at FAO, the olive production data for this country for 2021 is used.

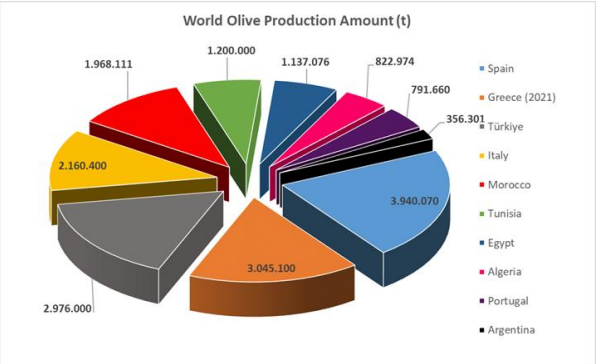

Figure 1. World-wide grain olive (table and oil) production (Anonymous, 2024a).

Türkiye stands out as the world's third largest olive producer after Spain and Greece, revealing the great potential Türkiye has in terms of olive production. According to FAO data, olive land in Türkiye accounts for 8.6% of total agricultural land and approximately 400,000 farmers make their living from olive production (Sarı and Külekçi, 2024). Although Türkiye's olive production efficiency is above the world average, it is 28.7% lower compared to European Union countries (Anonymous, 2024a). Therefore, the implementation of strategic measures to increase production efficiency will not only increase Türkiye's olive production capacity, but will also increase its competitiveness in international markets.

According to FAO data, olive oil production worldwide was 3 125 665 tons in 2019, 3 404 420 tons in 2020 and 3 348 153 tons in 2021. In 2021, there was a significant decrease in olive oil production in European countries such as Italy and Portugal, which are major olive oil producers, especially Spain, due to temperatures and droughts above seasonal norms (Özözen, 2024). Since FAO olive oil production data for 2022 is not yet available, the most recent data could not be included in this study. Spain and Italy account for the majority of olive oil production and exports worldwide. In the 2021/22 season, olive oil imports remained close to the previous year's level, while producer prices increased by 24%. Data for 2021 for the top 10 olive oil producing countries worldwide are presented in Figure 2.

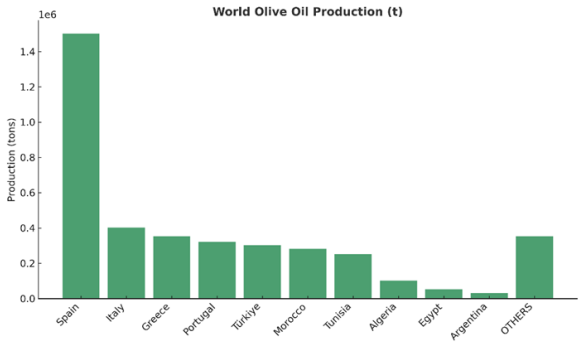

Figure 2. World olive oil production (Anonymous, 2024a).

In the past years, significant increases in olive production areas and quantities have been recorded in Türkiye, as in European countries such as Spain, Italy and Greece (Beltrán-Esteve, 2013; Çukur et al., 2013; Galluzzo, 2014; Niavis et al., 2018). In Türkiye, there has been an 89% increase in the number of olive trees and a 119% increase in olive production in the last 20 years. The number of 99 million olive trees in 2001 increased to over 187 million in 2020. According to TurkStat 2023 data, this number has reached 200 million (63 million trees for table olives and 137 million trees for olive oil production) (Anonymous, 2024b). Olives are grown in many regions of Türkiye, with the most intensive production in the Aegean, Mediterranean and South Marmara regions. The Aegean Region stands out as the largest olive production center in Türkiye. According to current data from TurkStat, table olive production in Türkiye is 490 000 tons and oil olive production is 1 030 000 tons (Anonymous, 2024b). It is seen that these values do not exactly match the FAO data.

In Türkiye, olives are of great economic and social importance, especially in the Aegean and Mediterranean regions. In terms of the components it contains, olive oil is more valuable than other oils used in human consumption. Studies show that olive oil contains nutritional properties equivalent to breast milk. As a matter of fact, Tosun (2019) emphasized in his study that olive oil is quite similar to breast milk in terms of phytochemicals, and the only difference is the plant sterols in olive oil. In this context, olive oil is considered as a "liquid gold" offered by nature.

Although the benefits of olive oil have been proven by the results of modern scientific research, it has been a product known and used by people in the regions where it is grown even in the past. It has been consumed and appreciated for centuries for different purposes. Today, olives are widely used in the food sector as well as being utilized as raw material for various value-added products. Most of the olives produced in Türkiye are cultivated to produce olives for oil. As of 2023, İzmir (185 957 tons), Muğla (163 282 tons) and Hatay (137 527 tons) stand out as the provinces with the highest oil olive production in Türkiye (Figure 3). Muğla is the second province with the highest oil olive production in Türkiye. Canik et al. (2020) stated that the fact that Muğla is the second largest province in Türkiye in this field, which brings olive oil obtained from the production of the olive tree, also called the "immortal tree", to the national economy, once again shows the strategic importance of the province.

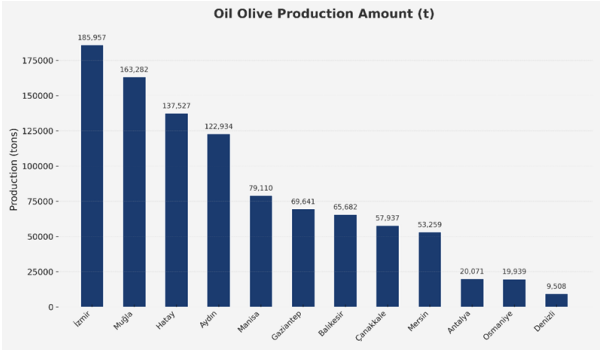

Figure 3. Amounts of oil olives produced by provinces in Türkiye (Anonymous, 2024b).

Table olive production also plays an important role in Türkiye's agricultural economy. This product makes great contributions in terms of utilizing the country's own resources, creating employment and providing raw materials to other sub-sectors (Çetin and Tipi, 2000). Table olive production in Türkiye is largely carried out by small family enterprises (Güngör, 2010). However, the lack of information and technology infrastructure in these enterprises limits quality production and increases costs. Olive production values in Türkiye continue to maintain their upward trend. The olive sector has taken its place among strategic products in the Common Market Order of the European Union (Tuna, 2005).

Both the consumption and production figures of table olives in Türkiye showed a very rapid growth between 1999 and 2009. Despite unfavorable climatic conditions such as global warming, this increase can be attributed to several reasons. Factors such as the migration of the young population to big cities, the tendency towards olive agriculture that requires less labor, the incentives given to the establishment of olive groves with the use of certified seedlings and the easy availability of olive saplings everywhere have been effective in this growth (Savran and Demirbaş, 2011).

The most widely cultivated table olive varieties in Türkiye include Gemlik, Ayvalık, Domat, Memecik, Erkence, Uslu, Kalamata (Eşek Zeytini), Yamalak Sarısı and Edincik Su. Especially Gemlik olives have a special importance as black table olives due to their high quality and prevalence (Canözer, 1991; Kaynaş et al., 1998). According to TURKSTAT 2023 data, the provinces producing the most table olives in Türkiye are Manisa (120 277 tons), Bursa (96 498 tons), Aydın (50 103 tons), Mersin (42 192 tons), Hatay (41 406 tons), İzmir (33 665 tons), Balıkesir (32 516 tons), Muğla (11 116 tons), Denizli (8 245 tons) and Antalya (7 559 tons). (Figure 4)

In Muğla, the second province with the highest oil olive production in Türkiye, olive fruits are processed into olive oil in olive oil production facilities after they are harvested. Farmers do not pay the processing fee directly in cash to the processing facilities in the province. Payment is made in kind depending on whether the producer brings the product to the facility or the facility transports the product from the garden. This practice is called "hak oil" in the region. In Milas district, where olive production is the highest, the right oil practice is carried out in two different ways: If the producer harvests the olives and brings the product to the processing facility himself, 7% of the olive oil obtained at the facility is taken as right oil. In the other case, if the olive processing facility takes the olives from the orchard and brings them to the processing facility itself, the right oil rate is 10%. This rate difference is mainly due to transportation costs (Acar, 2021). According to TURKSTAT 2023 data, olive production is carried out in all districts of Muğla and the total amount of production (oil and table) is as follows: Milas (79 294 tons), Menteşe (31 097 tons), Yatağan (18 547 tons), Bodrum (11 421 tons), Fethiye (9 933 tons), Seydikemer (7 952 tons), Dalaman (5 337 tons), Köyceğiz (5 225 tons), Ortaca (1 878 tons), Kavaklıdere (1 449 tons), Datça (1 132 tons), Marmaris (808 tons) and Ula (325 tons) (Figure 5).

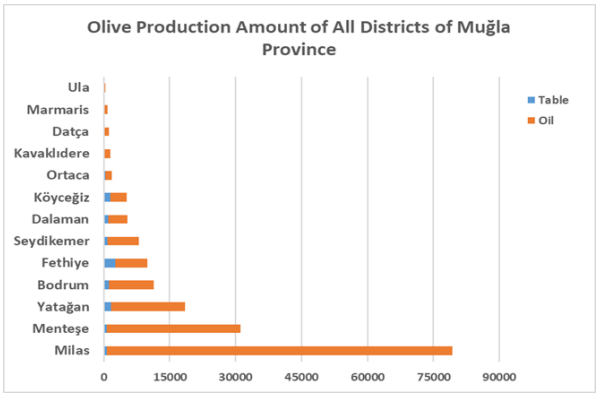

Figure 5. Olive production amounts of all districts in Muğla province (Anonymous, 2024b).

Muğla is a province located in the Aegean Region of Türkiye and has a strategic importance in terms of olive cultivation. Olive production has an important share in Türkiye's agricultural activities and Muğla is in a key position in this production. Both the geographical features and climate of the province are extremely favorable for olive cultivation. For thousands of years,

olives have stood out as one of the most important agricultural products of this geography and have become a basic source of livelihood for the people of the region. Olives and olive oil produced in Muğla are in demand not only in the domestic market but also in the international market. The olive sector enables the development of new value-added products in cooperation with the agricultural and industrial sectors in the region and thus contributes to the growth of the regional economy (Öztürk et al., 2009; Sönmez et al., 2015; Deliboran, 2019).

3. Value Added Products of Olive and Olive Oil

Value added refers to the selling price of a product minus the cost of inputs used in production (de Chernatony et al., 2000). This definition can in fact be related to profitability; value added simply refers to the difference between output and input (Brandenburger and Stuart, 1996). In today's global trade, it has become increasingly important to achieve high added value by developing new products in international markets where competition is intense (Demir, 2016; Desai et al., 2016; Akyol, 2018; Garg et al., 2021). The new product development process covers a dynamic process from the emergence of an idea to the transformation of this idea into a commercial product (Cengiz et al., 2010). In the agriculture and food sector, increasing consumer demands for healthy and practical food lead manufacturers to develop innovative and functional products. This makes it easier to capitalize on current market trends (Hoye, 2009; David et al., 2015; Sowmya et al., 2019).

Agricultural products are utilized not only as food but also as biological raw materials in many sectors. Maximizing the utilization of harvested agricultural products for a production that supports both environmental sustainability and high economic value is the basis of the value-added production approach. It is stated that wastes from olive and olive oil production are important products that should be utilized in this context. Special strategies need to be developed to transform these agricultural wastes into value-added products (Anand et al., 2013). Especially the treatment of wastewater containing biodegradable organic compounds is of great importance for the recovery of valuable products such as bioflocculants, bioplastics, biosurfactants, hydrogen, methane and electricity (Sangamithra et al., 2013; Naspolini et al., 2017; Sathyanarayana et al., 2017).

Thanks to its great potential, Türkiye's agricultural sector supports the country's development in various ways. In addition to meeting the food needs of the population, this sector is effective in many areas such as providing raw materials to industry, creating demand for industrial products and contributing to the increase in national income through exports. The role of the agricultural sector in economic development stems from its multifaceted contributions to the development process. The olive sector is an important part of the integration of agriculture and industry. Products obtained from olive trees are processed into table olives and olive oil and offered to consumers (Acar, 2021).

Olives have been used by many civilizations throughout history for different purposes and have been considered a symbol of peace, health and longevity. Mankind has consumed olives and the products derived from them not only as a food source but also for their healing properties. Olive production in Anatolia is a long-standing tradition and this product is of great importance in terms of foreign trade. Türkiye generates foreign exchange income by exporting some of the olives and olive oil it produces. However, despite being one of the world's leading olive producers, the desired level of exports has not yet been reached (Özaltaş et al., 2016). One of the most important factors in olive oil exports is the quality of the exported olive oil. Quality both increases the added value of the product and strengthens the olive oil image of the country in international markets. Among the factors that determine the quality of olive oil are olive cultivation processes, rapid pressing of the harvested olives and storage of the oil under suitable conditions after pressing. Although Türkiye is experiencing positive developments in these areas every year, the desired level of quality has not yet been fully achieved (Savran and Demirbaş, 2022).

The most important indicator of quality in olive oil is the acid ratio. Olive oils with high acidity are classified as low quality and farmers who produce olive oils of this quality lose profit. In recent years, countries such as Italy, Spain and Greece have prioritized small quantities of high-quality production over high quantities of low-quality production. However, this understanding is still quite new for Türkiye, and high-quality production may still remain in the background since the production quantity targets are at the level of leading producer countries (Özdoğan and Tunalıoğlu, 2017).

Olives and olive oil are not limited to table consumption and oil production; they are also used as raw materials for high value-added products in the health, cosmetics, and food industries. Polyphenols such as hydroxytyrosol and oleuropein, derived from olive leaves and fruit, exhibit antioxidant, immune-supporting, and anti-inflammatory effects, playing a protective role against heart disease, cancer, and neurodegenerative disorders (Foscolou et al., 2018; Zheng et al., 2022). In cosmetics, olive oil-based compounds are used in anti-aging products and topical ointments for burn treatment. Additionally, olive oil is widely used in soaps, creams, lotions, and shampoos due to its moisturizing and skin-regenerating effects (Rodrigues et al., 2015).

Olive oil is not only marketed as food in certain weight bottles, but has also been marketed as an alternative medicine product in capsule form on the front shelves of pharmacies for many years. Due to its high content of antioxidants, it is used as a health-supporting food supplement. Rich in vitamin E and oleic acid, these products support heart health and facilitate digestion.

Available in capsule form, they are easy to use on a daily basis (Visioli and Galli, 1998).

Olive pate (tapenade) is a value-added product often used in Mediterranean cuisine, prepared by combining olives with various spices and flavors. This product, which is especially in demand in the tourism and gastronomy sectors, belongs to the high-priced gourmet product category. Moreover, even flour has been obtained from olive paste and this subject has been the subject of different scientific studies (Rodrigues et al., 2022). An image of olive flours is presented in Figure 6.

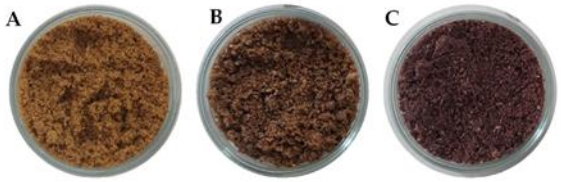

Figure 6. Olive flours obtained from olives harvested at different harvest periods; A: green olive period, B: color change period, C: black olive period (Rodrigues et al., 2022).

Olive pomace obtained during the olive production process is considered as an important raw material used in biodiesel and biogas production. Olive pomace is an energy source that supports both environmental sustainability and has high economic value (Inaloo and Saidi, 2022). Olive pits and skins are used in the production of biofuels, bioplastics and composite materials. Olive pits can be ground and added to animal feed or used in the production of biochar, an organic soil conditioner. Olive peel is also used as a raw material for the production of activated carbon. This activated carbon is used in various fields such as water purification systems, air filters and medical materials (Rodriguez et al., 2008).

Olive leaves are processed into medicinal plant products known for their antioxidant, antibacterial and antiviral properties. In particular, olive leaf tea is consumed for its effects such as regulating blood pressure and strengthening the immune system. Olive leaf extracts are used in food supplements and herbal medicine production (Borjan et al., 2020; Arslan et al., 2021).

There are still many questions about the extent to which components such as fatty acids, polyphenols, tocopherols, etc. that affect the quality of olive oil are incorporated into olive oil. More studies are needed on the properties of these components and the factors affecting their formation in order to obtain high quality olive oil. In a thesis study, it was aimed to obtain valuable products and reduce environmental impacts by processing the olive black water, which is produced during olive oil production and needs to be treated in order not to harm the environment, with biotechnological methods. In this process, studies have been carried out on the use of olive pomace as a raw material for useful components such as yeast production, extraction of phenolic compounds and antioxidant substances. Thus, both the economic value of this by-product was increased and its negative effects on the environment were minimized (Karakaya, 2018).

According to Savran and Demirbaş (2022), the value-added products obtained from olives and olive oil in Türkiye are listed as follows: Cold pressed olive oil obtained from early harvested olives; olives and olive oil with geographical indication; olive oil obtained from centuries-old olive trees; olives and olive oil produced with organic farming techniques; olive oil soap; olive paste; green olive roasting; olive oil-based cosmetic products; olive leaf tea; olive leaf extract; wooden products made from olive wood; table olives obtained through different processing methods (such as chocolate-covered olives, grilled olives); olive jam; bakery products using olives; olives and olive oils offered to the market in different packages and contents; and olive oil in vial (capsule or small bottles) format.

The biggest markets for olive oil produced in Muğla are European countries and USA. Especially organic and high-quality olive oil is more in demand in these markets (Anonymous, 2024a). This makes Muğla olive oil producers more competitive in the international market. At the same time, branding strategies are being developed in local markets. The geographical indication of Muğla olive oil has ensured the protection of the quality and origin of this product. Geographical indication is a practice that protects both the producer and the consumer by contributing to a better position of products in the market.

4. Challenges Faced by Olive Growers

Although olive trees are drought tolerant, their need for water increases, especially during critical developmental stages. Global climate change is causing major changes in precipitation regimes and increasing the severity and frequency of droughts. Especially in the Mediterranean Basin, climate change is seriously affecting agricultural production. Less rainfall and higher temperatures reduce the productivity of olive production and increase the pressure on water resources. One of the most effective measures that can be taken against this situation has been the use of drip irrigation systems, even for plants that require little water, such as olive trees (Tanasijevic et al., 2014).

In many regions where olive cultivation is practiced, intensive and unconscious agricultural activities lead to erosion and reduction of organic matter in the soil. In addition, the use of fertilizers and pesticides negatively affects soil fertility and reduces soil quality. This situation has become a major problem, especially for low-income olive producers, as switching to sustainable farming methods requires high costs (Parras-Alcántara et al., 2016).

Olive trees are faced with various pests, especially the olive fruit fly (Bactrocera oleae). The olive fruit fly can damage the fruits and cause serious yield losses (Lantero et al., 2023). Another important threat is fungal diseases such as Verticillium wilt seen in olive trees. Such diseases

reduce the productivity of the trees and make olive production unsustainable. Combating pests and diseases creates both financial and ecological costs (Montes-Osuna and Mercado-Blanco, 2020).

In recent years, there have been significant increases in the prices of inputs used in agriculture. The increase in fertilizer, pesticide, fuel and irrigation costs reduces the profitability of olive producers. In addition, labor costs constitute a major burden, especially for small-scale growers. This situation makes it difficult for producers to create a sustainable production model and reduces the profits obtained from olive production (Rodríguez Sousa et al., 2019). In addition, olive producers today are struggling with serious challenges such as climate change, soil degradation, diseases, increasing production costs and low market prices. In order to overcome these challenges, growers need to turn to sustainable agricultural practices, benefit from government support and adopt innovative agricultural techniques.

Fluctuations in olive oil prices are another important factor that negatively affects olive producers. Small producers who have to compete with large producing countries (Spain, Italy and Greece) in the world market have difficulty covering costs and are directly affected by international price fluctuations (Mili and Bouhaddane, 2021). Small-scale farmers who produce low-quality (high acidity) olive oil often face economic difficulties such as not being able to cover production costs.

Olive growers, especially when trying to enter international markets, face great difficulties in quality control and certification processes. Producers who want to produce organic or geographically indicated products must participate in these certification processes. However, these processes can be time-consuming and expensive; they pose a serious obstacle, especially for small-scale producers (Conte et al., 2020).

Olive producers in Muğla face external threats such as climate change. Factors such as irregular rainfall, extreme temperatures, drought and continuing to get yield from old trees negatively affect the productivity of olive trees. The decrease in the interest of the young population in agricultural production is another problem encountered in olive cultivation (Savran and Demirbaş, 2022). In addition, price fluctuations in the market and the lack of sufficient support for the olive sector cause producers to be in a difficult situation.

Olive cultivation activities in Muğla province are largely carried out on steep sloped lands. This situation causes labor difficulties in olive harvesting. Although small-sized harvesting machines have started to be used in the region, labor efficiency in sloped lands remains lower than in gardens with low slopes. In addition, harvesting is still done with sticks or similar tools in tall trees that the machines cannot reach, which causes the fresh shoots to break and the tree to experience alternate bearing problems. As it is known, olive is one of the fruit species that has the most alternate bearing problems, and incorrect harvesting methods lead to loss of yield and income.

5. Conclusions and Recommendations

To enhance the value of olive and olive oil production, all stakeholders must collaborate throughout the production process. With the growing emphasis on R&D and innovation, modern agricultural techniques are increasingly applied, boosting both efficiency and profitability. Industry collaboration supports sustainability and improves production quality. Technological advancements not only raise production capacity but also enhance product standards. Scientifically proven health benefits of olive oil have driven market demand, and cooperation between producers and industry promotes innovation and increases product value.

Olive and olive oil production has a strategic importance in the Turkish agricultural sector. Muğla province, as one of Türkiye's olive production centers, makes significant contributions to both national and international markets. However, olive producers face various challenges such as climate change, high production costs, productivity problems and market fluctuations. Overcoming these challenges is critical for the sustainability of the olive sector and increasing Türkiye's competitiveness in international markets.

By taking strategic steps such as providing more support to the agricultural sector, improving the quality of olive and olive oil production, and strengthening marketing activities, it should be aimed to expand olive grove areas and increase the demand for olive production in the future.

Muğla olive farming plays a significant role in Türkiye's agricultural economy and regional development. Beyond olive and oil production, sustainable value-added production can further strengthen the sector. Integrating technology and innovation will enhance global competitiveness. However, most producers are small-scale with limited infrastructure, leading to low productivity and higher costs. To address this, technical and hygiene standards must be improved, and control mechanisms effectively implemented.

Regions specialized in olive cultivation, such as Muğla, have made a significant contribution to Türkiye's position as an important actor in the world olive market. For this reason, Muğla has a competitive position not only in Türkiye but also in the world olive oil market.

Author Contributions

The percentages of the author' contributions are presented below. The author reviewed and approved the final version of the manuscript.

	H.İ.S.
C	100
D	100
S	100
DCP	100
DAI	100
L	100
W	100
CR	100
SR	100

C=Concept, D= design, S= supervision, DCP= data collection and/or processing, DAI= data analysis and/or interpretation, L= literature search, W= writing, CR= critical review, SR= submission and revision.

Conflict of Interest

The author declared that there is no conflict of interest with anyone.

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