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Olive groves and olive oil

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Editorial

EDUARDO DINIZ

Director-General of the GPP

This issue of CULTIVAR is dedicated to the olive and olive oil sector. The recent dynamism of this sector, both in Portugal and worldwide, combined with the hosting of major international events dedicated to the sector in Lisbon, makes this in-depth look at a historic crop – one deeply rooted in the national identity and agricultural landscape – particularly timely.

Olive groves and olive oil are closely linked to a native plant of undeniable botanical, agronomic, historical and cultural value to producing countries. Few agricultural crops have managed, over the course of millennia, to maintain such a deep connection with the land, the landscape, food (and other uses) and rural communities. The olive tree has accompanied civilisations, withstood adverse conditions, shaped local economies and become a symbol of permanence, resilience and adaptation.

This resilience is, in fact, one of the greatest strengths of this crop in a context of profound climate change. The olive tree's ability to adapt to difficult soil and climate conditions – particularly in terms of water requirements – combined with relatively simple production methods when compared with other permanent crops, has helped to consolidate its expansion and its continued presence

in Mediterranean regions. Olive oil's strong links to gastronomy, the Mediterranean diet and its recognised health benefits have also played a decisive role in the product's international recognition and in setting it apart from competing industrial products.



Photograph by the author – Traditional olive grove, Foz Côa, 2024

In recent decades, the olive oil sector has undergone a particularly significant transformation. Olive oil has evolved from a product often associated with a traditional image – one that was undifferentiated and, in certain contexts, even disparaging – into a product of high prestige. The image of producers and the regions associated with olive groves has also evolved profoundly. Today, olive oil has established itself as a strategic sector on a global scale, reconciling its nature as *an* agricultural *commodity* with a growing appreciation based on differentiation, quality and territorial identity.

This transformation did not happen by chance. It was the result of decades of investment, strategic foresight and the ability of the sector's stakeholders to adapt. The revitalisation of a traditional sector and a product that was historically undifferentiated constitutes a remarkable case of collective success. Investment in technology, mechanisation, irrigation and innovation has made it possible to increase productivity and create a competitive sector. The focus on quality, modernisation of production, technological innovation, internationalisation and brand building has enabled olive oil to establish itself in global markets, whilst simultaneously benefiting from the growing appreciation of Mediterranean dietary patterns and the worldwide demand for products associated with health and sustainability.

International trends confirm this trajectory. The global olive oil market continues to show prospects for sustained growth, driven by rising consumption in new markets, the product's nutritional value and the growing demand for natural and functional foods. At the same time, the volatility of agricultural markets and the effects of climate change reinforce the strategic importance of resilient crops adapted to Mediterranean conditions, such as the olive tree.

In Portugal, public policies have played a particularly significant role in this process of transformation. The combination of investment support, farm modernisation, the development of individual and collective irrigation, technological innovation

and the ability to attract investment and foreign capital has made it possible to create a more competitive, productive and export-oriented sector. At the same time, agri-environmental payments and support instruments for traditional systems have helped to preserve fundamental aspects of the national olive-growing heritage.

It is important to recognise that one of the most interesting developments in the Portuguese sector was precisely the ability of different production models to coexist. Contrary to some initial expectations, the dichotomy between more intensive olive groves and traditional olive groves did not lead to the exclusion of one system by the other. On the contrary, there has been a dynamic coexistence between distinct, often complementary, models.

The more intensive systems have enabled economies of scale, international competitiveness, export capacity and technological modernisation. Traditional systems, for their part, have preserved landscapes, biodiversity, cultural heritage, native varieties and forms of land use that are particularly relevant in more vulnerable regions. In many cases, these two models feed off one another and can enhance each other's value, whether through market differentiation, territorial complementarity or the growing appreciation of authenticity and origin. It is important, however, to recognise and continuously address the challenges associated with the economic viability of lower-yield olive groves, as well as to ensure a balance between more intensive production models and environmental sustainability objectives.

The challenge for the future will lie precisely in deepening this ability to reconcile competitiveness, sustainability and the promotion of regional identity. Producing more and better will remain important. But it will be equally crucial to ensure the balanced management of natural resources, strengthen the economic vitality of rural communities and consolidate the international reputation of Portuguese olive oil as a product of quality, culture and identity.

This issue of CULTIVAR seeks precisely to contribute to this discussion, bringing together different national and international perspectives on a sector that today represents one of the most dynamic, resilient and strategic expressions of contemporary Mediterranean agriculture.

The article by Jaime Lillo and Julia Álvarez, of the International Olive Council (IOC, which opens this issue, highlights that the global olive oil market is undergoing a structural transformation, characterised by growing demand, the modernisation of production and expansion into new markets. Despite price volatility, exacerbated by climate change, the sector has been adapting through innovation, a focus on quality and a commitment to sustainability. As the authors note, *“olive oil is no longer merely a traditional agricultural product”* but has established itself as a strategic commodity in global trade.

Tawfik El Achchabi *et al.*, from the Morocco’s Ministry of Agriculture, Marine Fisheries, Rural Development, Water and Forests, emphasise that Moroccan olive cultivation is a strategic sector, essential for the rural economy, employment and exports, which has been supported by policies such as the Green Morocco Plan and the Green Generation initiative. With over 1.24 million hectares of olive groves, Morocco has modernised production and strengthened its international presence, despite climatic and water-related challenges. The authors state that this is a sector *“deeply rooted in the traditions of our rural areas”* and with strong potential for sustainable growth.

According to Lorenzo León *et al.*, from the Andalusian Institute for Research and Training in Agriculture, Fisheries, Food and Organic Production (IFAPA), olive growing in Spain – with a history stretching back more than 2,500 years – has evolved from a traditional crop into a highly modernised sector and a world leader in olive oil production. Intensification, mechanisation, irrigation and varietal innovation have boosted competitiveness, despite the challenges posed by climate change, water scarcity and the fragmentation of farms. The authors emphasise

that “the future of olive growing therefore has a solid foundation”, based on research, digitalisation and sustainability.

Francisco Campello, of Agro.Ges, believes that Portugal has established itself as a global leader in the olive oil sector, thanks to the modernisation of olive cultivation and a focus on irrigation, mechanisation and quality – today, it is the world’s sixth-largest producer. However, he also warns that the sector faces challenges such as climate change, water scarcity, international competition and market volatility. In conclusion, the author stresses that *“the future of the sector will depend on combining competitiveness, sustainability and differentiation”*, placing value on innovation, brands and genetic heritage.

For his part, José Gouveia, an olive expert and former lecturer at the Lisbon College of Agronomics (ISA), traces the history of the olive tree, from its possible origins in Asia Minor, spreading later throughout the Mediterranean and becoming a symbol of peace, wisdom and prosperity. Domesticated between 10,000 and 3,000 BC, this crop was spread by the Greeks, Romans and peoples of North Africa. Olive oil, defined by the author as *‘olive juice’* or *‘liquid gold’*, stands out in the Mediterranean diet for its cardiovascular and nutritional benefits; today it is produced worldwide and valued both for its health benefits and in gastronomy.

In the Observatory section, we begin with our now customary article taking the pulse of the sector, this time featuring contributions from Joaquim Moreira of Acushla, an organic olive oil producer based in Trás-os-Montes; Nuno Santos of Casa do Azeite – the Portuguese Olive Oil Association, Fernando do Rosário, from the Interprofessional Association of the Olive Sector (AIFO), and Gonçalo Moreira, from Olivum – the Association of Olive Growers and Oil Mills of Portugal and the Olive Oil Sustainability Programme (PSA).

Next, José Pedro Salema, from the Alqueva Development and Infrastructure Enterprise (EDIA), demonstrates how the modern olive grove in Alqueva has transformed Portuguese

agriculture, covering 76,589 hectares (60 per cent of the irrigated area by 2025. Thanks to irrigation and technology, national production of



Photograph by Artur Pastor – Olive harvest, Alentejo, 1950s/60s, Lisbon Municipal Archives / Photographic Collection

olive oil has quadrupled since the 1990s, growing by 320 per cent. This development has made the sector highly competitive and professional, placing Portugal amongst the world's leading producers and exporters of olive oil.

The article by António M. Cordeiro *et al.*, from the National Institute for Agricultural and Veterinary Research (I.P. INIAV), highlights that olive growing faces challenges such as climate change, water scarcity and the need for mechanisation; and that, to tackle these, it is essential to emphasise the importance of national varieties and genetic improvement in order to create more productive, resilient and sustainable olive groves. The combination of genetic conservation, the selection of adapted materials, and digital technologies, sensors and artificial intelligence will enable the optimisation of irrigation, fertilisation and productivity in the future.

Vasco Fitas da Cruz and Diogo Coelho, from the University of Évora, state that the olive sector in Portugal, particularly in the Alentejo, has become more productive and competitive, but has also generated more by-products such as olive pomace, leaves and wastewater. The INOVIRCOLIVE

project, a research, development and implementation partnership between multiple public institutions and private organisations, has developed solutions such as composting, soil application and the extraction of bioactive compounds, thereby promoting a circular economy, cost reduction and greater sustainability within the olive oil sector.

The article by Nuno Rodrigues *et al.*, from CIMO – Mountain Research Centre, notes that olive growing in Portugal has great economic, social and environmental value, highlighting traditional olive groves and native cultivars. However, these face certain threats due to agricultural intensification. In Trás-os-Montes, sustainable development, combined with innovation and scientific research, is essential for preserving the biodiversity, quality and identity of olive products. The research carried out by the authors highlights the high nutritional value of Portuguese olives.

João Marques, from the GPP, points out that, under the CAP, the olive sector benefits from a wide range of support measures, particularly for investment, irrigation and management, which contribute significantly to the substantial growth of modern olive cultivation; however, public policies have also strengthened support for the traditional system through specific agri-environmental measures. Indeed, traditional olive groves remain essential to the landscape, culture and rural sustainability in Portugal, and this support helps to preserve biodiversity, combat rural depopulation and promote high-quality, authentic olive oils; it is vital for preserving a low-density system which, although less productive, must not be abandoned.

The article by Susana Gaspar, of the GPP, traces the evolution of olive oil from antiquity to the present day, highlighting its central role in the Mediterranean diet and in Portuguese food culture. In addition to its historical and symbolic value, it highlights the nutritional benefits of this foodstuff, particularly extra virgin olive oil, which is rich in healthy fats and antioxidants, noting its central role in the (new) Food Wheel and the Mediterranean Diet Wheel. It also advocates the promotion of this dietary pattern as a model of health, sustainability and cultural identity.

In the 'Reviews' section, we analyse the following: a study by Francisco Campello for Agro.Ges, '*Sustainability of olive groves in Portugal – challenges and responses*'; a recent Special Report by the European Court of Auditors, '*Control systems for olive oil in the EU – A comprehensive framework, but unevenly applied*'; the European Union–Mercosur Partnership Agreement and its role, particularly in the case of Brazil, in terms of its impact on the olive oil sector in Portugal; a study by Pedro Reis, of INIAV, entitled '*Olive groves in Portugal – dynamics, technologies and their relationship with rural development*'; and, finally, the chapters relevant to the olive grove and olive oil sector from Eugénio Castro Caldas's book, *Agriculture in the History of Portugal*.

This second sector-specific edition of CULTIVAR also includes a supplement, authored by Rui

Trindade with the collaboration of Helena Alegre from GPP, which brings together statistical data on the evolution of the olive and olive oil sector. It begins with a global overview offering the reader a panorama of the sector worldwide, before focusing on the European Union and finally centring on Portugal, with an analysis that is both more comprehensive and more specific regarding the various aspects of this crop in our country. This zooming in on the olive-growing and olive oil sector clearly shows the olive grove as one of the Mediterranean's principal agricultural landscapes and reveals the impact of the sector's recent modernisation and increased competitiveness, whilst also drawing attention to the challenges it faces in relation to climate change, water management and sustainability.

MAJOR TRENDS

CULTIVATE

v.t. *TO PREPARE THE LAND AND GROW CROPS ON IT.*

Global olive oil consumption: trends and challenges

JAIME LILLO AND JULIA ÁLVAREZ

International Olive Council (IOC)

Olive oil is not only an iconic product of our gastronomy, with deep roots in the culture and tradition of the Mediterranean basin; it is also a product increasingly recognised by consumers worldwide. Beyond its cultural and gastronomic significance, olive oil has established itself as a product of growing importance in global agri-food trade, subject to the pressures and opportunities inherent in an increasingly interconnected market.

Its current development reflects three major interrelated trends: price volatility,

Current developments reflect three major interrelated trends: price volatility, the rising value of the product, and expansion into new markets

due to climatic and production factors; the increase in product value, driven by a preference for higher-quality olive oils with added value; and expansion into new markets, which is altering global consumption patterns and generating new opportunities for medium- and long-term growth.

A volatile market against a backdrop of structural growth

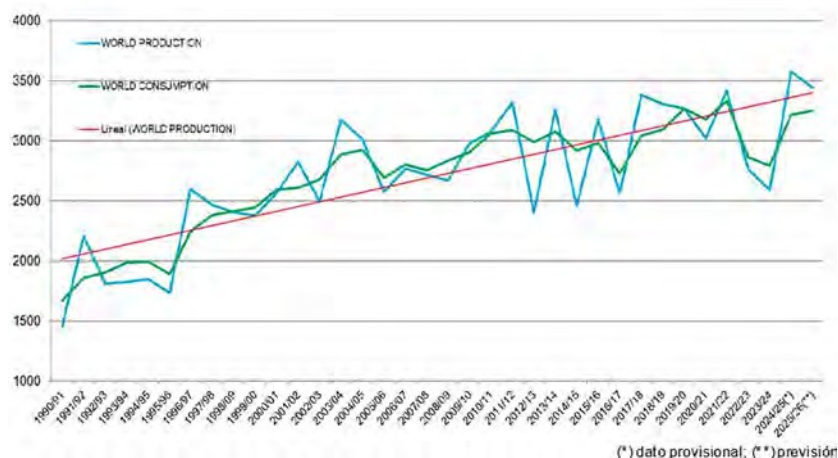
The first major trend shaping recent developments in the olive oil sector is the growing market

volatility. This phenomenon is closely linked to adverse climatic factors, such as prolonged droughts, extreme temperatures and significant reductions in harvests in the main producing countries. These fluctuations have become more pronounced in recent years as a result of the impact of climate change in the Mediterranean basin. This has led to greater

uncertainty for both producers and consumers, with changes in supply expectations and increased pressure on prices. However, this context of instability has also fostered more sophisticated planning strategies, diversification and risk management

within the sector, reinforcing its professionalisation.

This challenge is part of a clearly expansionary structural trend. Over the last three decades, both global production and consumption of olive oil have almost tripled, reflecting the product's gradual consolidation within the international agri-food market. Production rose from 1,453,000 tonnes in the 1990/91 marketing year to 3,572,000 in 2024/25, whilst global consumption increased from 1,666,500 to 3,215 thousand tonnes over the same period.

Figure 1 – Trends in olive oil production and consumption 1990–2026 (in 10³ t)

Source: IOC 2026

The 2021/22 marketing year marked a historic milestone, with 3,414,500 tonnes produced and 3,328,000 tonnes consumed, confirming a trend of sustained growth that transcends the occasional fluctuations of each marketing year. It is worth noting that global olive oil consumption stands at around 2% of total vegetable oil consumption, meaning there is scope for further growth.

From a historical perspective, this progress has been accompanied by a profound structural transformation of olive cultivation. At the beginning in the 1980s the global area under olive cultivation stood at around 7.5 million hectares, mostly rain-fed and concentrated in Mediterranean countries. Today, it stands at nearly 11.5 million hectares, spread across five continents. This expansion

... production continues to be concentrated mainly in the Mediterranean basin, with Spain taking a clear lead as the world's leading producer, followed by Italy, Greece, Portugal, Turkey and Tunisia...

is attributable not only to increased international demand but also to the adoption of new production models, including intensive and super-intensive systems, and an unprecedented process of technological modernisation. The mechanisation of harvesting, the digitalisation of irrigation, the genetic improvement of varieties and innovation in olive mills have transformed a traditional crop into a highly technological, efficient activity focused on distinctive quality.

Despite this positive trend, production remains concentrated mainly in the Mediterranean basin, with Spain taking a prominent lead as the world's leading producer, followed by Italy, Greece, Portugal, Turkey and Tunisia, which play a key role in global supply.

This solid structural foundation does not eliminate one of the sector's main challenges: its high exposure to

climatic factors. The adverse conditions recorded recently have led to a significant contraction in world production, which fell from 3.41 million tonnes in 2021/22 to 2.76 million in 2022/23, representing a drop of around 22 per cent. This reduction immediately altered the market balance and triggered significant price pressures. It is worth noting that there had never before been a decline in global olive oil production over two consecutive marketing years, as observed in 2022/23 and 2023/24.

At the same time, global consumption has not evolved uniformly either. On the one hand, as a result of the COVID-19 pandemic, we have observed greater consumer interest in looking after their health and an increase in global olive oil consumption, mainly

in non-traditional markets. On the other hand, demand had to adapt to the fall in olive oil production and, during the 2022/23 marketing years, estimated consumption fell to less than 3 million tonnes. The reduced availability of the product pushed prices to historically high levels and led to a moderation in demand, particularly in markets that are more price-sensitive and where olive oil is a traditional product for daily consumption.

However, the recovery in production that began in 2024/25 – with volumes exceeding 3.5 million tonnes and a relative moderation in prices – gave a fresh boost to consumption, which exceeded 3.2 million tonnes, with prospects for consolidation in 2025/26. Thus, although cyclical volatility remains a significant challenge, the sector's structural trend continues to be one of expansion, underpinned by solid foundation of demand, modernisation of production and international positioning.

Quality, differentiation and growth in the higher-value market segments

The second major trend defining the sector's recent development is the sustained increase in the average value per tonne exported. This phenomenon is due in part to relative scarcity caused by lower output in certain growing seasons, but also to a deeper transformation of international demand.

The international market not only predominantly purchases extra virgin olive oil (EVOO), a genuine fruit juice which is

Consumers are showing a growing interest in premium, organic and origin-certified products...

quite different from other vegetable oils, but also demands higher quality, differentiation and the intangible attributes associated with the product. As a result, the revaluation of EVOO has strengthened its positioning as a high value-added product in the global agri-food trade.

In this context, the growing interest in healthy lifestyles plays a decisive role. The consolidation of the Mediterranean diet as an international benchmark dietary model, associated with cardiovascular benefits and a high antioxidant content, has reinforced the perception of extra virgin olive oil as a food that is not only delicious but also functional and preventive. This health aspect encourages consumption whilst simultaneously promoting value creation and commanding higher prices compared with other vegetable oils.

At the same time, there is a clear trend towards products with higher added value. Consumers are showing a growing interest in *premium*, organic and origin-certified products, which favours differentiation strategies based on quality, authenticity and a connection to the local area. Designations of origin and quality labels have become key tools for building trust, providing transparency and justifying positioning in higher-price segments.

Added to this is the diversification of olive oil's uses beyond the strictly culinary sphere. Its incorporation into the cosmetics and pharmaceutical industries, thanks to its moisturising and antioxidant properties, broadens business opportunities and reinforces its image as a versatile product with high functional value. This diversification also helps to reduce exclusive dependence on food consumption.

Finally, growing awareness of traceability, sustainability and climate change is increasingly influencing purchasing decisions, espe-

cially amongst young people. Consumers demand transparent information on the product's origin, cultivation and extraction methods, and the environmental impact of production. Once again, olive oil is in a privileged position. The olive grove is a true domesticated Mediterranean forest that contributes to soil conservation, harbours biodiversity and captures CO₂ from the atmosphere, promoting a positive carbon balance of over 10 kg of CO₂ per litre of olive oil produced. This trend has encouraged more responsible and sustainable practices throughout the entire value chain, strengthening the sector's reputation and consolidating competitive advantages based on sustainability.

Taken together, these factors explain why extra virgin olive oil has moved away from competing solely on volume to increasingly competing on value. Its strategic positioning in global agri-food

trade is now based on distinctive quality, innovation, sustainability and consumers' growing willingness to recognise and pay for these attributes.

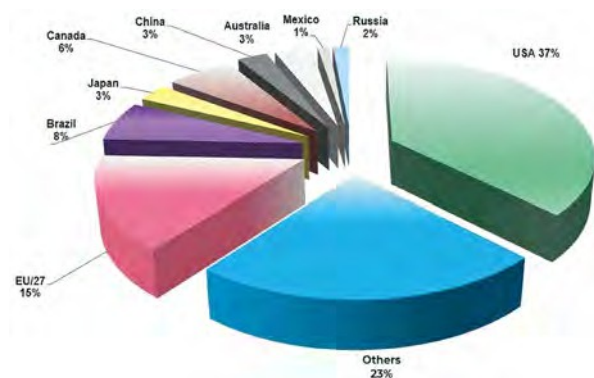
Globalisation of demand and expansion into new consumer markets

The third major trend characterising the sector's current landscape is the gradual expansion into non-traditional markets, particularly in Asia and the Americas.

Although *per capita* consumption remains high in Mediterranean countries, the high price of the product, together with

changes in lifestyle, such as an increase in eating out and growing demand for fast food, are altering traditional consumption patterns in these markets. In this context, the recent dynamism in demand stems mainly from non-traditional economies.

... the recent growth in demand stems mainly from non-traditional economies.



Source: IOC 2026

Taken together, seven major markets (the United States, the European Union, Brazil, Japan, Canada, China and Australia) account for around 70 per cent of global imports, exceeding 880,000 tonnes in the 2024/25 marketing year, which highlights both the growing importance of non-Mediterranean destinations and the influence of shifts in global consumption on the structure of international trade.

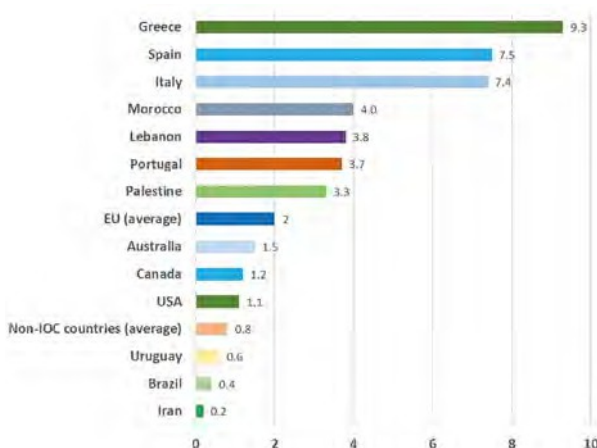
The United States remains the world's leading importer, accounting for approximately 37 per cent of the global total, and has established itself as a strategic market for the main exporting countries. However, despite its significance in terms of volume, *per capita* consumption remains moderate: around 1.1 kg per person. In Japan and Brazil, this consumption barely reaches 0.4 kg per person, whilst in Canada it stands at around 1.2 kg. The case of China is particularly telling: with over 1.4 billion inhabitants, estimated consumption stands at around 53,000 tonnes, a figure that is still relatively low. These indicators show that, for the

time being, only the more affluent classes have access to olive oil, but they also highlight significant scope for growth if dietary habits

associated with the Mediterranean diet become more established and consumer education is strengthened.

However, this international expansion has not been without difficulties. In recent years, the sector has faced tariff pressures and the imposition of regulatory barriers, particularly in the US market, one of the main destinations outside the European Union. These circumstances have forced European exporters to rethink their commercial strategies, stepping up the diversification of destinations and strengthening their competitive position in emerging markets.

Figure 3 – Olive oil consumption in kg per capita per year



Source: IOC 2026

The opening up and consolidation of new markets in Asia, Latin America and the Middle East has thus become a key strategy for mitigating risks, balancing trade exposure and sustaining growth in an international context characterised by geopolitical uncertainty, price volatility and changing consumption patterns.

The olive oil sector facing a more complex and regulated environment

In the future, the olive oil sector will have to face significant global challenges to maintain its growth and market position in the international agri-food sector.

The first challenge is to produce more in a sustainable and environmentally sound manner. Olive oil is

The first challenge is to produce more in a sustainable and environmentally sound manner.

part of the global challenge of feeding a growing population in a healthy and sustainable way, and to achieve this, we must tackle the consequences of climate change.

We must gain a better understanding of the relationship between olive groves and a changing environment and promote their adaptation. The mobilisation of genetic resources, international scientific cooperation, public-private collaboration, the diversification of the production regions

and the modernisation of cultivation techniques form the basis of our strength in consolidating the growing trend in

production, whilst seeking to mitigate fluctuations between harvest seasons.

Fierce global competition will remain one of the main challenges, in a market where major traditional producing countries coexist with new emerging players from other continents. In this context, differentiation based on quality, brand reputation and added value will be increasingly important for competing in the main import markets.

Furthermore, trade and regulatory barriers will continue to pose a significant obstacle to the expansion of international trade. Customs duties, sanitary and phytosanitary standards, as well as labelling and quality certification requirements, may limit access to certain markets. In this regard, the international harmonisation of quality standards and cooperation between regulatory bodies will be fundamental to facilitating trade flows and ensuring the transparency of the global market.

Another key challenge relates to logistical efficiency and the resilience of international supply chains. Reducing transport costs, improving trade

infrastructure and optimising distribution times will be essential factors in maintaining the product's competitiveness in an increasingly globalised

and demanding market.

Similarly, international promotion and consumer education will take on increasing importance. The sector's ability to communicate the healthy, sustainable and cultural attributes of olive oil will be crucial to strengthening its positioning against other vegetable oils. Harnessing the digital world to promote the benefits of olive oil consumption will help to expand its global recognition. Finally, we must bear in mind that the value chain will play a

Another key challenge relates to logistical efficiency and the resilience of international supply chains

key role: evolving consumer trends will continue to shape the sector's development. Rising demand for healthy, sustainable products with

certified traceability will force the industry to continually adapt to new global consumer preferences. Product innovation, environmental sustainability and transparency in the value chain will become ever more fundamental pillars to ensure the future competitiveness of olive oil on the international stage.

... evolving consumer trends shape the sector's development.

Conclusion: structural transformation and prospects for the global olive oil market

In conclusion, the global olive oil market is undergoing a process of structural transformation characterised by sustained growth in demand, the modernisation of production and the increasing internationalisation of consumption. Despite price volatility and significant exposure to climatic factors, the sector has demonstrated a remarkable capacity to adapt through technological innovation, the geographical diversification of markets and the positioning of the product in higher value-added segments.

The three key trends analysed (market volatility, product value enhancement and expansion into non-traditional markets) show that olive oil is no longer merely a traditional agricultural product but has established itself as an increasingly valued commodity in the global agri-food trade. The growing preference for healthy, sustainable products with quality certifications has

strengthened its international positioning, whilst the opening up of new markets – not only in the US but also in Asia and Latin America – presents significant opportunities for future growth.

However, the sector's development will depend on its ability to tackle global challenges, notably the response to climate change, international competition, trade barriers, logistical efficiency and the need to maintain effective promotion and differentiation strategies. Issues relating to health and environmental sustainability, traceability and innovation will continue to be key elements in meeting the demands of an increasingly well-informed and discerning consumer.

Thus, whilst the future of olive oil looks promising, it is closely linked to its ability to combine tradition and innovation, maintaining its cultural and gastronomic identity whilst adapting to an increasingly complex, dynamic and globalised economic and commercial context.

Evolución del consumo mundial de aceite de oliva: tendencias y desafíos

JAIME LILLO Y JULIA ÁLVAREZ

Conselho Oleícola Internacional (COI)

El aceite de oliva no es solo un producto emblemático de nuestra gastronomía con profundas raíces en la cultura y tradición de la cuenca mediterránea sino también un producto cada vez más reconocido por los consumidores de todo el mundo. Más allá de su dimensión cultural y gastronómica, el aceite de oliva se ha consolidado como un producto con una relevancia creciente en el comercio agroalimentario global, sujeto a tensiones y oportunidades propias de un mercado cada vez más interconectado.

Su evolución actual responde a tres grandes tendencias interrelacionadas: la volatilidad de los precios, provocada por factores climáticos y productivos; el aumento del valor del producto, impulsado por la preferencia por aceites de mayor calidad y valor añadido; y la expansión hacia nuevos mercados, que está cambiando el patrón mundial de consumo y generando nuevas oportunidades de crecimiento a medio y largo plazo.

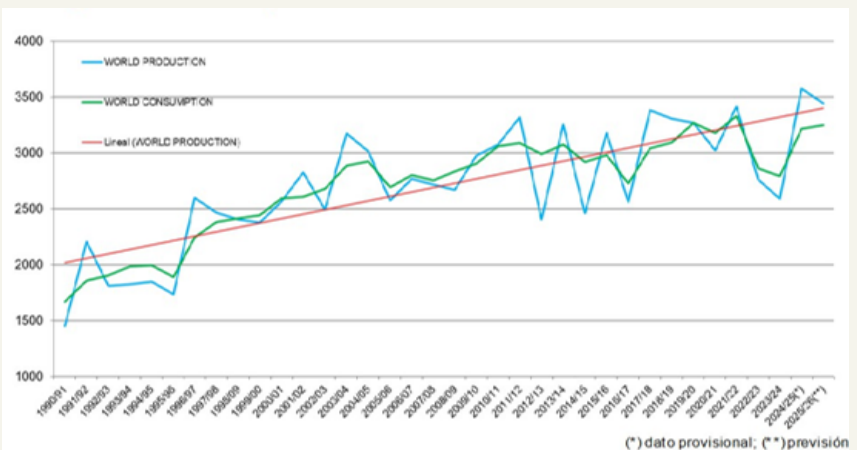
Un mercado volátil en un contexto de crecimiento estructural

La primera gran tendencia que define la evolución reciente del sector del aceite de oliva es la creciente volatilidad del mercado. Este fenómeno está estrechamente vinculado a factores climáticos adversos, como sequías prolongadas, temperaturas extremas y reducciones significativas de cosecha en los principales países productores. Tales oscilaciones se han visto acentuadas en los últimos años como consecuencia del impacto del cambio climático en la cuenca mediterránea. Por consiguiente, se ha generado

una mayor incertidumbre tanto para productores como para consumidores, alterando las expectativas de oferta y tensionando los precios. No obstante, este entorno inestable también ha impulsado estrategias más sofisticadas de planificación, diversificación y gestión del riesgo dentro del sector, reforzando su profesionalización.

Este desafío se inscribe en una tendencia estructural claramente expansiva. En las tres últimas décadas, tanto la producción como el consumo mundial de aceite de oliva casi se han triplicado, reflejando la consolidación progresiva del producto en el mercado agroalimentario internacional. La producción ha pasado de 1.453.000 toneladas en la campaña 1990/91 a 3.572.000 en 2024/25, mientras que el consumo mundial ha aumentado desde 1.666.500 hasta 3.215.000 toneladas en el mismo periodo. La campaña 2021/22 marcó un hito histórico, con 3.414.500 toneladas de producción y 3.328.000 de consumo, confirmando una dinámica de crecimiento sostenido que trasciende las fluctuaciones puntuales de cada campaña. Conviene recordar que el consumo mundial de aceite de oliva se sitúa en torno al 2% del consumo global de aceites vegetales, por lo que hay espacio para seguir creciendo.

Figura 1 – Evolución de la producción y el consumo de aceite de oliva (1990-2026)
Datos en 10³ t



Fuente: COI 2026

Desde una perspectiva histórica, este avance ha estado acompañado de una profunda transformación estructural del olivar. A comienzos de la década de 1980, la superficie mundial se situaba en torno a los 7,5 millones de hectáreas, mayoritariamente en régimen de secano y concentrada en los países mediterráneos. En la actualidad, el cultivo se aproxima a los 11,5 millones de hectáreas distribuidas en los cinco continentes. Esta expansión no solo responde al aumento de la demanda internacional, sino también a la adopción de nuevos modelos productivos, incluidos sistemas intensivos y superintensivos y a un proceso de modernización tecnológica sin precedentes. La mecanización de la recolección, la digitalización del riego, la mejora genética varietal y la innovación en las almazaras han transformado un cultivo tradicional en una actividad altamente tecnificada, eficiente y orientada a la calidad diferenciada.

Sin perjuicio de esta evolución positiva, la producción continúa concentrándose principalmente en la cuenca mediterránea, con un liderazgo destacado de España como primer productor mundial, acompañada por Italia, Grecia, Portugal, Turquía y Túnez, que desempeñan un papel clave en la oferta global.

Esta sólida base estructural no elimina uno de los principales retos del sector: su elevada exposición a los factores climáticos. Las condiciones adversas registradas recientemente provocaron una contracción significativa de la producción mundial, que pasó de 3,41 millones de toneladas en 2021/22 a 2,76 millones en 2022/23, lo que representa una caída cercana al 22 %. Esta reducción alteró de forma inmediata el equilibrio del mercado y desencadenó fuertes tensiones en los precios. Hay que señalar que nunca se había registrado una disminución de la producción mundial de aceite de oliva en dos campañas consecutivas, tal y como hemos observado en las campañas 2022/23 y 2023/24.

En paralelo, el consumo mundial tampoco evolucionó de manera uniforme. Por una parte, como consecuencia de la pandemia del COVID, observamos un mayor interés del consumidor por cuidar su salud y un incremento del consumo mundial de aceite de oliva, principalmente en los mercados no tradicionales. Por otra, tuvo que adaptarse a la caída de la producción de aceite y durante las campañas 2022/23, el consumo estimado descendió por debajo de los 3 millones de toneladas. La menor disponibilidad de producto elevó los precios hasta niveles históricamente altos y generó una respuesta moderadora de la demanda, especialmente en aquellos mercados más sensibles al precio y donde el aceite de oliva constituye un producto tradicional de consumo diario.

Con todo, la recuperación productiva iniciada en 2024/25, con un volumen incluso superior a los 3,5 millones de

toneladas y una relativa moderación de los precios, ha impulsado nuevamente el consumo por encima de los 3,2 millones de toneladas, con perspectivas de consolidación en 2025/26. Así, aunque la volatilidad coyuntural sigue siendo un desafío relevante, la tendencia estructural del sector continúa siendo expansiva, sustentada en fundamentos sólidos de demanda, modernización productiva y posicionamiento internacional.

Calidad, diferenciación y crecimiento en los segmentos de mayor valor del mercado

La segunda gran dinámica que define la evolución reciente del sector es el incremento sostenido del valor medio por tonelada exportada. Este fenómeno responde, en parte, a la escasez relativa provocada por menores producciones en determinadas campañas, pero también a una transformación más profunda de la demanda internacional. El mercado internacional no solo compra mayoritariamente la categoría aceite de oliva virgen extra (AOVE), un auténtico zumo de fruta que nada tiene que ver con otros aceites vegetales, sino que además exige mayor calidad, diferenciación y atributos intangibles asociados al producto. Como resultado, la revalorización del AOVE ha reforzado su posicionamiento como bien de alto valor añadido dentro del comercio agroalimentario global.

En este contexto, el creciente interés por los hábitos de vida saludables desempeña un papel determinante. La consolidación de la dieta mediterránea como modelo alimentario de referencia internacional, asociada a beneficios cardiovasculares y a un elevado contenido en antioxidantes, ha fortalecido la percepción del AOVE como un alimento no sólo delicioso, sino también funcional y preventivo. Esta dimensión saludable no solo impulsa el consumo, sino que favorece la creación de valor y unos precios superiores en comparación con otros aceites vegetales.

Paralelamente, se observa una evolución clara hacia productos de mayor valor añadido. Los consumidores muestran un interés creciente por referencias premium, ecológicas y con certificación de origen, lo que favorece estrategias de diferenciación basadas en la calidad, la autenticidad y el vínculo territorial. Las denominaciones de origen y los sellos de calidad se han convertido en instrumentos clave para generar confianza, aportar transparencia y justificar un posicionamiento en segmentos de precio más elevados.

A ello se suma la diversificación de usos del aceite de oliva más allá del ámbito estrictamente culinario. Su incorporación a la industria cosmética y farmacéutica, gracias a sus propiedades hidratantes y antioxidantes,

amplía las oportunidades de negocio y consolida su imagen como producto versátil y de alto valor funcional. Esta diversificación contribuye, además, a reducir la dependencia exclusiva del consumo alimentario.

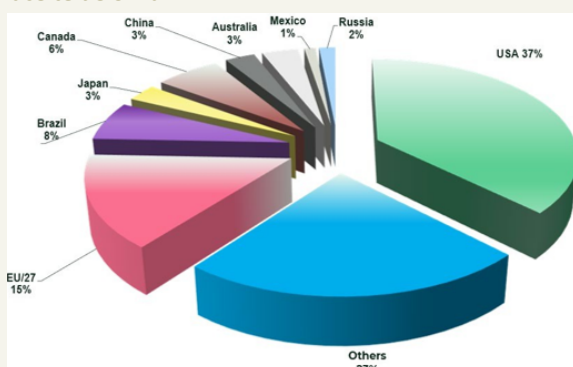
Finalmente, la creciente sensibilidad hacia la trazabilidad, la sostenibilidad y el cambio climático influye cada vez más en las decisiones de compra, particularmente en los jóvenes. Los consumidores demandan información transparente sobre el origen del producto, los métodos de cultivo y extracción, y el impacto ambiental de la producción. De nuevo encontramos los aceites de oliva en una situación privilegiada. El olivar es un auténtico bosque mediterráneo domesticado que contribuye a conservar el suelo, albergar biodiversidad y captura Co2 de la atmósfera propiciando un balance de carbono positivo de más de 10 kg de Co2 por litro de aceite de oliva producido. Esta tendencia, ha incentivado prácticas más responsables y sostenibles a lo largo de toda la cadena de valor, reforzando la reputación del sector y consolidando ventajas competitivas basadas en la sostenibilidad.

En conjunto, estos factores explican por qué el AOVE ha dejado de competir únicamente en términos de volumen para hacerlo cada vez más en términos de valor. Su posicionamiento estratégico dentro del comercio agroalimentario global se sustenta hoy en la calidad diferenciada, la innovación, la sostenibilidad y la creciente disposición del consumidor a reconocer y pagar por estos atributos.

Globalización de la demanda y expansión hacia nuevos mercados de consumo

La tercera gran dinámica que configura el escenario actual del sector es la expansión progresiva hacia mercados no tradicionales, especialmente en Asia y América.

Figura 2 – Distribución global de importaciones de aceite de oliva



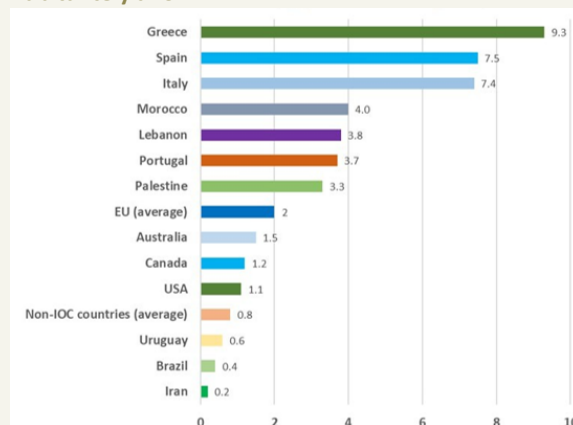
Fuente: COI 2026

Si bien el consumo per cápita continúa siendo elevado en los países mediterráneos, el elevado precio del producto, junto con los cambios en los estilos de vida, como el incremento de las comidas fuera del hogar y la expansión de la demanda de comida rápida, está modificando los patrones tradicionales de consumo en estos mercados. En este contexto, el dinamismo reciente de la demanda procede principalmente de economías no tradicionales.

En conjunto, siete grandes mercados (Estados Unidos, Unión Europea, Brasil, Japón, Canadá, China y Australia) concentran cerca del 70 % de las importaciones mundiales, superando las 880.000 toneladas en la campaña 2024/25, lo que pone de manifiesto tanto el peso creciente de los destinos extra mediterráneos como la influencia de las transformaciones en el consumo global en la configuración del comercio internacional. Estados Unidos se mantiene como el primer importador mundial, absorbiendo aproximadamente el 37 % del total global, lo que lo consolida como mercado estratégico para los principales países exportadores. Sin embargo, pese a su relevancia en volumen, el consumo per cápita sigue siendo moderado: en torno a 1,1 kg por habitante. En Japón y Brasil apenas alcanza los 0,4 kg por persona, mientras que en Canadá se sitúa alrededor de 1,2 kg. El caso de China resulta especialmente ilustrativo: con más de 1.400 millones de habitantes, su consumo estimado ronda las 53.000 toneladas, una cifra todavía reducida en términos relativos. Estos indicadores muestran que, por el momento, sólo las clases más pudientes pueden acceder al aceite de oliva pero también evidencian un amplio margen de crecimiento potencial si se consolidan los hábitos alimentarios vinculados a la dieta mediterránea y se refuerza la educación del consumidor.

No obstante, esta expansión internacional no ha estado exenta de dificultades. En los últimos años, el sector ha

Figura 3 – Consumo de aceite de oliva en Kg por habitante y año



Source: COI 2026

afrontado tensiones arancelarias y la imposición de barreras regulatorias, particularmente en el mercado estadounidense, uno de los principales destinos extracomunitarios. Estas circunstancias han obligado a los exportadores europeos a replantear sus estrategias comerciales, intensificando la diversificación de destinos y fortaleciendo su posicionamiento competitivo en mercados emergentes.

La apertura y consolidación de nuevos destinos en Asia, América Latina y Oriente Medio se ha convertido, así, en una estrategia clave para mitigar riesgos, equilibrar la exposición comercial y sostener el crecimiento en un contexto internacional caracterizado por la incertidumbre geopolítica, la volatilidad de precios y las transformaciones en los patrones de consumo.

El sector oleícola ante un escenario de mayor complejidad y regulación

De cara al futuro, el sector del aceite de oliva a nivel mundial deberá afrontar importantes retos para mantener su crecimiento y su posicionamiento dentro del comercio agroalimentario internacional.

El primer desafío es producir más de manera sostenida y sostenible. El aceite de oliva forma parte del reto global de alimentar a una población creciente de manera saludable y sostenible, para ello hay que hacer frente a las consecuencias del cambio climático.

Debemos entender mejor la relación del olivo con el entorno cambiante y favorecer su adaptación. La movilización de los recursos genéticos, la cooperación científica internacional, la colaboración público-privada, la diversificación de las regiones de producción y la modernización de las técnicas de cultivo son la base de nuestra fortaleza para consolidar la tendencia creciente de producción tratando de contener las oscilaciones entre campañas.

High levels of global competition will continue to be one of the main challenges, in a market where major traditional producing countries coexist alongside new emerging players from other continents. In this context, differentiation based on quality, brand reputation and added value will become increasingly crucial for competing in the main import markets.

Asimismo, las barreras comerciales y regulatorias seguirán representando un obstáculo relevante para la expansión del comercio internacional. Los aranceles, las normativas sanitarias y fitosanitarias, así como los requisitos de etiquetado y certificación de calidad, pueden limitar el acceso a determinados mercados.

En este sentido, la armonización internacional de estándares de calidad y la cooperación entre organismos reguladores será clave para facilitar los flujos comerciales y garantizar la transparencia del mercado global.

Otro reto fundamental estará vinculado a la eficiencia logística y a la resiliencia de las cadenas de suministro internacionales. La reducción de costes de transporte, la mejora de las infraestructuras comerciales y la optimización de los tiempos de distribución serán factores esenciales para mantener la competitividad del producto en un mercado cada vez más globalizado y exigente.

De igual forma, la promoción internacional y la educación del consumidor adquirirán una importancia creciente. La capacidad del sector para comunicar los atributos saludables, sostenibles y culturales del aceite de oliva será determinante para fortalecer su posicionamiento frente a otros aceites vegetales. Engancharse al mundo digital para divulgar los beneficios del consumo de aceite de oliva contribuirán a expandir su reconocimiento global.

Finalmente, debemos tener en cuenta la cadena de valor: la evolución de las tendencias de consumo seguirá marcando el desarrollo del sector. El aumento de la demanda de productos saludables, sostenibles y con trazabilidad certificada obligará a la industria a adaptarse de forma continua a las nuevas preferencias del consumidor mundial. La innovación productiva, la sostenibilidad ambiental y la transparencia en la cadena de valor se consolidarán como pilares fundamentales para garantizar la competitividad futura del aceite de oliva en el escenario internacional.

Conclusión: Transformación estructural y perspectivas del mercado global del aceite de oliva

En conclusión, el mercado mundial del aceite de oliva se encuentra en un proceso de transformación estructural caracterizado por el crecimiento sostenido de la demanda, la modernización productiva y la creciente internacionalización del consumo. A pesar de la volatilidad de los precios y de la fuerte exposición a factores climáticos, el sector ha demostrado una notable capacidad de adaptación mediante la innovación tecnológica, la diversificación geográfica de los mercados y la revalorización del producto en segmentos de mayor valor añadido.

Las tres grandes dinámicas analizadas (la volatilidad del mercado, la revalorización del producto y la expansión hacia mercados no tradicionales) evidencian que el aceite de oliva ha dejado de ser únicamente un producto agrícola tradicional para consolidarse como un producto

cada vez más valorado dentro del comercio agroalimentario global. La creciente preferencia por productos saludables, sostenibles y con certificaciones de calidad ha fortalecido su posicionamiento internacional, mientras que la apertura hacia nuevos mercados, no sólo en EE. UU. sino también en Asia e Hispanoamérica, abre oportunidades significativas de crecimiento futuro.

No obstante, el desarrollo del sector dependerá de su capacidad para enfrentar los desafíos globales, entre los que destacan responder al cambio climático, la competencia internacional, las barreras comerciales, la eficiencia logística y la necesidad de mantener estrategias

efectivas de promoción y diferenciación. Los aspectos relacionados con la salud y la sostenibilidad ambiental, la trazabilidad y la innovación seguirán siendo elementos clave para responder a las exigencias de un consumidor cada vez más informado y exigente.

De este modo, el futuro del aceite de oliva, si bien cuenta con buenas perspectivas, se presenta estrechamente ligado a su capacidad de combinar tradición e innovación, manteniendo su identidad cultural y gastronómica mientras se adapta a un entorno económico y comercial cada vez más complejo, dinámico y globalizado.

The current state of Moroccan olive growing and prospects for its development

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Ministry of Agriculture, Maritime Fisheries, Rural Development, Water and Forests, Kingdom of Morocco

Introduction

The olive sector is of strategic importance to Moroccan agriculture, combining strong economic performance, climate resilience and the enhancement of agricultural land. For this reason, the olive grove

has received special attention within the country's agricultural strategies, notably the Green Morocco Plan (2008–2020)¹ and the Green Generation (2020–2030)².

This sector is deeply rooted in the traditions of our rural areas, constituting a key

source of income, and forms an integral part of the shared Mediterranean heritage.

History and geographical distribution

Morocco is a land of olive trees, where this ancient tree is deeply rooted in its culture, cuisine and traditions. A symbol of conviviality

and the Mediterranean way of life, olive oil embodies a legacy passed down from generation to generation.

Archaeological evidence attests to a very ancient presence of the olive tree in North Africa, particularly particularly in the Rabat-Tétouan region

The olive sector in North Africa, particularly in Morocco, Tunisia, Algeria and Egypt, has seen sustained growth over the last two decades, driven by public policies, investment and international demand.

long before the external influences often attributed to the Phoenicians. This antiquity is also suggested by linguistic and cultural elements specific to the region.

In Roman times, olive growing underwent remarkable development and became an important

economic pillar, as evidenced by the numerous olive oil presses discovered at archaeological sites such as Volubilis, as well as in the regions of Lixus, Tangier and Salé. These historic areas largely correspond to today's main olive-growing regions, illustrating the continuity of a tradition of craftsmanship and a heritage with deep roots.

¹ <https://www.ada.gov.ma/fr/la-strategie-plan-maroc-vert>

² <https://www.ada.gov.ma/fr/nouvelle-strategie-du-secteur-agricole>

The importance of the olive sector in North African countries

The olive sector in North Africa, particularly in Morocco, Tunisia, Algeria and Egypt, has seen sustained growth over the last two decades, driven by public policies, investment and international demand.

The region has a total of over 4.5 million hectares of olive groves, with olive oil production ranging between 1.5 and 2.5 million tonnes, depending on the harvest. North Africa accounts for 20 to 25 per cent of global olive oil exports, originating largely from Tunisia, though Morocco is gradually strengthening its presence on the international market.

This trend is accompanied by the modernisation of production systems (localised irrigation, efficient mills) and improved quality. However, the sector continues to face significant challenges, notably climate variability, pressure on

water resources and the fragmentation of farms. In the long term, the sector's development in these countries is expected to focus on greater sustainability, a focus on quality and market diversification, confirming a structural transformation in course, despite a challenging climate.

The socio-economic importance of olive groves in Morocco

The olive tree, thanks to its products and age-old uses, as well as its multiple functions in combating erosion, enhancing agricultural land and helping to keep populations in mountainous areas, forms part of the main fruit-growing sector in Morocco and accounts for 65 per cent of the country's total fruit-growing area.

Olive growing is a major source of employment, providing over 51 million working days per year,

equivalent to more than 200,000 permanent jobs, of which 20 per cent are held by women.

The sector contributes to meeting the country's needs for edible oils, covering around 17 to 20 per cent of these needs, and to balancing the trade balance, generating foreign exchange earnings equivalent to 2.1 billion dirhams per year, or around 184 million euros (2020–2024 average).

Proportion of olive groves in the total area of fruit orchards in Morocco

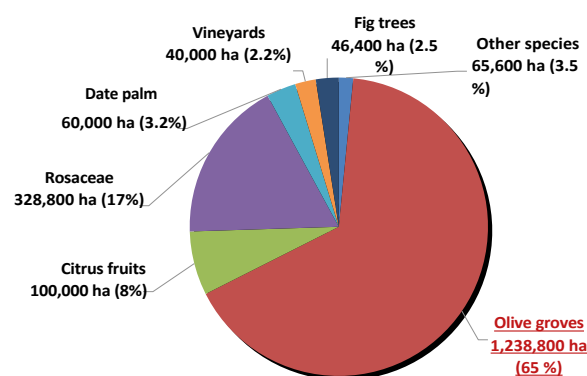
Olive groves cover an area of 1,238,800 hectares, representing 65 per cent of the total fruit-growing area, which makes the olive tree a key crop

vital to the country, particularly for olive oil production. Compared with other fruit crops, the olive tree is by far the dominant one, with citrus fruits accounting for 8 per cent, pome fruits 17 per cent whilst crops such as date

palms (3.2%), vines (2.2%) and fig trees (2.5%) are of lesser importance.

Olive groves cover an area of 1,238,800 hectares, accounting for 65 per cent of the total area under fruit cultivation, making the olive tree a of vital importance to the country...

Figure 1 – Proportion of olive groves in the total area of Moroccan fruit orchards



Geographical distribution

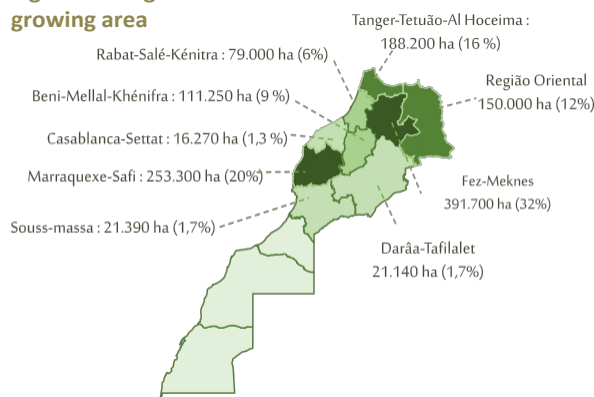
The distribution of this sector across agricultural areas shows that, with the exception of the Atlantic coast,

where olive cultivation is limited, this species is capable of adapting to all bioclimatic zones, from mountainous areas (1,200 mm of average annual rainfall) to arid and semi-arid areas (less than 200 mm).

Moroccan olive cultivation is mainly concentrated in the northern and central regions of the country. The Fez-Meknes and Marrakesh-Safi areas constitute the main production basins, accounting for more than half of the total olive-growing area on their own.

These are followed by Tanger-Tetouan-Al Hoceima, the Eastern region and Beni Mellal-Khenifra, where olive groves play a key role in the eco rural economy. In the south, cultivation is more limited but is expanding, particularly in the Souss-Massa and Drâa-Tafilalet regions, thanks to irrigation projects and the development of arid land.

Figure 2 – Regional distribution of the current olive-growing area

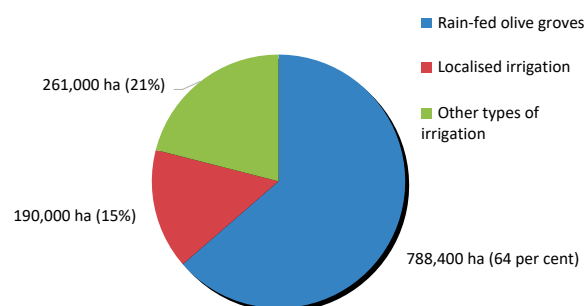


Production methods

Nationwide, the area under irrigation amounts to 451,000 ha, or 36% of the total area, compared with 788,400 ha under rain-fed cultivation (64% of the total). The area under localised irrigation covers 190,000 ha, 42% of the

irrigated land, with the remainder cultivated using other irrigation methods.

Figure 3 – Olive grove production methods in Morocco



Changes in area

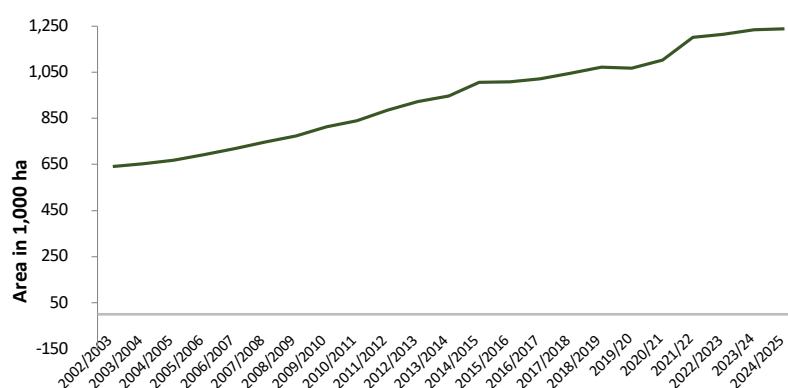
... the area under irrigated cultivation amounts to 451,000 ha, or 36 per cent of the total area, compared with 788,400 ha under rain-fed cultivation (64% of the total).

The area under olive cultivation in Morocco has been growing steadily since 2008, when the Green Morocco Plan was launched, rising from 748,000 ha in 2007/2008 to over 1.24

million hectares in 2024/2025, reflecting sustained growth in the sector.

This expansion, representing an increase of around 66 per cent between 2007/08 and 2024/2025, is the result of plantings carried out under Pillar II projects of that Plan (solidarity projects), support granted under the Agricultural Development Fund, and producers' efforts to establish new plantations, including on marginal land.

Figure 4 – Trends in olive-growing area (2002–2026)



Main olive varieties

Unlike other olive oil-producing countries, the varietal profile of olives in Morocco is characterised by its limited diversity. Indeed, the olive-growing landscape is dominated almost exclusively by the variety Picholine Marocaine

variety, which accounts for 90 per cent of all olive trees. The remaining 10 per cent consists of varieties resulting from clonal selection within this same variety, namely Haouzia and Menara, and some foreign varieties (Picual, Frantoio, Manzanilla, Gordal Sevillana, Arbequina, Koroneiki, etc.).

This is due to the widespread adoption of the Picholine Marocaine by producers, owing to its advantages, such as dual use (for olive oil and table olives), fruit quality and its adaptation to local conditions.

Moroccan Picholine

The Moroccan Picholine, well adapted to the agroclimatic conditions of Morocco and prized for its dual use (olive oil and fresh consumption), remains, however, susceptible to certain diseases and exhibits a high rate of alternate bearing (good and poor harvests), which can affect the regularity of production.



Picholine Marocaine variety

Menara

A variety derived from the Moroccan Picholine, characterised by a greater suitability for propagation by cuttings, an average flowering period and an



early bearing (from the third year onwards). It has high productivity, with an olive oil yield of around 24 per cent. The fruits, which are with

flesh that is easily separated from the stone, are suitable both for olive oil extraction and for the preparation of green or black olives. It is highly resistant to olive knot.

... the olive-growing landscape is dominated almost exclusively by the Picholine Marocaine variety, which accounts for 90 per cent of all olive trees.

Haouzia

A variety derived from the Picholine Marocaine, characterised by moderate flowering, early bearing and a strong

ability to propagate via cuttings. Hardy and with

great rooting capacity; it begins to produce from the third year onwards in irrigated soil. Highly productive, albeit with yield fluctuations, it yields an olive oil yield of around 23 per cent and is also suitable for the production of green olives. Resistant to peacock spot (*Spilotea oleaginea*), tolerant to olive knot and drought.



Haouzia variety

The Moroccan National Institute for Agronomic Research has developed five new varieties by crossing Moroccan varieties (Menara, Haouzia and M26) with foreign varieties. The selection criteria used were productivity, oil content and oleic acid composition, the vigour of the trees, their fertility and the consistency of their yield.

These five varieties are listed in the relevant official catalogue and are currently being propagated by nursery growers with a view to their distribution to farmers. The varieties are: Baraka (M26 × Picholine de Languedoc), Mechkate (M26 × Manzanilla), Agdal (M26 × Manzanilla), Tassaoute (Menara × Leccino) and Dalia (Menara × Arbequina). Three of these – namely Tassaoute, Dalia and Mechkate – are of particular interest to producers, due to their resilience in the face of climate change, as well

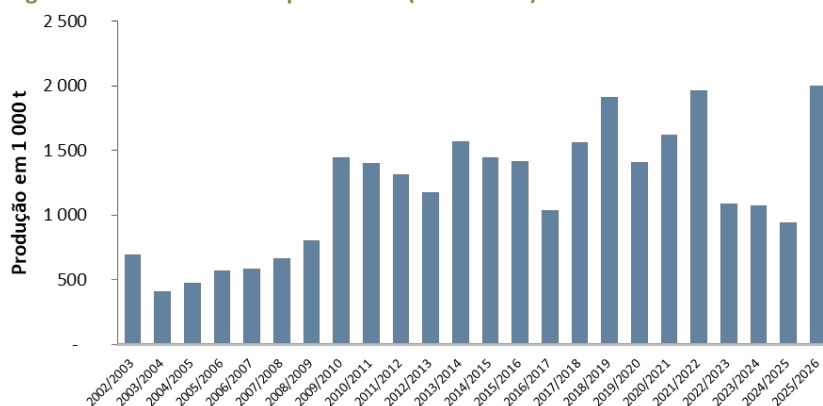
as their remarkable chemical and organoleptic qualities.

It is worth noting that the Kingdom of Morocco has the privilege of hosting the world's second-largest collection of olive germplasm in Tassaout (Marrakech). Since its creation in 2002, this collection has fully fulfilled its role in the conservation of genetic resources and in the fields of research, breeding and training. It currently comprises 580 varieties from around the world, with the aim of reaching 1,200 varieties.

Morocco has the privilege of hosting, in Tassaout (Marrakech), the world's second-largest collection of olive germplasm.

2025/26, revealing variability attributable to climatic conditions.

Figure 5 – Total fresh olive production (2002–2025)



As for the production of table olives from the industrial sector, this rose from 88,000 tonnes in the period 2003–2007 to 128,000 tonnes in the period 2021–2025, representing a 46 per cent increase.

With regard to productivity, a distinction must be made between two systems:

- Maintenance techniques that are not always appropriate;
- Climatic conditions, in particular rainfall;
- Alternate bearing, a physiological phenomenon characteristic of the olive tree.
- The rain-fed system, characterised by yields that remain low and range between 1.2 and 2.0 t/ha (over the last ten growing seasons);
- The irrigated system, in which the trees receive either permanent or supplementary irrigation. Yields obtained range, on average, between 1.4 and 2.7 t/ha (over the last ten growing seasons). In the intensive system, these yields can reach up to 10 to 15 t/ha.

Production rose from 549,000 tonnes per year in the period 2003–2007 to 1.7 million tonnes in 2018–2022 (+200 per cent), before falling to around 1.03 million tonnes in 2022–2024 due to drought. The target set for 2030 is 3.5 million tonnes.

This trend has resulted in olive oil production ranging between 9,000 and 200,000 t/year during the period from 2014/15 to

... 65 to 70 per cent of national olive production is destined for processing and 20 to 25 per cent for the canning industry.

Destination of production

Generally speaking, 65 to 70 per cent of national olive production is destined for processing and 20 to 25 per cent to the canning industry. The remaining 10 per cent corresponds to losses and household consumption.

Olive processing is carried out by a modern and semi-modern sector comprising 928 units, with a total capacity of 1,906,000 tonnes per year, and by a traditional sector consisting of around 11,000 *maâsras* (oil mills). The operation of these *maâsras* is largely intermittent, depending to a great extent on the volume of the olive harvest.

Olive preservation is carried out by 75 modern canning plants, with a total capacity of 203,000 tonnes per year, and by artisanal canning workshops.

Marketing

Domestic market

Olive oil production is mainly destined for the domestic market, accounting for around 85%, with a predominance of the informal sector. In years of high production, exports can account for a significant proportion.

In fact, throughout history, olive oil has been the main source of our edible oil requirements. It was only from the 1960s onwards, with changes in the habits of Moroccan households, that olive oil consumption began to decline in favour of increased consumption of seed oils. These now account for over 80 per cent of domestic consumption of edible oils, a large proportion of which is imported. The olive oil market remains unregulated and prices fluctuate from year to year, depending on production.

As for table olives, around 70% of the production leaving canning factories is exported, with the remainder consumed locally. Most of the table olives destined for the domestic market are sourced from small-scale, artisanal units in the informal sector, which produce around 200,000

to 250,000 tonnes. The production of table olives sold on the local market is characterised by a diverse range of products: green olives, black olives, semi-ripe olives, pitted olives, candied olives, stuffed olives, etc.

Exports (average for 2021–2024)

Olive oil production for export amounts to 10,000 tonnes, with the main destinations being the European Union (46%), the United States (43%) and Canada (5%). Exports of industrial table olives total 97,000 tonnes, of which 66% go to the European

Union, in particular to France and Belgium, 22 per cent to the United States and 3 per cent to Saudi Arabia. Olive pomace oil exports amount to 13,000 tonnes, mainly to Spain.

The development of the Moroccan olive sector has been supported by coherent public policies aimed at improving the competitiveness, sustainability and quality of its products.

Imports (average for 2021–2024)

Annual olive oil imports total 7,160 tonnes, with 57 per cent coming from the European Union, 33 per cent from Tunisia and 10 per cent from Turkey. Imports of table olives remain negligible, barely exceeding 1,300 tonnes per year.

Agricultural strategies adopted by Morocco

The development of the Moroccan olive sector has been supported by coherent public policies aimed at improving the competitiveness, sustainability and quality of its products. Driven by the Green Morocco Plan (2008–2020), this momentum has led to significant progress, notably the expansion of the area under cultivation, the modernisation of olive groves, the improvement of cultivation practices, as well as the organisation of producers and the development of value-added chains³.

³ 'Agrégation', as used in the original and in this context, is an innovative model of contractual organisation underpinning the Green Morocco plan, which links producers (aggregates) to a private partner or a professional organisation (aggregator) that operates a value-added

The Green Generation 2020–2030 agricultural sector strategy builds on the results achieved under the Green Morocco Plan, focusing on human capital, sustainability and performance through the modernisation of olive groves, the value-adding of products and the strengthening of supply chain management.

The main objectives set out under this new agricultural strategy for the development of the olive sector, up to 2030, are as follows:

- Expansion of the olive grove area to reach 1.4 million hectares;
- Increasing production to 3.5 million tonnes, compared with 1.7 million tonnes in 2020;
- Increasing industrial production of table olives to reach around 270,000 tonnes, compared with 200,000 tonnes in 2020;
- Promotion of exports of olive oil (including olive pomace oil) and table olives to reach 100,000 and 150,000 tonnes respectively.

The main initiatives, programmes and projects selected to achieve these objectives are as follows:

- Extending social security coverage to all operators in the sector and their employees;
- Development of new-generation professional organisations, namely associations and cooperatives;
- Strengthening of the inter-professional organisation and expansion of its membership base;
- Strengthening awareness-raising, support and training initiatives for olive growers;
- Continued expansion of olive grove area under solidarity projects and for the private sector through planting subsidies;
- Restoration and promotion of the sustainability of older olive groves planted under Pillar II (solidarity-based) projects;
- Development, strengthening and modernisation of olive processing and preservation capacity;
- Development and strengthening of storage and packaging capacity;
- Promotion of exports through the diversification of products and markets;
- Organisation, modernisation and upgrading of distribution and marketing channels;
- Promotion of localised irrigation and the adoption of good resource conservation practices.

agro-industrial facility. The system thus ensures market supply, whilst offering smallholder farmers access to modern techniques, finance, technical support and stable markets. See <https://www.ada.gov.ma/fr/concept> [Editor's note]

Situation actuelle de l'oléiculture marocaine et perspectives de son développement

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Introduction

La filière oléicole est une filière stratégique pour l'agriculture marocaine, alliant performance économique, résilience climatiques et valorisation des terres agricoles. De ce fait, l'olivier a bénéficié d'une attention particulière dans le cadre des stratégies agricoles, le Plan Maroc Vert (2008-2020) et la Génération Green (2020-2030).

Cette filière est profondément enracinée dans les traditions des zones rurales et constitue une source cruciale de revenus et fait partie intégrante du patrimoine méditerranéen commun.

Histoire et implantation territoriale

Le Maroc est une terre d'oliviers où cet arbre millénaire s'est profondément ancré dans la culture, la gastronomie et les traditions. Symbole de convivialité et d'art de vivre méditerranéen, l'huile d'olive incarne un héritage transmis de génération en génération.

Les données archéologiques attestent d'une présence très ancienne de l'olivier en Afrique du Nord, notamment dans la région de Rabat-Témara, bien avant les apports extérieurs souvent attribués aux Phéniciens. Cette ancienneté est également suggérée par des éléments linguistiques et culturels propres à la région.

Sous l'époque romaine, l'oléiculture connaît un essor remarquable et devient un pilier économique majeur, comme en témoignent les nombreuses huileries découvertes sur des sites tels que Volubilis, ainsi que dans les régions de Lixus, Tanger et Salé. Ces zones historiques correspondent largement aux principaux bassins oléicoles actuels, illustrant la continuité d'un savoir-faire et d'un patrimoine profondément enracinés.

Importance de la filière oléicole au niveau des pays d'Afrique du Nord

La filière oléicole en Afrique du Nord, notamment au Maroc, en Tunisie, en Algérie et en Égypte, connaît une croissance soutenue depuis deux décennies, portée par les politiques publiques, les investissements et la demande internationale.

La région totalise plus de 4,5 millions d'hectares d'oliveraies, avec une production d'huile variant entre 1,5 et 2,5 millions de tonnes selon les campagnes. Cette région représente 20 à 25 % des exportations mondiales d'huiles d'olive, largement tirées par la Tunisie, alors que le Maroc renforce progressivement sa présence à l'international.

Cette dynamique s'accompagne d'une modernisation des systèmes de production (irrigation localisée, unités de trituration performantes) et d'une amélioration de la qualité. Toutefois, cette filière reste confrontée à des contraintes majeures, notamment la variabilité climatique, la pression sur les ressources en eau et la fragmentation des exploitations.

A terme, le développement de la filière au niveau de ces pays devrait s'orienter vers davantage de durabilité, de valorisation qualitative et de diversification des marchés, confirmant une transformation structurelle en cours malgré un contexte climatique exigeant.

Importance socio-économique de l'olivier au Maroc

L'olivier, de par ses produits et leurs utilisations séculaires ainsi que ses fonctions multiples de lutte contre l'érosion, de valorisation des terres agricoles et de fixation des populations dans les zones de montagne, constitue la principale filière fruitière cultivée au Maroc et représente 65 % de la sole arboricole nationale.

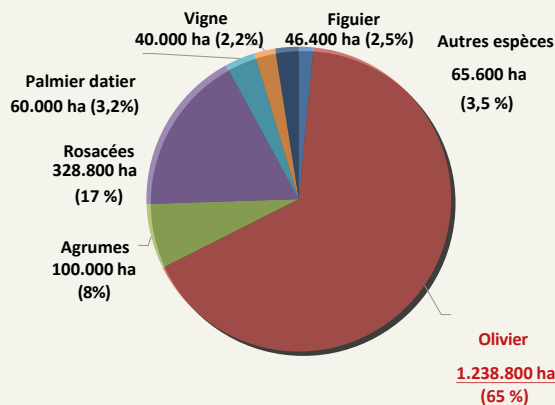
L'oléiculture constitue une source importante d'emplois procurant plus de 51 millions de journées de travail par an, l'équivalent de plus de 200.000 emplois permanents, dont la participation des femmes représente 20 %.

Cette filière contribue à la satisfaction des besoins du pays en huiles alimentaires en couvrant près de 17 à 20 % de ces besoins et à l'équilibre de la balance commerciale en assurant une entrée de devises équivalente à 2,1 milliards Dh/an, soit environ 184 Millions d'Euros (moyenne 2020-2024).

Part de l'olivier dans la sole arboricole marocaine

L'olivier occupe une superficie de 1.238.800 hectares, représentant 65 % de la sole arboricole nationale, ce qui en fait une culture clé pour le pays, particulièrement pour la production d'huile d'olive. Comparé aux autres cultures fruitières, l'olivier est largement dominant, avec les agrumes couvrant 8 %, les rosacées 17 %, et d'autres cultures telles que le palmier dattier (3,2 %), la vigne (2,2 %), et les figuiers (2,5 %).

Figure 1 – Part de l'olivier dans la sole arboricole nationale



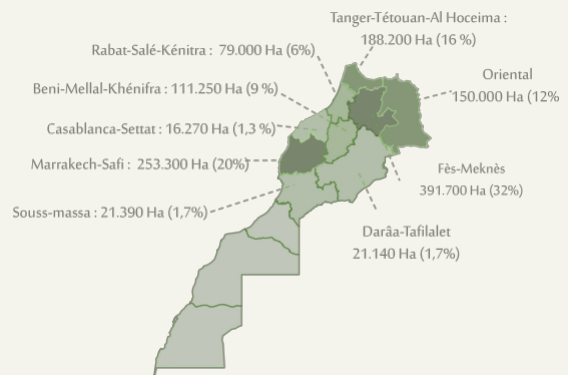
Répartition géographique

La répartition de ce patrimoine selon les zones agricoles montre, qu'à l'exception de la bande côtière atlantique où l'oléiculture est faiblement représentée, cette espèce présente des capacités d'adaptation à tous les étages bioclimatiques, allant des zones de montagne (1.200 mm) aux zones arides et sahariennes (moins de 200 mm).

L'oléiculture marocaine est concentrée principalement dans les régions du nord et du centre du pays. Les zones de Fès-Meknès et Marrakech-Safi constituent les principaux bassins de production, représentant à elles seules plus de la moitié de la superficie oléicole nationale.

Elles sont suivies par Tanger-Tétouan-Al Hoceima, l'Oriental et Béni Mellal-Khénifra, où l'olivier occupe une place essentielle dans l'économie rurale. Dans le sud, la culture est plus limitée mais progresse, notamment dans les régions de Souss-Massa et Drâa-Tafilalet, grâce aux projets d'irrigation et à la valorisation des terres arides.

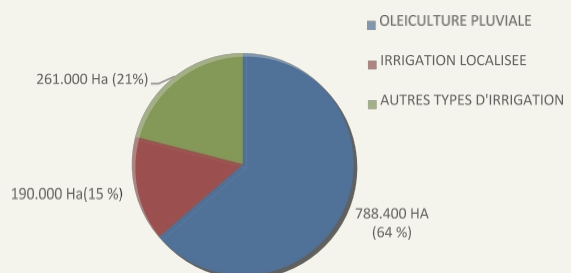
Figure 2 – Répartition régionale de la superficie oléicole actuelle



Mode de conduite

La superficie conduite en irrigué au niveau national porte sur 451.000 Ha, soit 36 % du total des superficies, contre 788.400 Ha en mode pluvial (64 % du total). La superficie conduite en irrigation localisée concerne 190.000 Ha, 42 % de la superficie irriguée, le reste en d'autres modes d'irrigation.

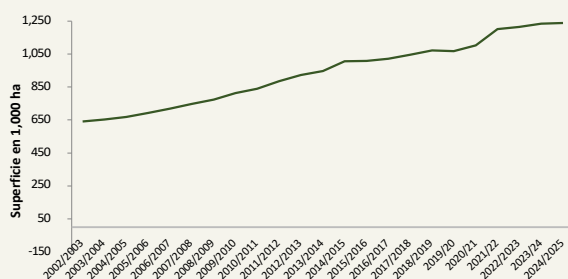
Figure 3 – Mode de conduite du verger oléicole



Evolution des superficies

La superficie oléicole au Maroc a connu une progression continue depuis 2008, date du lancement du Plan Maroc Vert. Cette superficie est passée de 748.000 ha en 2007/2008 à plus de 1,24 million d'hectares en 2024/2025, traduisant une croissance soutenue de la filière.

Cette expansion, soit une hausse d'environ 66% entre 2007/08 et 2024/2025, résulte des plantations réalisées dans le cadre des projets du Pilier II du Plan Maroc Vert.

Figure 4 – Evolution de la superficie oléicole(2002–2026)

(projets solidaires), des aides octroyés dans le cadre du Fonds de Développement Agricole et des efforts des producteurs pour la création de nouvelles plantations, y compris au niveau des terres marginales.

Principales variétés d'oliviers

Contrairement aux autres pays oléicoles, le profil variétal de l'olivier au Maroc est caractérisé par sa diversité limitée. En effet, le paysage oléicole est dominé par la seule variété « Pichline marocaine », qui représente 90 % du total des oliviers. Le reste, soit 10%, est constitué de des variétés issues de la sélection clonale au sein de cette même variété à savoir Haouzia et Ménara et quelques variétés étrangères (Picual, Frantoio, Manzanille, Gordal Sévillane, Arbéquine, Koroneiki, etc...).

Ceci est dû à une très grande adoption de la Pichline Marocaine par les producteurs pour les raisons de ses atouts tels la double utilisation, la qualité de ses produits et son adaptation aux conditions locales.

Pichline Marocaine:

La Pichline marocaine, bien adaptée aux conditions agroclimatiques du Maroc et appréciée pour son usage mixte (huile et table), elle demeure toutefois sensible à certaines maladies et présente un fort indice d'alternance, ce qui peut affecter la régularité de la production.

**Variété Pichline Marocaine**

Menara:

Variété issue de la 'Pichline marocaine', se distinguant par une meilleure aptitude au bouturage, une floraison moyenne et une entrée en production précoce (dès la 3^e année). Sa productivité est élevée, avec un rendement

en huile d'environ 24 %. Les fruits, à pulpe facilement détachable, conviennent à la fois à l'extraction d'huile et à la préparation d'olives vertes ou noires. Elle est très résistante à la tuberculose.

**Variété Ménara**

Haouzia:

Variété issue de la 'Pichline marocaine', caractérisée par une floraison moyenne, une entrée en production précoce et une forte capacité de bouturage. Rustique et très rhizogène, elle produit dès la 3^e année en sol irrigué. Productive mais alternante, elle offre un rendement en huile d'environ 23 % et convient aussi aux olives vertes. Résistante à l'œil de paon, tolérante à la tuberculose et à la sécheresse.

**Variété Haouzia**

Cinq nouvelles variétés ont été obtenues par l'Institut National de la Recherche Agronomique à travers le croisement des variétés marocaines (Ménara, Haouzia et M26) avec les variétés étrangères. Les critères de sélection retenus sont la productivité, la teneur en huile et composition en acide oléique, la vigueur des arbres, la fertilité et la régularité de production.

Ces cinq variétés sont inscrites au catalogue officiel et sont actuellement en cours de multiplication chez les pépiniéristes en vue de leur diffusion auprès des agriculteurs. Il s'agit des variétés : Baraka (M26 X Pichline de Languedoc), Mechkaté (M26 X Manzanille), Agdal (M26 X Manzanille), Tassaout (Menara X Leccino), et Dalia (Menara X Arbequine). Trois de ces variétés, en l'occurrence, Tassaout, Dalia et Mechkaté présentent un intérêt particulier pour les producteurs, en raison de leurs performances en matière de résilience face au changement climatique, ainsi que de leurs qualités chimiques et sensorielles remarquables.

A signaler que Le Royaume du Maroc a le privilège d'abriter la 2^{ème} collection mondiale de germoplasme d'olivier à Tassaout (Marrakech). Depuis son installation en 2002, cette collection a joué pleinement son rôle à des fins de conservation des ressources génétiques, de recherche, de sélection et de formation. Elle abrite actuellement 580 variétés mondiales, avec l'objectif d'atteindre 1.200 variétés.

Production et rendements

La production d'olives au niveau national est caractérisée par des fluctuations interannuelles importantes qui s'expliquent par l'effet conjugué de trois facteurs essentiels, à savoir :

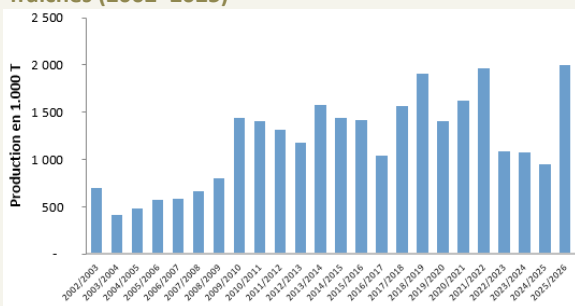
- Les techniques d'entretien non toujours adéquates ;
- Les conditions climatiques, en particulier la pluviométrie ;
- L'alternance, phénomène physiologique caractérisant l'olivier.

Cette production est passée de 549 000 T/an sur la période 2003-2007 à 1,7 million Tonnes sur 2018-2022 (+200 %), avant de reculer à près de 1,03 million t sur 2022-2024 sous l'effet de la sécheresse. L'objectif fixé à l'horizon 2030 est de 3,5 Millions de tonnes.

Cette évolution s'est traduite par une production d'huile d'olive oscillant entre 9.000 et 200.000 T/an durant la période 2014/15 et 2025/26, témoignant d'une variabilité suite aux contraintes climatiques.

Quant à la production des olives de table issues du secteur industrielle, elle est passée de 88.000 T lors de la période 2003-2007 à 128.000 T pour la période 2021-2025, soit une augmentation de 46 %.

Figure 5 – Evolution de la production totale en olives fraîches (2002–2025)



En ce qui concerne les rendements, il y a lieu de distinguer entre deux systèmes:

- Le système en bour caractérisé par des rendements qui demeurent faibles et oscillent entre 1,2 et 2,0 T/Ha productif (lors des dix dernières campagnes);
- Le système irrigué où les arbres reçoivent des irrigations pérennes ou d'appoint. Les rendements obtenus oscillent en moyenne entre 1,4 et 2,7 T/Ha productif (lors des dix dernières campagnes). Les rendements en système intensif peuvent atteindre jusqu'à 10 à 15 T/Ha.

Destination de la production

Globalement, la production nationale d'olive est acheminée à hauteur de 65 à 70 % à la trituration et 20 à 25 % à la conserverie. Les 10 % restants, constituent les pertes et l'autoconsommation.

La trituration des olives se fait par un secteur moderne et semi-moderne composé de 928 unités, détenant une capacité globale de 1.906.000 T/an et un secteur traditionnel constitué d'environ 11.000 maâsras. Le fonctionnement de ces maâsras s'effectue, pour une grande partie, par intermittence en dépendant largement de l'importance des récoltes des olives.

La conservation des olives est assurée par 75 unités modernes de conserverie des olives d'une capacité globale de 203.000 T/an et par des conserveries artisanales

Commercialisation

• Marché national :

La production d'huile d'olive est principalement destinée au marché intérieur, environ 85 %, avec une prédominance du circuit informel. En année de forte production, les exportations peuvent porter sur une partie importante de celle-ci.

En effet, l'huile d'olive a constitué le long de notre histoire, la source principale de nos besoins en huiles alimentaires. Ce n'est qu'à partir des années soixante, avec les changements des habitudes des ménages marocains, que la consommation de l'huile d'olive a commencé à fléchir en faveur d'une plus grande consommation d'huiles de graines. En effet, ces dernières représentent actuellement plus de 80 % de notre consommation en huiles alimentaires dont une grande partie est importée. Le marché des huiles d'olive reste libre et les prix connaissent des fluctuations d'une année à l'autre et ce, en fonction de la production.

Quant aux olives de table, environ 70 % de la production issues des conserveries industrielles est exporté ; le reste est consommée localement. La majeure partie des olives de tables destinées au marché intérieur est obtenu au niveau des unités artisanales du secteur informel qui produisent annuellement environ 200.000 à 250.000 tonnes. La production d'olives de table écoulée sur le marché local se caractérise par une gamme diversifiée de produits : olives vertes, olives noires, olives tournantes, dénoyautées, confites, farcies,...etc.

• **Exportations (moyenne 2021–2024):**

La production d'huile d'olive destinée à l'export s'élève à 10.000 tonnes, principalement vers l'Union européenne (46 %), les États-Unis (43 %) et le Canada (5 %). Les olives de table industrielles exportées atteignent 97.000 tonnes, avec 66 % vers l'Union européenne, en particulier la France et la Belgique, 22 % vers les États-Unis et 3 % vers l'Arabie Saoudite. L'huile de grignons d'olive exportée représente 13 000 tonnes, principalement vers l'Espagne.

• **Importations (moyenne 2021–2024):**

Les importations annuelles d'huile d'olive s'élèvent à 7.160 tonnes, provenant à 57 % de l'Union européenne, 33 % de Tunisie et 10 % de Turquie. Les importations d'olives de table atteignent restent négligeables et ne dépassent guère 1.300 tonnes par an.

Stratégies agricoles adoptées par le Maroc

Le développement de la filière oléicole marocaine s'appuie sur des politiques publiques cohérentes visant à améliorer sa compétitivité, sa durabilité et la qualité de ses produits. Impulsée par le Plan Maroc Vert (2008-2020), cette dynamique a permis d'importants progrès, notamment l'extension des superficies, la modernisation des vergers, l'amélioration des pratiques culturales, ainsi que l'organisation des producteurs et le développement de l'agrégation.

La stratégie du secteur agricole « Génération Green 2020-2030 » vient pour consolider les acquis réalisées dans le cadre du Plan Maroc Vert en misant sur le capital humain, la durabilité et la performance, à travers la modernisation des vergers, la valorisation des produits et le renforcement de la gouvernance de la filière.

Les principaux objectifs fixés dans le cadre de la nouvelle stratégie agricole « Génération Green 2020-2030 » pour le développement de la filière oléicole, à l'horizon 2030, sont les suivants:

- Extension de la superficie pour atteindre 1,4 millions ha;
- Amélioration de la production pour atteindre 3,5 millions T contre 1,7 T en 2020 ;

- Amélioration de la production industrielle des olives de table pour avoisiner 270.000 T contre 200 000 T en 2020 ;
- Promotion des exportations d'huile d'olive (y compris huile de grignons d'olive) et d'olives de table pour atteindre respectivement 100.000 T et 150.000 T.

Les principaux chantiers, programmes et projets retenus pour l'atteinte de ces objectifs sont les suivants

- Généralisation de la couverture sociale de tous les opérateurs de la filière et leurs employés ;
- Développement d'organisations professionnelles nouvelle génération, notamment l'agrégation et les coopératives ;
- Renforcement de l'organisation de l'interprofession et l'élargissement de la base des adhérents ;
- Renforcement des actions de sensibilisation, d'accompagnement et de formation des oléiculteurs ;
- Poursuite de l'extension de la superficie dans le cadre des projets solidaires et pour le privé via la subvention des plantations ;
- Réhabilitation et pérennisation des anciennes oliveraies plantées dans le cadre des projets pilier II (solidaires) ;
- Développement et renforcement et mise à niveau de capacités de trituration et de conserves d'olives ;
- Développement et renforcement des capacités de stockage et de conditionnement ;
- Développement des exportations à travers la diversification des produits et des marchés ;
- Structuration, modernisation et mise à niveau des circuits de distribution et de commercialisation ;
- Promotion de l'irrigation localisée et adoption de bonnes pratiques de préservation des ressources.

The current state and future of olive growing in Spain

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Olive cultivation in Spain has a history dating back more than 2,500 years, making it one of the country's most emblematic crops. Introduced by the Phoenicians and subsequently spread by the Romans, the olive tree quickly became a fundamental element of Mediterranean agriculture, both for local consumption and for trade throughout Europe.

To a greater or lesser extent, olive groves have always been, throughout every stage of Spain's history, an indicator of the economic situation, the level of modernisation or periods of crisis. In the mid-20th century, the arrival of other vegetable oils on the market,

rising labour costs and support for the cultivation of oilseeds have gradually reduced the profitability of olive groves, leading, for the first time in many years, to a decrease in the area under cultivation.

This period of crisis led to a period of restructuring which gradually enabled the modernisation of cultivation systems and the recovery and expansion of the cultivated area. Among these advances, we should note single-trunk planting systems and higher planting densities (intensive olive groves),

which are far more amenable to mechanisation and productive, and the introduction of irrigation using deficit irrigation strategies, which represented a highly significant strategic shift, improving the crop's profitability in many areas of traditional olive cultivation.

To a greater or lesser extent, olive groves have always been, throughout every stage of Spain's history, an indicator of the economic situation, the level of modernisation or periods of crisis.

Despite periods of fluctuating profitability, olive cultivation in Spain continues on an upward trajectory, positioning our country as the undisputed world leader in olive oil production.

The olive groves of the future therefore have a solid foundation, based on results obtained through research and technology transfer; this work must continue in the coming years to ensure the sector's sustainability.

Farming systems

As mentioned, the intensification of olive cultivation from the 1970s onwards, with the development of single-trunk plantations and the introduction of irrigation, alongside the modernisation of olive oil processing,

began to shape a new form of cultivation and a new industry.

Later, in the 1990s, the development of hedgerow-style olive groves, characterised by an increase in planting density, represented a further, even more radical change (Figure 1).

Figure 1 – High-density hedgerow olive plantation



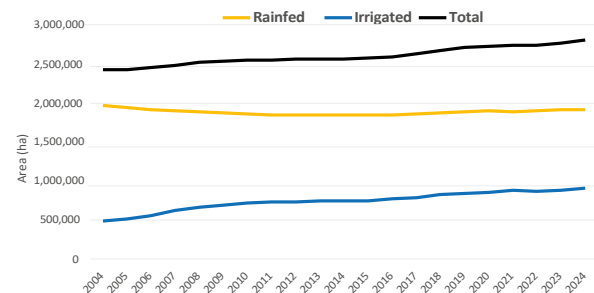
This model, the cornerstone of which is mechanical harvesting, involves higher investment costs than the other models. However, its higher productivity in the early years, resulting from the higher

number of trees per unit area and, above all, the possibility of a fully mechanised harvest, combined with the difficulty in securing labour for other models, has led, in recent years, to a remarkable expansion of this system in Spain and other olive-producing countries. Data from Spain

indicate that an increasingly significant proportion of new plantations are being established using this system. In Andalusia, for example, from 2010 onwards, 32% of new plantations were established using intensive systems with up to 800 olive trees per hectare and 26% with even higher densities (CAPADR, 2025). Everything seems to indicate that these systems will become increasingly predominant and will gradually reduce the share of traditional olive groves, which currently account for over 70 per cent of Spain's olive-growing area, covering more than 1.8 million hectares.

Irrigation has been a key factor in the development of this crop in Spain, contributing to increased production in much of the traditional olive grove, which began to be irrigated at the end of the last century...

Figure 2 – Evolution of olive grove area in Spain



Irrigation has also been a key factor in the development of this crop in Spain, contributing to increased production in much of the traditional olive grove area, which came to be irrigated at the end of the last century through the creation of a significant number of large-scale Irrigation Communities comprising a large number of smallholders, with annual irrigation allocations of 1,550 m³/ha or even less. During the period 2004–2024, the area of rain-fed olive groves remained virtually constant, as no new irrigation licences were granted for existing rain-fed olive groves, whilst new plantations on land with acquired

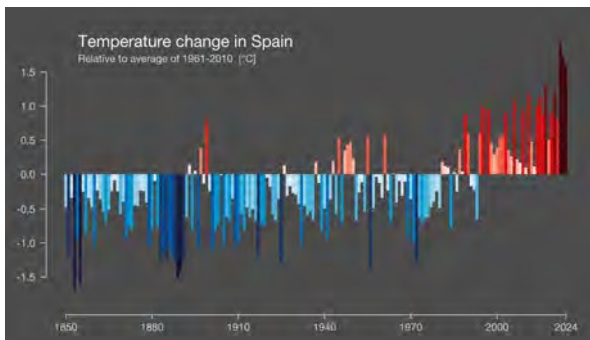
rights for irrigation have led to an increase in the area of irrigated olive groves, which rose from 500,000 to 900,000 hectares during that period (Figure 2).

Future developments will, of course, depend on the availability of water for

irrigation, which is constrained by water reserves and changes in rainfall against a backdrop of climate change, as well as on the profitability of the crop using higher-density models in rain-fed areas. Indeed, the potential effects associated with climate change will be another factor that will undoubtedly influence new olive grove plantings. The most recent climate projections, based on regionalised models such as EURO-CORDEX and the IPCC scenarios, all indicate that Spain will experience a clear and sustained rise in temperature throughout the 21st century. For the period 2030–2050, an increase is expected of approximately between +1.5 and 2.5°C

compared with pre-industrial levels, whilst by the end of the century (2080–2100) warming could range between +2 and +3°C in intermediate scenarios (SSP2–4.5), and exceed +5°C in high-emission scenarios (SSP5–8.5). This increase will be higher than the global average and will result in greater frequency, duration and intensity of heatwaves. This rise in temperature will undoubtedly be a critical factor in the temporal and geographical distribution of future olive groves, continuing the trend already observed in recent years (Figure 3).

Figure 3 – Trends in average temperature in Spain



Source: <https://showyourstripes.info/>

In this regard, it is important to highlight two main temperature-related factors that may adversely affect the crop:

the reduced accumulation of chill units due to rising temperatures in winter and the heat stress caused by episodes of extreme heat during critical stages, such as flowering and stone hardening. Experiments in subtropical climate zones, such as the Canary Islands, with particularly warm winters, reveal asynchronous and staggered flowering patterns that impair production and may affect the quality of olive oil (Figure 4). Similar phenomena are also observed in some areas of the Iberian Peninsula, confirming that the effects of climate change are already visible.

With regard to precipitation, the models reveal a trend that is more uncertain than in the case of temperature, but consistent towards

Figure 4 – Staggered flowering typical of areas where the chill requirements necessary for normal flowering in olive groves are not met



an overall reduction and greater variability, particularly in the South and the Mediterranean region. Estimates point to average reductions of around 10–20 per cent by the middle of this century, which could intensify to exceed 20–30 per cent in some regions by the end of the century. Furthermore, a decrease in the number of rainy days is forecast, alongside an increase in episodes of intense rainfall, implying a more extreme pattern: longer droughts alternating with torrential events.

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especially when these

extreme events coincide with phenological stages of the crop, such as flowering and lipogenesis. This will mean that the effects of extreme weather events will vary greatly, depending on the actual extent of global warming, the specific geographical area and the phenological stage the plant is in. This circumstance makes it even more difficult to predict the behaviour of the olive tree under future climatic conditions. The positive effect of increased CO₂ on water-use efficiency and photosynthesis will partly offset these negative impacts, but will by no means be able to fully reverse them.

In this context, the implementation of climate change adaptation strategies is essential to ensure the long-term sustainability of olive-growing systems. Thus, the controlled deficit

irrigation strategies already represent a substantial advance in the profitability of these systems, constituting a key element in ensuring their sustainability.

Controlled deficit irrigation strategies are based on the olive tree's varying sensitivity to stress, depending on its current phenological stage. Thus, the phenological stages of flowering, fruit set, ripening and lipogenesis are highly sensitive to water and heat stress, which must therefore be avoided. The aim of these strategies is to minimise water stress during these stages as much as possible, which is sometimes difficult in terms of availability water and in the case of limited irrigation allocations. Controlled deficit irrigation schedules usually concentrate the available water during the spring until the stone hardens, to ensure the harvest, and, above all, at the end of summer, when the water available in the soil is practically nil, as it has been consumed throughout the growing season, and lipogenesis processes are of great importance.

Thus, if water availability is scarce, summer is the time when the plant can withstand a certain degree of stress, affecting fruit growth, provided the fruit is intended for olive oil production. The same does not apply when the olive grove is intended for the production of table olives, which require water to maintain the size and turgidity of the fruit, so as not to compromise quality. This strategy of reducing irrigation in summer for olive groves intended for olive oil production – which is in line with the olive tree's physiological processes that restrict stomatal opening when environmental conditions are very severe – forms the basis of the application

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Olive varieties

The olive tree has traditionally been characterised by its vast genetic heritage, with countless varieties having been described in all the main producing countries. In Spain alone, the latest survey and cataloguing work indicates the existence of 427 cultivated varieties (Gómez-Gálvez et al., 2024). These varieties were selected by farmers of old over the centuries, meaning that most of them can be considered to be over a hundred years old, with some even dating back millennia. Some have also spread, under different names, throughout the Mediterranean basin.

This enormous varietal diversity was preserved until, more recently, changes in olive cultivation introduced alterations to the traditional varietal structure. Initially, the modernisation of olive groves led to the expansion of a small number of varieties, considered agronomically more suitable for an intensive system, which gradually replaced many of the other traditionally cultivated varieties. Thus, for example, in Andalusia, the world's leading producing region, just four varieties (Picual, Hojiblanca, Arbequina and Manzanilla de Sevilla) account for over 90 per cent of the olive grove area (CAPADR, 2025).

The development and subsequent expansion of hedgerow cultivation have made the need for new varieties adapted to this new system even more evident. The high planting densities and the fact that the trees are confined within relatively small hedgerows mean that most traditional varieties do not adapt well to the system, as they are excessively vigorous, large in size and have very

irrigation in vast areas of southern Spain, which, with water allocations well below optimal levels, yields excellent results compared to rain-fed olive groves.

stiff branches or rather loose crowns.

Thus, a key factor in the introduction of this cultivation system was the availability of the Arbequina variety, which by nature had a compact growth habit due to its early ripening, high yield and consistent fruit set, allowing for harvesting with grape-harvesting machines. Subsequently, the Arbosana variety was also identified, which was even better suited to the system, as its vigour and growth habit were less pronounced than those of the Arbequina. The initial expansion of the terraced olive cultivation system was thus almost exclusively due to these two varieties. This situation encouraged the development of breeding programmes aimed at broadening the range of varieties suited to this new system. However, due to the lengthy time required, it is only recently that breeding has been incorporated as a further common practice in olive cultivation.

In Spain, work carried out since the 1990s has enabled the selection and registration of new varieties from breeding programmes. The first variety obtained was Chiquitita / Sikitita (Rallo *et*

al., 2008), adapted for high-density terraced planting, the result of a joint programme between IFAPA and the University of Cordoba dedicated to developing new varieties for olive oil production. Within this same breeding programme, two new varieties have recently been registered, continuing the series that was started: Sikitita-2 and Martina. These are early-bearing and high-yielding varieties, with a tree architecture suited to medium-to-high planting density, and they produce Extra Virgin Olive Oil (EVOO) of high quality, stability and distinctive organoleptic profiles. These three varieties are descended from Arbequina and Picual.

The recent boom in the hedgerow olive system and the need for new, adapted varieties have, in recent years, encouraged the development of breeding initiatives in this direction. Consequently, new varieties resulting from breeding have been introduced, such as Oliana, Lecciana and Coriana (Agro-millora¹), I15 (Todolivo²) and Sultana (Balam³), the result of various public and private breeding programmes. And all the signs suggest that the number of new varieties will increase in the coming years. In all of them, the aim has been to achieve low vigour, early entry into production, high yield and oil content, as well as olive oils with remarkable nutritional and sensory characteristics.

A potential future risk stems from the fact that the new varieties mentioned above are derived from crosses in which the Arbequina variety has always been involved as a parent (either directly or indirectly, since the Arbosana variety, also

commonly used as a parent, stems, in turn, from the same Arbequina variety). This aspect may result in a dangerous genetic homogeneity in the new varieties. Consequently, the

The recent boom in the hedgerow olive-growing system and the need for new, adapted varieties have, in recent years, encouraged the development of breeding initiatives...

range of varieties available remains limited, and many more will be needed in the coming years to meet various requirements relating to plant architecture, adaptation to limiting factors, olive oil quality, etc.

Another area in which breeding work is yielding new, adapted varieties is the development of new materials resistant to the plant's main diseases. In this regard, as part of IFAPA's breeding programme for resistance to verticillium wilt, three new varieties (Urgavona, Castula and Iliturgitana) have been registered, exhibiting a high level of resistance and good agronomic characteristics, derived from crosses involving

¹<https://www.agromillora.com.olin/nuevas-variedades-para-el-olivar-en-seto/>

²<https://www.todolivo.com/todolivo-i-15-dossier/>

³<https://balam.es/sultana/>

Figure 5 – New varieties resistant to olive verticillium wilt



parents with some level of resistance to the disease (León and De la Rosa, 2022). These new varieties have been registered as particularly recommended in areas at high risk of verticillium wilt (Figure 5).

As in Spain, in other olive-producing countries, such as Italy, Israel, Morocco, Tunisia and Turkey, new varieties resulting from breeding

programmes have recently been registered, although they have seen little or no international dissemination.

A point of particular interest to bear in mind with these varieties is the need for extensive experimentation prior to their commercial release. Experience from previous cases involving new varieties – not only of the olive tree but also of other fruit trees – suggests that the introduction of these new varieties should take place gradually, with due caution and by assessing their adaptation to the different conditions they will encounter. Studies carried out in recent years at IFAPA highlight the complexity of characterising an olive variety in terms of specific levels of productivity, fat content or olive oil composition. Although these characteristics are undoubtedly influenced by genetics (inherent to the variety), they vary greatly depending on environmental conditions. This necessitates local trials over a sufficiently long period to determine which variety is best suited to specific environmental conditions and to identify any potential limitations to the cultivation of the

different varieties. Testing in this regard is limited, so recommendations should be interpreted with caution, particularly when comparing varieties that have not been tested under the same experimental conditions.

Breeding work will undoubtedly be an ongoing endeavour in the future, in response to the sector's diverse needs. Thus, for example, the emergence or worsening of various plant health problems, the threats arising from different climate change scenarios and the growing focus on organic farming systems highlight the importance of having new plant material with improved characteristics.

Against this backdrop of climate change, it will also become increasingly necessary for the olive groves of the future to be based on multi-varietal plantations, particularly on medium-sized or large-scale farms. Given that all varieties will have their respective advantages and

Against this backdrop of climate change, it will become increasingly necessary for the olive groves of the future to be based on multi-varietal plantations...

disadvantages, the use of different varieties on the same farm will enable us to diversify the risk in the face of an unpredictable climate scenario.

In short, the emergence of new, modern varieties better adapted to overcoming the current challenges facing agriculture will be a very important tool for increasing the current profitability of olive farms and ensuring their long-term sustainability.

Advisory and digitalisation

Currently, agriculture in general, and the olive sector in particular, are undergoing a veritable technological revolution with the implementation of the latest advances in sensors and digitalisation (Parra-López et al., 2021). These advances have been accelerated by two key factors: the emergence of new, advanced, low-cost sensors and the development of new connectivity systems. As regards advances in the field of sensors, the latest generation goes far beyond traditional sensors for

air humidity or temperature; low-cost sensors have been developed that can measure canopy temperature to identify water stress in plants at an early stage, or use computer vision techniques to identify pests or diseases, with the processing carried out by the sensor itself. As for advances in connectivity, this is no longer a limitation typical of rural areas thanks to the implementation of LoRaWAN⁴ networks, which are enabling communication between sensor networks and cloud-based servers, providing fast and cost-effective access to any user, anywhere.

All these advances are paving the way for the gradual widespread adoption of sensors in agriculture. The availability of a large volume of data generated by these systems will, in turn, facilitate the development of personalised advisory solutions based on artificial intelligence, capable of adapting precisely to the specific needs of each

user or context.

Furthermore, the integration of fixed and mobile sensors *in situ* with remote-sensing techniques will promote the development of digital twins and visualisation and analysis

platforms, based on open data models, leading to significant advances in early-warning systems for abiotic stress (water stress, heat stress) and biotic stress (pests and diseases), thereby enabling more profitable and sustainable olive groves.

Socio-economic factors in the olive sector: challenges for competitiveness and sustainability

The Spanish olive sector is characterised by a high degree of structural fragmentation, with over 2,750,000 hectares and around 350,000 holdings, of which more than 60–65 per cent are smaller than 5 ha, which limits the capacity for investment and modernisation (Carmona-Torres *et al.*, 2023).

In this context, the cooperative sector, which channels around 60% of the olive oil produced in our country, acts as a fundamental mechanism for aggregating supply and accessing markets, although the challenge of increasing added value at source, as opposed to bulk sales, remains (Vilar *et al.*, 2018). Added to this is the rise in production costs (20–40% over the last decade), with harvesting accounting for between 30% and 50% of the total. This context is giving rise to a growing duality between traditional models and high-density systems, which are more mechanised but also more capital-intensive.

On a social level, the sector generates between 40 and 50 million working days per year, particularly in Andalusia (where over 70 per cent of associated employment is concentrated), but

it faces a serious problem of ageing population: over 55 per cent of producers are over 55 years old, whilst fewer than 10–12 per cent are under 40. This imbalance threatens generational renewal and is constrained

by factors such as low profitability, price volatility and barriers to accessing land.

In terms of the market, Spain is the world's leading producer of olive oil, with an average output of around 1.2 million tonnes in recent years (≈45% of the global total), with more than 60% destined for export. However, the sector is characterised by high price volatility, with fluctuations that, in certain marketing years, have exceeded 100 per cent, creating enormous uncertainty in production, despite the growing dynamism of the premium, organic and origin-specific segments.

In this context, quality products (more than 30 PDOs – Protected Designations of Origin) allow for price increases of 10 to 30 per cent, although their

All these advances are paving the way for the gradual widespread adoption of sensors in agriculture.

⁴ LoRaWAN (Long Range Wide Area Network) is a long-range, low-power LPWAN (Low Power Wide Area Network) protocol designed for the Internet of Things [Editor's note]

international penetration is still limited, which highlights significant scope for growth, particularly in markets with high purchasing power, where traceability, origin and sensory quality are key purchasing decision factors

(Sayadi et al., 2017; Erraach and Sayadi, 2020; CAPADR, 2025). Similarly, organic olive groves have seen remarkable growth in recent decades: Spain has more than 250,000 hectares of such groves, of which approximately 60–65 per cent are located in Andalusia, positioning it as a world

leader in this production system (Rodríguez Sousa et al., 2020; Sayadi et al., 2024). Organic production accounts for around 10% of the

national total, driven by growing demand for sustainable and healthy products (Sayadi and Bertuglia, 2025), although its production costs are 20–30% higher, which requires adequate market valuation.

Finally, the circular bioeconomy is emerging as a strategic pillar for the sector (Cátedra Cerón et al., 2024; Sayadi et al., 2025), as it enables the recovery of between 4 and 5 million tonnes of by-products annually (greywater, olive pomace, prunings, leaves, stones and wastewater), of which less than 30–40% are currently utilised in an advanced manner. Biorefineries offer opportunities to generate bioenergy, biofertilisers and bioactive compounds with high added value, in an expanding market for phenolic compounds (>7–8% per year), with potential increases in profitability of 10–25%. However, their development requires overcoming technological, regulatory and scale barriers by encouraging innovation and public-private cooperation.

Taken together, these challenges highlight the need to move towards greater integration of the sector through larger, market-oriented cooperatives, as well as to foster professionalisation and generational renewal specific incentives and

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improved access to land. Similarly, it is essential to strengthen differentiation strategies based on quality, origin and sustainability, alongside the technological modernisation of traditional olive groves through adapted

mechanisation and digitalisation. Finally, the strengthening of the circular bioeconomy as a means of income diversification, alongside public policies aimed at creating value at source

and the reduction of price volatility and the promotion of multifunctional production models will be crucial to improving the competitiveness, sustainability and resilience of the Spanish olive sector.

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Situación actual y futuro del olivar en España

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El cultivo del olivo en España tiene una historia que abarca más de 2.500 años, lo que lo convierte en uno de los cultivos emblemáticos del país. Introducido por los fenicios y posteriormente expandido por los romanos, el olivo se convirtió rápidamente en un elemento básico de la agricultura mediterránea, tanto para el consumo local como para el comercio con toda Europa.

En mayor o menor medida, el cultivo del olivo siempre ha sido un indicador de la situación económica, del nivel de modernización o de los periodos de crisis a lo largo de todas las etapas de la historia de España. A mediados del siglo XX, la llegada de otros aceites vegetales al mercado, el aumento de los salarios y el apoyo al cultivo de semillas oleaginosas redujeron gradualmente la rentabilidad de los olivares, lo que provocó por primera vez en muchos años una disminución de la superficie cultivada de olivo. Este periodo de crisis desembocó en un periodo de reconversión que permitió poco a poco la modernización del cultivo y recuperar e incrementar la superficie cultivada. Entre esas modernizaciones cabe destacar el sistema de plantación con árboles de un solo tronco y mayor densidad de plantación (olivar intensivo), mucho más mecanizable y productivo y la introducción del regadío con estrategias de riego deficitario, que supuso un cambio estratégico de gran relevancia, mejorando la rentabilidad del cultivo en muchas zonas de olivar tradicional.

A pesar de los periodos de rentabilidad fluctuante, el cultivo del olivo en España continúa en una tendencia ascendente colocando a España como líder mundial indiscutible en la producción de aceite de oliva. El olivar del futuro se asienta por tanto en una base sólida, basado en evidencias procedentes de trabajos de investigación y transferencia tecnológica. Un trabajo que debe continuar en los próximos años para garantizar la sostenibilidad del sector.

Sistemas de cultivo

Como se ha comentado, la intensificación del cultivo desde los años setenta con el desarrollo de plantaciones

con un solo tronco y la introducción del riego, junto con la modernización de la industria de molturación del aceite de oliva, comenzaron a configurar una nueva forma de cultivo del olivo y de industria de transformación.

Más adelante, en los años noventa, el desarrollo del olivar en seto, caracterizado por un aumento de la densidad de plantación, supuso un nuevo cambio más radical para el olivar (Figura 1).

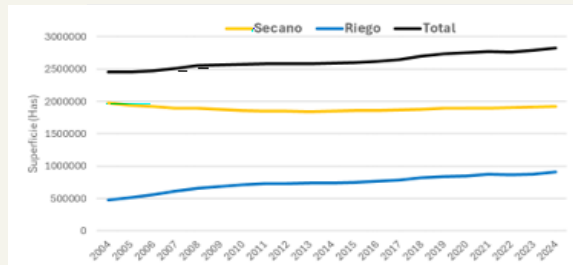
Figura 1 – Plantación de olivar en seto de alta densidad



Este modelo cuya piedra angular es la recolección con cosechadora mecánica, presenta unos costes de inversión superiores al resto de modelos, aunque su mayor productividad en los primeros años, motivado por tener número mayor de plantas por unidad de superficie, y sobre todo, la posibilidad de una recolección totalmente mecanizada, unido a la dificultad de obtener mano de obra para el resto de modelos ha propiciado una notable expansión de este sistema de cultivo en España y otros países olivareros en los últimos años. Los datos de España indican que una proporción cada vez más importante de las nuevas plantaciones se diseñan bajo este sistema de cultivo. Así, en Andalucía, a partir de 2010, un 32 % de las nuevas plantaciones se hacían en sistemas intensivos con hasta 800 olivos/hectárea y un 26% con densidades aún mayores (CAPADR, 2025). Todo parece indicar que estos sistemas serán cada vez más predominantes e irán reduciendo el peso del olivar tradicional, que actualmente supera el 70% de la superficie de olivar español, con más de 1,8 millones de hectáreas.

El riego ha sido también un factor determinante en la evolución del cultivo en España, contribuyendo al incremento de producción en gran parte del olivar tradicional, puesto en riego a final del siglo pasado mediante creación de un importante número de Comunidades de Regantes de gran superficie y elevado número de pequeños propietarios, con dotaciones anuales de riego de 1.550 m³/ha e incluso menos. Durante el periodo 2004-2024, la superficie en secano se ha mantenido prácticamente constante, pues no se han dado nuevas concesiones de riego para olivar de secano ya implantado, mientras que las nuevas plantaciones en terrenos con derecho adquirido para el riego han dado lugar a un incremento de la superficie de olivar regado, pasando de 500.000 hasta 900.000 hectáreas en dicho periodo (Figura 2).

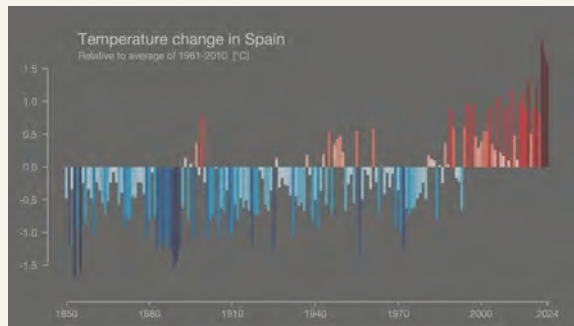
Figura 2 – Evolución de la superficie de olivar en España



La evolución futura dependerá sin duda de la disponibilidad de agua para riego, condicionada por las reservas de agua y evolución de precipitaciones en un contexto de cambio climático, y de la rentabilidad del cultivo utilizando modelos de mayor densidad en secano.

Precisamente, los potenciales efectos asociados al cambio climático serán otros factores que condicionarán sin duda las nuevas plantaciones de olivar. Las proyecciones climáticas más recientes, basadas en modelos regionalizados como EURO-CORDEX y en los escenarios del IPCC, coinciden en que España experimentará un aumento térmico claro y sostenido a lo largo del siglo XXI. Para el periodo 2030–2050 se espera un incremento aproximado de entre +1,5 y +2,5 °C respecto a niveles preindustriales, mientras que hacia finales de siglo (2080–2100) el calentamiento podría situarse entre +2 y +3 °C en escenarios intermedios (SSP2-4.5) y superar los +5 °C en escenarios de altas emisiones (SSP5-8.5). Este aumento será superior a la media global y se traducirá en una mayor frecuencia, duración e intensidad de las olas de calor. Este aumento de temperatura será sin duda un factor crítico en la distribución temporal y geográfica del olivar futuro, continuando con la evolución que se viene observando ya en los últimos años (Figura 3).

Figura 3 – Cambios en la temperatura media en España



Fuente: <https://showyourstripes.info/>

En este sentido cabe señalar dos factores principales relacionados con la temperatura que pueden afectar negativamente al cultivo: la menor acumulación de frío por el aumento de las temperaturas invernales y el estrés térmico provocado por episodios de calor extremo durante fases críticas como la floración y el endurecimiento del hueso. Experimentos en zonas de clima subtropical como las Islas Canarias, con inviernos especialmente cálidos, muestran floraciones asincrónicas y escalonadas que perjudican la producción y pueden afectar a la calidad del aceite de oliva (Figura 4). Fenómenos similares ya se observan en algunas zonas de la península, lo que confirma que los efectos del cambio climático ya son visibles.

Figura 4 – Floración escalonada típica de zonas donde no se completan los requerimientos de frío para una floración normal en olivar



En cuanto a la precipitación, los modelos muestran una tendencia más incierta que con la temperatura, pero consistente hacia una reducción global y una mayor irregularidad, especialmente en el sur y el área mediterránea. Las estimaciones apuntan a descensos medios del orden del 10–20 % hacia mediados de siglo, que podrían intensificarse hasta superar el 20–30 % en algunas regiones al final del siglo. Además, se prevé una disminución del número de días de lluvia junto con un aumento de episodios de precipitación intensa, lo que implica un régimen más extremo: sequías

más prolongadas alternadas con eventos torrenciales.

La mayor frecuencia de olas de calor y episodios de sequía tendrá un efecto combinado muy negativo sobre la producción y la calidad, especialmente cuando esos eventos extremos coinciden con fases fenológicas del cultivo como la floración y la lipogénesis. Esto hará que los efectos de los eventos climáticos extremos serán muy variables dependiendo del alcance real del calentamiento global, la zona geográfica concreta y el estado fenológico en el que se encuentre el cultivo. Esta circunstancia hace aún más difícil el pronóstico del comportamiento del olivo en condiciones climáticas futuras. El efecto positivo del incremento de CO₂ sobre la eficiencia en el uso del agua y la fotosíntesis compensará en parte estos impactos negativos, pero en ningún caso lograran revertir totalmente los impactos negativos.

En este contexto, la implantación de estrategias de adaptación al cambio climático se convierte en una estrategia crítica para asegurar la sostenibilidad de los sistemas olivareros en el tiempo. Así, las estrategias de riego deficitario controlado ya están suponiendo un sustancial avance en la rentabilidad de estos sistemas, siendo un componente clave para asegurar su sostenibilidad.

Las estrategias de riego deficitario controlado se basan en la diferente sensibilidad del olivo al estrés según el estado fenológico en el que se encuentre. Así, los estados fenológicos de floración, cuajado de fruto, maduración y lipogénesis son muy sensibles al estrés hídrico y térmico, por lo que deben ser evitados. Con las estrategias de riego deficitario controlado se pretende que el estrés hídrico en estas etapas sea el mínimo posible, lo cual a veces es complicado por la disponibilidad de agua y por unas dotaciones de riego limitadas. Los calendarios de riego deficitario controlado suelen concentrar el agua disponible durante la primavera hasta el endurecimiento del hueso para garantizar la cosecha y sobre todo a final del verano, donde el agua disponible en el suelo es prácticamente nula, pues se ha consumido a lo largo de la campaña, y los procesos de lipogénesis son de gran importancia. De esta manera, si la disponibilidad de agua es escasa, el verano es el momento donde el cultivo puede asumir cierto grado de estrés siempre que esté destinado para la producción de aceite, afectando al crecimiento del fruto, lo cual no es válido cuando el olivar está destinado a la producción de aceituna de mesa, que requiere agua para mantener el calibre y la turgencia del fruto para no ver mermada su calidad. Esta estrategia de reducción de riego en verano para el olivar con destino la producción de aceite, que se coordina con procesos fisiológicos del olivo que restringen la apertura

estomática cuando las condiciones ambientales son muy severas, es la base de la aplicación del riego en amplias zonas del sur de España, que con dotaciones muy inferiores a las óptimas presenta unos resultados excelentes frente al olivar de secano.

Variedades de olivo

El olivo se ha caracterizado tradicionalmente por disponer de un gran patrimonio genético, habiéndose descrito un gran número de variedades en todos los principales países productores. Solo en España, los últimos trabajos de prospección y catalogación indican la existencia de 427 variedades cultivadas (Gómez-Gálvez et al., 2024). Estas variedades fueron seleccionadas por los antiguos agricultores a lo largo de los siglos, por lo que la mayoría de ellas se pueden considerar centenarias e incluso algunas milenarias, expandiéndose algunas de ellas, bajo diferentes denominaciones, por toda la cuenca mediterránea.

Esta enorme diversidad varietal permaneció conservada hasta que, en fechas recientes, los cambios en la olivicultura introdujeron modificaciones en la estructura varietal tradicional. Inicialmente, la modernización del cultivo provocó la expansión de un reducido número de variedades, consideradas más adecuadas agrónomicamente para un cultivo intensivo que fueron reemplazando muchas de las otras variedades cultivadas tradicionalmente. Así, por ejemplo, en Andalucía, principal región productora del mundo, solo cuatro variedades ('Picual', 'Hojiblanca', 'Arbequina' y 'Manzanilla de Sevilla') concentran más del 90% de la superficie de olivar (CAPADR, 2025).

El desarrollo y expansión posterior del cultivo en seto puso aún más de manifiesto la necesidad de obtener nuevas variedades adaptadas a este nuevo sistema de cultivo. Las altas densidades de plantación y el hecho de mantener las plantas confinadas en setos de un tamaño relativamente reducido hacen que la mayoría de las variedades tradicionales no se adapten bien a este sistema de cultivo por ser excesivamente vigorosas, de gran porte, con alta rigidez de las ramas o copas poco compactas.

Así, un factor determinante del inicio de este sistema de cultivo fue contar con la variedad 'Arbequina' que, de manera natural presentaba un tamaño contenido debido a su precocidad, productividad y regularidad de fructificación, lo que posibilitaba su recolección mediante cosechadoras vendimiadoras. Posteriormente se identificó también la variedad 'Arbosana', que se adaptaba aún mejor al sistema, ya que su vigor y porte era inferior al de 'Arbequina'. La expansión inicial inicial

del cultivo en seto se debió por tanto casi en exclusiva a esas dos variedades. Esta situación impulsó el desarrollo de programas de mejora que permitieran ampliar el abanico de variedades adaptadas al sistema. No obstante, debido al largo periodo de tiempo necesario, solo en fechas recientes se ha incorporado la mejora como una práctica más del cultivo del olivo.

En España, los trabajos realizados desde la década de los 90 permitieron la selección y registro de nuevas variedades procedentes de programas de mejora. La primera variedad obtenida fue 'Chiquitita'/'Sikitita' (Rallo et al., 2008), adaptada para el cultivo en seto de alta densidad, fruto del programa conjunto del IFAPA y la Universidad de Córdoba dedicado a la obtención de nuevas variedades para producción de aceite. En este mismo programa de mejora se han registrado recientemente dos nuevas variedades que continúan la serie iniciada: 'Sikitita-2' y 'Martina'. Se trata de variedades precoces y productivas, con una arquitectura adaptada a media-alta densidad de plantación y productoras de un AOVE de alta calidad, estabilidad y perfiles organolépticos singulares. Estas tres variedades comparten como parentales a 'Arbequina' y 'Picual'.

El auge reciente del sistema de olivar en seto y la necesidad de nuevas variedades adaptadas ha impulsado en los últimos años el desarrollo de iniciativas de mejora en este sentido. Así, en los últimos años se han difundido nuevas variedades procedentes de mejora como 'Oliana', 'Lecciana' y 'Coriana' (Agromillora, <https://www.agromillora.com/olint/nuevas-variedades-para-el-olivar-en-seto/>), 'I15' (Todolivo, <https://www.todolivo.com/todolivo-i-15-dossier/>) y 'Sultana' (Balam, <https://balam.es/sultana/>) fruto de diversos programas de mejora, públicos y privados. Y todo hace indicar que el número de nuevas variedades va a crecer en los próximos años. En todas ellas se ha buscado bajo vigor, precocidad de entrada en producción, alta productividad y rendimiento graso y aceites de características nutricionales y sensoriales destacadas.

Un riesgo futuro potencial se deriva del hecho de que las nuevas variedades antes mencionadas descienden de cruzamientos donde siempre ha participado la variedad 'Arbequina' como parental (directa o indirectamente, ya que la variedad 'Arbosana', también común como parental, deriva a su vez de la misma variedad 'Arbequina'). Ello puede representar una peligrosa homogeneidad genética en las nuevas variedades. Por tanto, el abanico de variedades disponibles sigue siendo limitado y serán necesarias muchas más en los próximos años para cubrir diferentes necesidades relacionadas con la arquitectura de la planta, adaptación a factores limitantes, calidad de los aceites, etc.

Otra línea donde la mejora está aportando nuevas variedades adaptadas es el desarrollo de nuevos materiales con resistencia a las principales enfermedades del cultivo. En este sentido, en el programa de mejora del IFAPA para resistencia a Verticilosis se han registrado tres nuevas variedades ('Urgavona', 'Castula' e 'Iliturgitana') con alto nivel de resistencia y buenas características agronómicas, procedentes de cruzamientos en los que intervienen parentales con cierto nivel de resistencia a la enfermedad (León y De la Rosa, 2022). Estas nuevas variedades se han registrado como especialmente recomendables en áreas con alto riesgo de Verticilosis (Figura 5).

Figura 5 – Nuevas variedades resistentes a la Verticilosis del olivo



Al igual que en España, en otros países productores como Italia, Israel, Marruecos, Túnez y Turquía se han registrado recientemente nuevas variedades procedentes de programas de mejora, aunque han tenido escasa o nula difusión internacional.

Un punto de especial interés a considerar con estas variedades es la necesidad de una amplia experimentación previa a su difusión comercial. La experiencia de casos previos de nuevas variedades, no sólo en olivo, sino en otros frutales, aconseja que la difusión de estas nuevas variedades se realice poco a poco, con la debida precaución y valorando su adaptación a las diferentes condiciones que se van a encontrar. Los estudios realizados durante los últimos años en el IFAPA indican la complejidad para caracterizar una variedad de olivo con un nivel de productividad, rendimiento graso, o composición del aceite determinada. Estos caracteres, aunque tienen una indudable influencia genética (inherente a la variedad), varían mucho de unas condiciones ambientales a otras. Esto obliga a realizar una experimentación local durante un periodo de tiempo suficientemente largo para determinar la variedad que mejor se adapta a unas condiciones ambientales determinadas y las posibles limitaciones para el cultivo de las diferentes variedades. La experimentación en este sentido es limitada, por lo que las recomendaciones deben tomarse con cautela, en particular cuando se trata de comparar entre variedades que no han sido probadas bajo las mismas condiciones experimentales.

Los trabajos de mejora serán sin duda una constante en el futuro para atender a diversas demandas del sector. Así, por ejemplo, la irrupción o agravamiento de diferentes problemas fitosanitarios, las amenazas planteadas por los diferentes escenarios de cambio climático y la apuesta cada vez mayor por sistemas de agricultura ecológica indican la importancia de disponer de nuevo material vegetal con características mejoradas.

En este entorno de cambio climático también será cada vez más necesario que el olivar del futuro se base en plantaciones multivarietales, sobre todo en fincas de mediana o gran extensión. Dado que todas las variedades van a tener ventajas e inconvenientes, el uso de varias variedades en una misma finca nos va a permitir la diversificación del riesgo ante un escenario climático poco previsible. En definitiva, la aparición de nuevas variedades modernas y más adaptadas a superar los retos actuales de la agricultura representará una herramienta muy importante para incrementar la rentabilidad actual de las explotaciones olivareras y garantizar su sostenibilidad a largo plazo.

Asesoramiento y digitalización

En la actualidad la agricultura en general, y el sector olivarero en particular, vive una auténtica revolución tecnológica con la implantación de los últimos avances de sensórica y digitalización (Parra-López et al., 2021). Estos avances se han visto acelerados por 2 componentes esenciales: la aparición de nuevos sensores avanzados de bajo coste y el desarrollo de nuevos sistemas de conectividad. En relación con los avances en sensórica, los sensores de última generación van mucho más allá de los tradicionales sensores de humedad o temperatura del aire, desarrollándose sensores de bajo coste capaces de determinar la temperatura del dosel vegetal para identificar de manera temprana el estrés hídrico de los cultivos, o emplear técnicas de visión artificial para identificar plagas o enfermedades con procesamiento realizado por el propio sensor. En relación con los avances en conectividad, esta ha dejado de ser una limitación característica de las zonas rurales con la implantación de redes LoRaWAN que están permitiendo intercomunicar las redes de sensores con servidores ubicados en la nube, logrando un acceso rápido y económico a cualquier usuario y en cualquier lugar.

Todos estos avances están permitiendo avanzar hacia una progresiva universalización de la sensorización de la agricultura. La disponibilidad masiva de datos generados por estos sistemas facilitará, a su vez, el desarrollo de soluciones de asesoramiento personalizado basadas en inteligencia artificial, capaces de adaptarse de forma precisa a las necesidades específicas de cada usuario o

contexto. Además, la integración de sensores in-situ fijos y móviles con técnicas de teledetección propiciarán el desarrollo de gemelos digitales y plataformas de visualización y análisis, bajo estándares de dato abierto logrando significativos avances en los sistemas de alerta temprana frente a la ocurrencia de estreses abióticos (estrés hídrico, golpes de calor) y bióticos (plagas y enfermedades) y así lograr olivares más rentables y sostenibles.

Factores socioeconómicos del olivar: retos para la competitividad y la sostenibilidad

El sector olivarero español se caracteriza por una elevada fragmentación estructural, con más de 2.750.000 hectáreas y alrededor de 350.000 explotaciones, de las que más del 60-65 % son menores de 5 ha, lo que limita la capacidad de inversión y modernización (Carmona-Torres et al., 2023). En este contexto, el cooperativismo, que canaliza cerca del 60 % del aceite producido en nuestro país, actúa como un mecanismo clave de agregación de la oferta y acceso a mercados, si bien persiste el reto de incrementar el valor añadido en origen frente a la comercialización a granel (Vilar et al., 2018). A ello se suma el incremento de los costes de producción (20-40 % en la última década), con la recolección representando entre el 30 % y el 50 % del total. Este contexto está generando una creciente dualización entre modelos tradicionales y sistemas de alta densidad, más mecanizados pero también más intensivos en capital.

En el plano social, el sector genera entre 40 y 50 millones de jornales anuales, especialmente en Andalucía (más del 70 % del empleo asociado), pero enfrenta un acusado problema de envejecimiento: más del 55 % de los titulares supera los 55 años, mientras que menos del 10-12 % tiene menos de 40 años. Este desequilibrio compromete el relevo generacional y está condicionado por factores como la baja rentabilidad, la volatilidad de precios y las barreras de acceso a la tierra.

En el ámbito de mercado, España es el principal productor mundial de aceite de oliva, con una producción media en torno a 1.2 millones de toneladas en los últimos años (≈45 % del total mundial), destinando más del 60 % a la exportación. No obstante, el sector presenta una elevada volatilidad de precios, con fluctuaciones que en determinadas campañas han superado el 100 %, generando una notable incertidumbre en origen, a pesar del creciente dinamismo de los segmentos premium, ecológicos y diferenciados por origen.

En este contexto, las figuras de calidad (más de 30 DOP) permiten incrementos de precio del 10-30 %, aunque su penetración internacional sigue siendo limitada, lo que

evidencia un importante margen de crecimiento, especialmente en mercados de alto poder adquisitivo donde la trazabilidad, el origen y la calidad sensorial son factores determinantes de compra (Sayadi et al., 2017; Erraach y Sayadi, 2020, CAPADR, 2025). Asimismo, el olivar ecológico ha experimentado un notable crecimiento en las últimas décadas: España cuenta con más de 250.000 hectáreas, de las cuales aproximadamente el 60-65 % se localiza en Andalucía, situándola como líder mundial en este sistema de producción (Rodríguez Sousa et al., 2020; Sayadi et al., 2024). La producción ecológica representa alrededor del 10 % del total nacional, impulsada por la creciente demanda de productos sostenibles y saludables (Sayadi y Bertuglia, 2025), aunque presenta costes de producción entre un 20 % y un 30 % superiores, lo que exige una adecuada valorización en el mercado.

Finalmente, la bioeconomía circular emerge como un eje estratégico para el sector (Cátedra Cerón et al., 2024; Sayadi et al., 2025), al permitir la valorización de entre 4 y 5 millones de toneladas anuales de subproductos (alperujo, orujo, poda, hojas, hueso y aguas residuales), de los cuales menos del 30-40 % se aprovecha actualmente de forma avanzada. Las biorrefinerías ofrecen oportunidades para generar bioenergía, biofertilizantes y compuestos bioactivos de alto valor añadido, en un mercado de compuestos fenólicos en expansión (>7-8 % anual), con potenciales incrementos de rentabilidad del 10-25 %. No obstante, su desarrollo requiere superar barreras tecnológicas, regulatorias y de escala mediante el impulso de la innovación y la cooperación público-privada.

En conjunto, estos retos evidencian la necesidad de avanzar hacia una mayor integración del sector mediante cooperativas de mayor dimensión y orientación al mercado, así como de impulsar la profesionalización y el relevo generacional a través de incentivos específicos y mejoras en el acceso a la tierra. Asimismo, resulta clave reforzar las estrategias de diferenciación basadas en calidad, origen y sostenibilidad, junto con la modernización tecnológica del olivar tradicional mediante mecanización adaptada y digitalización. Finalmente, el fortalecimiento de la bioeconomía circular como vía de diversificación de ingresos, junto con políticas públicas orientadas a la creación de valor en origen, la reducción de la volatilidad de precios y el fomento de modelos productivos multifuncionales, será determinante para mejorar la competitividad, sostenibilidad y resiliencia del sector olivarero español.

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The future of olive growing and olive oil: key opportunities and challenges

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1. Introduction

Olive growing has established itself as one of the most successful agricultural sectors in Portugal, driven by a profound transformation that has taken place mainly over the last 15 years, which has consolidated the country's position as a key player in the global olive oil market.

The sector has undergone a veritable revolution, taking the country from a deficit situation to the position of the world's sixth-largest producer of olive oil. Portugal has become a net exporter: the third-largest exporter in the EU and the fifth-largest globally.

This revolution was based not only on an expansion of the areas dedicated to olive cultivation, but, above all, on the technological transition from traditional olive groves to modern irrigated systems, namely open-vase olive groves and, more recently, hedgerow-style olive groves. Currently, around 64 per cent of the national olive grove area consists of modern olive groves (vase or hedge), the vast majority of which are irrigated (38 per cent of the olive grove area is irrigated). The hedgerow olive grove system has enabled significant gains in productivity and high levels of mechanisation,

contributing to a reduction in unit production costs and to strengthening the economic viability and competitiveness of farms. Despite requiring less labour, the jobs generated by modern olive groves tend to be more specialised and better paid, which has contributed to the sector's development.

These changes in the countryside have been accompanied by the modernisation of olive mills, which have increased their processing capacity and significantly the quality of the olive oils produced — around 85 per cent of national

Despite this successful trajectory, the sector faces significant challenges.

production is classified as extra virgin olive oil. Thanks to investments in automation and efficiency, some Portuguese olive mills

are now among the most advanced in the world.

Despite this successful trajectory, the sector faces significant challenges. The growing volatility of international markets, the entry of new olive oil-producing countries and changes to trade agreements — such as the negotiations between the European Union (EU) and Mercosur or the imposition of tariffs by the United States — will introduce new competitive dynamics, forcing the sector to adapt rapidly to environments of greater

uncertainty and pressure on prices.

At the same time, climate change poses structural challenges to the sustainability of olive growing, namely in terms of water availability,

production variability and the incidence of pests and diseases – factors that could significantly affect production in the main producing countries of the Mediterranean basin.

This article seeks to analyse the main dynamics of the olive oil market, with the aim of anticipating trends and identifying the challenges and opportunities that the Portuguese olive sector will have to face.

2. Production trends

The global area under olive cultivation has been growing steadily, now reaching 11.8 million hectares, spread across 66 countries on five continents¹. However, 88 per cent of the global area is concentrated in the 10 largest producing countries, which account for 90 per cent of the total olive oil produced worldwide. Table 1 shows the trend in olive oil production in these countries over the last 15 years,

Over the last decade and a half, global olive oil production has risen from 2.86 to 3.09 million tonnes... This modest growth at a global level masks differing trends amongst producing countries.

as well as some data on the characteristics of the olive groves in each country.

Over the last decade and a half, global olive oil production has risen from 2.86 to 3.09 million tonnes,

corresponding to an average annual growth rate of just 0.5%. This modest growth at a global level masks differing trends amongst producing countries.

Spain remains the world's leading producer, but its share of global production has fallen from 44% to 35%, with an average annual rate of decline of -1.0%. It is important to note that part of this decline was due to extreme weather conditions – prolonged drought and heatwaves – during the 2022/23 and 2023/24 growing seasons, which resulted in historically low yields, significantly lowering the four-year average under consideration (2022–25). Italy, Greece and Syria also experienced significant falls in their production; these are countries with more fragmented structures, older olive groves and a lower proportion of irrigated land. Italy was the country with the sharpest fall in production, reducing its share of the world market from 16.8% to 9%, as a result of frequent droughts and the *Xylella fastidiosa* problem and the prevalence of old olive groves that are difficult

Table 1 – Distribution of global olive oil production by the main producing countries

Country	World Olive Oil Production				Average Annual Rate of Change	% of Irrigated Area	% of Area Hedge or vase
	Average 2007–2010		Average 2022–2025				
	t	%	t	%			
Spain 	1,264,875	44.3%	1077,842	34.9%	-1.0%	32 %	32%
Turkey	127,250	4.5%	365,250	11.8%	12.5 %	30 %	27 %
Tunisia	150,000	5.2%	306,750	9.9%	7.0%	3 %	11 %
Italy 	480,000	16.8%	279,356	9.0%	-2.8 %	23 %	21 %
Greece 	313,300	11.0%	251,875	8.2%	-1.3%	19 %	25 %
Portugal 	53,775	1.9%	153,475	5.0%	12.4 %	38 %	64 %
Morocco	110,000	3.8%	115,750	3.7%	0.3%	86 %	54 %
Syria	140,000	4.9%	114,000	3.7%	-1.2%	5 %	12 %
Algeria	44,750	1.6%	75,000	2.4%	4.5%	18 %	35 %
Egypt	4,875	0.2%	49,125	1.6%	60.5 %	40 %	41 %
Other countries	168,950	5.9%	301,975	9.8%	5.2%	–	–
World total	2,857,775		3,090,397		0.5%	29 %	37 %

Source: Compiled by the author based on data from the International Olive Council (IOC) and data from Juan Vilar Strategic Consultants

to mechanise. In terms of growth, the following stand out: Turkey, which, during the period under review, saw its production increase at an average annual rate of 12.5 per cent, rising from the sixth to the second largest producer in the world, and is now responsible for 12 per cent of the global volume of olive oil produced; Portugal, which recorded an average annual growth rate similar to that of Turkey, with its share

¹ Annual Report on the Situation of the Olive Oil Sector, July 2025, Juan Vilar Hernández.

rising from 1.9% to 5%; and Egypt, which, starting from a very low level of production, grew at an average annual rate of 60.5%, rising from 22nd to 10th place in the ranking of the largest producers. Both Portugal and Egypt now have a significant proportion of their olive groves cultivated using modern irrigation systems, a factor which has fuelled the growth observed.

The global olive-growing landscape has been expanding into other regions. Over the last 16 years, the number of producing countries has risen from 46 to 66. Countries such as Australia, the USA, Chile and Argentina, amongst others, have invested in the establishment of modern irrigated olive groves, emerging as producers of high-quality olive oil with low production costs. Many of these new

producing countries have a significant strategic advantage: as they are located in the southern hemisphere, they are able to supply the market with fresh olive oils between April and July, a period when European stocks are at their lowest.

Thus, the future development of global olive oil production will be shaped by two main trends, which are already becoming apparent: the geographical expansion of production and the modernisation of production systems.

Olive oil production will continue to expand into new regions beyond the traditional Mediterranean basin, driven by climate change and the opportunities created by growing demand for olive oil in emerging markets. These new producing countries will invest in modern, technologically advanced production systems, notably free-standing olive groves, benefiting from increasingly favourable agroclimatic conditions and greater availability of land and water.

Although these new regions still account for only a limited share of the global total, they show potential for growth and may gain in importance in the future as they consolidate their technical expertise, adapt varieties and benefit from more

suitable climatic conditions.

Traditional producing countries are expected to follow the path already embarked upon in Portugal and Spain, which involves converting traditional olive groves into modern irrigated ones, wherever conditions allow, in order to increase production and reduce costs.

3. Consumption trends

Global olive oil consumption has risen steadily over recent decades, driven primarily by the growing popularity of the Mediterranean diet, the spread of Mediterranean cuisine worldwide, and by the growing awareness of its health benefits.

However, as with global production, the growth in olive oil consumption has also turned out to be considerably more subdued over the last 15 years. Global consumption rose from 2.8 million tonnes in the 2007–2010 four-year period to just over 3 million tonnes in the

2022–2025 period, representing an average annual growth rate of just 0.3%. It should be noted that the final four-year period includes the years 2022 and 2023, during which global consumption fell very significantly due to the historic price rise caused by the prolonged drought in Spain.

Table 2 shows the trend in olive oil consumption in the 10 leading consumer countries, which account for 69 per cent of global consumption.

The three largest consumers of olive oil in the world are Italy, Spain and the USA, which account for around 43 per cent of global consumption. The other consuming countries (apart from the top 10) account for 31 per cent of consumption, which demonstrates the wide geographical spread of consumption of this product (198 countries). It should also be noted that the USA, France, Brazil and Germany are among the 10 largest consumers,

...the future development of global olive oil production will be shaped by two main trends, which are already becoming apparent: the geographical expansion of production and the modernisation of production systems.

Table 2 – Distribution of global olive oil consumption by the main producing countries

Country		World Olive Oil Production				Average Annual Rate of Change	Per Capita Consumption kg/capita
		Average 2007–2010		Average 2022–2025			
		t	%	t	%		
Italy		687 675	23.8%	461 225	15.2%	-2.2%	7.76
Spain		543,375	18.8%	442,000	14.6%	-1.2%	9.23
USA		258,750	8.9%	407,250	13.5%	3.8 %	1.18
Turkey		108,500	3.8%	182,500	6.0%	4.5%	2.09
Morocco		81,250	2.8%	147,500	4.9%	5.4 %	3.89
France		110,675	3.8%	120,275	4.0%	0.6%	1.81
Greece		237,250	8.2%	88,375	2.9%	-4.2%	8.70
Brazil		48,500	1.7%	81,875	2.7%	4.6%	0.39
Algeria		43,125	1.5%	79,500	2.6 %	5.6%	1.71
Germany		51,150	1.8%	71,686	2.4 %	2.7 %	0.85
Other countries		721,933	25.0%	945,406	31.2%	2.1 %	–
World total		2,892,183		3,027,591		0.3%	

Source: Own calculations based on data from the IOC and UN population data, DHESA. Per capita consumption shown is the average for 2022–2025.

despite having little or no olive oil production of their own.

Analysing the data broken down by country, it can be seen that olive oil consumption has essentially declined mainly in the major producing countries of the European Union (Italy, Spain, Greece and Portugal), along with one non-European producer: Syria. During the period under review, Portugal reduced its olive oil consumption by around half (-3.2% per year), although part of this reduction is a consequence of the sharp rise in the price of olive oil observed between 2022 and 2024.

Despite the strong expansion of olive oil consumption into new geographical areas observed in recent decades, it remains heavily concentrated amongst a small fraction of the world’s population.

Virtually all other consumer countries recorded more or less significant increases in olive oil consumption, with notable increases in the USA (the third-largest consumer of olive oil, with growth of 3.8% per annum), Morocco (5.4% per annum) and Turkey (4.5% per annum).

Despite the strong expansion of olive oil consumption into new geographical areas observed in recent decades, the same it remains highly concentrated amongst a small fraction of the world’s population. Table 3 analyses the distribution of global olive oil consumption across different countries, according to their respective *per capita* consumption.

Table 3 – Distribution of olive oil consumption and the world’s population by country according to their respective *per capita* consumption (2022–2025)

Per Capita Olive Oil Consumption in Different Countries	% of World Consumption	% of the World Population
Up to 0.4 kg/person/year	9 %	31 %
Between 0.4 and 1 kg per person per year	5 %	3 %
Between 1 and 2 kg per person per year	27 %	7 %
Between 2 and 8 kg per person per year	35 %	3 %
More than 8 kg per person per year	18 %	1 %
No consumption	–	55 %

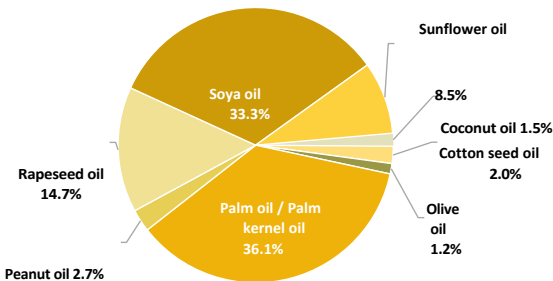
Source: Own analysis based on data from the IOC and UN population data, DHESA

The group of countries with *per capita* consumption exceeding 2 kg per person per year accounts for 53% of global olive oil consumption, but only around 4% of the world’s population.

In contrast, 55 per cent of the population does not consume olive oil and 31 per cent consumes very small quantities (up to 0.4 kg per person per year). Thus, around 80% of the world’s population consumes little or no olive oil, a situation which highlights enormous potential for growth in consumption, particularly in non-traditional markets.

Olive oil, despite its unique characteristics and health benefits, falls within the category of vegetable oils, where it competes with various substitutes —

Figure 1 – Distribution of global vegetable oil consumption



Source: USDA Foreign Agricultural Service, 2026

generally less healthy and sustainable. In terms of global vegetable oil consumption, olive oil accounts for just 1.2% of the total, a share far lower than that of alternatives such as palm oil or soya oil (see Figure 1). This figure demonstrates that

olive oil is not an undifferentiated fat, but rather a niche/premium product, when compared with lower-cost palm, soya or sunflower oils, which are refined using chemical processes.

We can therefore conclude that global olive oil consumption is well placed to grow sustainably in the coming decades, provided that production keeps pace with this increase in demand, ensuring a sufficient and competitive supply to meet it.

To this end, it will be essential for olive oil production to also experience sustained growth, through the introduction of new production areas and the conversion of traditional, low-yield olive groves into modern, irrigated ones. Otherwise, stagnating production will limit consumption: increases in demand will translate into higher prices, reinforcing olive oil's positioning as a *premium* or luxury product rather than an everyday consumer good, a situation that will lead to its replacement by other vegetable oils. This became quite evident in 2022/23, when reduced supply drove olive oil prices to record highs, leading to a sharp fall in consumption.

4. International Trade

The expansion of olive oil consumption into new geographical areas has driven the growth of international trade, a trend that has been clearly visible over the last 15 years.

Olive oil, despite its unique characteristics and health benefits, falls within the category of vegetable oils, where it competes with various substitutes — generally less healthy and sustainable.

The four largest exporting countries — Spain, Italy, Tunisia and Portugal — currently account for 79% of global olive oil exports. Portugal ranks fourth place, driven by a very significant increase in export volume

Table 4 – Trends in olive oil exports from the main exporting countries

Country	Global Olive Oil Exports				Average Annual Rate of Change
	Average 2007–2010		Average 2022–2025		
	t	%	t	%	
Spain 	702 319	50.5%	903,280	42.1%	1.9 %
Italy 	309,634	22.3%	321,010	15.0%	0.2%
Tunisia	119,250	8.6%	243,250	11.3%	6.9 %
Portugal 	42,838	3.1%	218,684	10.2%	27.4 %
Greece 	98,706	7.1%	165,664	7.7%	4.5 %
Turkey	21,875	1.6%	119,750	5.6%	29.8 %
Syria	19,000	1.4%	46,250	2.2%	9.6%
Argentina	15,875	1.1%	26,875	1.3%	4.6 %
Chile	3,250	0.2%	16,375	0.8 %	26.9 %
France 	5,200	0.4 %	12,027	0.6%	8.8 %
Other countries	53,293	3.8%	70,760	3.3%	2.2 %
World total	1,391,240		2,143,926		3.6%

Source: Compiled by the author using data from the COI and EUROSTAT.

Table 5 – Trends in olive oil imports by the main importing countries

Country	Global Olive Oil Imports				Average Annual Rate of Change
	Average 2007–2010		Average 2022–2025		
	t	%	t	%	
Italy 	511 326	33.8%	502 872	23.9%	-0.1%
USA	258,250	17.1%	408,250	19.4%	3.9 %
Spain 	53,781	3.6%	218,705	10.4%	20.4 %
France 	111,305	7.4%	120,405	5.7%	0.5%
Portugal 	75,702	5.0%	103,456	4.9%	2.4 %
Brazil	48,500	3.2%	81,875	3.9%	4.6%
Germany 	59,205	3.9%	76,012	3.6%	1.9%
Canada	34,000	2.2%	61,375	2.9%	5.4 %
Japan	33,750	2.2%	44,125	2.1%	2.0%
Australia	30,625	2.0%	34,500	1.6%	0.8%
Other countries	296,157	19.6 %	456,301	21.6%	3.6 %
World total	1.512.601		2.107.876		2.6%

Source: Compiled by the author using data from the IOC and Eurostat.

(27% per year), having overtaken Greece. Turkey and Chile also recorded significant increases in their exports.

As regards imports, Italy remains the world's largest importer of olive oil, accounting for 24 per cent of the global volume, although it is the only one of the major importers to have seen a decrease in volume (-0.1 per cent). It should be noted that this country also has the highest consumption of olive oil in the world.

The US is the second-largest importer of olive oil, accounting for over 19 per cent of the volume imported, with an average growth rate of 3.9 per cent per year. Spain ranks third, with 10 per cent of imports, standing out as the country that has seen the greatest increase in import volumes over the last 15 years (20 per cent per year). Portugal ranks sixth, with an average growth rate of 2.4 per cent per year.

The US imports olive oil from various countries, with its main suppliers being Spain, Italy, Tunisia and Turkey. France, meanwhile, imports mainly from Spain and Italy.

Brazil, for its part, imports olive oil predominantly from Portugal (60 per cent of imports), Chile and Argentina.

Portugal's imports come mainly from Spain (90%), with small quantities sourced from other origins, notably producer countries in North Africa, Argentina, Chile and Italy. Exports from Portugal have been mainly destined for Spain (around 55% of the volume), Brazil (23%), Italy (13%), France (2%) and the US (2%). Although Portugal has made a notable effort to add value to the product through own-brand products and packaging (with a focus on markets such as Brazil), bulk exports continue to account for around 70% of total exports, particularly to Spain and Italy.

As it is traded globally, olive oil is heavily exposed to international trade policies.

The EU–Mercosur agreement establishes a free trade area with Brazil, Argentina, Uruguay and Paraguay, facilitating access to a market of over 273 million consumers through the elimination of customs tariffs. For the EU, this elimination will be phased in over 15 years, whilst for the Mercosur countries it will be immediate. The agreement could benefit the olive oil sector by facilitating entry into markets where consumption is still low and by making the current temporary suspension of tariffs on olive oil exported to Brazil permanent. Furthermore, it provides for the protection of Geographical Indications, reinforcing the distinctiveness and added value of Portuguese olive oil.

However, the agreement also presents challenges, such as the expansion of modern olive groves in Argentina and Uruguay, which could compete with European olive oils in both local and

European markets. It may also intensify regional competition among European producers, particularly with Spain and Italy.

Portugal will need to focus on market diversification and enhancing the product's value through its own brands and higher-quality olive oils.

For its part, the US, one of the main importers of European olive oil has recently imposed a 15% tariff on goods from the EU, including olive oil. This measure increases the cost of European olive oil for American consumers and may encourage its substitution with cheaper oils, although the *premium* extra virgin olive oil segment has shown greater resilience due to its nutritional and gastronomic value. The rise in the cost of European olive oil also favours the entry of olive oil from third countries.

The future outlook for the international trade in Portuguese olive oil is generally positive, underpinned by growth in global demand and expansion into a growing number of markets. However, the sector faces significant challenges, such as its heavy reliance on Spain and the high proportion of bulk exports, which limit value creation. To strengthen its position, Portugal will need to focus on market diversification and on

enhancing its products through own-brand products and higher-quality olive oils.

5. Strategic constraints for the Portuguese olive-growing sector

Despite the success of Portuguese olive growing and the positive market outlook, the sector's future will also depend on its ability to address a range of structural challenges. Among these, the following stand out:

Climate change

The prolonged droughts and heatwaves that affected the Mediterranean basin during the 2022/23 and 2023/24 growing seasons — with devastating consequences for production in Spain, Italy and Greece, and more moderate effects in Portugal — served as an unequivocal warning of the sector's vulnerability to climate change. Scientific projections point to a gradual worsening of these phenomena, with reduced rainfall and milder winters. These changes will affect critical stages in the olive tree's life cycle, such as flowering, pollination and fruit set, reducing the productivity of olive groves, particularly rain-fed ones. Rising temperatures will create conditions for increased pest pressure and diseases, which have an impact on production costs and the quality of the olive oils produced.

Adapting to these new conditions requires an integrated approach that includes genetic improvement and the selection of varieties more resistant to heat and water stress, the implementation of precision irrigation or even regulated deficit irrigation (where possible), the use of cover crops, and the application of organic matter and biochar to promote water retention in the soil. In this context, it is important to emphasise the need for Portugal to continue to invest in the expansion of irrigation as an essential adaptation strategy for the sustainability

of its agriculture and the olive-growing sector in particular.

Climate change will also cause a geographical shift in olive-growing areas. In the medium term, it is predicted that producing regions will shift to more northerly latitudes: in Italy, the number of olive groves is increasing in the north whilst stabilising or declining in the south. Areas where conditions are currently unfavourable for olive cultivation may become more suitable for the crop in the future.

Preservation of traditional olive groves

The olive sector in Portugal faces the strategic challenge of reconciling two distinct production systems, both of which are fundamental to the country's sustainability and identity: modern irrigated olive groves, which drive the sector's productivity and competitiveness; and traditional rain-fed olive groves, which, although they have high cultural, landscape and biodiversity value, have low productivity, difficulties with mechanisation and high production costs.

The olive sector in Portugal faces the strategic challenge of reconciling two distinct production systems, both of which are fundamental to the country's sustainability and identity: modern irrigated olive groves and traditional rain-fed olive groves...

The maintenance of traditional olive groves, which still account for 36 per cent of the national olive-growing area, will require creating the conditions to ensure their economic viability. The strategy to ensure this viability involves the allocation of support

under the CAP and the PDO/PGI certification of the olive oil produced. Such certification is essential for adding value to olive oils from these systems, distinguishing them from olive oil produced using modern irrigation systems, and highlighting their unique organoleptic characteristics, linked to the olive varieties used and the respective production processes.

Preserving genetic heritage

Portugal possesses one of the world's richest olive tree varietal heritages, with over 40 varieties

identified, including around 17 associated with PDOs. These traditional varieties are deeply adapted to local soil and climate conditions and constitute a valuable genetic reservoir,

with characteristics such as drought resistance, cold tolerance and hardiness, which are fundamental to developing varieties better adapted to future climate scenarios.

However, many of these varieties are not suited to intensive cultivation systems nor do they achieve high levels of productivity. Consequently, the modernisation of Portuguese olive groves has been based on the introduction of foreign varieties, such as Arbequina and Arbosana, which

are more productive and better suited to these systems. This trend jeopardises national varietal diversity, promoting the homogenisation of olive groves and olive oil profiles.

The replacement of native varieties with foreign ones

compromises the distinctive character of olive oils derived from traditional varieties such as Galega or Cordovil, whose unique profiles are essential for differentiating and enhancing the value of Portuguese olive oil in an increasingly standardised global market.

Investing in the improvement of traditional varieties, making them compatible with modern production systems, is therefore a key strategy for strengthening the sector's competitiveness. This approach will make it possible to combine production efficiency with the production of distinctive, high-quality olive oils.

6. Conclusion

Portuguese olive growing is in a particularly favourable position to continue growing, as a result of the modernisation of production systems, the improvement in olive oil quality and the growing

Portugal possesses one of the world's richest olive tree varietal heritages, with over 40 identified varieties, including around 17 associated with PDOs.

It will be essential to continue investing in production efficiency, irrigation and innovation, whilst also promoting traditional olive groves, protecting the national genetic heritage, strengthening own-brand products and diversifying markets.

Portugal's position as a major producer and exporter on the world market. However, the sector's future success will depend on its ability to respond to an increasingly demanding

context, marked by market volatility, competition from new producing regions, climate change and growing pressure on water resources.

The sector's future will thus depend on combining competitiveness, sustainability and differentiation. It will be essential to continue investing in production efficiency, irrigation and innovation, whilst also promoting traditional olive groves and protecting the national genetic heritage, strengthening own-brand products and diversifying

markets. Only in this way can Portugal consolidate its international position, creating greater value for Portuguese olive oil and ensuring the resilience of national olive growing in the coming decades.

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Olive growing and olive oil production in Portugal

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Origin and spread of the olive tree

Some studies suggest that the olive tree originated in Asia Minor. Others believe that its cultivation spread from Syria to Greece via Anatolia. It is also thought to have originated in Lower Egypt, Ethiopia, the Atlas Mountains, certain regions of Europe, or southern Caucasus, stretching from Iran to the Mediterranean coasts of Syria and Palestine.

The wild olive tree (*Olea europaea*, var. *sylvestris*), *zambujeiro* in

Portuguese, is thought to have spread naturally, perhaps carried by migratory birds such as thrushes and others, to wherever it found climatic conditions favourable to its growth. "Where the olive tree does not grow, the Mediterranean dies."

Over the centuries, the olive tree has been a symbol of victory and peace, of progress, abundance, wisdom, justice and fertility. Champions were crowned with olive branches, and with the oil from its fruit, the darkness of homes was dispelled, delicacies were seasoned, ailments were treated and athletes were anointed. It was the Sacred Tree!

***"Where the olive tree does
not grow, the
Mediterranean dies."***

It was the Sacred Tree!

The domestication of the olive tree began in the Palaeolithic and Neolithic periods, that is to say, between 10,000 and 3,000 years BC, possibly in Mesopotamia, from where it spread to Egypt (2,000 years BC) and then to the islands of Asia Minor and mainland Greece (1,800 years BC).

In the first half of the early first millennium BC, the olive tree spread through Assyria. From the 6th century BC onwards, it spread throughout the Mediterranean basin, reaching Libya, Tunisia and

the island of Sicily. From Sicily, it was taken by the Greeks to southern Italy, where it spread all over the country.

The Phoenicians and Egyptians in the 9th century BC, the Greeks in the 7th century BC, and later the Carthaginians in the 3rd century BC arrived in North Africa by sea.

The proximity between Tingitania (modern-day Morocco and the south of the Iberian Peninsula, and the geographical and climatic similarities between these two regions, meant that they shared many aspects of olive cultivation. At that time, these peoples exchanged luxury goods, such as olive oil and wine, for the foodstuffs they required.

This is how the domesticated olive tree, which the Greeks wisely cultivated and which found astute and intelligent followers in the Romans—who were equally devoted to the olive tree and olive oil—came to Portugal.

By the 1st century BC, the capital of Baetica – now Andalusia – was already surrounded by olive groves, but it was the Romans who brought these groves into production, adopting the Greeks' cultivation methods. They grafted the wild olive trees, making them productive, and developed the practice of transplanting them, as attested by Virgil, author of *The Georgics*, when he says: *'Olive trees demand great effort and toil. They are all transplanted, arranged in rows, and their upkeep entails great expense'*.

The sixteenth century was a period of growth in olive cultivation, due to increased demand from a growing population and also because of the needs arising from the discovery and colonisation of the New World. The olive tree and olive oil reached Brazil, Argentina, Chile and even North America.

More recently, the growing demand for olive oil – a result of its health benefits and exceptional culinary qualities – has boosted international production, leading to an increase in olive groves, not only in traditional producing countries but also in countries where olive trees were not previously part of their agricultural landscape. Examples of this include Australia, South Africa, some Asian countries such as China, and others in Latin America such as Argentina, Peru and Chile, and, more recently still, Egypt, Saudi Arabia and Pakistan.

Olive groves and olive oil

The olive tree has always been associated with religious practices, myths and traditions, artistic and cultural expressions, and medicinal and culinary uses.

In Ancient Greece, women who wished to conceive would spend long periods in the shade of olive trees and sleep beneath their leaves.

Royal sceptres were made from its wood, and monarchs, priests and athletes were anointed with its oil. The leaves were used to make garlands and wreaths for the victors.

Six thousand years ago, the Egyptians credited Isis, wife of Osiris, the supreme god of their mythology, with teaching them how to cultivate the olive tree.

Pallas Athena, goddess of peace and wisdom, daughter of Zeus, was regarded by the Greeks as the mother of the tree under which Remus and Romulus were said to have been

born, descendants of the gods and founders of Rome.

The mythological Aristaeus,

son of Apollo and the nymph Cyrene, is credited with the invention of beekeeping and the extraction of olive oil.

Whether through this legend or some more prosaic means, humankind soon learnt to make the most of the excellent energetic, biological, nutritional and organoleptic qualities of this natural oil.

The Romans already possessed extensive knowledge of olive pressing techniques and the storage and preservation of olive oil.

The Greeks and Arabs devoted themselves to expanding olive cultivation and refining the processes of olive oil extraction, a term derived from the Arabic 'az-zait', meaning 'olive juice'.

For me, this is the best definition of olive oil: 'OLIVE JUICE'.

In Portugal and the Alentejo

In Portugal, where evidence of the olive tree dates back to the Bronze Age, olive groves and olive oil have, over the centuries, experienced periods of abundance and others of scarcity. For example, by the end of the 19th century, olive groves in the

Alentejo covered as much as 570,000 ha.

With the onset of the Industrial Revolution, Portuguese olive growing entered a very difficult phase due to a shortage of labour in the fields.

Production costs have risen, and this, combined with the poor quality of the olive oil produced and fierce competition from much cheaper seed oils, has led to a fall in *per capita* consumption – which in Portugal stood at around 10.5 kg in the 1960s – to approximately 3.6 kg *per capita* by 1980. Nowadays, consumption in Portugal stands at around 8 kg per person per year.

Olive oil production in Portugal exceeded 120,000 tonnes in the 1950s, but by the start of the 21st century, output had fallen to less than 30,000 tonnes.

However, and fortunately for us, things have changed for the better in recent years, and today Portugal is regarded as an unrivalled investor in Europe in this sector.

In just a few years, Portugal's share of the European Union's olive oil production rose from 1.5 per cent to 5.0 per cent of the total. The investment made in the Alqueva dam has played a significant role in this. Water from the dam reaches 140,000 ha of fertile, gently sloping land. In 2008, Portugal had only around 4,000 to 6,000 ha of irrigated olive groves.

Alqueva is placing Portugal amongst the world's leading producers. A veritable olive-oil powerhouse. Olive production in Portugal has quadrupled in just 10 years. At present, Portugal is already the 4th or 5th largest exporter in the world, exporting around 500 million euros' worth of olive oil, unfortunately mostly in bulk. I repeat, unfortunately, mostly in bulk.

Even so, the olive oil trade balance has shifted from a deficit of 55 million euros in 2008 to a current surplus of around 250 million euros.

Why consume olive oil?

Because it is a healthy fat and because it is an unrivalled ingredient in its contribution to culinary delights! Olive oil was also the only means the ancients had for lighting, and the Greeks used it to anoint their bodies after bathing and to keep their muscles supple in the gymnasium.

It was the main fuel used to burn bodies on funeral pyres and was then poured over the ashes to perfume them. Beauty creams were made from clay powder or other ingredients, mixed with olive oil. Regular scalp massages with a mixture of

olive oil, egg yolk, beer and lemon juice kept their hair strong. Olives and olive oil were used for cooking, but also for making perfume and bath oil.

... the olive oil trade balance has shifted from a deficit of 55 million euros in 2008 to a current surplus of around 250 million euros.

It is therefore not surprising that olive oil was in short supply in Greece as a foodstuff. But it was not just olive oil that was in short supply; by around 600 BC, there was no fertile land left for growing cereals or for rearing livestock.

The Egyptians, in the 9th century BC, and later the Greeks, in the 7th century BC, and the Carthaginians, in the 3rd century BC, were thus forced to migrate by sea. These peoples reached as far as the Iberian Peninsula, where they exchanged luxury goods – olive oil and wine – for the food they needed.

The Greeks introduced the cultivation of olive trees and vines to the West: Sicily, Italy, North Africa and the Iberian Peninsula. This is how olive oil and the olive tree came to us; with the Roman invasion in 218 BC, their cultivation developed and expanded.

Olive oil, a source of health and wellbeing

The Seven Countries Study (Greece, Italy, Yugoslavia, Finland, Japan, the Netherlands and the United States), conducted by Ancel Keys, provided important epidemiological evidence of the effects of fats and various fatty acids on serum cholesterol levels. This study, which began in the 1950s, was the first of many that have since demonstrated the benefits of the Mediterranean diet for human health.

In Mediterranean countries, where olive oil is the main source of dietary fat, the incidence of chronic diseases and the rate of cardiovascular mortality are among the lowest in the world, whilst life expectancy is among the highest.

Furthermore, olive oil has been shown to have numerous medical benefits in the prevention of various diseases:

- It prevents carcinogenesis, ageing and cellular oxidation, and protects against damage caused by free radicals.
- It prevents atherosclerosis and its associated risks, high blood pressure, heart attacks, kidney failure and strokes.
- It reduces total cholesterol, LDL cholesterol and triglycerides, and increases HDL cholesterol.
- It reduces LDL oxidation; its antithrombotic and antiplatelet effects have been demonstrated, and it is one of the best options for the prevention and management of diabetes *mellitus*.
- It improves the functioning of the digestive and hepatobiliary systems; it has a protective and toning effect on the skin, preventing the appearance of skin lesions and reducing the signs of ageing, for example in the brain.
- Epidemiological studies have suggested that olive oil has a protective effect against certain malignant tumours (breast, prostate, endometrial and digestive tract).
- It stimulates growth and promotes calcium absorption and bone mineralisation, playing an important role during growth and in the prevention of osteoporosis.

And all this is because olive oil is predominantly monounsaturated and a good source of essential fatty acids (linolenic acid, linoleic acid and arachidonic acid, whilst being rich in fat-soluble vitamins (A, D, E and K, antioxidants, tocopherols and polyphenols.

How to choose olive oil?

But, after all, what is olive oil?

In nature, olive oil is the energy reserve that olives can draw on the moment they are released from their mother, the olive tree, and must survive on their own until they germinate and send out the roots that will allow them to absorb the nutrients necessary for the growth and development of a new tree.

But nature goes even further: once the droplets of olive oil have formed, it endows them with scent and flavour so that wild animals, particularly birds, are attracted to them and can carry the olives – or at least the stones – to distant areas, thereby ensuring the survival and dispersal of the species. Nature also endows olive oils with pigments, which are responsible for their colour, and with vitamins and antioxidants of high biological and nutritional value.

It is this olive oil, thus formed by Nature, that humankind, stubbornly and brutally, steals from the olives for its own benefit.

Olive oil is, therefore, a natural product, and it is this natural product that is intended for use in food, with all the characteristics and qualities with which Mother Nature has endowed it.

Composition of olive oil

When everything proceeds normally, olive oil is formed mainly inside the cells of the olive pulp, in tiny droplets. These consist primarily of glycerides, the major components of olive oil, resulting from the esterification of glycerol with fatty acids.

The glycerides, in turn, are surrounded by a biomembrane and have little influence on the organoleptic characteristics of the olive oil.

At the same time, secondary reactions give rise to minor components: hydrocarbons (squalene, phosphatides, sterols (β -sitosterol), tocopherols (vitamin E, fat-soluble vitamins (A, D, E and K, polyphenols responsible for the bitter and pungent flavour, pigments responsible for the colour of the olive oil (chlorophyll for the green and carotenoids for the yellow) and the volatile compounds responsible for the aroma and flavour of each olive oil.

As the olives ripen, the olive oil gradually loses its green colour and takes on a yellow hue. It should be noted that the decision on when to harvest the olives should not be based on their colour, but rather on their fat content in the dry matter.

During this ripening process, the polyphenol content of the olive increases to a maximum and then, due to the activity of the polyphenol oxidase enzyme declines. The same applies to the content of volatile compounds, which, as mentioned, are responsible for the aroma and flavour of the olive oil. Olive oil is colour, aroma and flavour: it is liquid gold!

Olive oil in the Mediterranean Diet

Olive oil is the cornerstone around which most dishes in the Mediterranean diet are prepared. Not only is it beneficial in its own right, but it also encourages the consumption of other foods that would be less appetising without it, particularly vegetables and greens.

With olive oil, you combine the useful with the pleasant. But be careful: olive oil is a fat and, as such, is high in calories, which can contribute to obesity.

And what is it that people seek in olive oil?

As well as the abundant energy that olive oil

provides, people also seek the characteristics of colour, aroma and flavour that lend a touch of refinement to their cuisine. This is what makes virgin olive oils so special: alongside colour, their aroma and flavour make them the finest and most desirable fat in traditional Mediterranean cuisine.

Olive oils can vary in colour, aroma and flavour, depending on the region, the olive variety, the degree of ripeness, the health of the fruit, the extraction process, the method of storage, the age of the oil, etc.

When olive oil is extracted, virgin olive oils are obtained which, depending on the condition of the olives from which they were produced and, above all, the time elapsed between harvesting and extraction, will have distinct qualities that classify them into their commercial categories, those available for sale: Extra Virgin Olive Oil,

Virgin Olive Oil and Olive Oil (a blend of virgin and refined). Among the olive oils produced, we can also distinguish those with a 'Protected Designation of

Origin' (PDO), 'Organic Olive Oils', 'Farm-Produced Olive Oils' and 'Single-Variety Olive Oils'.

'PDO Olive Oils' originate from a defined geographical area, with characteristic soils and climate, and are produced exclusively from olives of specific olive tree cultivars. These factors, combined with the know-how of the region—which is embodied in the way the trees are tended, the olives are harvested and the oil is extracted—endow them with distinctiveness and unique chemical and sensory characteristics.

In Portugal, studies carried out on the soils, climate, topography, olive cultivars, the chemical and sensory characteristics of the olive oils, and socio-economic aspects have made it possible to define six homogeneous production zones, protected by a PDO:

— 'Azeites de Trás-os-Montes', with the cultivars Madural, Verdeal de Trás-os-Montes, Cobrançosa and Cordovil de Trás-os-Montes.

*Olive oil is colour, aroma
and flavour: it is
liquid gold!*

- ‘Azeites da Beira Interior’, subdivided into ‘Azeites da Beira Alta’, comprising the cultivars Galega, Cornicabra, Carrasquenha, Negrinha, Madural and Cobrançosa, and ‘Azeites da Beira Baixa’, comprising the cultivars Galega, Bical de Castelo Branco and Cordovil de Castelo Branco.
- ‘Ribatejo Olive Oils’, comprising the Galega, Lentisca and Cobrançosa cultivars.
- ‘Azeites do Norte Alentejano’, comprising the Galega, Cobrançosa, Redondil, Cordovil and Blanqueta de Elvas cultivars.
- ‘Azeites do Alentejo Interior’, comprising the cultivars Galega Vulgar (minimum 60 per cent), Cordovil de Serpa and Cobrançosa.
- “Moura Olive Oils”, made from the Cordovil de Serpa, Verdeal Alentejana and Galega Vulgar cultivars.

‘Organic Olive Oils’ come from olive groves managed in accordance with organic production methods, which impose various restrictions, such as the prohibition or restricted use of fertilisers and pesticides.

‘Farm-produced olive oils’ are olive oils where all operations, from the cultivation of the olive trees to the production and packaging of the oil, are carried out on the farm itself.

‘Single-Variety Olive Oils’ are olive oils obtained from a single olive cultivar.

In olive oil, the characteristics that should most catch our attention are, apart from colour, the aroma and flavour. The colour depends primarily on the ripeness of the olives. If the olives are greener when the oil is extracted, the oil combines shades of yellow with green; and as the olives contain a high level of antioxidants at this stage, the oils may be very fruity, but also bitter and pungent.

The variety of olive has a decisive influence on the aroma and flavour of the olive oils. The region and even the specific location where the olive trees are planted are also factors that influence the aroma

and flavour of the olive oils. It is not uncommon for the same variety, when planted in different locations, to produce olive oils with distinct characteristics.

It is these specific characteristics that should lead us to discover olive oils, for it is in this diversity of characteristics that much of their richness and charm lies.

The main olfactory, gustatory, tactile and kinesthetic attributes of virgin olive oils are: fruitiness – fresh, green or ripe fruit – pungency and sweetness.

As positive attributes:

- Ripe and/or green olives
- Other fruits: apple, pear, banana, tomato, pepper, carob, tropical fruits
- Red fruits: blackberry, raspberry, strawberry, redcurrant, blueberry
- Nuts: almond, walnut, hazelnut, pine nut
- Green: olive leaves, fresh herbs, artichoke, tomato plant, banana peel, almond skin, fig leaves, cabbage, broom, green tea, camomile
- Bitter, spicy, astringent
- Sweet

Other acceptable attributes:

- Aromatic herbs: thyme, Spanish lavender, rosemary, marjoram, mint, spearmint
- Spices and similar: cinnamon, cloves, cocoa, chocolate, vanilla, mushrooms
- Rural aromas: hay, straw, wildflowers, roses, eucalyptus, pine/resin

Negative factors in olive oil, when there are production issues

- If the biomembrane surrounding the cells ruptures, the water present comes into contact with the glycerides, causing a hydrolysis reaction, with the consequent release of fatty acids and an increase in the oil’s acidity.

- If contact with air is allowed, an oxidation reaction occurs: the glycerides, on contact with air, form peroxides and hydroperoxides; these, in turn, through auto-oxidation, release smaller volatile compounds such as aldehydes, ketones, ethers and esters, which, taken together, are responsible for the rancid flavour.

Negative attributes or defects arising from the post-harvest degradation of the olive:

- sourness, due to fermentation
- winey flavour, due to alcoholic fermentation
- mould, caused by fungal contamination

Due to poor storage of olive oil:

- putrid sediment
- due to auto-oxidation: rancidity

Having outlined the main characteristics of olive oil, we should establish some connection with the ways in which it can be used.

Of course, there are no fixed rules, and people will use olive oils according to their own taste and preference. What really matters is that you are aware that there are olive oils with very different characteristics that can be used raw, in soups, on grilled dishes, in roasts, in stir-fries and stews, in pastries, confectionery, ice cream and also for frying.

And one must not forget that extra virgin olive oils are at their best in marinades, in emulsions (with coriander, chilli, vanilla, etc.) and when added at the very end of cooking, so that the heat does not destroy the volatile compounds responsible for the very best qualities of olive oil: its aroma and flavour.

Just as mankind has changed its eating habits throughout history, why not also experiment with different olive oils on different occasions, to experience, as Maimonides said, the harmony between Nature and Man. For this Jewish philosopher, a native of Córdoba, the body exists as a vehicle for human well-being, just as condiments are vehicles for the qualities of Nature: eating can therefore create – or fail to create – harmony between Nature and humankind.

And don't forget: the choice of an olive oil should not be based solely on acidity and price, but rather on its aroma and flavour, which are what truly set olive oils apart from one another.

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OBSERVATORY

***CULTIVAR* = CULTIVATE**

Fig. *TO DEVELOP OR IMPROVE BY EDUCATION OR TRAINING.*

The sector's perspective

JOAQUIM MOREIRA, NUNO SANTOS, FERNANDO DO ROSÁRIO AND GONÇALO MOREIRA

Once again, in this second issue dedicated to a specific agricultural sector (following Cultivar No. 24 on vineyards and wine¹), we have decided to consult directly with a number of stakeholders, both in the business sector and within industry associations, across the entire supply chain. We therefore put the following question to Joaquim Moreira, a producer of organic olive oil in Vila Flor, Trás-os-Montes; to Nuno Santos, president of Casa do Azeite – the Portuguese Olive Oil Association, to Fernando do Rosário, president of AIFO – the Interprofessional Association of the Olive Sector, and to Gonçalo Moreira, manager of Olivum – the Association of Olive Growers and Oil Mills of Portugal. The answers are quite diverse, as usual, but reveal a wide consensus in terms of confidence in the sector's prospects.

The question:

Given your experience and the regional and sectoral context in which you operate, which are, in your view, the main challenges and opportunities currently facing the olive oil sector, both at regional level and in the national and/or global market? And what strategic direction do you consider desirable to

ensure its sustainability and competitiveness in the medium to long term?

The answers:



Joaquim Moreira
Acushla²

Joaquim Moreira is an entrepreneur with a long career that began when, whilst still in highschool, he created his first textile

company. In 1993, he set up Tetribérica, a company specialising in international textile trade. He changed direction in 2004 and founded Acushla, using a word of Celtic origin meaning 'the beating of my heart'. He currently manages several companies dedicated to organic farming and olive oil production, tourism and trade, all of which are strongly committed to sustainability, particularly in environmental and social terms. He is the father of four children and an enthusiast of mountain biking, running, yoga and meditation – practices he considers essential for mental and physical wellbeing.

¹https://www.gpp.pt/images/GPP/O_que_disponibilizamos/Publicacoes/CULTIVAR_24/

²<https://www.acushla.pt/>. Images from Acushla

Challenges, opportunities and the strategic direction of the olive oil sector

I speak on this subject with my feet firmly on the ground – quite literally. I am talking about Trás-os-Montes. A region that for centuries has cultivated olive trees not as a business, but as an intrinsic part of its identity, its landscape and its way of being in the world. It was precisely this region, this light and this soil that brought me here and which lie at the heart of Acushla.

Over 20 years ago, following a long and demanding process of studying the regions with the greatest potential for olive cultivation in Portugal, I found in Lodões, in the heart of Vila Flor, the right place to produce an olive oil of the highest quality. Quinta do Prado, with its approximately 300 hectares – comprising 215 hectares of new olive groves and 14 hectares of century-old olive groves – has become my life's work. With over 100 international awards, won at competitions in Japan, China, the USA, Switzerland, the UK, Italy, Spain, Israel, Argentina and other countries, I can say that the effort has been well worth it. But it would be dishonest of me to stop at simply celebrating, because the challenges facing this sector are real, profound and urgent.

A region with a unique olive-growing identity

Trás-os-Montes is not merely a region that produces olive oil. It is a unique olive-growing ecosystem, shaped by centuries of coexistence between humans and the olive tree. The native varieties of this region – Cobrançosa, Madural, Verdeal and Cordovil – are found nowhere else in the world with the same character, concentration and genetic purity. These are varieties that have stood the test of time, adapted to the harsh climate of the north-eastern interior, and produced olive oil when there was no technology to assist them. They are, in themselves, a living heritage.

The traditional Trás-os-Montes olive grove is also a landscape. Centuries-old olive trees of generous stature, planted on terraces and slopes that no machine can work with ease. An olive grove that

demands a human presence, skilled labour and knowledge accumulated over generations. It is not an industrial production site; it is an inhabited territory, with history and soul.

Two models, two approaches, one country

Portuguese olive cultivation is today characterised by a wide diversity of production models, and this is a treasure that we must learn to interpret correctly. The significant growth of intensive irrigated olive groves in the south of the country, with high-density hedgerow cultivation, advanced mechanisation and high productivity per hectare, was a leap towards modernisation that put Portugal on the map of the world's major producers, making us the fifth-largest global producer and the third-largest European exporter. This growth deserves recognition.



However, it is important that the market and public policies also recognise the reality and costs of the Trás-os-Montes model. The rugged terrain, the poor and stony soil, the small and medium-sized landholdings, the lack of large-scale irrigation and the reliance on a harvest with a higher proportion of manual labour mean that the cost of producing a litre of olive oil in Trás-os-Montes is structurally higher. This is not a sign of inefficiency; it is the price paid for preserving a model that holds irreplaceable environmental, cultural and territorial value. The challenge lies in ensuring that this value is adequately remunerated by the market and recognised by policies supporting the sector.

The quality this region produces, which deserves to be celebrated

Despite all the structural constraints, Trás-os-Montes regularly produces olive oils of exceptional quality,

recognised in the most demanding international competitions. And it is important to highlight who the true pillars of this quality are: the good cooperatives and producers with their own mills who have made excellence a deliberate choice.

The cooperatives of Trás-os-Montes play an absolutely central role in this sector. It is they who bring together thousands of small olive growers, who ensure the marketing of the produce, who invest in equipment and quality processes, and who keep communities alive that would otherwise be threatened by depopulation. Without the cooperatives, traditional olive growing in Trás-os-Montes would be demographically unsustainable.

Alongside the cooperatives, there is a growing number of producers with their own mills who consciously prioritise quality over quantity. These are facilities that operate at controlled temperatures, practising cold extraction to preserve the polyphenols, aromas and nutritional properties of extra virgin olive oil. They monitor the olives' ripeness, minimise the time between harvest and pressing, and invest in sensory analysis and rigorous certification. In this regard, Acushla was a pioneer: our mill was the first in Trás-os-Montes to achieve FSSC 22000 certification in food safety, the sector's most stringent international standard. The result is a product with superior organoleptic characteristics, extremely low acidity and a sensory profile that represents the very best this region has to offer the world.

The challenges we cannot avoid

Climate change is already having a visible impact on the olive groves of Trás-os-Montes. Erratic rainfall, increasingly intense summers and growing pressure from pests demand constant adaptation, which comes at a real cost. International trade instability, with US tariff pressures and growing Spanish competitiveness in markets such as Brazil – where Portugal historically held a dominant position – is placing added pressure on producers who are already operating on tight margins.

And then there is the collective challenge that concerns me most: the lack of a strong, organised common voice. Portugal still lacks an inter-professional olive oil organisation with the investment and profile of its Spanish counterpart, which allocates around 8 million euros annually to the coordinated promotion of its olive oil. Until that happens, Portuguese producers – and those from Trás-os-Montes in particular – will continue to compete in a fragmented manner in a global market that values scale and consistency in communication. We need a national umbrella brand that showcases the best of what we do, without diluting the regional identities that are our greatest source of differentiation.

The direction I consider necessary and urgent

The medium- to long-term sustainability of this sector requires clarity about who we are and what we want to be. For Trás-os-Montes, the path lies in consistent differentiation: certified quality, PDO – Protected Designation of Origin, indigenous varieties, cold pressing, organic or integrated production, full traceability and a genuine story of origin. It is this positioning that justifies the price, builds loyalty among discerning consumers and makes this region resilient in the face of global competition.

This means that the market must learn to recognise and pay a fair price for this distinction. It requires clear communication to domestic and international consumers about what distinguishes a Transmontano PDO olive oil – produced in traditional olive groves and cold-pressed – from a standard olive oil. It requires distributors, leading restaurants and specialist retailers to play their part in promoting the value of its origin.

It also implies public policies that recognise the territorial and environmental value of the traditional Trás-os-Montes olive grove, not only as a producer of olive oil, but as a guardian of biodiversity, landscape, culture and population in areas that need concrete reasons to remain inhabited and active.

Acushla is, for me, proof that this path is possible and viable. But what I genuinely hope for is for this

path to be followed throughout the region by cooperatives, small-scale producers and the younger generations who can still find in this land and these centuries-old olive trees a meaningful vision for the future.

Trás-os-Montes has the olive trees. It has unique varieties. It has accumulated knowledge. It has proven quality. What it needs now is for the world to know this clearly and to be willing to pay what this rarity is truly worth.



Nuno Santos
Casa do Azeite³

Nuno Santos holds a degree in Management from the Portuguese Catholic University and Harvard Business School. He is president of Fedolive – the

European Union Olive Oil Industry – and, since May 2023, of Casa do Azeite – the Portuguese Olive Oil Association, which has “40 member companies representing, collectively, around 85 per cent of all branded olive oil packaged in Portugal”. He is also CCO (Chief Commercial Officer) at Sovena, one of the world’s leading companies in the olive oil sector, which owns the country’s largest olive grove. Sovena was founded in Portugal over 100 years ago, but now has a strong international presence.

The year marking the 50th anniversary of Casa do Azeite – Associação do Azeite de Portugal provides a unique opportunity to take stock of the sector’s evolution over the past half-century and, at the same time, to reflect on the future, identifying the main challenges and opportunities facing the national olive oil industry.

Over the last five decades, the olive oil sector in Portugal has moved from a situation of great structural fragility to a position of growing importance on the international stage. In the 1970s and 1980s, a traditional production model predominated, characterised by low levels of

productivity, a high reliance on labour and a marked exodus from rural areas. Production was irregular and insufficient, reflecting the sector’s lack of modernisation and low competitiveness.

Portugal’s accession to the European Economic Community in 1986 marked the beginning of a new phase. With the support of the Common Agricultural Policy, incentives began to emerge for the modernisation and restructuring of farms and businesses in the sector, albeit gradually. During the 1990s, significant structural constraints persisted, such as the predominance of small-scale farms and the widespread ageing of olive groves. In terms of consumption, it is worth highlighting the EU consumer aid programme, co-managed by Casa do Azeite and the Portuguese State, which had a significant impact on increasing the consumption of packaged olive oil. By narrowing the price gap with other liquid fats and by helping to organise the sector and control bulk sales, this programme helped to raise *per capita* consumption from around 4.5 kg to approximately 6.5 kg.

The most profound transformation of the sector, however, took place from the start of the 21st century onwards, with the completion of the Alqueva project. The expansion of irrigation in the Alentejo, combined with a large-scale land tenure structure, enabled significant investment in highly mechanised olive groves planted in the vase and hedgerow systems, which achieve very high levels of productivity.

Over the last two decades, Portugal has consolidated its position as a major global producer, with significant growth in exports and a clear affirmation of the quality of its olive oil. Today, the sector is characterised by high dynamism, strong competitiveness and the adoption of state-of-the-art technologies, positioning it amongst the most modern globally.

Challenges

Despite this favourable context, significant challenges remain, both on the production and consumption sides. On the supply side, issues that cut across the agricultural sector stand out,

³<https://www.casadoazeite.pt/pt>

such as climate change, which causes instability in production and high price volatility. Added to these are structural challenges, particularly associated with traditional olive groves, which are often ageing, uncompetitive and labour-intensive, with limited capacity for investment.

Efficient water management plays a central role in ensuring stable production and prices, making the system more predictable. Developments in the Alentejo demonstrate the importance of infrastructure such as the Alqueva dam in this regard.

Another significant challenge relates to rising production costs, driven by increases in the prices of fertilisers, energy and fuel, as well as by global logistical disruptions linked to unstable geopolitical contexts. These factors have been eroding the profitability of producers and businesses, putting pressure on the entire value chain and increasing the risk that less competitive farms will be abandoned.

On the demand side, changes in food consumption patterns and the low international profile of Portuguese olive oil are notable. In the main European producing countries, there is a trend towards declining consumption, influenced by an increase in eating out and low olive oil consumption among young adults. Reversing this trend will require investment in promotion, education and communication targeted at the younger generations.

Low international profile is another structural challenge. With the exception of the Brazilian market, where Portugal holds a strong position, the majority of exports are in bulk, unbranded and with low added value. This highlights weaknesses in terms of positioning, marketing and scale. It is essential to strengthen the presence of national brands in foreign markets and to develop a consistent strategy for promoting the product's origin.

Opportunities

Despite these challenges, the sector offers significant opportunities for growth. Global demand

for olive oil has been rising outside the main producing countries, driven by health concerns and changes in dietary habits. Markets such as the United States offer high growth potential, given their still low *per capita* consumption.

The Mediterranean diet reinforces this potential, being widely recognised for its health benefits. Portugal can position its olive oil as an integral part of this lifestyle, adding cultural and symbolic value to the product.

Olive oil also stands out as a natural product, obtained exclusively through mechanical processes, in line with the 'clean label' trend. This characteristic constitutes a competitive advantage amongst more informed and discerning consumers.

Furthermore, there are numerous opportunities for differentiation, notably through traditional Portuguese varieties, distinct sensory profiles and a strong connection to the local area. Innovation can take the form of developing premium products, new packaging solutions or olive oil tourism initiatives, whilst preserving authenticity.

The sector also has the potential to establish itself as environmentally sustainable. Olive groves can contribute to carbon sequestration, and the adoption of sustainable agricultural practices – already very common in Portugal today – helps to reduce the environmental footprint. Initiatives such as the Olive Oil Sustainability Programme help to formalise this commitment and reinforce credibility in the markets.

Strategic Direction

Against this backdrop, it is essential to transform opportunities into competitive advantages through strategy, scale and effective communication. Defining a strategic direction requires joint reflection and coordinated action.

The future of the traditional olive grove is a key issue. Beyond its economic value, it represents a cultural and landscape heritage that must be preserved. Traditional varieties, such as Galega,

Cobrançosa and Cordovil, are distinctive assets, but they require research and development to ensure their economic viability.

Sustainability must be established as a cornerstone, with a focus on water efficiency and the adoption of technologies and good agricultural practices.

At the same time, it is essential to strengthen the organisation of the sector, promoting greater coordination between production, processing and marketing.

Consumer education is equally crucial. Increasing knowledge about olive oil contributes to its appreciation and to growth in consumption.

Finally, Portugal must clearly establish itself as a source of high-quality olive oil, investing in a consistent 'country brand' strategy, with coordinated communication and a presence in international markets.

In summary, the olive oil sector in Portugal must pursue a development model that balances tradition and innovation, preserves its unique assets, and continues to modernise in a sustainable manner, whilst strengthening its organisational and communication capabilities to compete in an increasingly demanding global market.



Fernando Rosário

AIFO: Interprofessional Association of the Olive Sector

Fernando Rosário is an animal husbandry engineer, olive grower and an expert in the olive sector. He is chairman of the Board of AIFO

and chairman of the Board of Directors of the Beja and Brinches Agricultural Cooperative. He was also chair of the 'Olives and Olive Oil' Working Group of COPA-COGECA (Committee of Professional Agricultural Organisations – General Confederation of Agricultural Cooperatives), the organisation representing agricultural producers and their cooperatives in the European Union, and is currently a member of this group. He also serves on the International Olive Council (IOC).

The olive oil sector currently faces a series of very demanding structural challenges, both nationally and internationally, the most critical of which is undoubtedly the impact of climate change. Irregular rainfall, prolonged droughts and increasingly frequent heatwaves are causing significant instability in production, with large fluctuations in the quantity produced and, at times, also affecting the quality of the olive oil. This volatility increases economic risk and places additional pressure on natural resources, particularly water.

When we refer to olive groves, we mean both those managed using modern, irrigated, technologically advanced and production-oriented systems, and traditional systems on a smaller scale with lower profitability per unit of area. It is important to bear this asymmetry in mind so as not to undermine the sector's territorial and social cohesion, particularly in the most vulnerable rural regions.

There is also the issue of the organisation of the value chain. Despite growth in production and exports, capturing greater value throughout the sector remains a challenge. There is an urgent need to promote the 'Azeite de Portugal' brand – a role that AIFO will take on in the short term – as well as to establish strong brands and effectively communicate the origin, quality and sustainability of olive oil in a highly competitive international market that remains largely price-driven.

Despite these challenges, I believe that the olive oil sector offers very significant opportunities. Globally, there is a trend towards growing demand, driven by the increasing recognition of olive oil as a healthy product associated with the Mediterranean diet, and by the expansion of consumption in new markets as well as in less established ones. At the same time, the *premium*, organic and sustainable segments have also been gaining ground, which opens up scope for differentiation strategies.

In Portugal's case, these opportunities are particularly evident, which is why the country has been establishing itself as a producer of high-

-quality olive oils, with growing international recognition. Good agricultural practices have been introduced and improved, with a focus on resource efficiency – particularly in the efficient use of water and energy – thereby reinforcing the reputation of Portuguese olive oil, as also evidenced by modern olive cultivation in regions such as the Alentejo.

I also see enormous potential in innovation, whether in terms of precision farming and digitalisation, or in the valorisation of by-products and the adoption of circular economy models. These factors simultaneously enable us to reduce costs, mitigate environmental impacts and increase the sector's resilience in the face of climate and market uncertainties.

In my view, the future of the olive oil sector lies in an integrated, long-term strategy based on several complementary pillars. Firstly, it is essential to invest seriously in adapting to climate change, encouraging more resilient and resource-efficient production systems, thereby promoting environmental sustainability.

Secondly, it is vital to focus on adding value to the product. This involves promoting and enhancing the 'Azeite de Portugal' brand, as well as reinforcing differentiation through quality, origin, innovation and the credibility of sustainable practices, moving away from approaches based solely on volume or price.

Another focus is on strengthening the organisation of the sector. Cooperation between producers, the consolidation of inter-professional structures and greater coordination between production, processing and marketing are crucial to improving competitiveness and ensuring a more balanced distribution of value.

Finally, I consider it essential to pursue promotion and internationalisation, targeting both markets that view olive oil merely as a commodity and those that distinguish it as a cultural, gastronomic and healthy product.

If it manages to align sustainability, local identity, innovation and market strategy, the olive oil sector will be well placed to establish itself firmly and sustainably on the global stage.

In short, significant investment – both public and private – will be required in AIFO in order to communicate, promote and internationalise this great product that is olive oil. Portuguese olive oil stands out for its identity and quality, which have been amply validated and recognised.



Gonçalo Moreira

Olivum: Association of Olive Growers and Mills of Portugal

Gonçalo Moreira is an agricultural engineer, holds a master's degree in nutrition, is an agricultural

entrepreneur and manager of Olivum, an association that represents over 56,000 hectares of olive groves and 21 mills, accounting for around 70 per cent of national olive oil production. He has also worked in nutrition and health and has been a lecturer. At Olivum, he is responsible, amongst other projects, for the Olive Oil Sustainability Programme (PSA), a pioneering initiative launched in 2022 and developed in partnership with the University of Évora. This serves as a benchmark for promoting sustainable agricultural production practices and enhancing the value of the national olive sector, with the aim of functioning as a kind of seal to certify the sustainability and traceability of olive oil.

Olive groves and olive oil in Portugal: competitiveness, sustainability and strategic enhancement of the sector

Abstract. The Portuguese olive and olive oil sector is currently enjoying a period of international recognition, underpinned by productivity gains, the modernisation of olive mills, the expansion of irrigation and consistent improvements in quality.

Table 1 – Technical indicators providing an overview of the olive oil sector in Portugal and worldwide

Indicator	Value / ranking	Source
Olive grove area in Portugal	380 779 ha	GPP (2025)
Area of olive groves used for olive oil production	374 226 ha	GPP (2025)
Share of olive groves in the national UAA	around 10%	GPP (2025)
National production 2024/2025	177,000 t; 6th largest producer worldwide; 4th largest producer in the EU	GPP (2025)
National forecast 2025/2026	160,000 t	GPP/SIMA (2026)
National production 2021/2022	206,000 t; an all-time high in recent records	Casa do Azeite (n.a.)
National exports 2024	1.6 billion euros; trade surplus of 974 million euros	GPP (2025)
Projected global production 2024/2025	3.375 million tonnes	Casa do Azeite (n.a.); COI
Projected global consumption 2024/2025	3.065 million tonnes	Casa do Azeite (n.a.); IOC
‘Water that Unites’ Strategy	around 300 measures; potential for over 1,000 million m ³ of additional available water	Government of Portugal (2025)
EU funding for agri-food promotion 2026	€205 million in total; up to €160 million in grants	European Commission (2025); GPP (2026)

Note: Figures presented are based on the sources indicated and the campaigns available at the time of consultation.

The challenge for the coming decade will be to turn scale into value: further distinguishing Portuguese olive oil and protecting its authenticity, promoting all types of olive groves, consolidating sustainable practices and opening up new markets. This text identifies the main challenges and opportunities facing the sector and proposes strategic lines of action to ensure competitiveness, sustainability and territorial cohesion in the medium to long term.

1. Context: a sector undergoing structural change

Over the last two decades, Portugal has established itself as one of the world’s most dynamic olive-producing countries. The Portuguese olive sector has modernised, increased productivity, incorporated irrigation, technology and expertise, and benefited from technically advanced mills. The GPP notes that, over the last 20 years, olive production has increased by around 300 per cent, in a process that has not merely involved producing more, but also producing better, with a large proportion of domestic olive oil classified as extra virgin (GPP, 2025).

In the 2024/2025 marketing year, Portugal was the world’s sixth-largest olive oil producer and the fourth-largest in the European Union, with 177,000 tonnes, and consolidated its position as the world’s fifth-largest exporter and the EU’s third-largest, with exports worth 1.6 billion euros and a trade surplus of 974 million euros in 2024 (GPP, 2025). These figures confirm that olive oil is now a strategic agri-food sector for the country, given its economic, territorial, environmental and reputational significance.

2. Global production and volatility: the new competitive landscape

Global olive oil production remains concentrated in the Mediterranean basin and is heavily exposed to soil and climate conditions. Casa do Azeite, based on data from the International Olive Council, estimates a recovery in global production to 3.375 million tonnes in 2024/2025, following the declines in 2022/2023 and 2023/2024, seasons in which global production stood at 2.760 and 2.564 million tonnes, respectively. In the European Union, Portugal is projected to produce 177,000

Figure 1 – Global olive oil production by marketing year, in thousands of tonnes



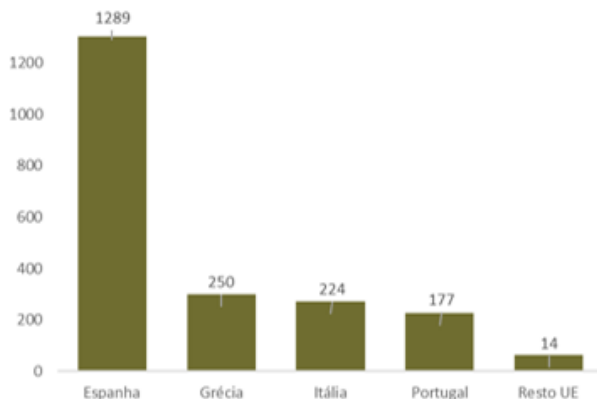
Source: Casa do Azeite/COI; * provisional data; ** forecast

Figure 2 – Olive oil production in Portugal by marketing year, in thousands of tonnes



Source: Casa do Azeite/COI and GPP/SIMA; * forecast

Figure 3 – Olive oil production in the European Union in 2024/2025, in thousands of tonnes; Portugal: 177



Source: Casa do Azeite/COI and GPP

tonnes in 2024/2025, behind Spain, Greece and Italy, with a forecast of 160,000 tonnes for 2025/2026 (Casa do Azeite, n.d.; GPP, 2025; GPP, 2026).

This volatility in production has direct consequences for prices, stocks, trade flows and consumer perception. Geopolitical instability, energy costs, logistical pressures and exposure to extreme weather events all exacerbate this uncertainty. For Portugal, the response cannot rely solely on growth in volume;

it must combine production efficiency, certified quality, traceability and greater value capture in differentiated markets.

3. Alqueva, irrigation and 'Água que Une': productivity with responsibility

The growth of Portugal's olive groves is closely linked to the Alentejo region and the Alqueva Multi-Purpose Project. Irrigation has made it possible to stabilise yields, reduce climate-related risks, attract investment, professionalise farms and enable more mechanised and efficient production systems. EDIA's 2025 Irrigation Campaign Report identifies, within the Alqueva subsystem, a total irrigated area of around 64,779 hectares, highlighting the scale of the infrastructure for regional agriculture (EDIA, 2026).

Water is both a factor in competitiveness and a strategic constraint. The 'Water that Unites' strategy identifies the need for integrated, multi-sectoral, robust and intelligent management, based on efficiency, resilience and sustainability. The Government of Portugal (2025) estimates that our country has around 51,000 million m³ of water per year, abstracts 4,324 million m³ annually and may face, by 2040, a 6% reduction in water availability and a 26% increase in consumption. For the olive oil sector, this implies increased monitoring, precision irrigation, water reuse, reduction of losses, digitalisation and a rigorous assessment of the added value of water.

4. Enhancing the value of olive oil: origin, certification, PDO and varieties

The main economic challenge is to transform quality into value. Portugal has already demonstrated its production capacity and consistent quality, but it needs to increase the proportion of olive oil marketed with a brand, origin, certification, traceability and its own narrative. This enhancement must be based on national varieties, Protected Designations of Origin (PDOs), single-variety olive oils, regional blends, different production systems, foreign varieties

produced in Portugal, and the sensory diversity of the region.

Certification should be seen as a tool for differentiation and for building trust. The Olive Oil Sustainability Programme (PSA), developed by Olivum with technical and scientific support from the University of Évora, comprises 98 criteria organised into 26 chapters and enables the assessment of the environmental, social, economic and cultural dimensions of production and processing, with the aim of promoting the sector's sustainability, as well as the differentiation and enhancement of olive oil and the national olive-growing sector. This type of framework is particularly relevant for markets that value sustainable, healthy, traceable and responsibly produced food.

5. Sustainability across all olive grove systems

The sector's competitiveness depends on a balanced coexistence between different olive grove models. The modern olive grove, whether in vase or hedgerow, has brought productivity, mechanisation, efficiency, export scale and technological capacity. Traditional olive groves, in turn, preserve genetic, landscape, cultural and environmental heritage, ensuring services such as soil conservation, biodiversity, carbon sequestration, territorial cohesion and Mediterranean identity.

Traditional olive groves face high harvesting costs, relatively low productivity, labour shortages, an ageing farming population, abandonment and pressure to convert to other uses. It is therefore essential to develop a Strategic Document for the Sustainability of Olive Groves, with targets, indicators, support measures and specific policies for each production context, including adapted mechanisation, the promotion of traditional varieties, payments for ecosystem services, PDOs, olive tourism and regional promotion.

6. Labour, mechanisation, artificial intelligence and efficiency

Labour shortages are a widespread constraint, with a particular impact on harvesting and traditional olive groves.

The solution lies in skills development, attracting young people, workplace safety, the professionalisation of operations and increased mechanisation. In modern olive groves, mechanisation is already a structural element of competitiveness; in traditional olive groves, it is important to develop solutions that are technically appropriate, economically viable and compatible with the preservation of the trees and the landscape.

The next frontier will be the systematic integration of digital technologies. Sensors, remote sensing, predictive models, precision farming, robotics, automation and artificial intelligence will make it possible to improve production forecasts, optimise irrigation and fertilisation, anticipate plant health risks, reduce costs and document sustainable practices. This approach is in line with the objectives of the CAP 2023–2027, which include competitiveness, innovation, digitalisation, climate action, sustainable management of natural resources and strengthening farmers' position in the value chain (European Commission, n.d.).

7. Circular economy: by-products as strategic assets

The valorisation of by-products from olive groves and olive mills is one of the major opportunities for sustainability and economic efficiency. Olive stones, olive pomace, olive mill effluent, leaves, prunings and biomass can be channelled towards composting, organic fertilisation, biogas production, energy recovery, animal feed, the extraction of bioactive compounds or the development of biomaterials. The sector must shift from a waste management approach to one focused on resource recovery.

The reclassification of olive stones as an energy-recoverable by-product was a significant step forward, but administrative barriers remain, particularly regarding the incorporation of olive pomace into composting. Olivum has argued that, as this is an exclusively mechanical extraction process, the agronomic and industrial utilisation of these waste streams should be promoted, creating low-carbon solutions, reducing costs and strengthening the circularity of the sector.

Table 2 – Technical approaches to the utilisation of by-products from olive groves and olive mills

Flow / by-product	Potential uses	Strategic value
Olive pomace	Energy recovery; biomass; renewable fuel of agricultural origin	Reduction in energy costs and replacement of fossil fuels
Olive pomace	Composting; organic fertilisation; biogas; extraction of valuable compounds	Circularity, soil carbon and reduced pressure on final disposal sites
Olive mill effluent	Treatment, controlled fertigation where applicable, anaerobic digestion, recovery of compounds	Mitigation of environmental impacts and nutrient recovery
Leaves and prunings	Composting; biomass; mulch; incorporation of organic matter	Organic matter, soil conservation and energy potential
Non-compliant olives and olive oil	Authorised industrial cycles; energy or technical recovery	Waste reduction and protection of food authenticity

Note: Specific application depends on the legal framework, technical analysis, food safety and economic viability.

8. Olive tourism, catering and new consumers

Olive tourism is a strategic tool for promoting the region, particularly relevant to traditional olive groves. Just as wine tourism has helped to promote grape varieties, regions and brands, olive tourism can promote national varieties, olive mills, landscapes, heritage, gastronomy and Mediterranean culture. The catering sector is a prime channel for raising awareness: olive oil menus, guided tastings, food and wine pairings, *chef* training and distinctive service can bring consumers closer to the origin and quality of Portuguese olive oil.

In international markets, olive oil should be promoted as a healthy, sustainable and culturally distinctive food. The growth in new consumers, particularly in the United States, Brazil, Japan, Canada, Saudi Arabia and Australia, demonstrates that there is scope to increase demand outside traditional markets (Casa do Azeite, n.d.). The opening up of new markets, economic diplomacy and European promotional programmes must be mobilised to consolidate markets where Portugal is already recognised and to win over consumers in regions with high potential.

9. Fraud, authenticity and reputation

Fraud in olive oil poses a direct threat to the sector's reputation and consumer confidence. In a product of high value and subject to strong

commercial pressure, adulteration, mislabelling and the misuse of designations of origin distort competition and penalise producers who invest in quality. The response requires traceability, inspection, laboratory analysis, documentary checks and cooperation between authorities, operators and sectoral organisations.

Authenticity and transparency must be treated as economic assets. The value of Portuguese olive oil depends on trust: trust in its origin, category, production method, sustainability and the correspondence between what is declared and what is delivered to the consumer.

10. A collective agenda: a national and inter-professional strategy

The sector needs a unifying vision. It would be desirable to draw up a Strategic Document for the Sustainability of Olive Groves and Olive Oil, with quantifiable targets, monitoring indicators and lines of action covering production, processing, water, soil, carbon, biodiversity, by-products, certification, promotion, research, innovation, olive tourism and external markets.

In this context, AIFO – Interprofessional Olive Oil Association – can play a central role in promotion, communication, market development, quality assurance and sectoral coordination, in order to make the most of European promotional instruments: the European Commission

Table 3 – Matrix of challenges, opportunities and strategic direction

Dimension	Challenges	Strategic direction
Market and value	Volatile prices; bulk weight; international competition	Brands, origin, PDO, certification, promotion and new markets
Production	Labour shortages; costs; climate; water	Mechanisation, precision, AI, water efficiency and training
Traditional olive groves	Low productivity; abandonment; ageing; harvesting costs	Land enhancement, PDO, olive tourism, environmental services and specific support
Sustainability	Regulatory pressure; environmental scrutiny; need for evidence	Certification, metrics, monitoring, carbon, biodiversity and the circular economy
Reputation	Fraud, mislabelling and loss of trust	Traceability, inspection, laboratory analysis and transparent communication
Governance	Institutional fragmentation and insufficient promotion	National strategic document and representative inter-professional body

Note: Summary matrix drawn up on the basis of sectoral analysis and Olivum's internal documents.

has earmarked 205 million euros in 2026 for the promotion of sustainable, high-quality agri-food products, of which 160 million is allocated to single and multi-country programmes. To be effective, it must reflect the current reality of the sector, bringing together organisations with real influence and representativeness, and act as a platform for convergence between modern and traditional olive groves, olive mills, brands, PDOs, research and public policy.

Conclusion

The future of Portuguese olive oil will depend on the ability to combine scale with value, technology with the local area, productivity with sustainability, and tradition with innovation. Portugal is well placed to strengthen its position amongst the world's leading producers, but it must do so by capturing more value at source, protecting authenticity, promoting all types of olive groves and promoting olive oil as a healthy, sustainable and identity-defining food.

The sector must act in a coordinated manner: producing efficiently, certifying rigorously, communicating ambitiously, making the most of by-products, investing in water and technology, protecting traditional olive groves, and using international promotion to reach new consumers. Portuguese olive oil represents an economic, environmental and cultural opportunity for the country. The challenge is to

transform this into a collective, measurable and lasting strategy.

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Olival in Alqueva: sustainability, investment and regional development

JOSÉ PEDRO SALEMA

Chairman of the Board of Directors of EDIA – Empresa de Desenvolvimento e Infraestruturas do Alqueva, S.A.

The development of modern olive groves within the catchment area of the Alqueva Multi-Purpose Project (EFMA) represents one of the most significant transformations in Portuguese agriculture in recent decades. Benefiting from the availability of irrigation, the favourable soil and climate conditions of the Alentejo and technological advances in agricultural production, the olive sector has established itself as one of the region’s main economic activities, playing a pivotal role in boosting the local economy.

Currently, olive groves are the dominant crop in the Alqueva irrigation areas. By 2025, the area under this crop had reached around 76,589 hectares, corresponding to approximately 60 per cent of the system’s irrigated area. The expansion

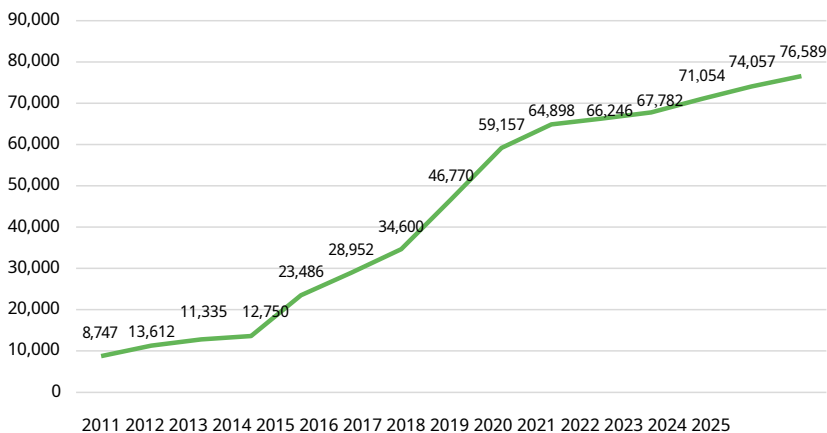
recorded over the last decade reflects the competitiveness of this production in the international context and the growing professionalisation of the regional agricultural sector.

The expansion of modern olive groves in Alqueva must be understood in the context of a broader transformation of the

Portuguese olive sector. Over the last two decades, Portugal has seen very significant growth in olive oil production, driven mainly by increased productivity and the establishment of new areas of modern, highly productive olive groves in the Alentejo. Between the mid-1990s and the present day, domestic olive and olive oil production has almost quadrupled, with this growth being strongly driven by the expansion of production in the Alentejo and the introduction of modern irrigation systems.

This development has profoundly transformed Portugal’s position in the international olive oil market. In around twenty years, domestic production increased by more than 320 per cent,

Figure 1 – Olive grove area in Alqueva 2011–2025 (ha)



a rate of growth far exceeding the global average, placing the country amongst the world's leading producers and bringing it close to the top three.

At the same time, olive oil exports have seen remarkable growth, multiplying several times over in both volume and value, and recently exceeding one billion euros annually, highlighting the sector's growing competitiveness in international markets.

The Alentejo plays a central role in this transformation. Currently, the region accounts for the bulk of national olive production. In 2024, Portugal produced around 1.34 million tonnes of olives, of which more than 1.1 million tonnes came from the Alentejo, demonstrating the region's central role in the national olive sector.

This significance reflects a combination of several factors: the availability of irrigation, the size of the farms, the adoption of modern technologies and the growing integration between agricultural production and the processing industry.

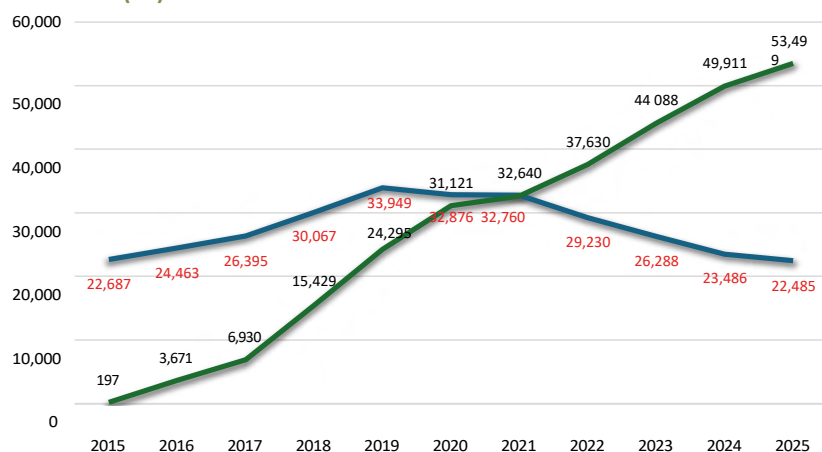
The development of olive groves in Alqueva is linked to a significant level of private investment. The costs of establishing modern plantations vary, on average, between around 10,000 and 12,000 euros per hectare, to which are added other indirect costs associated with the development of agricultural holdings.

Taking into account the area already planted, it is estimated that the cumulative investment in new olive groves in the Alqueva region amounts to over 750 million euros, and could reach 850 million euros when machinery and ancillary investments are included. This figure does not include the cost of purchasing or leasing the land, nor the investments made in the associated agro-industry, namely modern olive mills and processing plants, where the amount invested is estimated to be between 400 and 500 million euros. It can therefore be estimated with some certainty that, within the Alqueva catchment area, the total cumulative investment in the olive oil sector may already exceed 1,300 million euros.

In addition to direct agricultural investment, there has also been strong development of the associated agro-industry, with the installation and modernisation of high-tech olive oil mills. The Alentejo region currently hosts a very significant proportion of these industrial units, many of which are located within the Alqueva catchment area, thereby strengthening the integration of the sector and the capacity for local processing of production.

This process of agricultural modernisation was also accompanied by a significant influx of foreign capital, particularly in the early stages of irrigation development. Spanish investors played a decisive role in introducing intensive and technologically advanced models of olive cultivation, establishing some of the first large-scale modern farms in the region.

Figure 2 – Area of vase olive groves (blue) vs. hedgerow olive groves (green) 2015–2025 (ha)



Over time, Portuguese farmers have acquired technical knowledge and experience in managing these production systems, and now account for the bulk of investment in olive cultivation.

This development demonstrates the capacity for knowledge transfer and the consolidation of an increasingly competitive agricultural business sector.

One of the most striking examples of this change is the transition from vase olive groves to the hedgerow system.

The vast majority of farm holdings have opted to convert their olive groves to the hedgerow system, with around 2,000 trees per hectare. In this model, the olive trees are planted at closer intervals and managed to form a continuous wall of vegetation, similar to a hedge.

The main advantage of this system lies precisely in its high degree of mechanisation. Most agricultural operations – from pruning to harvesting – can be carried out using specialised machinery, drastically reducing the need for labour. In a context where the availability of agricultural workers is steadily declining, this feature makes the hedgerow olive grove particularly attractive to many farmers.

Furthermore, the hedgerow system allows for a faster start to production and higher productivity per hectare, contributing to greater farm profitability. Olive grove management also becomes more predictable and uniform, facilitating the planning of cultivation operations and the optimisation of resources.

The economic impact of this development is evident at various levels. Beyond agricultural production itself, the olive oil sector has contributed to the establishment of modern industrial extraction and processing facilities, strengthening the region's technological capacity and creating new value chains.

The presence of large integrated producers, often with their own mills and a strong presence in foreign markets, has helped to position Portuguese olive oil as a competitive and internationally recognised product.

At the same time, growing international demand for high-quality olive oil has strengthened the sector's competitiveness, stimulating investment and consolidating Portugal's position as a major exporter in this market.

The expansion of olive groves also had a significant impact on the value of agricultural land. The introduction of irrigation and the possibility of establishing permanent crops with high added value contributed to a reconfiguration of the regional land market, increasing interest from national and international investors and promoting the conversion of areas previously occupied by extensive rain-fed crops or by less profitable annual crops.

On a social level, the development of olive groves has contributed to the economic revitalisation of a region that had, for decades, been characterised by depopulation and an ageing population. Although the mechanisation of olive cultivation reduces the need for labour compared with traditional agricultural models, the sector has generated direct and indirect employment in various areas, including agricultural management, mechanisation, irrigation, technical services, logistics and industrial processing. Olive cultivation has thus contributed to the creation of regional wealth, to retaining the population and to strengthening territorial cohesion.

Environmental sustainability is also a key pillar of the sector's development. Olive groves are a crop that is very well adapted to the climatic conditions of the Mediterranean region and, compared with other irrigated crops, exhibit relatively moderate levels of water consumption, particularly when combined with efficient localised irrigation systems. Efficient water management is of particular importance in the context of climate change and growing pressure on water resources, with technical monitoring and technological innovation being essential elements in ensuring long-term sustainability.

Furthermore, as a permanent crop, olive groves can contribute to improving soil structure and carbon sequestration, particularly when appropriate agronomic practices are adopted, such as grass cover between rows or sustainable fertilisation management. The growing emphasis on sustainable agricultural practices has also led the sector to develop its own initiatives, such as environmental certification and monitoring

programmes, which seek to integrate the environmental, economic and social dimensions of sustainability.

In recent years, there has been a growing focus on sustainable production practices. Sectoral sustainability programmes and environmental monitoring initiatives have been promoting the adoption of good agricultural practices, including efficient water management, reduced use of plant protection products, biodiversity conservation and improved energy efficiency on farms. This trend reflects the growing demands of international markets and consumers regarding the sustainability of agri-food supply chains.

Among these programmes, the Alentejo Olive Oil Sustainability Programme, run by OLIVUM and the University of Évora, is particularly noteworthy; this programme is already contributing, as was the case in the wine sector, to the establishment of a set of innovative best practices in the olive oil sector. EDIA itself has developed a programme called 'Sustainable Alqueva', which cuts across all existing sectors operating in Alqueva, including the agro-industrial sector and tourism. It is intended to serve as a further approach to disseminating existing best practices that can be implemented in the various economic areas linked to the Alqueva Project.

Despite the positive results achieved, the development of olive groves in Alqueva also presents challenges that must be monitored on an ongoing basis. These include, in particular, the need to ensure the sustainable management of water resources in the context of climate change, the preservation of the territory's landscape and ecological diversity, and the strengthening of the social and economic integration of local communities.

In this context, the sustainability of olive groves in Alqueva must be understood from an integrated perspective, one that combines the objectives of economic competitiveness with environmental protection and the social development of the region. The consolidation of this model will depend on the ability to continue promoting technological innovation, good agricultural practices, transparency in resource management and dialogue with society.

SUSTAINABLE ALQUEVA

The Sustainable Alqueva project forms part of the strategy for the economic, social and environmental enhancement of the Alqueva region, promoting development models based on sustainability, efficient use of resources and business innovation.

The initiative aims to strengthen the competitiveness of economic activities associated with the region, encouraging the adoption of more efficient and responsible practices, in line with the challenges of the climate and energy transition.

Targeting the sectors of agriculture, agro-industry and tourism, the project seeks to support businesses and economic actors in incorporating solutions that balance productivity, the sustainable use of natural resources and the creation of added value.

In this context, capacity-building activities, technical sessions, workshops and demonstration initiatives are being promoted to facilitate the transfer of knowledge and the sharing of best practices amongst businesses, producers and organisations within the scientific and technological sector.

The project is the result of a partnership between EDIA, NERBE/AEBAL – the Business Association of the Lower Alentejo and Coast – and NERE – the Évora Region Business Centre; these organisations are working together to promote initiatives supporting the business community and to strengthen coordination between different sectors of activity in the region.

Co-funded by Portugal 2030, under the Alentejo 2030 Regional Programme, 'Sustainable Alqueva' helps to consolidate Alqueva as a region of innovation applied to sustainability, promoting an integrated approach that combines efficient water and energy management, the circular economy, adaptation to climate change and the economic valorisation of resources.

In summary, the modern olive groves established in the Alqueva region have become one of the main drivers of the transformation of Portuguese agriculture. The combination of investment, technological innovation, supply chain organisation and favourable natural conditions has enabled the country to establish itself as a major producer of olive oil on the international stage. The sector's future will depend on its ability to continue integrating economic competitiveness, environmental sustainability and social development, ensuring that the growth achieved translates into lasting benefits for the region and the country.

The olive grove of the future: how to select the best materials for productivity, sustainability and efficiency in the context of climate change

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Introduction

Olive growing currently faces a range of structural challenges that affect the sector's sustainability and competitiveness. Among these, climate change, water scarcity, the need for full mechanisation of cultivation operations, and increasing pressure on pest and disease control stand out.

The choice of plant material plays a central and strategic role. National varieties, the result of long processes of edaphoclimatic adaptation and empirical selection carried out by farmers, offer significant potential to address these challenges,

provided they are properly characterised and evaluated in new types of olive groves (such as hedgerow groves) and in new production systems. In genetic improvement programmes, genetic diversity within progeny is another avenue for finding materials adapted to the sector's new requirements.

Portuguese Olive Reference Collection: a strategic reservoir of possibilities

The Portuguese Olive Reference Collection - CPRO (Figure 1) constitutes a fundamental scientific infrastructure for the preservation and enhancement of conservation of the genetic

Figure 1 – View of a CPRO plot (C. Inês 2015)



resources of *Olea europaea* L. in Portugal. Located at Herdade do Reguengo, within the INIAV, I.P. Elvas Innovation Centre, since 2012, the Collection brings together a representative set of native olive accessions and varieties, enabling their *ex situ* conservation under favourable growing conditions.

The CPRO ensures the preservation of inter-varietal genetic diversity and provides a reliable repository of germplasm that supports comparative studies and the phenotypic and agronomic characterisation of the various olive materials under evaluation. This information is essential for decision-making regarding the use of materials adapted to different types of olive groves, as well as for the selection of varieties as parents for the Genetic Improvement Programme. During each annual cycle, productivity, consistency, resilience to climate change – including water and heat stress – growth habits suited to different types of olive groves, and emerging biotic pressures are some of the characteristics sought to be determined in the material held in the collection.

The CPRO thus plays a strategic role in generating scientific data for knowledge and innovation in olive cultivation, enabling, in particular, the development of more sustainable and efficient cultivation practices.

By integrating conservation with characterisation and evaluation, the Collection makes a decisive contribution to the protection and enhancement of the national genetic heritage and to strengthening the competitiveness and sustainability of the Portuguese olive sector.

Olive grove production: balance between growth habits, fruiting and productivity

The architecture of the olive tree, its leaf area and exposure to solar radiation play a decisive role in light penetration and the overall efficiency of the canopy. An adequate, well-distributed and well-lit leaf area promotes production, whilst shading or vegetative imbalance can limit fruiting and exacerbate phenomena such as fruit drop or yield

alternation. In the different types of olive groves, productivity in a given climatic year depends on the balance between vegetative growth, photosynthetic capacity and production factors (e.g. water, nutrients), which together regulate production and the availability of assimilates for the reproductive organs.

Olive varieties differ significantly in their vegetative growth habit, which directly influences their adaptation to olive grove types based on a higher number of plants per planted area. There are intermediate situations, and the key is to consider what will be essential for the olive tree to achieve the highest levels of production and consistency. The interaction between vegetative and reproductive processes over a biennial cycle is therefore of great importance, with photosynthesis, which takes place in the leaves, forming the basis for the production of photoassimilates, which sustain both vegetative growth and fruit development, as well as the biosynthesis of olive oil.

In traditional olive groves, characterised by low planting density and fairly broad vase canopies, there is often an irregular distribution of light within the tree, reducing photosynthetic efficiency in shaded areas. In intensive olive groves, with a higher plant density and vase canopies trained through precise fruit set pruning, there is better interception of radiation and a higher proportion of active leaf area. In hedgerow olive groves, the canopy architecture is optimised to maximise lateral sun exposure, promoting high photosynthetic efficiency per unit area. The balance between leaf area and light is carefully managed to avoid excessive shading, and carbon assimilation sustains high levels of fruiting and productivity.

The selection of parent trees has been carried out on the basis of agronomic, phytosanitary and technological knowledge derived from the collection and/or from comparative trials, whether or not conducted under controlled conditions. The results of the evaluation of native varieties at the CPRO confirm the high inter-varietal variability that exists across all the characteristics studied.

Depending on the vegetative growth of the olive trees, varieties can be recommended according to the type of olive grove:

- Traditional or intensive rain-fed olive groves with vase training: varieties with strong vigour and an upright or open growth habit (either on their own roots or using vigorous rootstocks, as well as varieties of medium to low vigour). In traditional or intensive olive groves with irrigation: varieties of medium to low vigour are used.
- Hedgerow olive groves: varieties with medium to low vigour, a medium growth habit and extensive lateral branching.

The model olive tree for hedgerow olive groves

A genetic improvement programme based on hybridisation requires the conception of an ideal plant model to be achieved. This involves conceiving the ideal plant in terms of various aspects: morphological, physiological, productive and environmental adaptability; capable of yielding a product in sufficient quantity and of a quality appropriate to its intended use – olive oil or table olives; and resistant to or tolerant of pests and diseases, as well as the most common abiotic stresses.

Figure 2 – Hedgerow olive grove



The hedgerow olive grove system (Figure 2), which is highly mechanised, requires a very specific varietal ideal type. The model olive tree for this system aims to maximise production efficiency, facilitate mechanical harvesting and ensure resistance to stress factors. Based on the characteristics of the species, ideally, these olive trees should include:

- Architecture and growth: trees of low to medium vigour; compact, upright habit and short branches, but with a high level of branching on the fruiting branches.
- Production behaviour: trees entering production early or very early; high productivity per unit area; and consistent production.
- Fruit characteristics: high olive oil yield; and fruit with a good pulp-to-stone ratio.
- Tolerance/resistance to the most common pests and diseases, such as the olive fruit fly, olive moth, peacock spot and olive scale.

The integration of these characteristics will help reduce dependence on plant protection products and increase the sustainability of production systems. Training systems such as the hedgerow olive grove were developed on the basis of foreign varieties. Portuguese native varieties are traditionally associated with olive groves trained in the vase system (traditional or intensive). However, some native varieties possess agronomic characteristics compatible with the hedgerow olive grove system and which can contribute to the creation of more resilient and productive olive groves under Mediterranean conditions.

Genetic improvement of the olive tree through hybridisation

The olive tree is a species well-adapted to regions with a Mediterranean climate, where winters are mild and rainy and summers are hot and dry. In this region, as a result of climate change, there will be a rise in temperatures, a concentration of rainfall, and a greater number of extreme events (temperature and rainfall) of longer duration.

Plant breeding is, by definition, a key tool for developing varieties that are not only more productive but also more resilient to abiotic and biotic stresses. The first stage of breeding is the creation of inter-varietal genetic diversity. Given that the olive tree is a heterozygous and allopolyploid species, the variability is expected to be very extensive. Initially, we worked with open-pollinated progenies of 'Galega Vulgar' and 'Cobrançosa', and in recent years we have launched a programme of controlled pollination involving targeted crosses between olive varieties, selected on the basis of growth habits, early maturity, productivity, consistency, profitability and resistance to the main diseases and pests.

Each olive tree grown from seed exhibits unique and distinctive characteristics (Figure 3). The process involved in developing a new olive variety is a long one, and the genotypes are evaluated from the very first years. At the end of each stage, a selection process takes place, whereby the most promising genotypes – those meeting the selection criteria defined by the programme – are chosen, and these proceed to the next stage.

Figure 3 – *Olea europaea* L. seedlings, 6 months after germination



Prior to the first selection stage, the materials, following germination, undergo a period of forced vegetative growth with the aim of shortening the juvenile phase (Figure 4) (under natural conditions, this can last between 10 and 15 years). The juvenile phase ends when inflorescences are first observed.

Figure 4 – *Olea europaea* L. seedlings in the growth-forcing phase



The first stage involves the evaluation and selection of the best of these genotypes (F1). The main selection criteria are early entry into production and oil yield. Upon completion of this stage, the best F1s are propagated vegetatively, with a view to establishing experimental plots with replicates at various locations.

Among the progeny of 'Galega Vulgar', the overall objective is to select genotypes with high levels of resistance to olive knot and higher oil yields, whilst preserving vigour, early maturity and olive oil quality. Currently, two genotypes under consideration as candidates for new olive varieties are at an advanced stage of selection.

The contribution of new technologies to our understanding of olive plant material

The introduction of monitoring technologies has been transforming the way in which the agronomic behaviour of varieties is understood, monitored and evaluated. The integration of sensors applied to the soil, the plant and the fruit enables a more objective, continuous and real-time approach. This equipment is an essential tool for the objective assessment of varietal performance, enabling the identification of genotypes that are more water-efficient and more resilient to stressful conditions. Furthermore, emerging technologies, including optical sensors and artificial intelligence-based approaches, have demonstrated potential in the classification of varieties and the assessment of

olive oil, reinforcing the role of precision agriculture in modern olive cultivation.

The olive cultivation research team at INIAV's Elvas Innovation Centre – Herdade do Reguengo, alongside conservation, the study of native olive tree materials and genetic improvement, has been involved in studies on the development and application of digital monitoring tools for olive groves.

a) Artificial Intelligence and Data Science Solutions in Digital Agriculture

The optimisation of rational fertilisation in crops, particularly under more intensive conditions, is of great importance for the efficient use of nutrients, for reducing losses through leaching and/or volatilisation, and for food quality and safety.

As part of an approach to reduce the cost of nutritional analysis, three fertilisation regimes were implemented in experimental plots of hedgerow olive groves at Herdade do Reguengo: a) the recommended regime for hedgerow olive groves; b) a higher rate than recommended; and c) a control treatment (with levels below those recommended).

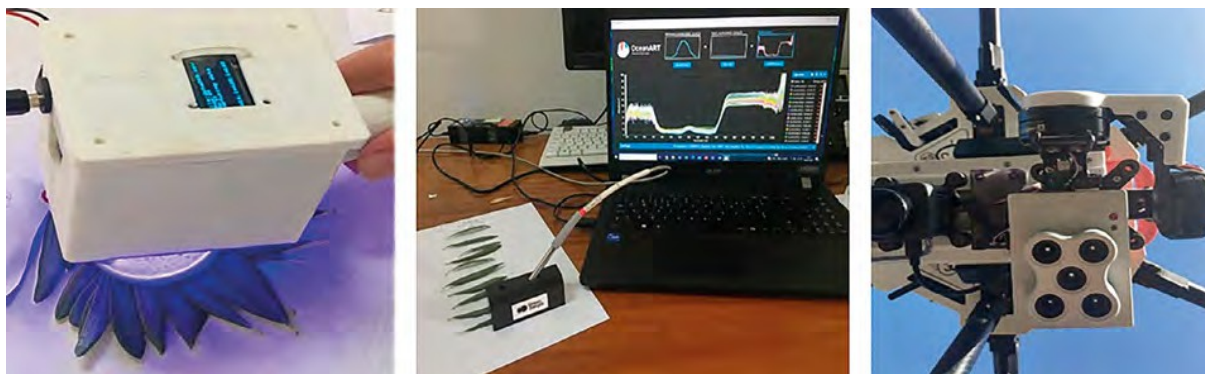
Three types of reflectance sensors were used (Figure 5). The variations induced by fertilisation have, sooner or later, repercussions on the nutrient content of the leaves, such as the ratios between the main macronutrients – Nitrogen (N), Phosphorus (P) and Potassium (K) – which result in changes to their colour.

To assess leaf reflectance in the laboratory, we have been using three types of sensors, namely: a sensor considered to be low-cost (AMS S7265x 18-channel multispectral sensor), developed by the University of Huelva (Spain); a high-resolution spectrometry sensor from Ocean Insight (FLAME-T-XR1); and a multispectral sensor (MicaSense RedEdge-MX, AgEagle Aerial Systems Inc., Wichita, KS, USA) mounted on an UAV – Unmanned Aerial Vehicle (HEIFU®, Beyond Vision, Lisbon, Portugal). The images were captured by the multispectral sensor under field conditions, using a UAV flying over the experimental plot.

On the same dates that the sensors were used, leaf samples were collected for chemical nutrient analysis in order to 'train' and 'validate' the machine learning models by correlating the collected data.

The machine learning models revealed a strong correlation between the sensor data and the nutrient levels in the leaves. The multispectral sensor performed best for the nutrients P and K ($R^2 = 0.75$ and $R^2 = 0.73$, respectively). The FLAME spectrometer was more accurate for N ($R^2 = 0.64$). As for the low-cost sensor, the results were not promising, and a different approach is required. In conclusion, these results have demonstrated the potential of optical sensor-based technologies for the non-destructive, real-time monitoring of chemical nutrients.

Figure 5 – Low-cost sensor (left), 'FLAME' spectrometer (centre), multispectral sensor mounted on an unmanned aerial vehicle (right)



b) Intelligent cooperative robotics applied to precision olive cultivation

We have been collaborating with other partners on the development of an advanced technological solution for irrigation and fertilisation in hedgerow olive groves, by optimising water and nutrient efficiency and implementing differentiated management based on zones or trees with greater needs.

A cooperative robotic system is used: a ground-based robot, equipped with cameras and sensors, which navigates autonomously between the rows

agronomic parameters, such as the crop yield potential, its water and nutrient status, and the fruit's stage of ripeness.

In a commercial olive grove planted in the hedgerow system, we have established plots with different irrigation and fertilisation regimes, with the aim of inducing controlled levels of water and nutrient stress in the olive trees. Among the treatments under consideration, water savings of close to 50% have been observed (Figure 7); with regard to fertilisation, in one of the treatments under observation, the application of fertiliser was eliminated. To monitor the annual cycle of the olive grove, we have installed sensors in the soil, on the plant and on the fruit.

Figure 6 – Autonomous ground robot (top) and aerial robot – drone (bottom) – for collecting visual samples from the crowns of olive trees



Source: <https://olivaria.eu/description/>



of olive trees and collects visual samples from the canopies; and an aerial robot (drone) that flies over the olive grove recording zenithal images (Figure 6). The images and data processed with the aid of Artificial Intelligence, together with the integration of information from the soil and plant sensor systems and real-time data analysis, will enable inferences to be drawn about essential

For soil monitoring, probes were installed to continuously record information that is made available in real time: on moisture, temperature, electrical conductivity and levels of N, P and K at three depths – 20, 40 and 60 cm (Figure 8).

The effect of induced water and nutrient stress was also determined by measurements taken on twigs and leaves, specifically the potential water status

Figure 7 – Experimental plot and fertigation treatments applied

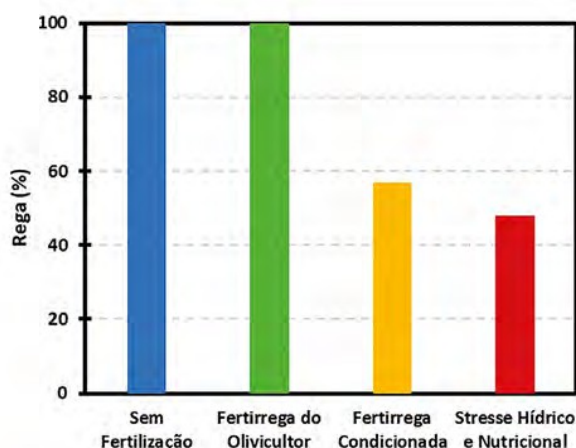
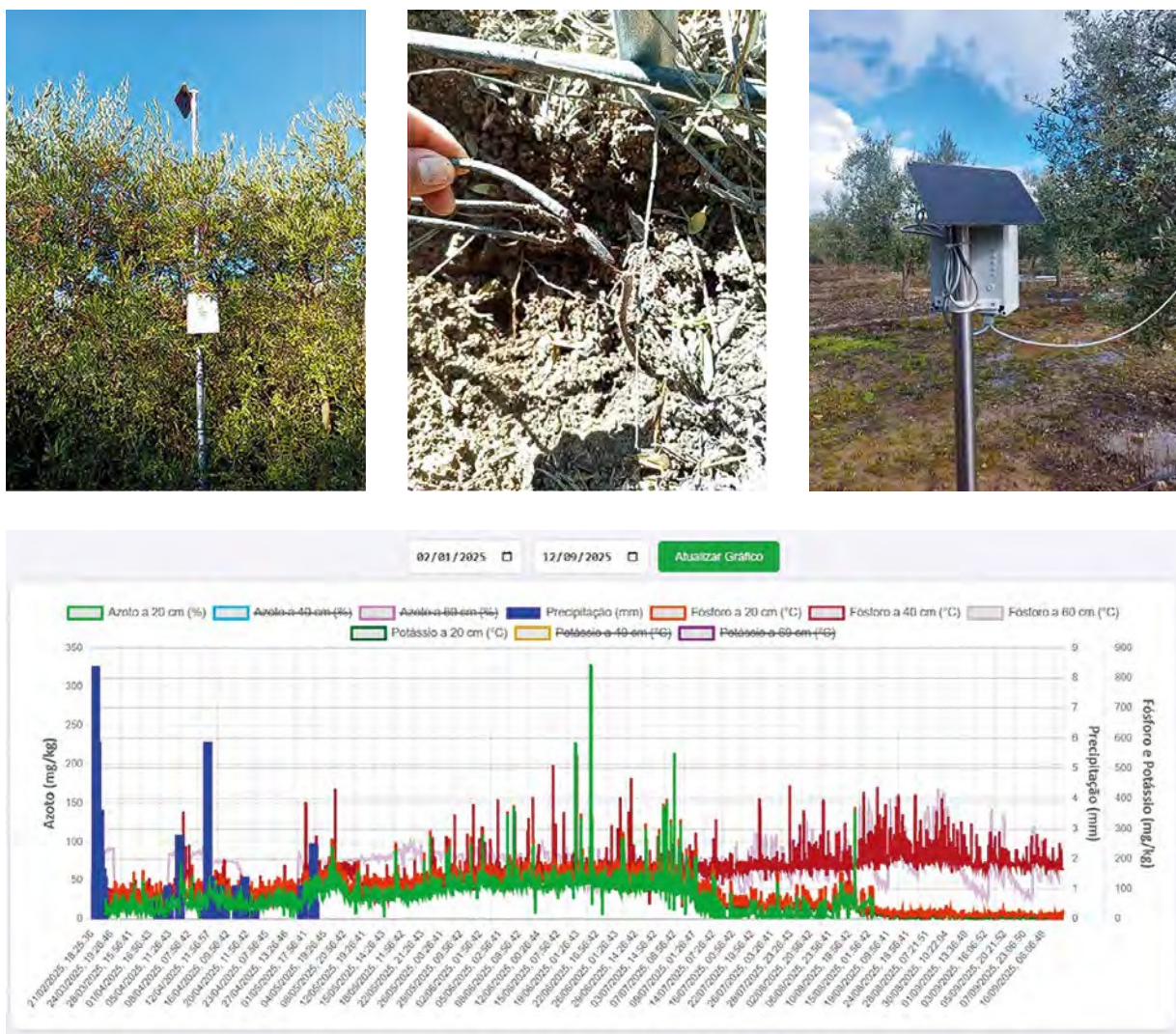


Figure 8 – Soil parameter monitoring probes (detail of the data logging and transmission module, equipped with a solar panel for power supply, and connection cables between the data acquisition unit and the sensors inserted into the soil); below, a graph generated by the sensors capable of measuring the levels of the N, P and K macronutrients throughout the 2025 growing season



and nutritional analyses. Portable sensors—a porometer and a Dualex (Table 1)—were also used to measure stomatal conductance and chlorophyll *a* reflectance, respectively, in fully developed leaves from the current growing season. Monitoring of fruit development was based on near-infrared (NIR) spectroscopy technology. Using this analytical tool, it is possible to rapidly determine the fat content and moisture content in dry matter (% Fat in Dry Matter - FDM) in olive paste.

The use of sensors integrated into collaborative robotics has been driving a revolution in agricultural management by enabling, for example, the application of water and fertilisers precisely where they are needed.

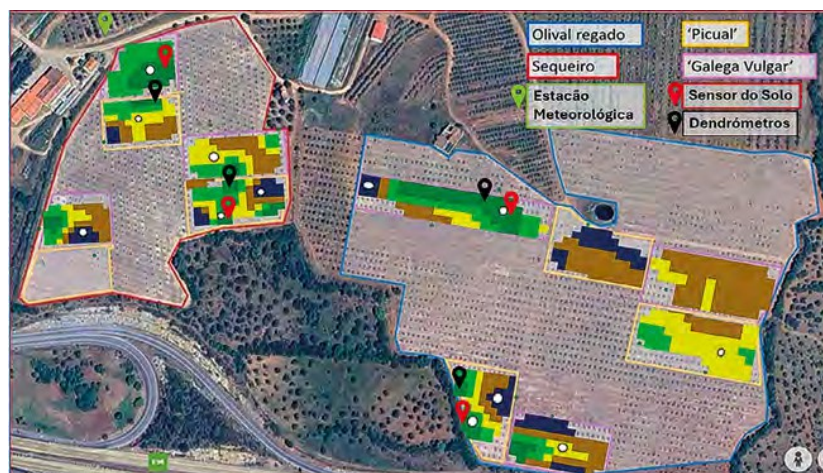
The combination of ground-based and aerial platforms, coupled with Artificial Intelligence, makes it possible to track the entire olive grove cycle – from tree pruning to olive ripening – with unprecedented precision. Continuous monitoring of variables relating to soil (water and nutrients), foliage (chlorophyll content) and fruits (% FDM) provides a comprehensive picture of the olive grove's 'health'.

c) Advanced, innovative and digital technologies for the agro-industrial sector at EUROACE

Another approach to new technologies has been the use of remote sensing techniques

Figure 9 – Experimental plots at Herdade do Reguengo (INIAV, Elvas, Portugal) and the location of soil probes, dendrometers and the weather station

Note: the white circles indicate the location of the three monitored trees; in ascending order of NDWI: blue < yellow < green.



(satellite images) in the agroforestry digitisation of processes throughout the value chain through the generation, validation and transfer of knowledge in advanced, innovative and digital technologies to improve the competitiveness and sustainability of the agri-food sector in the EUROACE Euroregion¹. With regard to olive trees, assessments are currently underway on experimental plots of intensive olive groves of the 'Galega Vulgar' and 'Picual' varieties, cultivated both on rainfed and irrigated land, and on a plot of hedgerow olive groves of the 'Arbequina' variety.

The monitoring plots were selected on the basis of *Sentinel-2* satellite imagery, using the Normalised Difference Water Index (NDWI). On the map (Figure 9), this index is represented by colours ranging from blue to green. For each variety and irrigation regime, three sampling points were defined, corresponding to different levels of water availability: low (blue), medium (yellow) and high (green).

As part of the application of innovative technologies for agroforestry digitisation, we have been using digital tools for monitoring and managing the olive grove, enabling the

collection of data relevant to Life Cycle Assessment and to the evaluation of CO₂ sequestration potential (Table 1).

Correlations are sought between the information received from the various types of sensors and direct field measurements. In general, the integration of different monitoring approaches will enable the optimisation of data collection in the olive grove, balancing accuracy, cost and operational feasibility.

Figure 10 – Non-destructive measurements using the LI-600 porometer/fluorometer (top) and the Dualex (bottom) on olive leaves (*Olea europaea* L.)



¹ The Alentejo-Centro-Extremadura Euroregion (EUROACE) is a cross-border and inter-regional cooperation partnership dating back to the 1990s, but formalised in 2009, comprising the regions of the Alentejo and Center (Portugal) and of Extremadura (Spain) covering more than 100,000 km² and encompassing around 3.5 million inhabitants. Its aim is to promote joint development, competitiveness and innovation, whilst improving the quality of life in these territories. [Editor's note]

Table 1 – Sensors used in olive groves and monitored parameters

Fixed Sensors	
Soil sensors	– Monitoring soil moisture and temperature; – Monitoring electrical conductivity.
Dendrometers	– Monitoring trunk circumference growth; – Monitoring fruit development; – Detecting signs of stress, particularly water stress.
Weather station	– Monitoring local weather conditions; – Supporting modelling of pest and disease risk; – Contributing to irrigation management by estimating evapotranspiration; – Integrating data with soil sensors to gain a better understanding of water dynamics.
Portable Sensors	
LI-600 Porometer/Fluorometer (LI-COR®)	– Measuring stomatal conductance (CO₂ flux and transpiration); – Measuring chlorophyll <i>a</i> fluorescence, an indicator of photosynthetic efficiency.
Dualex (Metos® – Pessl Instruments)	– Measuring chlorophyll content; – Determining the polyphenol index and nitrogen balance.
Manual measurement and collection of plant material	
Vegetative vigour	– Tree height (crown and trunk) and crown diameter; – Trunk circumference; – RESGEN-COI methodology
Yield	– Fruit yield (kg/tree); – Maturity index and fat content (% FDM).
Wood density	– Ratio of volume to trunk biomass; – Elemental C/N analysis of trunks.
Nutrition	– Foliar nutritional analysis; – Soil analysis.

Portable sensor technology offers an efficient alternative to traditional methodologies, reducing the need to collect plant tissue for lab analysis or measurement, thereby leading to a reduction in associated costs. However, it requires field visits and greater operational effort (Figure 10).

Remote sensing (satellite imagery) offers greater potential for optimising resources, enabling continuous, large-scale data acquisition with less need for direct intervention. This approach could contribute to a significant reduction in costs and more efficient and comprehensive monitoring of the production system.

Outlook and conclusions

The adaptation of national olive cultivation to future challenges will depend, to a large extent, on our ability to make the most of plant material. National varieties represent a source of natural genetic diversity and a strategic resource. Through the Breeding Programme, using either open or controlled pollination, we achieve greater genetic diversity. The agronomic characterisation carried out at CPRO, which began in 2012, has been essential for the evaluation of varieties and for identifying materials with characteristics suited to different olive grove management systems. In the very near future, the various fields of biotechnology may make a significant contribution.

In a rapidly changing sector, the olive industry faces a dilemma: whether to focus exclusively on international varieties optimised for mechanisation or to rediscover the potential of national varieties. The answer may lie in striking a balance between the two. The full mechanisation of olive groves and the climatic conditions prevailing in Portugal, which favour the development of diseases in the canopy and on the fruit, are two major factors limiting the productivity and profitability of olive farms.

The use of sensor technologies and the comparative analysis of multisensory data is fundamental to understanding the behaviour of plant material under adverse conditions, enabling the precise assessment of the crop's water and nutritional requirements. Furthermore, this continuous flow of information constitutes an essential database for the training and programming of Artificial Intelligence algorithms applied to agricultural management.

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Olive grove by-products as a strategic resource: contributions of the INOVCIRCOLIVE project to circularity in the olive sector

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A sector in transition

Recent developments in the olive oil sector in Portugal, particularly in the Alentejo region, have been characterised by an intensification of production driven by the expansion of intensive and super-intensive systems. This production model has led to significant gains in productivity and efficiency in the use of water and production factors, as well as a strengthening of the olive oil sector's international competitiveness. At the same time, the increasing mechanisation and integration of production processes have contributed to greater predictability and uniformity in production.

However, this structural transformation has brought with it new challenges, particularly regarding the management of surpluses generated throughout the value chain. Among the main waste streams are olive pomace, leaves resulting from olive cleaning, pruning waste and wastewater from olive mills. The spatial and temporal concentration of these materials, often with vertically integrated

farms, poses difficulties in terms of storage, transport and final disposal.

However, these by-products offer significant potential for valorisation, both as sources of organic matter and nutrients, and as raw materials for industrial processes with higher added value. Their integration into circular economy strategies not only reduces environmental impacts but also generates new economic opportunities and strengthens the sustainability of production systems.

It was within this context that the INOVCIRCOLIVE¹ project (Funding by PRR_C05_i03_000208) was developed, with the aim of promoting innovative, scientifically-based solutions for the integrated recovery of olive oil production by-products (including olive pomace, pruning waste, olive leaves, wastewater from olive oil mills, olive stones and olive wood), as well as other by-products from the agri-food chain.

¹<https://www.inovcircularive.uevora.pt/>

At the same time, the current legal framework (Decree-Law No. 102-D/2020) supports 'waste de-classification mechanisms', allowing certain materials, once they meet specific criteria, to cease being classified as waste and instead be used as products. This instrument facilitates their recovery and reuse, reducing administrative constraints associated with waste management and promoting their integration into circular economy models.

Figure 1 – INOVCIRCOLIVE Project Logo



The INOVCIRCOLIVE project involved the collaboration of 13 partners, coordinated by the University of Évora, namely: the University itself; the National Institute for Agricultural and Veterinary Research – INIAV; the National Competence Centre InovTechAgro; Alentejo Science and Technology Park – PACT; Alentejo Centre for Agricultural and Agri-Food Biotechnology – CEBAL; Centre for the Study and Promotion of Alentejo Olive Oil – CEPAAL; Portugal Rural; Torre das Figueiras; António Rosado; Courela do Zambujeiro; Planície de Verão Agro-Pecuária, Lda (Casa Relvas); Cano Olive Growers' Cooperative; Industrial and Commercial Olive Oil Society – SICA.

The approach adopted in INOVCIRCOLIVE was based on the integration of laboratory research, field trials and validation in a real-world farming context, enabling the simultaneous assessment of both the technical effectiveness and operational feasibility of the proposed solutions.

An analysis of the farms involved revealed a predominance of intensive systems, frequently associated with vertically integrated models. This context proved particularly favourable for the implementation of local value-added strategies, reducing logistical costs and enhancing the internal circularity of the systems. Generally speaking, producers demonstrated openness to adopting

innovative practices, particularly when these were linked to direct economic benefits and a reduction in operational costs.

Composting: a well-established solution

Composting has established itself as the main method of agricultural recovery of olive grove residues. As part of the project, various processes were developed and monitored, involving combinations of olive leaves, olive pomace and manure, with the aim of optimising critical parameters such as the carbon-to-nitrogen ratio, moisture content, temperature and aeration.

A key factor in the success of the process was the correct formulation of the initial mixtures. To this end, prior knowledge of the physico-chemical characteristics of the organic materials used proved essential, namely their dry matter content, carbon and nitrogen content, and biodegradability. Accordingly, prior to constructing the composting heaps, representative samples were collected from the raw materials available on the farms, which were subsequently analysed in the laboratory. This approach enabled the proportions of the different materials to be adjusted to ensure suitable conditions for initiating the process, guaranteeing values close to the ideal for the C/N ratio and moisture content.

Figure 2 – Compost heaps containing surplus material from the olive sector



Source: INOVCIRCOLIVE Project

Figure 3 – Application of compost using a tractor and spreader



Source: INOVIRCOLIVE Project

Monitoring of the composting process included regular checks on temperature, moisture content and the state of degradation of the organic matter, enabling adjustments to be made to management practices, such as turning the heaps and, where necessary, correcting the moisture content.

The results obtained demonstrated the production of stable composts with physico-chemical characteristics suitable for agricultural use. One of the most significant findings was the substantial reduction in the content of phenolic compounds throughout the composting process, a key factor in minimising potential phytotoxic effects associated with the direct application of certain olive grove by-products.

The application of the compost in field trials revealed consistent increases in soil organic matter content, as well as improvements in soil structure, porosity and water-holding capacity. These effects are particularly relevant in Mediterranean contexts, where soil degradation and water scarcity constitute major constraints on agricultural production.

For a more efficient use tailored to the needs of crops, it is also important to characterise the final compost and the soil prior to application. Carrying out analyses allows application rates and methods to be adapted to the specific conditions of

each plot, promoting more rational nutrient management and preventing imbalances in the soil-plant system.

In addition to the agronomic benefits, composting has proved to be an economically viable solution, helping to reduce costs associated with surplus management and lessen dependence on mineral fertilisers. Its implementation also contributes to the local utilisation of resources, promoting closed nutrient cycles within the farm.

Direct application: opportunities and limitations

The direct application of by-products to the soil was also analysed as a complementary valorisation strategy. Wet olive bagasse demonstrated potential for incorporation into the soil as a source of organic matter, contributing to the improvement of the physical and chemical properties of the soil. However, its large-scale use is constrained by technical and logistical factors.

Among the main limitations, the need for specific equipment for its distribution and storage management stand out, given its high moisture content and the seasonal nature of its production. It is also important to consider the time lag between the period of pomace production and the conditions most favourable for its application to the soil, which may require interim storage or pre-treatment solutions.

With regard to the leaves resulting from olive harvesting, the results indicate the possibility of utilising them in permanent crops, such as vineyards, where they act as a source of organic matter and contribute to soil protection. However, their application faces limitations in terms of uniform distribution and the operational capabilities of the available equipment.

In this context, it is particularly important to carry out preliminary analyses of both the materials to be applied and the target soils.

The physico-chemical characterisation of by-products provides information on their content of organic matter, nutrients and potentially limiting compounds, whilst soil analysis makes it possible to assess soil fertility and the specific needs of the crops. This information is essential for determining appropriate application rates, avoiding nutritional imbalances and minimising the risk of negative impacts, thereby ensuring a more efficient and sustainable use of these materials.

Despite these constraints, direct application remains a relevant alternative in certain contexts, particularly when integrated into local surplus management strategies, thereby reducing costs and simplifying operations.

Innovation and the bioeconomy

In addition to agricultural valorisation solutions, the project explored approaches aimed at utilising bioactive compounds present in olive grove by-products. Olive pomace and leaves contain significant concentrations of phenolic compounds, known for their antioxidant and antimicrobial properties.

Through adapted extraction processes, it was possible to obtain concentrated fractions of these compounds, which were subsequently used in the development of formulations with potential application as biocides. These results demonstrate the viability of integrating biorefinery principles into the olive sector, promoting the transformation of surpluses into products with high added value.

Although these solutions are still at a development stage, they offer significant potential for technology transfer and can contribute to the diversification of economic activities associated with the olive oil sector, strengthening its link to the bioeconomy and innovation.

Circularity and sustainability

An analysis of the environmental impacts associated with the recovery practices studied revealed generally positive results. Solutions based on composting and soil application did not show significant increases in greenhouse gas emissions and are compatible with sustainable agricultural systems.

Furthermore, the local recovery of surplus materials helps to reduce emissions associated with transport and off-site treatment, thereby contributing to a reduction in the carbon footprint of farms. The integration of different waste streams, including livestock by-products, has also enabled the development of symbiotic solutions between activities, promoting a more efficient use of available resources.

In this context, the adoption of practices to utilise olive grove surpluses plays a strategic role in promoting the circular economy, contributing to more resilient, efficient and environmentally sustainable agricultural systems.

Concluding remarks

The results of the INOVCIROLIVE project demonstrate that surplus materials from the olive sector can be utilised efficiently, ceasing to be regarded as waste and instead becoming resources with economic and agronomic value. As part of the project, the business partners channelled a significant proportion of their surplus materials into valorisation processes, with particular emphasis on composting. More broadly, a benchmarking study carried out among olive farm holdings showed that, in many cases, the percentage of surplus material sent for composting far exceeds 20 per cent, particularly with regard to olive leaves and branches and olive pomace.

Composting thus presents itself as a technically established and easily adoptable solution, already implemented on several farms. The project

contribution proved decisive for its technical optimisation, scientific monitoring and the characterisation of the compost produced, reinforcing producers' confidence in this practice. At the same time, approaches based on the valorisation of bioactive composts open up new prospects in the field of the bioeconomy, promoting the creation of products with higher added value.

These solutions help to reduce pressure on natural resources, lower the costs associated with the treatment and recovery of surpluses, and foster the development of innovative products with higher added value. At the same time, they promote the development of a circular bioeconomy in the olive oil sector through the introduction of

new business models and the creation of opportunities for the implementation of industrial symbiosis practices.

The widespread adoption of these solutions will depend on continued efforts to transfer knowledge, the technical training of producers, and the creation of conditions conducive to innovation. Coordination between research, the production sector and public policy will be crucial to consolidating the transition to circular models in the olive oil sector.

The valorisation of olive grove by-products thus represents a strategic opportunity to enhance the sustainability, resource efficiency and competitiveness of the olive sector in Portugal.

Table olives: cultivars, territory and identity

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1. Introduction

In Portugal, olive cultivation has a long tradition, with olive trees grown from north to south across the country, particularly in inland regions. This crop is of great interest not only from an economic perspective, but also from social, landscape and environmental standpoints. There are records of a considerable number of olive cultivars in our country, constituting a largely unknown heritage that is worth understanding, preserving and promoting. Among the known cultivars, few are grown nationwide, with Cobrançosa and Galega being the most notable, whilst the majority are of regional importance. They form the basis of the excellent products (olive oils and table olives) obtained from the fruit of traditional Portuguese cultivars, and many centuries-old olive groves still remain.

Despite their importance, these centuries-old olive groves are currently under threat. The olive oil sector faces a context of fierce international competition and market liberalisation, which has led to a fall in prices and producers' profit margins. To increase productivity and competitiveness,

many farmers have opted to convert traditional olive groves into intensive and super-intensive systems, also known as high-density systems; it is estimated that around half of Portugal's olive groves are already managed using these models.

Although more productive and suitable for mechanisation, these systems often lead to the replacement of native cultivars with foreign ones better suited to intensive production. As a result, there is a loss of century-old trees, genetic diversity and Portugal's varietal heritage, as well as a risk that the distinctive character and authenticity of olive oils and olives associated with native cultivars will disappear. Thus, the preservation of traditional olive groves and native cultivars is essential to ensure the sector's sustainability, the conservation of biodiversity and the promotion of the identity of national olive products.

The Trás-os-Montes region has natural and structural characteristics that hinder the implementation of intensive farming systems. The rugged terrain, the prevalence of smallholdings—which limits mechanisation—and the lack of water and large-scale storage facilities hinder

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implementation of intensive systems and reduce producers' competitiveness in national and international markets. Thus, the current context of climate change and the growing scarcity of water resources underscore the importance of maintaining traditional rain-fed olive groves and preserving native cultivars, which are better adapted to and more resilient in the face of adverse environmental conditions. In this context, the sustainable development of the Trás-os-Montes olive grove depends, above all, on the adoption of differentiation strategies based on the quality, authenticity and diversity of the products.

Innovation is also an essential factor in strengthening the sector's competitiveness. The promotion of traditional, little-known cultivars, associated with products possessing unique flavour and aroma characteristics, enables the region's olive products to stand out and be valued. In the case of olive oils, recent studies (Rodrigues et al., 2019, 2020) show that olive oils extracted from olives grown on century-old olive trees of rare cultivars have distinct physico-chemical compositions and sensory profiles, revealing aromatic notes such as apricot, green cherry, broccoli, pineapple or kiwi.

These characteristics contribute to the authenticity, quality and distinctiveness of the 'Azeite de Trás-os-Montes', making it more attractive to consumers and specialist markets. This kind of work is also beginning to be applied to table olives.

Most table olives are a fermented product of high nutritional importance in Mediterranean countries and are considered one of the oldest fermented foods (Perpetuini et al., 2020). In addition to standing out for their lipid profile, rich in monounsaturated fatty acids,

these oils, which are particularly rich in oleic acid (Rocha et al., 2020), also contain significant amounts of vitamin E (α -tocopherol) and compounds with significant biological activity. The utilisation of these compounds has been gaining in importance, driving the development of new food products.

This paper provides a brief overview of the ongoing research projects at the Mountain Research Centre of the Polytechnic Institute of Bragança, which aim to investigate, characterise and enhance the value of olive oils and table olives produced in northern Portugal, thereby contributing to the preservation of their identity and the promotion of the regions from which they originate.

2. Characterisation of the regional olive-growing heritage

The regional olive-growing heritage, consisting largely of centuries-old olive trees, represents an important endogenous resource with high potential for promoting rural development in the Trás-os-Montes region (Figure 1). The preservation of these trees contributes to the conservation of agricultural

Figure 1 – Panoramic view of traditional olive groves in the Trás-os-Montes region, highlighting the importance of the olive tree in the agricultural landscape and rural heritage of the region



Figure 2 – Examples of centuries-old olive trees and fruits from different traditional cultivars forming part of the olive-growing heritage of the Trás-os-Montes region, currently undergoing morphological, physico-chemical and genetic characterisation



biodiversity, the protection of the landscape and the preservation of ancestral cultural practices associated with olive cultivation and the production of olive oil and table olives. At the same time, the growing demand for authentic and distinctive products has created economic incentives for the enhancement of these olive groves, particularly in the *gourmet* sector and more discerning markets.

The sustainable management of traditional olive groves may also favour production systems better suited to the small-scale farming reality characteristic of the region, promoting the enhancement of local products and the creation of new sources of income. In this context, rural tourism linked to olive groves, incorporating activities related to production, processing and

gastronomy, could play a significant role in the sustainable development of the most disadvantaged rural areas.

Thus, the preservation and enhancement of traditional olive cultivation are seen not only as a means of protecting the natural and cultural heritage of Trás-os-Montes, but also as a strategy capable of strengthening the regional economy and affirming the identity of Portuguese olive oils. To this end, over the last five years, intensive work has been carried out to survey and study the region's olive-growing heritage, involving the morphological, physico-chemical and genetic characterisation of numerous specimens. Figure 2 shows some examples of this olive-growing heritage currently undergoing characterisation.

3. Table olives from the Trás-os-Montes region

Table olive production in the Trás-os-Montes region is based, above all, on the use of traditional cultivars adapted to local soil and climate conditions and integrated into predominantly traditional production systems. Among the most widely used cultivars are Negrinha de Freixo, Cobrançosa and Santulhana, recognised for their sensory characteristics and technological suitability for table olive production; a survey and characterisation of regional table olives is currently underway (Figure 3).

Table olives from these cultivars have been the subject of a considerable number of studies, ranging from the characterisation of pitted green olives processed from these cultivars (Sousa *et al.*, 2011) to the characterisation of the associated microbiota (Oliveira *et al.*, 2017; Martins *et al.*, 2025) and their antioxidant (Malheiro *et al.*,

2011) and antimicrobial activities (Sousa *et al.*, 2006; Pereira *et al.*, 2006), and, more recently, to the assessment of their functional and probiotic potential (Oliveira *et al.*, 2017), as well as to the promotion of the traditional fermentation processes associated with their production (Martins *et al.*, 2024).

In addition to these cultivars, there are others with local distribution that have not yet been studied or have been insufficiently characterised from a morphological, genetic, physico-chemical and sensory perspective. This varietal heritage represents an important genetic and cultural resource, with the potential to differentiate and enhance the value of regional products.

Studies carried out to date highlight the uniqueness of the olives produced in this region, particularly in terms of their chemical composition, sensory profile and functional potential, reinforcing the importance of their preservation and promotion in the context of the sustainability and authenticity of agri-food products from Trás-os-Montes.

Figure 3 – Samples of table olives collected from traditional producers in the Trás-os-Montes region, currently undergoing morphological, physico-chemical and sensory characterisation



At the same time, the growing appreciation of traditional foods and products of distinct origin has been increasing scientific and commercial interest in these cultivars, creating new opportunities for promoting the local economy and for affirming the gastronomic and cultural identity of the Trás-os-Montes region.

4. Table olives as a source of bioactive compounds

Bioactive compounds exert physiological effects on the human body, playing important roles in the prevention of chronic diseases. Monounsaturated fatty acids, such as oleic acid, are associated with anti-inflammatory and cardioprotective effects (Garrido-Romero *et al.*, 2025). Their consumption has been linked to an increase in high-density lipoprotein cholesterol (HDL-c) and a reduction in total cholesterol and low-density lipoprotein cholesterol (LDL-c) (Rocha *et al.*, 2020), resulting in benefits for the cardiovascular system.

In addition to monounsaturated fatty acids, other relevant nutritional components include vitamin E (fat-soluble), particularly α -tocopherol, and dietary fibre, namely pectin, hemicelluloses, cellulose and lignin (Rocha *et al.*, 2020). Vitamin E is the main vitamin present in olives, and its function is to protect the human body from oxidative damage caused by reactive oxygen species (ROS), which are formed during metabolic processes or are present in the environment (Rocha *et al.*, 2020). Furthermore, this compound may exert significant neuroprotective effects (Rocha *et al.*, 2020).

Other bioactive compounds can be found in table olives, namely (Rocha *et al.*, 2020; Garrido-Romero *et al.*, 2025): a) Phenolic compounds, including the following classes: (i) Simple phenols (e.g. hydroxytyrosol, tyrosol); (ii) Flavones (e.g. luteolin, luteolin-7-O-glucoside, apigenin and apigenin-7-O-glucoside); (iii) Flavonols (e.g. rutin); (iv) Anthocyanins (e.g. cyanidin-3-O-glucoside); (v) Phenolic acids (e.g. 5-O-caffeoylquinic acid), (vi)

Cinnamic acid derivatives (e.g. verbascoside), and (vii) Secoiridoids (e.g. oleuropein, oleacein); b) Triterpenic acids / Triterpenes (e.g. maslinic acid, oleanolic acid, ursolic acid, uvaol).

Amongst polyphenols, flavonoids are of particular relevance to human health due to their antioxidant, anti-inflammatory and anti-cancer properties. These properties stem from their ability to neutralise free radicals and modulate key cellular signalling pathways, such as NF- κ B and MAPK. The NF- κ B pathway is involved in the cellular response to stimuli such as stress, cytokines, free radicals, ultraviolet radiation, LDL oxidation, and viral and bacterial antigens, playing a key role in regulating the immune response to infections. MAPK is a type of serine/threonine-specific protein kinase involved in regulating cellular responses to a wide range of stimuli, such as osmotic stress, heat shock and pro-inflammatory cytokines, influencing functions such as cell proliferation, gene expression, differentiation, mitosis, cell survival and apoptosis. These compounds also have the ability to influence enzymatic activity and inhibit pro-inflammatory mediators, contributing to their therapeutic potential (Garrido-Romero *et al.*, 2025). With regard to oxidative stress and inflammation, hydroxytyrosol—a compound formed during the degradation of oleuropein—emerges as a potent antioxidant, unlike tyrosol, acting to neutralise reactive oxygen species (ROS) and activate cellular antioxidant systems, such as glutathione, superoxide dismutase, haem oxygenase-1 and NAD(P)H quinone oxidoreductase-1, possibly via the activation of the Nrf2 and AMPK/FoxO3a pathways (Rocha *et al.*, 2020).

Carotenoids and phytosterols are other important bioactive compounds. Carotenoids, such as β -carotene and lutein, also offer benefits for human health. These compounds can reach the colon, promoting beneficial changes in the bacterial flora, as well as contributing to the integrity of the digestive system and ensuring the barrier function of the mucosa (Garrido-Romero *et al.*, 2025).

Phytosterols, due to their structural similarity to cholesterol, are able to reduce its intestinal absorption, thereby contributing to cardiovascular health (Garrido-Romero *et al.*, 2025).

Polyphenols, triterpenes and other phytochemicals also influence the microbiota present in the digestive system, having a beneficial effect on bacterial populations such as *Lactobacillus* and *Bifidobacterium*. These compounds help to reduce the growth of pathogenic microorganisms and promote the production of short-chain fatty acids and other health-related metabolites, thereby strengthening the integrity of the intestinal barrier (Garrido-Romero *et al.*, 2025).

It should be noted that one of the main limitations of most studies conducted to date is that data are generally obtained from *in vitro* assays or animal models, as well as the lack of standardised intervention protocols. It is therefore necessary to conduct clinical trials in humans and to assess the inter-individual variability of the microbiota (Garrido-Romero *et al.*, 2025). Furthermore, it must be borne in mind that the bioavailability of isolated compounds may differ when they are included in a food matrix, as the bioactivity determined in individual assays may differ from the actual bioavailability in the diet. In the future, personalised nutritional strategies based on olive-derived compounds may be developed.

5. Application of new technologies, processes and uses

Increasingly, table olive producers are seeking technologies capable of extending shelf life and improving the stability of their products. Among the technologies tested to date, the following examples stand out: (i) Partial replacement of NaCl in brines with other salts, such as KCl, CaCl₂ and MgCl₂, in Spanish-style green olives, with the salts affecting the sensory characteristics (López-López *et al.*, 2023). Moreno-Baquero *et al.* (2013),

when studying chopped olives with spices to which they added mixtures of NaCl, KCl and CaCl₂, obtained olives with a lower sodium content but enriched in potassium and calcium, the latter having increased their bitterness; (ii) Application of CO₂ during fermentation and subjected to low-salt brines (Zullo & Ciafardini, 2024), with CO₂ inhibiting the growth of bacteria and moulds; (iii) Application of red LED light during the fermentation process of green olives to promote the growth of lactic acid bacteria and reduce bitterness more rapidly (Martins *et al.*, 2024); (iv) Modified-atmosphere packaging, with the advantages cited as increased shelf life and product stability, as well as the inhibition of the growth of fungi and undesirable microorganisms. However, this may affect the microbiota present and alter product quality (Michailidou *et al.*, 2021a,b); and (v) The increasing application of omics technologies to olive fermentation processes, involving the use of metagenomics, metatranscriptomics, metaproteomics and metabolomics. These methodologies enable the study and understanding of the microbiota, metabolite formation and fermentation processes, allowing the identification of biomarkers associated with food quality and safety (Vaccalluzzo *et al.*, 2020).

In recent years, table olives have been gaining increasing prominence in modern cuisine. As such, they are widely used in gastronomy as an appetiser or as an ingredient in various foods, such as pizzas. The incorporation of olive derivatives into food products has been the subject of study, with the following examples being particularly noteworthy: (i) The incorporation of olive pomace into yoghurts, providing a source of fibre and hydroxytyrosol (Ribeiro *et al.*, 2021); (ii) Olive powders, produced from green olives, olives changing colour and black olives, rich in phenolic compounds (Rodrigues *et al.*, 2022); (iii) Beef burgers enriched with phenolic extracts derived from olive mill wastewater, acting as natural antimicrobial preservatives (Roila *et al.*, 2024).

There has also been a growing trend towards the development of functional foods. In this field, probiotic olives have been developed through the addition of beneficial microorganisms such as *Lactobacillus*.

In the non-food sector, the bioactive compounds in olives show potential for application in nutraceuticals, cosmetics and active packaging, due to their antioxidant and antimicrobial properties.

In general terms, all the products described above contribute to the valorisation of by-products from the olive industry, which is an essential aspect of the transition to circular economy models. These models can help reduce the amount of waste produced, create economic value and promote sustainability.

6. Conclusions

The table olives produced in the Trás-os-Montes region represent much more than a traditional food; they are an element of identity deeply linked to the region's agricultural, cultural and landscape heritage. The preservation of native cultivars and traditional olive groves therefore plays a strategic role in conserving biodiversity, enhancing rural areas and affirming the authenticity of Portuguese agri-food products.

Scientific studies carried out over recent decades have shown that these olives possess unique physico-chemical, sensory and microbiological characteristics, as well as high functional potential associated with the presence of bioactive compounds. At the same time, traditional fermentation processes have proved important not only for producing distinctive products, but also as a source of microorganisms with probiotic and technological potential.

The growing demand for authentic, sustainable and health-promoting foods creates new opportunities for adding value to Trás-os-Montes table olives in specialised markets and segments with higher

added value. In this context, the application of new technologies for processing, preserving and valorising by-products could help to increase the sector's competitiveness, promote circular economy models and strengthen the environmental and economic sustainability of the sector.

However, significant challenges remain regarding the preservation of traditional olive groves, adaptation to climate change – in particular to increasing water scarcity – and the need to deepen scientific knowledge of numerous local cultivars that are as yet poorly characterised. It is therefore essential to continue the work of surveying, characterising and enhancing the value of this olive-growing heritage, whilst fostering collaboration between research, producers and the local community.

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Public policies in Portugal to support olive groves

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Introduction

Under the Common Agricultural Policy (CAP), the olive sector, like any other sector, is eligible for various types of support, particularly in terms of support for productive investment, risk management, the organisation of production, and the generation and sharing of knowledge. However, this support naturally tends to be dominated by modern, irrigated olive groves, which are highly innovative and efficient. Amidst the enthusiasm resulting from the significant growth of this crop and its marked modernisation – with the rapid expansion of vase and hedgerow olive groves – there was a risk that the other type of olive grove, the traditional one, would be overlooked, thereby accelerating the trend towards its disappearance.

However, the coexistence and interdependence of the various production systems, alongside the preservation of the traditional system, are essential. Recognition of this fact has led to an emphasis on support for traditional olive groves within the context of public policy, notably through the establishment of a specific agri-environmental scheme. This support has been vital for this production system, which faces greater challenges in terms of economic viability but plays an environmental, social, territorial and cultural role of the utmost importance.

Trends in olive grove areas

The available data indicate that, from 1995 to 2018, the area under olive groves remained stable and that, since then, there has been some growth. During this period, there was continuous growth in irrigated olive groves, which means there was an expected decline in traditional olive groves. This decline was not, however, very significant and has been slowing down, particularly since 2018, which can be attributed to the public support available for this type of grove.

How should traditional olive groves be defined?

Traditional olive groves can be broadly defined as an extensive, low-density system, generally comprising 100 to 200 olive trees per hectare, with very old trees – often over a hundred years old – in areas that tend to be small or very small in size, but which possess high ecological, landscape and cultural value. Furthermore, accounting for more than a third of the national olive-growing area and being widely found throughout the interior of mainland Portugal, in Trás-os-Montes, Beira Interior and the Alentejo, this system forms the basis of the identity of Portuguese olive oil, which is widely recognised for its quality and authenticity.

The significance of the traditional olive grove

The traditional olive grove – older, less productive and less profitable, with production heavily influenced by the alternating harvest and fallow cycle, cultivated as a rain-fed crop and, as a rule, alongside other crops to supplement income – faces a clear threat of abandonment or replacement by vase and hedgerow olive groves.

These latter olive groves can, should and are increasingly managed in such a way that their excellent productivity – and consequent higher profitability, which ensure economic sustainability – is complemented by environmental and social sustainability.

This does not preclude recognition that the traditional olive grove is absolutely essential for the preservation of the rural landscape, the sustainability of rural communities, social and territorial cohesion, and the very culture and traditions of the rural world. It also plays a crucial role in preserving biodiversity, protecting against soil erosion and sequestering carbon; it is therefore an essential ally in combating climate change and ensuring the resilience of the rural world to such change. For all these reasons, its preservation, sustainability and enhancement are of the utmost importance.

Of course, given its limited productivity, the difficulty of mechanisation, its small scale, the ageing of producers and the labour shortage, amongst other factors, economic viability is a challenge and is only possible through the promotion of this olive oil, which is produced under very specific conditions and is therefore particularly well-suited to being marketed in niche markets. To this end, it will be necessary to promote the production of top-quality olive oils, certified as organic or bearing a Protected Designation of Origin (PDO), Protected Geographical Indication (PGI) or Traditional Speciality Guaranteed (TSG) status, whilst minimising olive grove maintenance operations (pruning, fertilisation and phytosanitary treatments) to a minimum and, undoubtedly, with appropriate regulation and public support.

Other strategies that can contribute to the future of traditional olive groves include: a focus on agritourism and environmental education activities; the promotion of cultural events linked to olive groves; improvements to the organisation of production and marketing; the integration of technology adapted to their specific characteristics to increase their efficiency; the training of new generations of farmers and the promotion of generational renewal.

Regulation and public support for olive groves

Decree No. 3387 of 1917 established, for the first time, a system for the protection of olive groves, over a hundred years ago. The most recent protective legislation, in force since 1986, is Decree-Law No. 120/86⁽¹⁾, which requires prior authorisation for the grubbing-up or clear-cutting of olive groves, thereby protecting traditional olive groves against destruction or uncontrolled replacement.

Direct public support is provided primarily under the CAP - Common Agricultural Policy, either through a specific agri-environmental measure or through other forms of support.

Interventions under the CAPSP – the CAP Strategic Plan – which may benefit any olive grove, whether modern or traditional, include:

- Intervention C.1.1.3 ‘Agroforestry Mosaic’, which includes support for olive groves where these contribute to a mosaic of cultivated plots that helps minimise the risk of fire;
- Intervention C.1.1.7 ‘Integrated Production (PRODI) – Arable Crops’, providing support for improving the sustainable management of agricultural holdings, particularly in environmental terms and in the context of climate change.
- Intervention C.1.1.8 “Organic Farming (Conversion and Maintenance)”, which supports a comprehensive system for the management of agricultural holdings and the production of high-quality food and animal feed, which combines best

¹ <https://diariodarepublica.pt/dr/legislacao-consolidada/decreto-lei/1986-207628496>

Assessment of the olive oil and olive sector

In preparation for the current CAP implementation cycle, the CAP Strategic Plan (CAPSP/PEPAC) 2023–2027, a sectoral analysis was carried out, which states that the olive oil and table olive sector, through active management based on innovative and sustainable agricultural production, represents a key factor in maintaining agricultural activity throughout mainland Portugal, without marked regional variations, contributing to an increase in farmers' incomes, despite the negative perception identified regarding the way modern olive groves are managed.

In this sectoral analysis, needs and weaknesses were identified, such as: a shortage of labour in traditional olive groves, high production costs, difficulties in organising the sector into Producer Organisations (POs), limited Research and Development (R&D) into the improvement of native varieties, obstacles to the application of plant protection products (for example, against the serious threat posed by *Xylella fastidiosa*), difficulties in environmental management, a low level of generic promotion and consumer information, weak bargaining power with large retailers, and uncertainties and vulnerabilities regarding markets and trade policies. On the other hand, needs common to the vegetable sector as a whole were identified, such as water availability, the lack of insurance against climate change and risk management, as well as producer prices heavily dependent on the Spanish market.

Quality schemes, healthy eating, the Mediterranean diet, voluntary labelling and short supply chains are areas identified as having the potential to contribute to the enhancement of traditional olive production, particularly when it benefits from PDO/PGI/TSG designations. However, consumer preference is currently evident only in a small segment of the market, as shown by the fact that this type of PDO/PGI/TSG olive oil accounts for just 2% of total production.

environmental practices, a high level of biodiversity, the preservation of natural resources, and the application of stringent animal welfare standards

- Intervention C.3.1.1 'Productive Investment in the Agriculture-based Bioeconomy – Modernisation': processing or marketing of agricultural products; support services related to agriculture.
- Intervention C.3.1.2. "Investment in the Agriculture-Based Bioeconomy to Improve Environmental Performance"
- Intervention C.4.1.1. "Insurance" contributes to risk and disaster management;
- Intervention C.4.2 "Support for the Promotion of Quality Products" contributes to enhancing the value of products of distinctive quality and to promoting and publicising national agricultural products on the domestic and external markets, including olive oil;
- Interventions C.4.3.1 'Establishment of producer groups and organisations' and C.4.3.2 'Inter-professional organisations' contribute to optimising production costs, improving access to agricultural service providers, promoting the organisation of production and fostering vertical cooperation;
- Intervention C.5.1 "Operational groups for innovation" helps to promote cooperation for innovation within the R&D system;
- Intervention D.2.3 'Integrated Management in Critical Areas – Preservation of the Barroso landscape mosaic', which includes olive groves.

CAPSP Interventions that may benefit traditional olive groves alone include:

- Intervention C.1.2.2 "Natura Network Payment", which includes support for traditional olive groves; in Type 3 restricted areas (the geographical area corresponding to the polygon resulting from the overlap of: Moura/ Barrancos, Moura/Mourão/Barrancos, Évora, Reguengos, Alvito/Cuba and Cuba), where, due to the proximity of the Alqueva reservoir, intensive irrigated olive cultivation would theoretically be possible, but where such a change in land use is not permitted; in these areas, a higher Natura payment is available for traditional olive groves;
- Intervention C.1.1.2.2 'Permanent Crops and Traditional Landscapes' helps to counteract the abandonment of systems of high biodiversity value or traditional landscapes, which include, amongst others, traditional olive groves.

This agri-environmental support is, in practice, the most comprehensive and widespread support available to traditional olive groves.

There is also a set of interventions supporting productive investment and irrigation, which are likely to be used in modern olive groves; traditional olive groves are therefore not expected to benefit from them, although they are not excluded from this support:

- Intervention C.1.1.1.2 'Efficient use of water', which contributes to improving the management of water resources through their appropriate provision and use;
- Intervention C.2.1.1 Productive agricultural investment;
- Intervention C.2.1.2 Agricultural investments to improve environmental performance;
- Intervention C.2.2.2: Productive investment for young farmers;
- Intervention D.3.1. "Development of sustainable irrigation";
- Intervention D.3.2. "Improving the sustainability of existing irrigation systems".

The importance of public support for olive groves – both modern and traditional – and for olive oil can be illustrated by data on investment under the 2020 Rural Development Programme (RDP), up to

2025. Meanwhile, data from Intervention C.1.1.2.2 "Permanent Crops and Traditional Landscapes" highlight the specific support provided for traditional olive groves.

Public support for investment in olive groves

Investment in olive groves that received CAP support under the 2020 Rural Development Programme (PDR2020) between 2014 and 2024 was very significant in terms of total investment value, public expenditure on support, and the number of hectares of olive groves established. As can be seen in the table below, 3,374 projects were submitted with a proposed investment of 451 million euros and public expenditure on support of 173 million euros, corresponding to an area of 107,099 hectares. It should be noted that the proportion of support relative to the total investment varies considerably depending on the type of project. Larger projects had a support rate of 33.3 per cent. Projects involving young farmers and small-scale projects, on the other hand, had rates of 45.7 per cent and 48.2 per cent respectively, reflecting a commitment to ensuring greater support for those starting up in the sector and for small farms.

As regards olive oil, 193 projects were submitted with a proposed investment of 81 million euros and public support expenditure of 24 million euros



Approved Projects in the Olive Growing and Olive Oil Sectors

Data reported as at 31 December 2025 on investment applications from 2014 to 2024

unit: thousand euros

Main sector: Olive growing

Agriculture	Approved				
	No. of Projects	Proposed Investment	Public Expenditure (Support)	Area (ha)	% Support /Investment
Investment in the farm	797	273 784	91 143	70 769	33.3%
Setting up Young Farmers (Investment)	560	117,195	53,543	12,621	45.7%
Small-scale investment in farming	2,017	60,402	29,129	23,709	48.2%
Total Olive Growing	3,374	451,381	173,814	107 0GG	38.5%

Source: Managing Authority for the 2014–2020 Rural Development Programme

unit: thousand euros

Main sector: Olive oil

Agri-industry	Approved			
	No. of Projects	Proposed Investment	Public Expenditure (Support)	% Support /Investment
Investment, processing and marketing of agricultural products	61	62,669	16,913	27.0%
Small-scale investments in the processing and marketing of agricultural products	132	19,116	7,730	40.4%
Total Olive Oil	193	81,785	24,642	30.1%

Agri-environmental support for traditional olive groves

This support was initially established in 1999 under the Rural Development Plan – RURIS; however, it was discontinued and only resumed under PDR2020, the 2014–2020 Rural Development Programme, and subsequently continued under the current CAPSP.

In the PDR2020, this support was included under operation 7.6.1 ‘Traditional Permanent Crops’, whilst in the CAPSP it constitutes sub-intervention C.1.1.2.2.1.1 ‘Permanent Crops – Traditional Olive Groves’, which forms part of intervention C.1.1.2.2 ‘Permanent Crops and Traditional Landscapes’.

Support for ‘Traditional Permanent Crops’ is intended to ensure the maintenance of traditional permanent crop systems (traditional olive groves and traditional orchards: fig orchards, almond groves, chestnut groves, traditional Algarve orchards, extensive and rain-fed orchards) which are important for environmental conservation, the maintenance of biodiversity, plant genetic heritage and the preservation of characteristic landscapes. Traditional olive groves are clearly the most important of these systems.

The eligibility criteria are:

- a minimum area of 0.3 hectares within the geographical area of application;
- planting density within the specified limits: ≥ 45 and ≤ 240 trees per hectare, with at least 80 per cent of the olive trees being 30 years of age or older; a minimum of 70 per cent or 60 per cent is permitted, with a reduction in support of 10 per cent or 20 per cent respectively, which allows for some renewal of the olive grove.

The commitments are:

- to maintain the eligibility criteria throughout the five-year commitment period;

- to ensure the trees remain in good vegetative and health condition, in particular through pruning and clearing;
- to control spontaneous woody vegetation dominated by shrubs taller than 50 cm, so that they do not occupy more than 10 per cent of the area covered by the commitment;
- to control herbaceous or woody vegetation without the use of herbicides.

The support provided is as follows:

- for the first 10 hectares, 162 euros per hectare,
- for the next 40 hectares, 90 euros per hectare; and
- for hectares beyond the fiftieth, 50 euros per hectare, thereby prioritising support for smaller holdings, which are the most common, whilst also taking economies of scale into account.

It should be noted that these support amounts have been in place since the start of the previous programming period, the PDR2020, and that an update of these figures would be justified, given the inflation observed since 2014.

Figures and characteristics of olive groves under the CAP’s agrienvironmental support

The area of olive groves on holdings making use of the CAP’s Single Application (SA) scheme amounted to 318,154 hectares in 2024², of which 135,122 hectares – that is, 42.47% of the total – are irrigated, and 183,031 hectares – 57.53% – are rain-fed. Traditional olive groves account for around two-thirds of the rain-fed olive grove area, that is 117,000 hectares, corresponding to 37% of the total olive grove area under the Single Application scheme.

It should be noted that of the olive grove area in the SA that does not receive support for traditional olive groves, 115,646 hectares, or 50.89%, is located on farms with a type of farming

² It should be noted that the total olive grove area, according to the 2019 Agricultural Census (RGA) was 377 234 hectares, there is therefore a significant area of olive groves situated on holdings that do not receive any form of support.

specialising in olive groves, meaning that two-thirds of their Standard Output (SO) comes from olive groves. In contrast, on holdings receiving support for traditional olive groves, the area on specialised holdings is 24,360 hectares, or 26.8 per cent – a considerably lower proportion, as might be expected.

The olive groves for which applications were submitted in 2024 under the traditional olive grove support measure cover 90,896 hectares, i.e. 77 per cent of the total estimated area of traditional olive groves (117,000), which is a very significant proportion. The portion of traditional olive groves that does not apply for this support is likely to consist of: plots that do not meet all the eligibility criteria, or very small plots for which applying would not be worthwhile, though they may also be areas that have already been abandoned.

In terms of payments made under the 2024 Programme, the number of beneficiaries was 23,400, the area for which payments were made was 89,749 hectares (slightly less than the 90,896 ha for which applications were submitted) and the amount paid was 12,346,470 euros, representing an average area of 3.8 ha, a payment per holding of 527.6 euros and 137.5 euros per hectare.

With regard to the characteristics of the holdings and the area supported under this measure, it can be seen that 26.8 per cent of the area receiving support belongs to holdings specialising in olive cultivation, 23 per cent to holdings specialising in cattle or other ruminants, using extensive farming methods,

24% to mixed farming holdings and 14% to other mixed holdings. This is therefore a scheme used primarily by non-specialised holdings. Furthermore, in terms of structure, 15.5% of the area covered by the scheme is on holdings of less than 5 ha, 27.8% on holdings between 5 and 25 ha, 25.7% on holdings between 25 and 100 ha, and the remaining 31% on holdings of more than 100 ha. Regionally, 61.1% of the area is in the Alentejo, 17.8% in Trás-os-Montes and 14.1% in Beira Interior. In other words, 93% of the area is in these three regions. It should also be noted that 97.4% of the area covered by this support is in less-favoured areas, with 22.5% in mountainous areas and the remainder in areas with other natural or specific constraints.

Conclusion

The traditional olive grove is a symbol of Portugal's rural identity, a living heritage that has shaped – and should continue to shape – the landscape, culture, economy and rural society of Portugal. It is also an indispensable component in enabling a more ecological, resilient and sustainable form of agriculture. Support for its preservation is therefore essential and must remain a key priority in public policy. On the other hand, the modern olive grove has been an undeniable success, with a remarkable expansion of its area from north to south of the country, but with a clear focus on the Alqueva region; the high level of investment supported under the 2020 Rural Development Programme (PDR 2020) has clearly been a significant factor in this growth.

From the olive grove to the table: the evolution of our diet and the nutritional value of olive oil

SUSANA DA SILVA GASPAR

Office of Planning, Policy and General Administration (GPP)

1. Olive oil in the history of food and the development of the Mediterranean diet

Throughout history, olive oil has played a central role in shaping Mediterranean dietary patterns, constituting the main source of vegetable fat in regions where the olive tree thrived. The production of olive oil from olives dates back to the third millennium BC in the Levant, particularly in the regions that today correspond to Syria and Palestine (Flandrin & Montanari, 1998). Although the Phoenicians played a decisive role in spreading olive cultivation and the circulation of olive oil throughout the Mediterranean around the 6th century BC, it is important to note that wild olive trees already existed long before their arrival (Aguilera, 2001; Flandrin & Montanari, 1998).

Over time, olive oil, flour (made from cereals) and wine became established as the so-called 'Mediterranean triad', forming the structural basis of the region's food culture. This triad, whose origins date back to the earliest agricultural societies of the eastern Mediterranean, found cultural expression among the Greeks and reached full institutionalisation during Roman rule, establishing itself as an enduring agricultural, economic and symbolic model (Aguilera, 2001; Flandrin & Montanari, 1998).

In the Middle Ages (between the 5th and 15th centuries), olive oil remained a central element in the diet and symbolic practices of societies across the Mediterranean basin, in both Christian and Islamic territories, reflecting the continuity of traditions deeply rooted since antiquity. Nevertheless, it did not entirely replace animal fats, particularly amongst rural populations and those with fewer resources, for whom the latter remained more accessible. Olive oil was frequently associated with a product of greater value and prestige, with a status distinct from that of everyday cooking fats (Flandrin & Montanari, 1998; Vossen, 2007).

It is important to note that this predominance was not uniform, being strongly influenced by climatic and geographical factors that determined the viability of olive cultivation. Outside regions suitable for olive growing, animal fats quickly gained the upper hand, drawing a clear culinary boundary between the Mediterranean olive-growing basin and other parts of Europe.

In addition to its role as a foodstuff, olive oil was widely used as a fuel for lighting throughout history, notably through oil lamps in domestic and

religious contexts, highlighting its importance in the daily lives of Mediterranean societies across different historical periods (Flandrin & Montanari, 1998).

It was only at the beginning of the Modern Era (15th to 18th centuries) that butter came to be valued as a prestige product and associated with the more affluent classes (Flandrin & Montanari, 2001; Montanari, 2015). In Europe, but particularly in the northern countries, the consumption of butter also appears to be linked to the waning influence of the Roman Church over dietary practices, a process that began to take shape in the 16th century and became more evident in the 17th and 18th centuries. In contrast, in the southern countries, where the Church retained greater normative authority, the use of olive oil became even more widespread than in the Middle Ages (Flandrin & Montanari, 2001).

The Contemporary Period (19th and 20th centuries) brought about profound changes in the history of food. The Industrial Revolution spurred the development of the food industry, significantly altering methods of production, preservation and consumption. At the same time, phenomena such as population growth, rural exodus and the development of transport and global trade contributed to dietary diversification. Among the products introduced, tropical oilseeds stand out, with peanut oil emerging as a strong competitor to olive oil and other oils traditionally consumed in Europe. At the same time, the spread of vegetable oils and margarines contributed to the decline in the consumption of butter and other animal fats (Flandrin & Montanari, 2001).

Despite the overall increase in food availability throughout the nineteenth century, the first half of the twentieth century was marked by armed conflicts that had profound impacts on European social and dietary structures, a detailed analysis of which is beyond the scope of this discussion.

Within this historical context, the development of what is now known as the Mediterranean diet was the result of a gradual process, with roots in antiquity.

This dietary pattern developed amongst populations in the Mediterranean basin, where olive trees and vineyards grew wild and olive oil served as the main source of fat. Its initial form was characterised by frugality and, as we have seen, by the triad of bread, olive oil and wine, complemented by pulses and dairy products from sheep and goats. Meat consumption was limited and generally associated with festive or ritual occasions. Over the centuries, this pattern was progressively enriched and transformed, in line with historical contexts and cultural exchanges (Capurso, 2024).

The Mediterranean Diet, as it is understood today, stems from the scientific identification of traditional dietary patterns and lifestyles among Mediterranean populations, developed over centuries of cultural, agricultural and social interactions (Real & Graça, 2019). The term first emerged in the 1950s, in the context of the work of Ancel Keys, whose *Seven Countries Study* highlighted the association between these dietary patterns—particularly in Southern Europe—and a lower incidence of cardiovascular disease. This model is characterised by a predominance of plant-based foods, the use of olive oil as the main added fat, moderate consumption of fish, wine and animal products, as well as an emphasis on seasonality, diversity and frugality in eating (Keys, 1980; Real & Graça, 2019).

Beyond its nutritional dimension, the Mediterranean diet incorporates cultural, social and environmental components, and is recognised as a true way of life. It includes practices such as socialising over meals, regular physical activity and respect for natural rhythms and local produce. This multidimensional approach was formally recognised in 2010 with the inscription of the Mediterranean Diet on UNESCO's Representative List of the Intangible Cultural Heritage of Humanity, a distinction which Portugal joined in 2013, with Tavira being designated as the national representative community (Reguant-Aleix *et al.*, 2009; Real & Graça, 2019).

Portugal exhibits Mediterranean characteristics, not only because of its history and its social and cultural practices, but also through its dietary

habits, which are very similar to those of other countries in the same latitude in this part of the world. The Mediterranean dietary pattern thus emerges as a direct product of the country's history and identity.

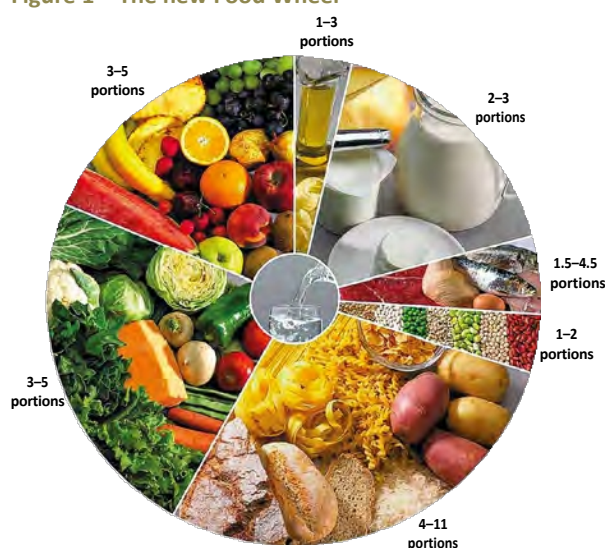
In this context, the Mediterranean Diet takes on particular significance as a cultural heritage and a model for sustainable eating. However, despite this favourable backdrop, the most recent national data indicate limited adherence to this dietary pattern (Real & Graça, 2019; Rodrigues *et al.*, 2022). In 2020, only around 26% of the population showed a high level of adherence to the Mediterranean model, indicating that the majority of Portuguese people do not follow this health-promoting dietary pattern. At the same time, socio-economic factors, such as price, are identified as significant barriers to the consumption of foods characteristic of the Mediterranean diet, including olive oil (DGS, 2020).

In this process of institutional recognition and affirmation of the Mediterranean Diet as a dietary model and lifestyle to be promoted, its inclusion in national dietary guidelines is particularly noteworthy. The adaptation of the Portuguese dietary guide — the Food Wheel — to the principles of the Mediterranean Diet in 2016, giving rise to the Mediterranean Food Wheel, was a significant milestone, as it translated this dietary pattern into concrete recommendations and highlighted the role of foods considered fundamental to the structure of the Mediterranean dietary model (DGS, 2016; Real & Graça, 2019).

2. Olive oil in the Mediterranean Diet: nutritional importance and its place in the Food Wheel

The Food Wheel is the official dietary guide in Portugal, designed as an educational tool to guide the population's eating habits. In its version adapted to the Mediterranean Diet — the Mediterranean Food Wheel — this model highlights the central role of certain key foods in the Mediterranean dietary pattern. Among these, olive oil plays a central role, as the main recommended

Figure 1 – The new Food Wheel



source of fat, reflecting both its nutritional importance, its constant presence in culinary practices and its cultural significance within the Mediterranean context.

In addition to highlighting specific foods, the Mediterranean Food Wheel incorporates broader aspects associated with the Mediterranean lifestyle, such as conviviality at the table, the use of local and seasonal produce, and regular physical activity, establishing itself as a tool for promoting healthy eating habits, sustainable and culturally rooted.

Figure 2 – The Mediterranean Food Wheel



It is important, however, to emphasise that this guide does not replace the Portuguese Food Wheel, launched in 2003 as an update to the initial 1977 version, but rather functions as a complement that reinforces and contextualises the existing guidelines (Rodrigues *et al.*, 2006).

The Food Wheel is organised into seven food groups represented in different proportions, which indicate each group's relative contribution to the daily diet, as well as the respective recommended portions. Water is depicted at the centre, highlighting its essential role in the composition of food and in sustaining life. Each group has specific nutritional functions and should form part of the daily diet; it is recommended to vary the foods within each group to ensure dietary diversity and balance.

With regard to the fats and oils group, the Food Wheel recommends moderate daily consumption, recognising their nutritional importance but emphasising that the quality of the fat is crucial (FCNAUP, 2003). Indeed, fats differ in their fatty acid composition and their effects on health, which underpins the principle that 'too much is a mistake and too little is a deficiency', promoting informed, balanced consumption tailored to the body's needs (Peres, 1997). This group performs essential functions, notably in supplying essential fatty acids and facilitating the absorption of fat-soluble vitamins; within the context of the Mediterranean diet, this should be achieved primarily through olive oil, as the main source of added fat.

Fats perform fundamental nutritional functions in the human body. As well as facilitating the absorption of fat-soluble vitamins, they provide essential fatty acids, which are indispensable for the structure and function of cell membranes and for the regulation of various biological processes, including inflammatory, hormonal and metabolic phenomena. Furthermore, all fats provide approximately 9 kcal per gram,

the highest energy density amongst the macronutrients. Thus, although they differ in their nutritional quality, their energy contribution is equivalent, which reinforces the need for moderation in consumption (Peres, 1992; 1997).

However, fats do not constitute a homogeneous group; they differ in their fatty acid composition and their physiological effects. They can be classified as saturated, monounsaturated and polyunsaturated, each with distinct nutritional properties. This diversity underscores the importance of prioritising the quality of fat in the diet, guiding informed and balanced choices, since both excess and deficiency can compromise essential biological functions (Peres, 1997).

In this regard, it is important to consider not only the composition of fats, but also the way in which they are used in food preparation. In his book *Food and Nutrition*, Emilio Peres emphasises that olive oil, due to its predominantly monounsaturated structure and the presence of antioxidant compounds, exhibits greater stability when heated compared with oils rich in polyunsaturated fatty acids, such as maize, sunflower or soya oils, as well as with some margarines, which are more susceptible to thermal oxidation. This greater stability does not, however, imply excessive use, but rather appropriate and moderate use, tailored to cooking methods. The author thus highlights the importance of the quality of the fat, the type of culinary preparation and temperature control in preserving the nutritional value of foods and preventing the formation of undesirable compounds (Peres, 1992).

Within the context of the Mediterranean diet, olive oil plays a central role as the main source of fat. Among its various categories, virgin olive oils stand out; these are obtained directly from olives using mechanical processes and without recourse to refining processes. Within this group, extra virgin olive oil is of particular importance, distinguished by its higher quality and greater concentration of bioactive compounds.

Across the board, olive oils are characterised by a favourable lipid profile, dominated by monounsaturated fatty acids, in particular oleic acid (omega-9), which is associated with beneficial effects on cardiovascular health and the modulation of inflammatory processes, whilst simultaneously having low levels of saturated fatty acids (Jiménez López *et al.*, 2020; Farag & Gad, 2022). In addition to this profile — common to olive oils in general — extra virgin olive oil is distinguished by its high content of phenolic compounds, such as hydroxytyrosol, oleuropein and oleocanthal, which are responsible not only for its distinctive sensory properties but also for its widely documented antioxidant and anti-inflammatory effects (Jiménez López *et al.*, 2020; Silva Soto *et al.*, 2025). These characteristics stem from its production process, which relies exclusively on mechanical methods, generally carried out at low temperatures, thereby preserving the integrity of the bioactive compounds and the product's nutritional properties.

Thus, the prominence of olive oil in the Mediterranean diet reflects an integrated approach to nutrition, which combines nutritional quality, traditional culinary practices, sustainability and cultural identity, reinforcing its contribution to the promotion of healthy and sustainable dietary patterns.

Conclusion

The Mediterranean Diet is recognised as a living intangible cultural heritage, whose significance stems from the convergence of dietary practices and lifestyles historically rooted in Mediterranean communities and their subsequent scientific systematisation and institutional recognition, culminating in its inscription by UNESCO as an expression of identity, culture and sustainability, of particular significance in the Portuguese context.

In recent decades, the fast pace of life, combined with reduced time available to organise daily meals, as well as the gradual devaluation of shared meals, has been reflected in a gradual decline in the importance of meals in this context. Paradoxically,

there has never been greater access to information on food and nutrition. Nevertheless, there is a tendency to favour simplistic narratives or quick fixes, often disconnected from food quality, production methods and the impacts associated with food systems. At the same time, in certain contexts, there has been a decline in the value placed on a balanced diet, as a result of the growing adoption of eating habits associated with other cultures, which are progressively supplanting the Mediterranean dietary pattern.

Eating practices are embedded in complex contexts, influenced by multiple social, cultural, economic and environmental factors, which shape the way we organise our meals, select our food and structure our daily eating habits. These dynamics help to explain the gradual shift away from traditional dietary patterns, such as the Mediterranean Diet, and the increasing adoption of less balanced eating habits. In this context, it is essential to promote greater dietary literacy and to value practices that strengthen the link between food, culture and health, whilst respecting the real-life contexts in which these practices take place.

In this context, olive oil, as a cornerstone of the Mediterranean Diet, plays a central role not only because of its nutritional value, but also because of its cultural significance and its integration into balanced dietary practices. The fact that adherence to this dietary pattern remains relatively low, coupled with challenges relating to access, reinforces the need for public policies and integrated strategies that promote the appreciation and transmission of the Mediterranean Diet to future generations, taking into account not only the knowledge aspect but also the socio-economic contexts in which dietary choices are made. In this context, it is important to promote olive oil not in isolation, but as an integral part of a broader dietary model, the effective adoption of which results from a combination of information, accessibility, availability and the social context.

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REVIEWS

***CULTIVAR* = CULTIVAR**

n. Botany. ***A VARIETY OF A PLANT THAT HAS BEEN DELIBERATELY DEVELOPED BY BREEDING.***

Sustainability of olive groves in Portugal

ANA RITA MOURA

Office of Planning, Policy and General Administration (GPP)

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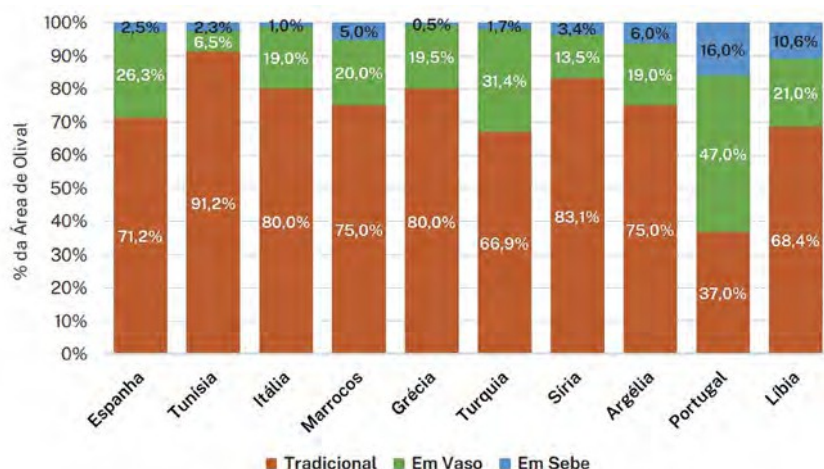
Keywords: sustainability, vase and hedgerow olive groves, traditional olive groves, olives and olive oil

Olive cultivation has been gaining prominence, particularly in recent decades, with the introduction and rapid expansion of olive groves planted in vase and hedgerow systems¹ — both more ‘intensive’ production systems — particularly in the Alentejo region. Accordingly, with the aim of understanding the significance of olive cultivation and clarifying how each of the production systems practised in line with sustainability principles operates, the Amélia de Mello Foundation decided to invite AGRO.GES to

produce a book dedicated to this topic. The book is organised into four main chapters. The first chapter provides an overview and history of olive cultivation worldwide, particularly with regard to geographical location, scale, production, consumption and international trade. The second chapter examines olive cultivation in Portugal in greater detail. The third chapter focuses on the main production systems, highlighting traditional olive groves, vase olive groves and hedgerow olive groves. Finally, the last chapter addresses the three dimensions of sustainability: economic, environmental and social,

¹ Both terms refer to the shape of each plant’s canopy, as well as the number of plants per unit area (hectare).

Figure 3 – Share of different production systems by area – main countries



Source: *International Olive Growing*, 2018, Juan Vilar Consultores Estratégicos, S.L.; 2019 Agricultural Census, INE

increases in olive oil production in Spain and Portugal, in contrast to Italy and Greece; the main producing countries are also those that consume the most olive oil *per capita*.

The second chapter examines the development of the olive sector in Portugal over the last 20 years, using the variables of area, production, consumption, price and international trade as in the previous chapter, but also

as defined by the UN – United Nations².

In the first chapter, one can learn about the evolution of olive-growing area worldwide; the global distribution of olive-growing area, by country, by production purpose (olive oil or table olives) and by production system (traditional, vase and hedgerow); the evolution of olive oil production worldwide, by quality of oil produced (lampante, virgin and extra virgin); the evolution of table olive production worldwide; the evolution of olive oil consumption (and that of other vegetable oils) worldwide, by country and *per capita*; international trade in olive oil and olives; and the evolution of olive oil prices by quality.

Some key findings from this chapter: half of the world's olive-growing area is located in southern Europe (Spain, Italy, Greece and Portugal); predominance of rain-fed production; predominance of traditional olive groves in the main producing countries with the exception of Portugal (47% in the vase system, see Figure 3 of the document, p.25, reproduced here); larger

presenting information on irrigation, certification (PRODI and OF – Organic Farming) and the characteristics of olive mills. This chapter highlights a number of points: Portugal is the world's seventh-largest producer and fourth-largest exporter of olive oil (according to the UN International Trade Database³; by 2024, Portugal was already the world's third-largest exporter of olive oil and, according to FAO statistics⁴, the sixth-largest producer of olive oil worldwide); olive groves account for 9.5% of the UAA – Utilised Agricultural Area (and 43.8% of the area under permanent crops); 52.4% of the olive grove area is located in the Alentejo; 42 per cent of the Alentejo's olive grove area is concentrated on holdings of over 100 ha; 41.1 per cent of the Alentejo's olive grove area consists of vase olive groves, 30.6 per cent is traditional olive groves and 28.3 per cent is hedgerow olive groves; 95 per cent of the olive oil produced is extra virgin; Portugal ranks fourth in the world for *per capita* olive oil consumption (7.1 kg/capita).

² «Sustainable development is how we must live today if we want a better tomorrow, by meeting present needs without compromising the chances of future generations to meet their needs. **The survival of our societies and our shared planet depends on a more sustainable world.**

It's a bit of a juggling act. Three different balls must be kept in the air at once: economic growth, social inclusion, and environmental protection. If one or two fall to the ground, the act is over. An economy might grow rapidly, for instance – but only for so long if most people remain poor and all the natural resources are used up.

Where development is sustainable, everyone has access to decent work, quality health care and education. Natural resource use avoids pollution and permanent losses to the environment. Public policy choices ensure that no one is left behind due to disadvantages or discrimination."

Source: <https://www.un.org/sustainabledevelopment/blog/2023/08/what-is-sustainable-development/>

³ UN Comtrade Database: <https://comtradeplus.un.org/TradeFlow>

⁴ FAO – Food and Agriculture Organisation of the United Nations – FAOSTat: <https://www.fao.org/faostat/en/#data/QCL>

Chapter three examines the main olive-growing systems (traditional, vase and hedgerow) in greater depth, highlighting their key characteristics and using a comparative table (Figure 33 of the document, p. 104, reproduced here). The traditional olive grove older

Figure 33 – Olive grove production systems

			
	Olival Tradicional	Olival em Vaso	Olival em Sebe
Densidade de Plantação	80 a 100 oliveiras/ha	200 a 500 oliveiras/ha	1 600 a 2 000 oliveiras/ha
Produtividade Média (Azeitona)	500 a 800 kg/ha	7 000 a 9 000 kg/ha	12 000 a 14 000 kg/ha
Peso na Área de Olival Nacional (%) - 2019	37%	47%	16%
Principais Variedades	Galega, Cobrançosa, Cordovil e Verdeal	Arbequina, Cobrançosa, Picual	Arbequina e Arbosana
Regime de Exploração mais Comum	Sequeiro	Regadio	

Source: Author's own work

system (prevalent worldwide), which is less profitable and productive, with output determined by the 'alternate bearing' cycle, practised as rain-fed farming and in combination with other crops to supplement income, has gradually been abandoned or replaced by the vase and hedgerow systems, or maintained thanks to CAP support. The vase olive grove, which emerged in the 1990s, is more productive than the traditional olive grove; it predominates in terms of area and is mainly cultivated under irrigation. Finally, the hedgerow olive grove, which is more recent, more productive, easier to mechanise and cultivated under irrigation, reaches full production more quickly.

Chapter four addresses the major challenges to the sustainability of olive groves from an economic, environmental and social perspective, by type of production system. For the economic analysis, the variables used include yield, productivity, production costs (e.g. intermediate consumption, labour, fixed capital), investment, the price of olives and olive oil, and irrigation requirements for alternative crops. For the environmental analysis, the study examines the use of soil, water resources,

fertilisers and pesticides, carbon sequestration, the impact on biodiversity and the landscape, and sustainable production methods. As for the social analysis, it draws on variables relating to employment and demography.

Some findings from this chapter suggest that the use of modern, research-backed techniques can provide:

- **economic sustainability** (greater profitability and resilience of the hedgerow olive grove; vase and hedgerow olive groves have lower irrigation requirements compared to alternative crops; increased importance of olive growing in national agricultural production);
- **environmental sustainability** (soil protection⁵ ; lower water requirements compared with other irrigated crops⁶ ; good agricultural practices prevent water and soil contamination⁷ ; lower need for pesticide application compared with other permanent crops⁸ ; greater carbon sequestration capacity compared with traditional olive groves⁹ ; good agricultural practices prevent the reduction of biodiversity caused by vase and

⁵ "hedgerow and vase olive groves ensure good levels of soil protection against water erosion, improved soil organic matter levels and a lower potential for soil salinisation" (p.120)

⁶ "olive groves are one of the irrigated crops with the lowest water requirements for irrigation" (p.123)

⁷ "fertilisation of olive groves, carried out in the modern and rational manner described above, will have no negative impacts either on the contamination of surface water and groundwater or on soil salinity or acidity" (p.130)

⁸ "Olive groves have an average application rate of just 2.3 kg of active ingredient per hectare, a figure that is considerably lower than the average application rates for the other permanent crops discussed" (p.134)

⁹ "Carbon sequestration in a hedgerow olive grove is around nine times higher than that achieved by a traditional olive grove" (p.142)

hedgerow olive groves¹⁰ ; moderate impact on the traditional landscape¹¹);

- **social sustainability** (more jobs, better pay and retaining the population in rural areas¹²);

Finally, the last chapter highlights some conclusions regarding this modernisation process (which are generally positive), notably, in economic terms, the increased investment momentum associated with vase and hedgerow olive groves (with a preferred location in the Alentejo, within the Alqueva hydro-agricultural development area); Portugal's international standing in olive oil production and exports; the sector's positive contribution to national agricultural production and to the economy's trade balance; gains in productivity and efficiency associated with the use of 'dwarf' olive tree varieties and the availability of water and soil; and the greater economic profitability associated with these olive grove production systems.

In terms of the environmental sustainability of these new types of olive groves, the conclusions are also positive, *"with no significant negative impacts of cultivation on the environment having been identified"*. The *"modern olive grove is capable of ensuring high efficiency in the use of resources", whilst also ensuring a high level of soil protection against erosion, an improvement in soil fertility, and the capacity to sequester large quantities of CO₂"*.

With regard to social sustainability, the report highlights the *"ability to guarantee significant levels of employment (...) thereby helping to retain the population in the regions where the olive groves are located"*.

Conclusions/comments

As discussed in the study, olive cultivation is widespread across the countries of the Mediterranean basin, having flourished in this region for thousands of years. Portugal is no exception: with a predominantly Mediterranean climate, characterised by hot, dry summers and cold, rainy winters, olive cultivation is a defining feature of the landscape, in agriculture and in Portuguese cuisine (the Mediterranean diet). In recent decades, with the globalisation of the economy and the need to compete in a wider and more dynamic world, alongside the growth of the urban population and the decline of the rural population (where agriculture is more prevalent), more modern olive production systems have begun to emerge – systems that are more productive, less labour-intensive and more efficient in their use of resources.

The expansion of the Alqueva project and the need to compete in the international market were key factors in the rapid growth of the area under vase and hedgerow olive groves in the Alentejo. Many Portuguese and foreign investors were attracted by the profitability generated by modern olive cultivation, which already had a track record of success in southern Spain and had yielded good economic results. Interest in olive groves for olive oil production in the Alentejo has continued (the area grew significantly between 2015 and 2019), although it has remained at 206,000 hectares since 2020.

This book seeks to explain how the 'new' olive production systems work, as well as to highlight their importance in today's world and, in particular, in Portugal, whilst also emphasising the environmental (and social) challenges and the respective responses through the implementation of good agricultural practices. The study thus aims

¹⁰ *"hedgerow and vase olive groves, whilst representing a form of agricultural intensification and consequently having a greater potential to reduce biodiversity than more extensive systems, can significantly mitigate their impact through appropriate agricultural practices and the safeguarding of refuge areas to promote functional biodiversity"* (p.144/5)

¹¹ *"When viewed on a regional scale, it is evident that the proportion of olive groves in the total agricultural area is no longer particularly significant, with the region's traditional landscapes still largely predominating – landscapes associated with rain-fed cereal crops, pastures, traditional olive groves and cork oak forests."* (p.148)

¹² *"As well as creating employment, olive growing has made it possible to improve labour productivity and, consequently, to increase workers' wages, thereby creating better conditions for improving quality of life and retaining local populations."* (p.155)

to contribute to clarify issues surrounding vase and hedgerow olive groves —often referred to as intensive and super-intensive olive groves and viewed with suspicion by the population—through statistical and bibliographic analysis and technical information.

It would be interesting to publish a new, updated version of the book containing more recent statistical data as well as new developments (e.g. scientific articles, projects) in the field of olive and olive oil production. And, possibly, to include other topics or explore some of those already mentioned in greater depth, namely regarding the agricultural workforce (e.g. impact on the rural community –

basic services for the rural population; agricultural labour recruitment services – wages and contracts), other environmental challenges associated with vase and hedgerow olive groves (e.g. air quality in rural communities – pollution and odours); the olive and olive oil sector (e.g. the formation of olive and olive oil prices between producer and consumer; the organisation of production; business statistics); recognition of Portuguese olive oil (e.g. awards, quality schemes); income and investment support for the sector (e.g. PDR2020, CAPSP); morphological and genetic characteristics of the main olive varieties (e.g. drought tolerance, lifespan, resistance to diseases and pests).

"The EU olive oil control system – A comprehensive framework, but uneven implementation"

HELENA ALEGRE

Office of Planning, Policy and General Administration (GPP)

Reference

TITLE: Special Report 01/2026, The EU olive oil control system – A comprehensive framework, but uneven implementation

AUTHORS: European Court of Auditors

PUBLISHER: Publications Office of the European Union

DOCUMENT TYPE: Report

DOCUMENT LOCATION: https://www.eca.europa.eu/ECAPublications/SR-2026-01/SR-2026-01_EN.pdf

LANGUAGE: Portuguese

NUMBER OF PAGES: 84

DATE OF PUBLICATION:
2026

Keywords: Olive oil control system, authenticity, safety, traceability, non-compliance with olive oil controls

Given the great importance of the olive oil sector to the European Union (EU) – as the Union is the world's leading producer, consumer and exporter of olive oil – the European Court of Auditors (ECA) carried out an audit of the olive oil control system in the EU. The olive oil produced here enjoys a well-established reputation for authenticity and quality, whilst also being a product of great economic, cultural and public health significance. Since its price is higher than that of other oils and fats, it is

essential to ensure strict compliance with high standards of quality and authenticity, in order to justify this price difference to consumers. This report aims to summarise all the findings, conclusions and recommendations resulting from the audit.

Scope and method of the audit

The ECA examined the control systems established and implemented by the Member States (MS) and the Commission to ensure that olive oil sold in the EU is authentic, safe and traceable, and to assess whether the system of controls and sanctions applied by the MS is effective.

It also assessed the Commission's oversight of the MS's control systems. The audit took place between 2018 and 2023 in four MS – Belgium, Greece, Spain and Italy – and covered the Commission (DG SANTE and DG AGRI), as well as the competent authorities in these four countries. The Court selected these Member States because Greece, Spain and Italy account for around 91% of the EU's olive oil production and, amongst non-producing countries, Belgium is the Union's largest exporter of olive oil.

The report is structured into three main sections. The first section sets out the key messages, addressing the relevance of the subject to the European Union and presenting a summary of the Court's main conclusions and recommendations. The second part sets out in detail the ECA's observations regarding the legal framework for olive oil conformity checks and its implementation by Member States. The final part of the report consists mainly of the annexes, the European Commission's replies and supporting evidence intended to supplement and justify the technical and methodological basis underpinning the conclusions presented.

Main conclusions and recommendations of the ECA

The Court concluded that, although the EU legal framework applicable to olive oil conformity checks is comprehensive, Member States do not apply it in full. The Court also concluded that Member States rarely detect contaminants at levels above the legal limits in olive oil samples, although there are weaknesses in the control systems, particularly with regard to contaminants other than pesticides. The Court's audit also revealed that traceability checks do not always make it possible to identify the origin of olive oil.

In light of these findings, the ECA made five main recommendations:

Recommendation 1: Strengthen the Commission's supervision of Member States' control systems for olive oil

Recommendation 2: Clarify the rules for blending of different virgin olive oils

Recommendation 3: Improve guidance on checks for contaminants in olive oil

Recommendation 4: Clarify and provide guidance on traceability check requirements

Recommendation 5: Improve the traceability of olive oil

The deadlines set for the implementation of these recommendations range from 2026 to 2028, depending on the time required for such implementation.

Comments on the report

The report is very well structured, as it enables the reader to quickly grasp its context and the main objectives and conclusions of the audit, even for readers with little technical knowledge of the sector. Furthermore, presenting the key messages, conclusions and recommendations right at the start of the report makes it easier to read and enables non-specialist decision-makers to immediately grasp the most relevant findings.

The report provides an analysis of the weaknesses in EU regulations governing the control of olive oils and the shortcomings in their implementation by Member States, whilst also highlighting the existence of specific risks in certain areas. It serves as a catalyst for introducing improvements to public policies in this area, since highlighting existing gaps provides the Commission and Member State governments with information on the need to step up inspections and improve certain specific practices.

Although Portugal has not been included in this analysis, the document remains an important tool, as by highlighting the weaknesses in other Member States' control systems, it may serve as a starting point for an analysis of our own control system. Furthermore, the improvements that the Commission intends to implement in response to the ECA's recommendations will also affect the national control system in the coming years.

European Union–Mercosur Partnership Agreement – Impact on the national olive oil sector

EDUARDO LOPES

Office of Planning, Policy and General Administration (GPP)

Reference

TITLE: European Union–Mercosur Partnership Agreement **DOCUMENT TYPE:** Bilateral agreement
DOCUMENT LOCATION: https://policy.trade.ec.europa.eu/eu-trade-relationships-country-and-region/countries-and-regions/mercosur/eu-mercosur-agreement/text-agreement_en
DATE: 17 January 2026

Nature and scope of the Agreement

Following more than two decades of a complex and demanding negotiation process, the European Union (EU) and the four founding countries¹ of the regional economic bloc known as the ‘Southern Common Market’ (Mercosur) signed, on 17 January 2026 in Asunción, Paraguay, the Partnership Agreement and the Interim Agreement on trade. The latter, which covers exclusively the liberalisation of trade and investment, will function as a stand-alone instrument until the EU–Mercosur Partnership Agreement is ratified and enters into force².

The Partnership Agreement will establish the world’s largest free trade area, covering a market of over 700 million consumers, of whom approximately 270 million reside in Mercosur countries.

Strategic importance for Portugal and the case of Brazil

For Portugal, the Agreement is a key instrument for strengthening and consolidating national exports of agricultural and agri-food products to Mercosur.

¹ Argentina, Brazil, Paraguay and Uruguay. Venezuela, although a full member, has been suspended since 1 December 2016. Bolivia is currently undergoing regulatory alignment to finalise its full accession. Once this process is complete, it will be able to begin negotiations for its integration into the EU–Mercosur Partnership Agreement.

² Subject to ratification by all Member States.

Table 1 – Ranking of Portugal’s trading partners by country – National exports of agricultural and agri-food products (average 2021–2025, in thousands of euros)

P	Country	Value	% of Total
1 st	Spain	3,477,117	37.54%
2 nd	France	878,706	9.49%
3 rd	Italy	642,252	6.93%
4 th	Brazil	482,288	5.21%

INE/GPP data: 23 March 2026

Of the four countries in that economic bloc, Brazil stands out as the priority market and the one of greatest strategic importance for national economic operators. The depth and uniqueness of the historical, cultural and social ties constitute a distinctive asset, with potential to strengthen and diversify national exports. The sharing of a common language proves to be a facilitating factor in the penetration and consolidation of Portuguese brands, which are frequently associated with the so-called ‘market of nostalgia’³.

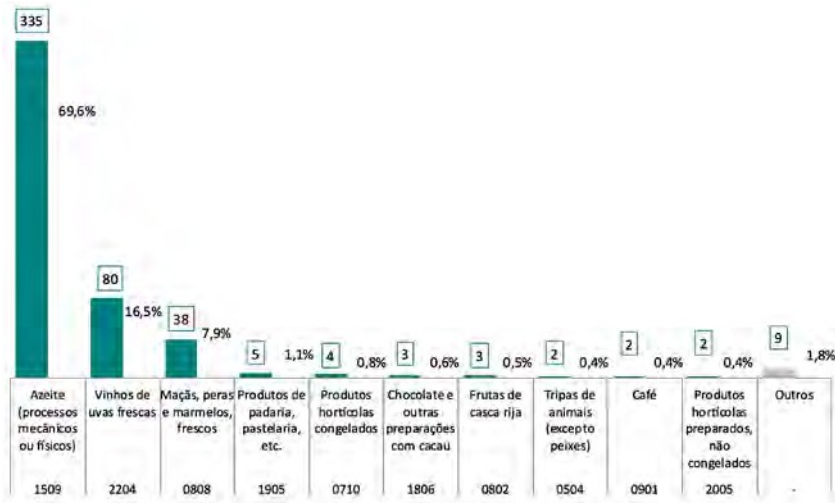
During the period 2021–2025, Brazil consolidated its position as the fourth-largest destination for national exports from the agricultural and agri-food sector. With an annual average of 482.3 million euros, growth was sustained by distinctive products of high quality and distinct identity, reaffirming Brazil as a strategic market for Portuguese companies.

The olive oil sector and its exceptional performance

Brazil is already a significant market for the national olive oil sector, being one of the main destinations for our exports. Indeed, during the

period under review, olive oil emerged as the leading product, accounting for approximately 70 per cent of the total value of agricultural and agri-food exports.

Table 2 – Exports of agricultural and agri-food products to Brazil – average 2021–2025, in millions of euros (4-digit CN code)



Data from INE/GPP: 23 March 2026

The period beginning in 2021 was marked by unprecedented growth. Starting from a turnover of 233.8 million euros in that year, olive oil exports recorded, in just four years, cumulative growth of 88.6 per cent, reaching 440.9 million euros in 2024. This significant increase reflects the strategic appreciation of Portuguese olive oil in the Brazilian market.

³ The expression ‘nostalgia market’ refers to the niche market comprising communities of emigrants (or their descendants) who consume products and services from their country of origin to maintain an emotional and cultural connection to their roots.

Table 3 – Olive oil exports (4-digit CN code) to Brazil, 2021–2025 in thousands of euros

CN code	Description	2021	2022	2023	2024	2025	Five-year average
1509	Olive oil (mechanical or physical processes)	233 792	300 130	352 882	440 918	349 446	335,433

INE/GPP data – 23 March 2026

The year 2025 saw a correction to this upward trend, with a 20.7% decline compared with the previous year, whilst still maintaining a growth trajectory in value relative to 2021, with cumulative growth of 50%.

Expected benefits of the EU–Mercosur Agreement

Although the Mercosur economies are characterised as emerging and dynamic markets, structural obstacles persist that constrain market access and external competitiveness. The agreement will provide greater regulatory transparency and predictability for European economic operators by removing tariff and non-tariff barriers to access to this economic bloc.

In this context, the economic relationship with Brazil is of particular importance to Portugal, not only because of the current trade relationship, but also due to the size of the market and existing historical ties.

The gradual dismantling of the tariff duties currently levied by Brazil on olive oil imports will, in future, help to boost national exports.

The Agreement provides for strengthened mechanisms to protect and promote products with a Protected Designation of Origin (PDO), contributing decisively to the mitigation of counterfeiting and unfair competition⁴.

Table 4 – Dismantling of tariff duties applied to olive oil under the EU–Mercosur Agreement

Current customs duties	After entry into force	
	Mercosur offer	Dismantling
10%	Zero on 1 January of the 15th year	16 equal annual phases

⁴ The agreement ensures the protection of 36 Portuguese Geographical Indications. The list includes 6 olive oils with Protected Designation of Origin (PDO): Azeite de Moura, Azeite do Alentejo Interior, Azeites da Beira Interior (Azeite da Beira Alta, Azeite da Beira Baixa), Azeite de Trás-os-Montes, Azeites do Norte Alentejano and Azeites do Ribatejo.

Olive groves in Portugal – dynamics, technologies and their relationship with rural development

MANUEL LOUREIRO

Office of Planning, Policy and General Administration (GPP)

Reference

TITLE: O olival em Portugal – dinâmicas, tecnologias e relação com o desenvolvimento rural

AUTHORS: Pedro Reis, INIAV – National Institute for Agricultural and Veterinary Research

PUBLISHER: Animar – Portuguese Association for Local Development

DOCUMENT TYPE: Book

DOCUMENT LOCATION: https://www.inia.pt/images/publicacoes/livros-manuais/caderno_olivalem-portugal.pdf

LANGUAGE: Portuguese

NUMBER OF PAGES: 37

PUBLICATION DATE: 2014

Keywords: olive groves in Portugal, history of olive groves, regional development

The RURANIMAR project (“Enhancement and coordination of community engagement policies and practices in a rural context”) was a research and intervention initiative focused on rural development in Portugal. Scientifically coordinated by Fernando Oliveira Baptista (ADISA – Association for the Development of the Lisbon College of Agronomy) and promoted by the Animar Association, it aimed to analyse rural dynamics and promote local policies.

Studies were carried out on the relationship between agriculture, rural development and social dynamics, resulting in the publication of several papers on agriculture and rural policies, edited by the ANIMAR Association. This publication is one of the project’s many and varied outputs.

The document is organised into the following chapters:

- The emergence of olive groves and high-quality olive oil (1860–1930)
- The promotion of olive oil production (1931–1959)
- The crisis in olive groves and olive oil (1960–1989)

- The inability to respond to rising consumption (1990–2004)
- The dynamics of new olive groves and the emergence of a dual system (2005–present)
- Olive-growing systems, innovation and rural development

The study begins with a series of historical references and an analysis of olive cultivation in Portugal, highlighting the ‘revolution’ initiated by Alexandre Herculano in the late 1850s in a sector that was then in a state of considerable decline, and the shift in the uses of olive oil between 1850 and 1950, from lighting to food, which had a major impact on improving quality.

It describes the dominant olive-growing systems in the country over the last two centuries and examines the main changes that have taken place from the mid-19th century to the present day, referring to the technological and structural changes that have occurred.

In particular, it refers to the pressure exerted on the sector by the authorisation to market peanut oil as edible oil as early as 1929, as well as the creation of the National Olive Oil Board shortly afterwards, in 1937, and later the emergence of a cooperative system with strong state support, accompanying the gradual increase in the importance of olive groves in terms of area, production and quality during this period.

It highlights the crisis in production and consumption brought about by the emergence, in the 1960s, of other edible oils derived from oilseeds such as safflower and sunflower, which were cheaper and well promoted through marketing. The crisis was exacerbated by rural depopulation and land abandonment, which were felt very strongly during this period. It also highlights how mechanisation, despite its advantages, disrupted a certain ecological balance by removing working animals – which were a source of soil fertility – thereby contributing to soil degradation and erosion.

In the 1990s, reports on the health benefits of the Mediterranean diet – and of olive oil as its main source of fat – led to a further shift in consumption patterns, with domestic producers struggling to meet this increased demand.

The sector has continued to evolve, but the second major ‘revolution’ took place with the commissioning of the Alqueva Multi-Purpose Project and the completion of the first phase of its irrigation scheme, at the start of the 21st century.

Thus, throughout this document, the changes in olive cultivation that have been taking place are discussed, along with the various factors that have influenced these changes, as well as the policies adopted regarding olive cultivation, the production and consumption of olive oil, and the technological advances that have led to a marked improvement in quality.

Finally, the study also reflects on current olive-growing systems and their relationship with innovation and rural development. As mentioned, its analysis already covers the impact of new hydro-agricultural developments in the Alentejo region and refers to the emergence of the dualism in olive cultivation currently existing in our country, which has been the subject of various public policies: on the one hand, traditional rain-fed olive groves; on the other, new large-scale, irrigated olive groves managed in vase or hedgerow systems using the most modern technology and applying much of the knowledge acquired in the meantime.

It concludes with a chapter devoted to olive-growing systems, innovation and rural development, which emphasises this duality in existing production systems and the dynamics associated with them, concluding with the need for public policies targeting both systems, as well as research and innovation.

This work dates back to 2014, and it is worth noting that this has effectively been the guiding principle of the public policies adopted by Portugal under the Common Agricultural Policy in its successive implementations: maintaining support interventions for traditional olive groves whilst, at the same time, supporting producers’ efforts in new irrigated plantations, which have completely transformed the landscape of olive production in the country and enabled Portugal to become a net exporter of high-quality olive oil.

Olive growing in *Agriculture in the History of Portugal*

CRISTINA SÁ

Office of Planning, Policy and General Administration (GPP)

Reference

TITLE: A agricultura na História de Portugal, pp. 65–66, 490–491, 533–535

AUTHOR: Eugénio de Castro Caldas

PUBLISHER: Empresa de Publicações Nacionais, Lda., Lisbon

DOCUMENT TYPE: Book

DOCUMENT LOCATION: <https://purl.pt/23019>

LANGUAGE: Portuguese

NUMBER OF PAGES: 599

YEAR OF PUBLICATION: 1998

Keywords: olive tree, olive oil, Mediterranean diet, healthy eating, edible oils

In these pages, Eugénio de Castro Caldas shows the importance of the olive tree and olive oil throughout history, highlighting their role in Mediterranean civilisations and the economic transformations of the 20th century resulting from the industrialisation of the food sector.

1. Introduction

The olive tree, scientifically known as *Olea europaea* L., is one of the oldest plants cultivated

by humanity, and is often considered the first tree to have been domesticated. Its significance extends beyond the agricultural sphere, taking on cultural, symbolic, economic and dietary importance.

2. Origin and spread of the olive tree

According to Alphonse de Candolle, an influential 19th-century botanist, the olive tree originated in the region of Asia Minor and Syria, where its cultivation is thought to have begun some 6,000 to 7,000 years ago. Studies indicate that it spread throughout the Mediterranean, encompassing Europe and North Africa. Wild forms of the olive tree already existed in various regions; in

Portugal they are known as ‘zambujeiros’.

Archaeological remains confirm the presence of the olive tree since the Upper Palaeolithic, highlighting its ancestral connection to humankind.

Another significant aspect is its longevity, with some trees dating back thousands of years, which reinforces its symbolic and historical value.

3. The olive tree in antiquity

In Classical Antiquity, the olive tree played a central role in Mediterranean civilisations, particularly in Greece and Rome.

The Greeks used olive oil as a staple of their diet, alongside bread, wine and honey: olive oil was considered highly nutritious and essential to health. Furthermore, it was also used on the body for cosmetic, therapeutic and sporting purposes.

The Romans, for their part, also attached great importance to the olive tree, considering its wood sacred and its branches symbols of peace, progress and victory. As the olive tree was one of the main crops on Roman rural estates, olive oil became a valuable commercial product, transported throughout the Roman Empire in amphorae.

Of the vast legacy left by the Romans in various fields, one cannot fail to mention, in this context, the work of Cato the Elder, *De agri cultura*, in which the author sets out rules on planting this tree, tending the surrounding land, harvesting the olives and the operation of the olive press. Although this work was written over 2,000 years ago, many of its teachings and fundamental principles remain relevant to olive cultivation in Portugal today, the main difference being that modern olive growing has transformed these foundations into a highly technological and intensive system.

4. The olive tree on the Iberian Peninsula

The introduction of the olive tree to the Iberian Peninsula is attributed to the Phoenicians and the Greeks, although it was during the Roman period that its production expanded significantly.

The olive oil produced in Hispania gained renown, being widely mentioned in ancient texts and becoming an essential product in both the diet and the economy.

During the Visigothic and Arab periods, olive cultivation remained significant; by the Middle Ages, olive groves were often situated near settlements, thus serving as an indicator of human presence.

5. Olive oil: a key player in various fundamental roles throughout the ages

- Food: the main fat used in Mediterranean cuisine;
- Lighting: fuel for lamps and altars;
- Medicine: used in the treatment of illnesses;
- Hygiene and beauty: for body and skin care.

This versatility demonstrates its importance in traditional societies.

6. Changes in the 20th century

6.1. Difficulties in the first half of the century

At the start of the 20th century, in Portugal, the agricultural sector was facing disorganisation and economic difficulties. To address this situation, economic coordination bodies were established in the 1930s with the aim of regulating production and trade. In the olive oil sector, the National Olive Growing Board (1931) and the National Olive Oil Board (1937) were particularly significant. Despite these measures, problems such as high production costs, low levels of mechanisation and irregular harvests persisted.

6.2. The second half of the century: competition from industrial oils

From the Second World War onwards, industrial edible oils such as peanut, sunflower and soya oils appeared on the market. These products, which were cheaper and produced on a large scale, became strong competitors to olive oil. In Portugal, peanut oil in particular had a major impact, significantly altering dietary habits, especially in the preparation of fried foods.

The emergence of these oils highlighted the crisis facing olive oil even more sharply, as they directly led to that product losing its competitiveness in the market.

However, it is important to note that the production of these oils relies on chemical extraction and refining processes, whereas olive oil is produced simply by pressing olives, making it a completely natural product and, consequently, much healthier.

6.3 Challenges facing olive oil:

- Competition from cheaper products;
- Fraud (adulteration with refined oils);
- Difficulty in ensuring quality;
- Abandonment of olive groves;
- Rising production costs.

7. Current situation and contemporary significance

Despite the difficulties, olive oil remains a product of great importance, particularly in the Mediterranean diet.

It differs from industrial oils in that it is natural and retains unique characteristics in terms of flavour, quality and nutritional value. Research has helped to improve production and reduce costs, enabling some recovery in the sector.

8. Conclusion

The history of the olive tree and olive oil reflects the evolution of Mediterranean societies over thousands of years. This product has been essential to diet, the economy and culture, and remains relevant to this day.

Despite competition from industrial oils, olive oil continues to stand out for its natural qualities and historical significance, serving as a symbol of Mediterranean identity.

Comment

Almost 30 years after the publication of this work, successive scientific advances have confirmed the importance of olive oil as the basis of a natural and healthy diet, in contrast to the chemical nature of the edible oils often – if not increasingly – used in the manufacture of food products. In recent years, palm oil has gained particular prominence, a subject not yet addressed by this author. Scientific studies seem to indicate that it is harmful to human health, particularly when consumed in considerable quantities.

This review therefore aims to highlight the importance of olive oil, so that its higher cost compared to oils obtained chemically from seeds is viewed not as a superfluous expense, but as an investment in our health and quality of life.

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