

Module 1 – Agroforestry for Multifunctional Olive systems
Course 1 - Introduction to Agroforestry for Olive multifunctional system
Chapter 2 - Olive Cultivation in the Mediterranean Region

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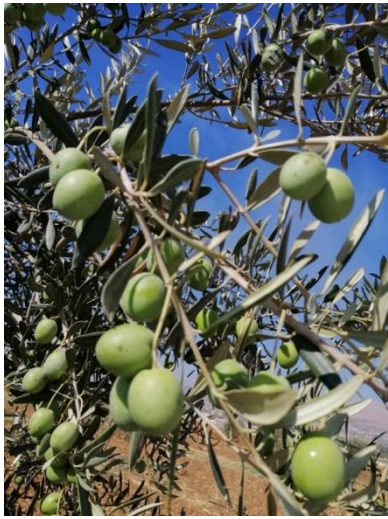
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Photos by Milad El Riachy

Introduction and History

- The olive tree (*Olea europaea*, L.) is a short evergreen tree or shrub that rarely exceeds 8–15 m in height. Its cultivation dates back 8000 years, and it is considered one of the first trees to be cultivated, even before the invention of writing
- Worldwide, olive has been called aceite, elaia, elaiwa, huile, olea, oleum, oil, oli, olive, oliva, zai, zait, zaitun, zeirtum, zeytin, zertum, zeta and zeytun
- Olive trees are cultivated in all the countries in the Mediterranean region. In addition, they have been more recently introduced to other regions with a similar climate, such as some countries of South America, South Africa, China, Australia, New Zealand, Mexico, and the United States



Introduction and History

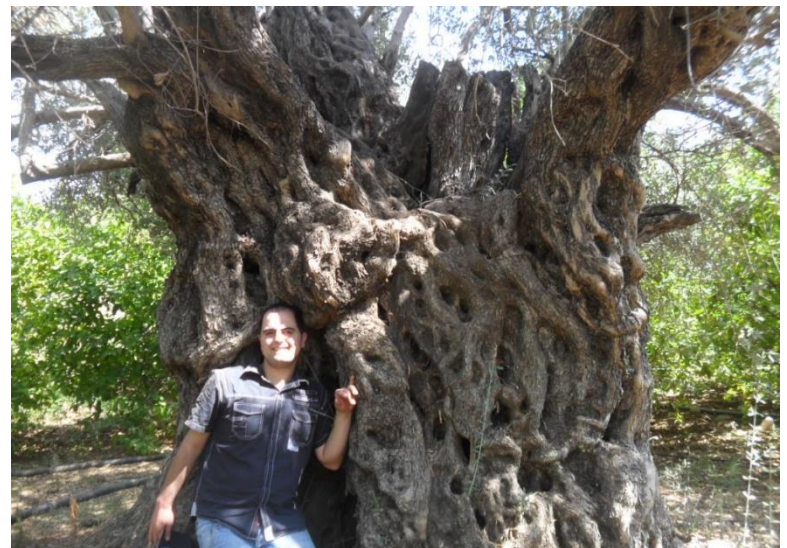


Photos by Milad El Riachy

- The olive tree has been cultivated since 6000 years BC east of the Mediterranean sea, in the Levant region which is represented today by the following countries: Lebanon, Syria, Palestine, Türkiye and Jordan
- For thousands of years, ancient Egyptians, Lydians, Ionians, Greeks, Romans, Seljuks and Ottomans cultivated olives and produced olive oil
- Phoenicians and especially Romans spread olive trees from the East Mediterranean region to Spain and Tunisia and introduced it to North Africa and the southern part of Europe
- Both olives and olive oil have had noteworthy social, economic, artistic and cultural effects on the civilizations of the countries in the Mediterranean basin

Introduction and History

- As part of the Near East Levant, where the olive tree was primarily domesticated, Lebanon has been home to the olive tree for millennia. Canaanites and later Phoenicians were said to be the first to plant olive trees in this region and to play a major role in spreading the olive tree around the Mediterranean during the Bronze Age (3500 - 1200 B.C.)
- One of their settlements, Byblos (a coastal town in central Lebanon), became the major port of the Mediterranean from which cedar wood and olive oil were exported to Egypt and other countries of the Mediterranean sea



Introduction and History

Photo by
Milad El
Riachy



Lebanon is home to ancient groves, and some of its olive trees are believed to be among the oldest in the world. This is the case for some olive trees of the Northern village of Bcheale, which date back at least 1500-1700 years, bearing witness to the long history of this tree in the country. These trees have important historical and ornamental values and are already classified as monumental



Photos by Ali Chehade

Economic Importance

- For thousands of years, the olive has been one of the most important sources of income for many civilizations in the East Mediterranean
- The actual estimated world olive growing area is approximately 10 million hectares; more than 90% of them are located in the Mediterranean Basin, mainly in Spain (25%), Tunisia (13%), Italy (11%), Morocco (10%), Greece (9%) and Türkiye (8%)

Olive growing area and yield (FAO, 2016–2018)

Country	Production (t)	%	Area (ha)	%
Spain	7,817,206	38	2,551,841	25
Greece	2,224,096	11	851,194	9
Italy	2,171,166	11	1,144,782	11
Türkiye	1,776,822	9	852,011	8
Morocco	1,338,896	7	1,024,707	10
Egypt	912,549	4	81,523	1
Algeria	747,225	4	429,217	4
Portugal	697,456	3	358,647	4
Tunisia	675,156	3	1,372,104	13
World	20,337,435		10,185,151	

- The world's production of olives is approximately 20 million tons, and the main producers are Spain (38%), Italy (11%), Greece (11%) and Türkiye (9%)

Economic Importance

Health Benefits

Olive oil has been part of human diets, and has been used for medicinal purposes, since ancient times.

- Over the last few decades, the growing awareness of olive oil's nutritional value has helped inspire increased demand for this tasty, healthy product, resulting in the expansion of olive tree cultivation into new areas
- Olive oil contains a high proportion of monounsaturated fatty acids (MUFA), as well as a significant amount of natural compounds called polyphenols which have antimicrobial, antioxidant, and anti-inflammatory properties, meaning they help prevent many serious, common diseases
- When used to replace animal fat, olive oil can help control cholesterol levels, as both the European Union and the US Food and Drug Administration (FDA) have acknowledged

Economic Importance

Health Benefits

In 2012 the European Food Safety Authority (EFSA) approved a health claim about olive oil that states, “olive oil polyphenols contribute to the protection of blood lipids from oxidative stress.” As Dr. Prokopios Magiatis explains, this “means protection of LDL cholesterol from oxidation, and consequently protection from heart attack and stroke.” The EFSA limited this claim to olive oils containing “at least 5mg of hydroxytyrosol and its derivatives (e.g. oleuropein complex and tyrosol) per 20mg of olive oil”; this also includes oleacein and oleocanthal

There are more of these polyphenols in some olive oils than others, with early harvest extra virgin olive oils (EVOOs) from certain olive varieties having the highest phenolic content and thus the greatest health benefits

Olive oil phenols have killed cancer cells in test tubes, decreased inflammation like ibuprofen does, and inhibited the growth of tumors

Economic Importance

Health Benefits

Scientific studies have provided support for claims that consumption of two to three tablespoons of extra virgin olive oil daily can reduce inflammation, improve “good” (HDL) cholesterol function, and provide the following health benefits:

- Extra virgin olive oil can help lower

- triglycerides
- blood pressure
- blood glucose levels
- total blood cholesterol
- “bad” (LDL) cholesterol

Extra virgin olive oil can help decrease the risk of and/or alleviate

- strokes
- depression
- skin cancer
- osteoporosis
- heart disease
- breast cancer
- type 2 diabetes
- rheumatoid arthritis
- Alzheimer's disease
- hardening of the arteries
- development of atherosclerosis

Source:

<https://www.greekliquidgold.com/index.php/en/health-benefits/olive-oil-health-benefits/164-health-benefits>

Economic Importance

- In the last five years, world olive oil production has been between 2 900 000 and 3 100 000 metric tons
- The world's leading producer is Spain, which each year produces up to 46 to 50% of the world's olive oil. Spain is followed by Italy, Greece, Tunisia, Türkiye, Morocco, Syria, Portugal and Algeria

Global production of VOO (IOC, 2020-2021)

Producing countries	M Tons	% Total
Spain	1371	46.6
Italy	285	9.7
Greece	255	8.7
Tunisia	229	7.8
Turkey	215	7.3
Morocco	151	5.1
Syria	119	4.0
Portugal	100	3.4
Algeria	88	3.0
Egypt	36	1.2
Argentina	31	1.1
Jordan	24	0.8
Chile	20	0.7
Australia	19	0.6

Economic Importance

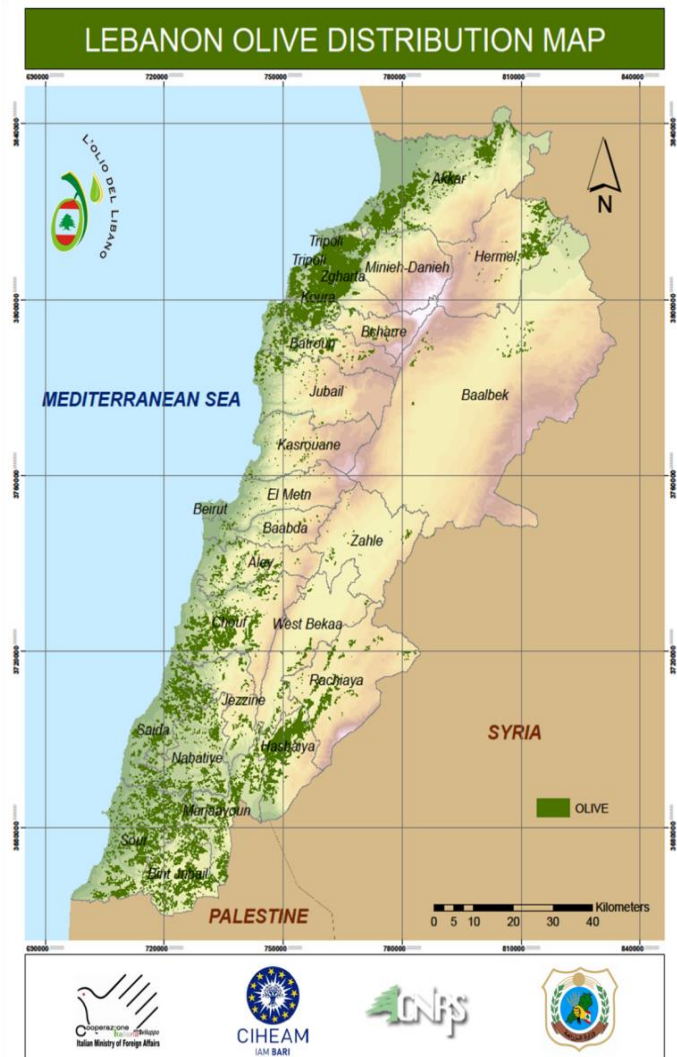
Olive oil represents only around 3% of the vegetable fats consumed by humans, so there is great potential for market expansion as consumers become more aware of its health benefits.

Global Consumption of VOO (IOC, 2018-2019)

Consuming countries	M Tons	% Total
Spain	525	17.8
Italy	500	16.9
Greece	130	4.4
Portugal	75	2.5
France	81	2.7
Germany	62.4	2.1
UK	60.5	2.1
Other EU	95.4	3.2
Total EU	1 529.3	51.8
USA	315.5	10.7
Turkye	163	5.5
Morocco	140	4.7
Syria	87	2.9
Algeria	78	2.6
Brazil	78	2.6
Japan	55	1.9
Australia	47	1.6
Canada	43	1.5
Other non EU	414.2	14
Total non EU	1420.7	48.2
World total consumption	2950	100

Economic Importance (Lebanon)

- The olive holds a major place in Lebanese Agriculture. According to the latest olive map prepared in 2010 by the Italian funded project “Olio del Libano,” the area under olive cultivation was estimated at 45,000 ha (about 18% of the total cultivated area)
- Olive trees are cultivated in the plain and on hills and mountains, from 45 to 1200 m above sea level. The olive orchards are distributed as follows: North Lebanon (40%), South Lebanon (39%), Bekaa region (13%) and Mount Lebanon (10%)
- Family plantations are typically fragmented in small orchards of 0.2 to 2.0 ha, although large orchards are more common in the main areas of cultivation in the southern and northern parts of the country (Chalak, 2013)



Olive cultivation areas in Lebanon (Azzone, 2009).

Economic Importance (Lebanon)

- The total olive yield in Lebanon is estimated at 85,200 tons (MOA, 2010)
- 80 % of the yield is used to obtain virgin olive oil, with the remaining 20% used for table olives
- The economic value of olive growing is estimated at US\$176 million, or approximately 20 per cent of the value of Lebanese agricultural plant production, with significant yearly fluctuations
- Around 10% of the national labor force is employed by the olive and olive oil sector, which offers thousands of seasonal jobs, mainly to perform manual harvesting and traditional milling

Photos by Milad El Riachy



Economic Importance (Lebanon)

- In Lebanon, the olive and olive oil industry is a traditional business which is commonly run by families in rural areas
- The olive and olive oil sector are recognized as vital for poverty alleviation, supporting livelihoods and fostering the anchorage of the Lebanese people to their land
- It has always been considered the backbone of the domestic economy in the parts of Lebanon where olive growing supports the livelihood of large numbers of small holder farmers (Chalak, 2012)



Photos by Milad El Riachy



Economic Importance (Lebanon)

- Lebanon has 492 olive mills and around 36 complementary industries including soap, coal, packaging and composting, which are mainly located in North and South Lebanon, providing many jobs



Photos by Milad El Riachy



Economic Importance (Lebanon)

➤ Olive and Olive Oil department at LARI

- + 1 Research laboratory (GC-MS; GC-FID; HPLC-DAD-FL; CE; TD-NMR, etc.)
- + 8 Routine analysis labs
- + 3 Collections of olive varieties



Photos by Milad El Riachy



Economic Importance (Lebanon)

➤ Ancient olive trees all over the country



Kawkaba



Kfarmatta



Al Mary



Berghouz

Economic Importance (Italy)

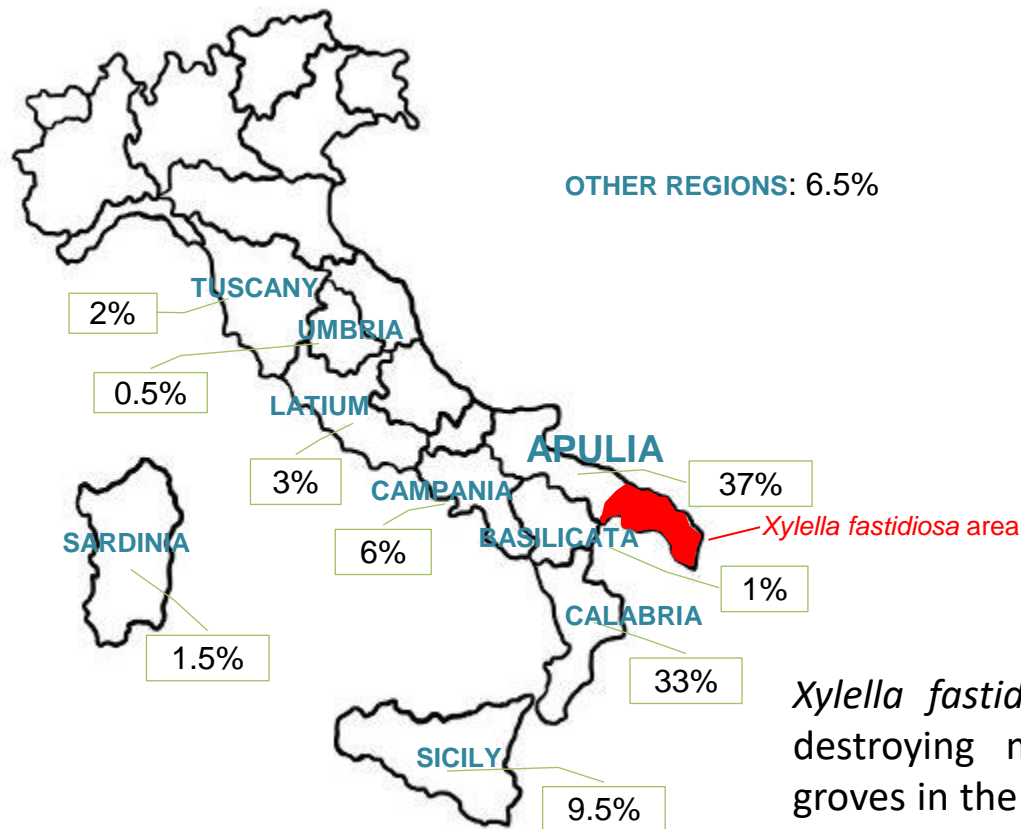
- Italy ranks 2nd in terms of **olive oil** production (**339,000 tons**), far behind Spain (1,491,500 tons) and closely followed by Greece (232,000 tons) and, outside the EU, Tunisia and Turkey

2021 (ISTAT Data)	Total surface (x 1,000 Ha)	Total production (x 1,000 ton)
Olives for oil	1,121	2,275
Table olives	35	91
Total olives	1,156	2,366
Total olive oil		339

- For the production of **table olives** Italy (**91,000 tons**) is certainly preceded by Spain (659,500 tons) and Greece (175,000 tons)
- Italy can boast the recognition of **43 PDO** and **3 PGI oils**, about half of those registered overall in the European Union
- The **economical value of the olive sector** in Italy stands at approximately **2.2 billion euros** for the **agricultural** phase (4.3% of Italian agricultural production) and **3.2 billion** for the **industrial** component
- Export** of the Italian olive oil amount to **1.53 billion euros**, 52% represented by the US (about 500 million euros), Germany and Japan

Economic Importance (Italy)

Regional distribution of olive growing in Italy



Most of the Italian olive groves are traditional, still preserving most of the cultivar patrimony

Apulia is the main olive producing region (37%), followed by Calabria (33%) and Sicily (9.5%)

Xylella fastidiosa emergency is destroying most of the olive groves in the south of the Apulia region

Economic Importance (Italy)

Main Italian olive cultivars



Economic Importance (Greece)

Olives and olive oil have been central to Greek life and the Greek economy since ancient times. For example, archaeological finds related to olive cultivation during the Minoan era confirm the importance of olives in everyday life and for the Minoan economy. Discoveries such as fragments of olive pits, lamps, parts of oil mills, and clay pots support the belief that the Minoans prospered largely thanks to olive growing

Today, olives and olive oil continue to have great economic, social, and environmental importance in Greece. The olive and olive oil sector provides main or supplementary employment for more than 450,000 rural families. Olive oil accounts for 7-10% of the agricultural GDP per year, and while bulk sales continue to dominate, increasing amounts of bottled olive oil are also being exported throughout the world

Photo by Lisa Radinovsky



Economic Importance (Greece)

Olive cultivation contributes decisively to the sustainability of disadvantaged areas, the maintenance of social cohesion in them, the protection of soils from erosion, and the preservation of the natural beauty of the Greek landscape

Olive growing is one of the most significant and dynamic sectors of the agricultural economy of Greece. Olives and olive oil are ubiquitous in Greek life: as a basic component of the Greek diet, and in archaeology, agrotourism, food tourism, art, and religion



Economic Importance (Greece)

Globally, Greece has a prominent position in the olive sector, claiming first place for the production of extra virgin olive oil (as a percentage of total production), the third spot in the production of olive oil, and fifth place for the production of table olives, in an average year. Greek olive oil production has ranged from 132,000 to 435,000 tons annually in the last two decades (depending on conditions)

In recent years, according to various accounts, 70-80% of the olive oil produced in Greece has been extra virgin. High quality Greek extra virgin olive oils and flavored olive oils have won many prizes at international olive oil competitions. High phenolic Greek extra virgin olive oils are also increasingly admired—and purchased at high prices—for their health benefits



Photos by Lisa Radinovsky



Economic Importance (Greece)

Olive cultivation in Greece covers more than one million hectares with 120 to 170 million olive trees. Approximately 20% of the total cultivated areas in Greece are covered by olive groves, with about 81% of the cultivated olive trees grown for their oil, while the remaining 19% produce table olives. Small family farms are common, and high-density plantations are fairly rare

Photos by Lisa Radinovsky



31 Greek olive oils and 11 of the country's table olives are recognized with the status of PDO (Protected Designation of Origin) or PGI (Protected Geographical Indication). The most commonly cultivated Greek olive variety is Koroneiki (55-60%). Other important Greek varieties include Mastoidis (Tsounati and Athinolia), Megaritiki, Manaki, Kolovi, Chalkidiki, Kalamon, and Conservolia (Amfissa)

Economic Importance (Greece)

Predominantly used for oil, the small Koroneiki olives yield especially delicious, healthy, aromatic oils. Conservolia, Kalamon and Gaidourelia olives dominate the table olive market. During the last six years, Greece has produced 175 to 315 thousand metric tons of table olives annually



Although olives thrive in almost all parts of Greece, the Peloponnese and Crete share 75% of total production. There are more than 200,000 olive growers in these two regions. The annual olive oil production there typically exceeds 200,000 tons, of which 90% may be extra virgin

Photos by Lisa Radinovsky



Economic Importance (Greece)



Economic Importance (Greece)



The ancient olive tree of Vouves, Crete (Photo by Lisa Radinovsky)

Economic Importance (Jordan)

- Jordan can be considered one of the homelands and natural habitats of cultivated olives. The olive tree has nutritional, social and economic importance in the life of the Jordanian people
- A joint report by Jordanian and French archeologists indicated that an ancient village (Hadeib Al-Reeh, in the Rum area of southern Jordan) could be the oldest site of olive tree cultivation in the world. Ash analysis from three village fireplaces revealed cultivation of olive trees dating back to the Chalcolithic period (ca. 5400 BC)
- In a scientific breakthrough achieved by a research team from the National Agricultural Research Center (NARC) and two Jordanian Universities, it was reported that the historical olive cultivar 'Mehras' from the 'Maysar' area in Hashemiya town of Ajloun is considered one of the oldest olive genotypes in the Mediterranean region



Photo by Salam Ayoub



Photo by Salam Ayoub



Photos by Salam Ayoub

Economic Importance (Jordan)

- Olive cultivation spreads throughout the Hashemite Kingdom of Jordan in its mountains, plain and desert areas, where olive cultivation is distributed over the three regions of the Kingdom (North Region constitutes 60%, Central Region constitutes 32%, and Southern Region constitutes 8%)
- The cultivation of olives in Jordan has developed remarkably, as the area planted with olives increased to reach 570,000 dunums, and the number of planted trees reached about 11 million trees, equivalent to 72% of the area planted with fruit trees and 20% of the total cultivated area

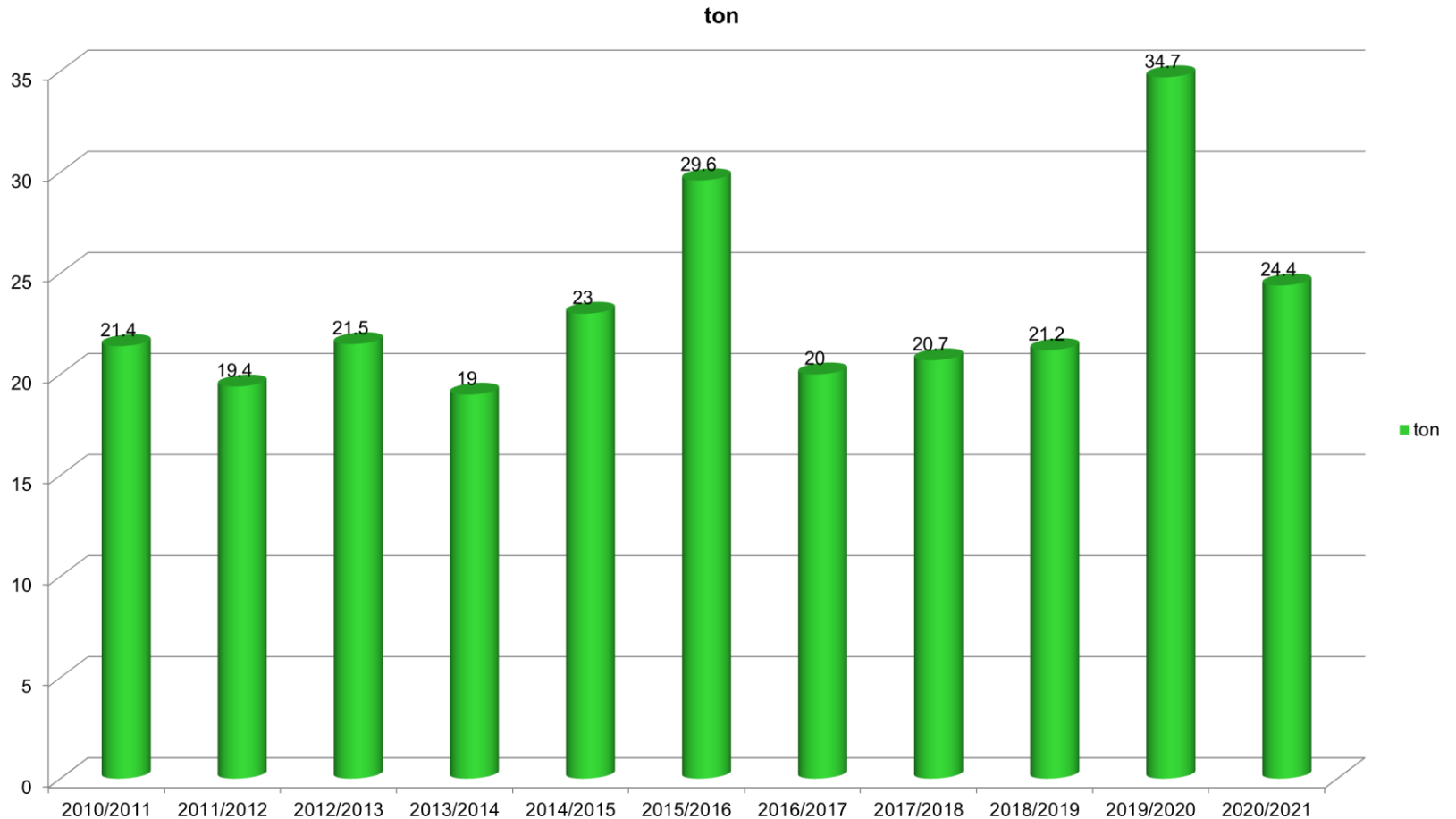


Photo by Salam Ayoub

Economic Importance (Jordan)

- The average annual production of olive fruits is estimated to be about 154,000 tons, 22% of which are used as table olives and 78% as olive oil
- The average annual production of olive oil is about 25 thousand tons
- Since 2000, Jordan has achieved self-sufficiency in olive oil and has begun a new stage of development by exporting olive oil to many countries of the world. The most important of which are the Arab Gulf countries and USA
- The number of olive mills in 2020/2021 reached 137 mills, 15 mills operating is two phase system, and 118 mills using the three phase system, and 4 using hydraulic presses
- The average production of olive pomace (solid waste) is around 43000 tons annually, which is used after drying and pressing as a substitute for fuel in the operation of mills and as domestic fuel for heating
- The annual production rate of the liquid waste (Zebar) is around 200,000 m³
- The average annual quantity of olive fruits allocated for table olives during (2011-2020) about 28000 tons. The average export of Processed Table Olive during (2011-2020) was 242 tons

Olive oil production in Jordan (1000 tons)



Source of data : Department Of Statistics

Economic Importance (Jordan)

- In order to put Jordan on the map of the world's olive oil producing and exporting countries, the Jordanian government joined the International Olive Council (IOC) at the end of 2002
- Jordan's membership in this council helped improve the quality of Jordanian olive oil and establish panels for the sensory evaluation of olives and olive oil
- Moreover, the National Agricultural Research Center; the scientific arm of the Ministry of Agriculture, has established the Olive Research Department, which is responsible for conducting studies and scientific research in the field of olive and olive oil technology to keep up with all global developments, by providing an infrastructure that includes research stations, olive oil laboratory and field gene bank for olive cultivars



Olive oil Laboratory at NARC



Photos by Salam Ayoub



Photo by Salam Ayoub



Photo by Salam Ayoub

Economic Importance (Jordan)

- In Jordan the main autochthonous cultivars are 'Nabali Baladi', 'Nabali Muhassan', 'Souri', 'Rumi', 'Kanabisi' and 'Nasouhi Jaba'
- Several clones of these cultivars are widely spread in different areas of Jordan and several names for their clones are known to depend on the region they were grown



Photo by Salam Ayoub



Photo by Salam Ayoub

Importance in Mediterranean culinary practices



Catalan pa amb tomaquet (bread +olive oil+ tomatoes)



French Provencal tapenade (puree of anchovies +caper + olive oil)



Greek moussaka (Eggplant and ground beef casserole)



Italian Pesto



Lebanese appetizers+olive oil

Olive oil is common in

Importance in Lebanese and Jordanian culinary practices

- Olive and olive oil are the heart and soul of Lebanese cuisine. Olives can be included in salads, and in several recipes with pasta, pizza, fish, potato, cheese and breads, labneh, fowl mdamas, tabbouli, hummus, baba gannouj, kibbeh, stuffed grape leaves, cabbage and koosa



Photos by Milad El Riachy



Importance in Greek culinary practices

- Olives and olive oil have long been central to Greek cuisine. Today, Greeks tend to have both on their table. They eat them with bread and in salads, and olive oil is poured onto many foods—everything from fish to boiled greens, from meat to grilled vegetables—as a finishing touch after cooking. Some Greeks claim to put olive oil on everything. Olive oil is used for stewing, sautéing, frying, and baking, and in salad dressings, marinades, and sauces. It is common in baked goods such as cookies, cakes, breads, and piecrusts, as well as casseroles and savory pie fillings



Photos by Lisa Radinovsky



Importance in Greek culinary practices

- Greeks consume more olive oil per person than anyone else in the world. There is a whole class of Greek foods so rich in olive oil that they are called “ladera,” or “oily,” since the lentils, beans, green beans, peas, cauliflower, spinach and rice, meats, and other foods are swimming in the olive oil that adds flavor and nutrients



Photos by Lisa Radinovsky



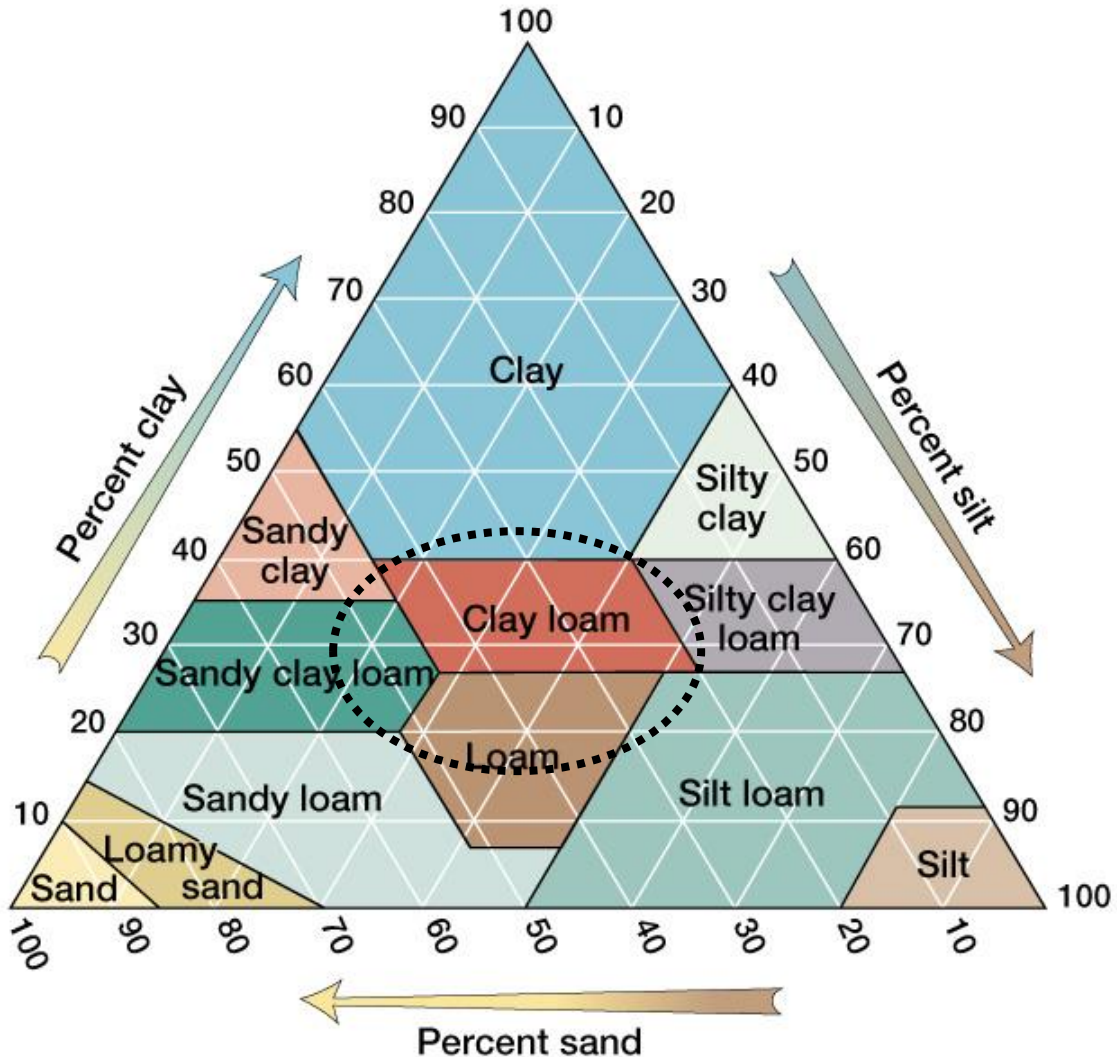
Importance in Italian culinary practices

- Up to the middle of the 20th century, **olive oil was considered just a source of fat** in the diet, along with animal and other vegetable fats
- In recent years, EVOO has acquired many new different roles, as a **beneficial healthy food** and as a **gourmet with high organoleptic value**
- EVOOs are now used in traditional and innovative cuisine as **food itself**, to make **sauces** and for **seasoning pasta, pizza, bread, fish, meat, soups, salads and marinated food**
- Olive oil is also **recommended for frying**, due to its high heat resistance that allows to improve dish taste and quality without degrading the nutritional value
- The latest trend is the use of **fruity EVOOs in pastry, for cake mixes, creams, ice creams, etc.**
- Consumers start to recognize EVOOs based on their **territorial origin**, the **varietal composition** and the **olive cultivation and oil mill technologies**



Geo-climatic requirements

Soil requirements



Geo-climatic requirements

- Soil properties such as soil water holding capacity also play noteworthy roles in olive tree development. Despite being well adapted to low fertility, shallow and poor soils, the best conditions for olive trees are deep, fertile soils with moderate water content
- Olives grow well on almost any well-drained and aerated soil with pH values of 6.5 – 8.5
- Olive trees are tolerant of mild saline conditions, but extremely salty soil should be avoided
- Olives prefer moderately fine textured soils ranging from sandy to silty clay, loamy soils



Geo-climatic requirements

Climate requirements: Temperature

- The olive tree is a typical Mediterranean species that can withstand long drought periods and high temperatures (above 40°C)
- An olive tree typically cannot withstand temperatures below -8°C for more than one week

Photos by Juan Caballero



- However, insufficient winter chill in coastal zone can severely reduce crop yields
- Spring frost can jeopardize production

Geo-climatic requirements

- Very high summer temperatures may also limit olive yield performances and the tree's photosynthetic rate if temperatures exceed 40 °C
- Hot, dry winds would jeopardize production, especially if accompanied by drought
- The optimum monthly mean temperatures for olive cultivation are approximately 7 °C in January and 25 °C in July

Precipitation

- Another very important climatic factor is precipitation. Although olive trees are drought-tolerant species, their distribution in arid zones is limited by annual precipitation lower than 350 mm
- About 90% of the olive trees grown in the Mediterranean Basin are primarily under rainfed conditions, and water availability is still considered an important resource to improve yields
- Drought can jeopardize production
- Severe droughts will kill olive trees; excess water can also kill the olive tree

Main Varieties



Photo by Milad El Riachy

- The large expansion area and long life of the olive tree explain the vast number of existing cultivars, over 2600
- The behavior of each variety in each region results from genetic determinism, which is expressed in the characteristics of each cultivar
- These genetic traits are then expressed in phenology, fruit ripeness, resistance to stress, resistance to pests and diseases, final yield and oil quality
- Despite the different characteristics of each cultivar, it is known that most of these expressions are also strongly conditioned by the pedoclimatic conditions prevalent in each olive grove.

Main Varieties

The most common cultivars in the main producing countries

Country	Main Cultivars
Spain	Arbequina, Aloreña, Cornicabra, Empeltre, Farga, Gordal Sevillana, Hojiblanca, Lechín de Sevilla, Manzanilla de Sevilla, Morisca, Negral, Nevadillo, Picual, Picudo
Greece	Amphissis, Chalkidiki, Conservolia, Kalamon, Koroneiki, Kolybada, Lianolia, Mastoidis, Megaritiki
Italy	Ascolana, Bella di Cerignola, Biancolilla, Bosana, Canino, Carolea, Casaliva, Coratina, Frantoio, Leccino, Moraiolo, Nocellara del Belice, Nocellara etnea, Ogliarola, Pendolino, Peranzana, Taggiasca
Turkey	Ayvalik, Domat, Erkence, Çakir, Memecik, Memeli, Uslu, Izmir Sofralik, Gemlik
Morocco	Picholine Marocaine, Dahbia, Haouzia, Menara, Meslala
Egypt	Aggizi Shame, Kosiem, Maraki, Meloky, Hamed, Sebhawi, Sinawy, Toffahi, Wateken
Algeria	Aaroun, Azeradj, Blanquette, Bouchouk, Chemlal, Ferkani, Khadraya, Hamra, Limli, Mekki, Sigoise, Roulette
Portugal	Galega, Corbrançosa, Cordovil, Verdeal Transmontana, Carrasquenha, Lentrisca, Madural
Tunisia	Chetoui, Chemlali, Oueslati, Chemlali Tataouine, Zalmati, Gerboui, Baroni, Rkhami

Arbequina

- Arbequina is a Spanish low vigor, very resistant and very productive variety; these characteristics make it ideal for use in super high density olive systems
- Arbequina trees are considered self-fertilizing, with an early entry into production, high and constant productivity; they also possess an excellent rooting capacity. They resist diseases such as tuberculosis, maculation of the leaf and verticillium, which can affect them only slightly; as for the cold, the Arbequina olive tree is widely resistant to low temperatures
- From the Arbequina olives we get an oil of high quality, even with low stability. Arbequina oil can be marketed both as monovarietal and with other oils that increase its stability



Photo by Luciana Baldoni

Baladi

- This variety is present in all the main areas where the olive is cultivated in Lebanon
- Baladi, the most widespread variety in Lebanon, has been shown to have a large morphological variability. This variability is most likely the result of its broad geographical distribution throughout Lebanon, so that it is associated with different environmental conditions and cultural practices, and of clonal variation after years of domestication
- In addition, the name “Baladi” has been used by farmers to indicate olive genotypes that were believed to be Lebanese. This has probably contributed to the great heterogeneity found under the name “Baladi”
- Baladi is mainly used for oil production, but also for table olives



Photo by Ali Chehade



Photo by Claudio Rannoccia

Baladi

- The production of the tree is very high and slightly alternant. Its self-fertility is very low; therefore, it requires the presence of pollinators
- Baladi trees are susceptible to the olive fly and the olive moth, which makes the monitoring of these insects particularly important
- During olive ripening, the fruit pulp consistency can be considered high until mid October; afterwards it becomes medium. Therefore, the risk of damage from olive handling, transport and storage, which could decrease oil quality, is low
- Fruits become black at maturity (after mid-October), with an average weight of 1.7g and high oil content (28%). The percentage of oleic acid is around 66%, and the phenolic content is between 162-277 mg/kg of oil
- All the qualitative parameters of the oil meet the IOC's trade standards for extra virgin oil. The only exception is represented by Δ -7-stigmastenol, which sometimes has values higher than 0.5%, the maximum value allowed by IOC trade standards. This means that its content has to be carefully controlled before selling it on international markets. If it is too high, it is recommended to blend Baladi oil with other olive oils in order to reduce its concentration

Chemlali

- Chemlali olive trees originated in Tunisia, on the African coast of the Mediterranean Sea, where this cultivar has demonstrated exceptional tolerance to cold. The Chemlali tree is highly tolerant to salt water damage to leaf tissues, and the roots are very drought resistant in the sandy soils. Chemlali is a self-compatible variety characterized by early flowering. It produces a high amount of pollen
- Extra virgin olive oil from Chemlali has a low amount of oleic acid (55-59%), and a high content of linoleic acid (16-20%), far more than other oils



Photo by Luciana Baldoni

Coratina

- Coratina is one of the most important Italian olive varieties. It is especially beloved in the area of Puglia, which is home to the largest olive growing region in Italy
- The Coratina olive tree is a moderately vigorous tree with pendulous trend shape with medium size dark green elliptical leaves. The fruit is ovoid with a big to medium caliber (5g) and good oil yield
- The Coratina variety is characterized by early entry into fruiting and high productivity, even in hot, dry climates and rocky soils
- Coratina produces fruity oils with a very high content of phenolic compounds



Photo by Luciana Baldoni

Doebli

- This cultivar is mainly concentrated in the coastal area of Syria, an area with relatively high rainfall
- It is one of the most important cultivars in Syria, as it covers about 12% of the total surface cultivated with olives
- The production, even if strongly alternant, is high
- It is mainly used for oil production, but the olives are also processed as table olives
- All the qualitative parameters of the oil meet the International Olive Council's (IOC's) trade standards for extra virgin oil, with the exception of Delta-7-Stigmastenol, which is sometimes higher than 0.5%



Frantoio

- Frantoio is an Italian olive variety, originally from the region of Tuscany
- Frantoio olives produce extra virgin olive oil of high stability and excellent quality; it is highly valued in Italy and worldwide
- The olive variety Frantoio is rustic and also has very good characteristics for oil production
- The Frantoio olive tree produces early and has early high productivity. The entry into production is affected by climatic influences, with delays in hot and dry areas
- Compared to other varieties, Frantoio requires a greater number of chill hours to obtain maximum productive potential



Photo by Luciana Baldoni

Hojiblanca

- The Hojiblanca variety is the third most important in Spanish groves. Proof of this lies in the almost 18 million olive trees currently growing throughout the heart of Andalusia. These trees can adapt to extreme soils and climates
- The Hojiblanca is a prestigious variety, and a major commercial brand of olive oil uses its name. Its fruits are more and more frequently consumed as table olives in Spain, mainly due to its acceptable quality and easy harvesting
- The fruits of Hojiblanca ripen very slowly and delay the harvest, a fact that leads to certain amount of alternation of high and low yield years, particularly among the oldest cultivars
- The oils from Hojiblanca are highly prized in both the single-varietal version and when combined with others to make a coupage



Photo by Luciana Baldoni

Khodeiry

- This cultivar is mainly concentrated in the coastal area of Syria, an area with relatively high rainfall
- It is one of the most important cultivars in Syria, as it covers about 10% of the total area cultivated with olives
- The production is high and quite constant. The presence of pollinators is important
- It is mainly used for oil production (25.3%), but the olives are also utilized as table olives
- All the qualitative parameters of the oil meet the IOC's trade standards for extra virgin oil, with the exception of Delta-7-Stigmastenol, which is sometimes higher than 0.5%
- Because of its characteristics, especially the high and slightly alternant production of oil, this cultivar is recommended in the establishment of new orchards in the areas where its cultivation is concentrated

Leccino

- The Leccino olive is one of the primary olive cultivars used for the production of olive oil
- Originating in Tuscany, Leccino is one of the main olive cultivars found in Italian olive groves, and it is now grown all over the world
- The Leccino tree grows well in cooler climates, but it is not as tolerant to heat as Spanish olive cultivars. The tree grows quickly and has a dense canopy. It tends to be highly productive under good conditions and has a tendency to grow more like a tree than a bush, unlike most olive trees
- Average oil yield is 18-21% of the fruit. It is not self-pollinating, but requires the presence of another cultivar, commonly Pendolino, for pollination

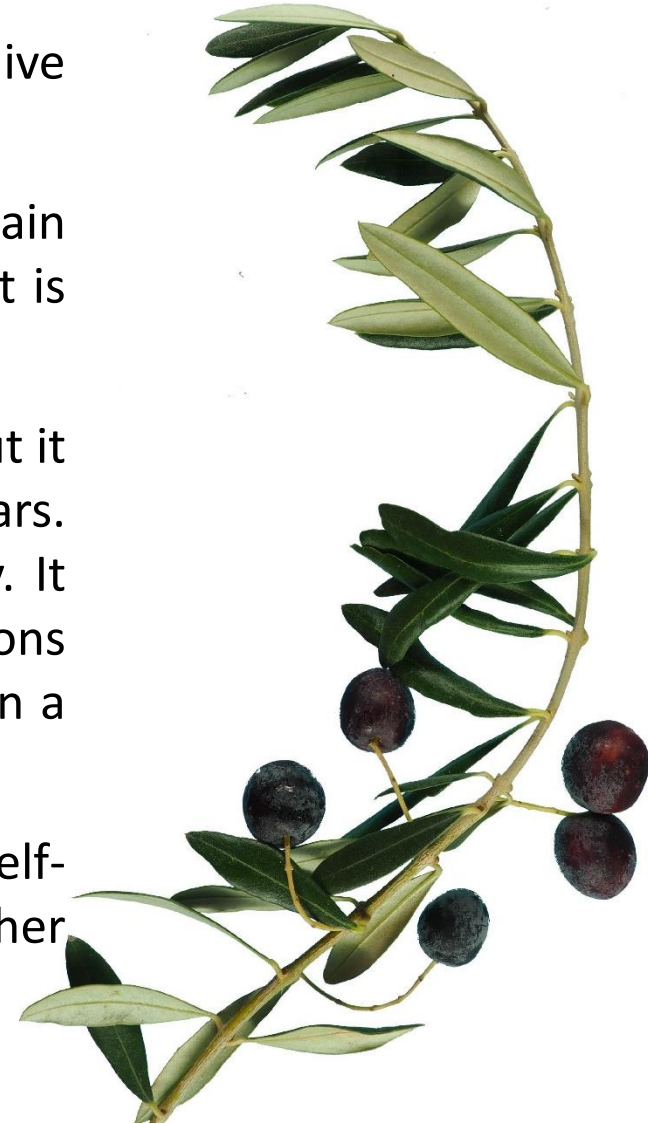


Photo by Luciana Baldoni

Manzanilla de Sevilla

- Manzanilla de Sevilla (in Spain), originally from the area of Seville, Spain, is now grown in many geographic areas around the world
- Manzanilla olives are dual-purpose, used for both table olives and olive oil
- Manzanilla de Sevilla has a well balanced, delicate, bitter-salty flavor, and it can be consumed in both green and black (ripened) states



Photo by Luciana Baldoni

Nabali or Nabali Baladi

- The Nabali cultivar is one of the most widespread local cultivars in Palestine. It is suitable for both table olives and oil
- Its name comes from a village near Jerusalem, Bier Nabala. The Nabali tree is sensitive to adverse weather conditions during flowering and thus has a tendency for inconstant and alternate bearing
- The Nabali is characterized as medium strength, with scattered twigs and moderate canopy structure. Flowers bloom from the end of March to April. The average weight of the fruit during ripening is 2.5 grams, and the average seed weight 0.39 grams
- Fruits become black at maturity (after mid-October), with an average length of 2.2 cm, average diameter of 1.46 cm and high oil content. The percentage of oleic acid is around 66.2%, and the phenolic content is around 380 mg/kg of oil

Picholine Marocaine

- Picholine Marocaine is a variety originally raised in Morocco. Today, 96-98% of olives grown in Morocco are from this variety. The fruits are harvested both when green, for table olives, and when ripe, for olive oil
- This variety is very close to the French Picholine variety, which is also called Picholine de Languedoc
- The Picholine Marocaine olive variety has high vigor and an erect port with elliptical-lanceolate leaves
- Picholine Marocaine is very resistant to the aridity of African lands
- The Picholine olive tree is of medium precocity and high productivity; its precocity is improved in olive groves in cooler areas
- Picholine extra virgin olive oil is of excellent quality; it is highly appreciated in Morocco and in the rest of the world



Photo by Luciana Baldoni

Soury/Sorani

- This cultivar originated in the Lebanese town of Sour (Tyr), and now it is cultivated primarily in northern and southern Lebanon
- Like Baladi, Soury is one of the main Lebanese cultivars. The olives are used for the production of oil and as green table olives
- The production, even if mostly alternant, is high. Its self-fertility is very low; therefore it requires the presence of pollinators
- It is important to remember that previous studies have shown a large morphological variability within the Soury denomination. This variability is most likely the result of its broad geographical distribution throughout Lebanon, so that it is associated with different environmental conditions and cultural practices, and of clonal variation after years of domestication



Photo by Ali Chehade

Soury/Sorani

- The fruits are red at turning color and then black at full ripeness (after mid-October), with an average weight of 2.7 grams and a high oil content (31%). The percentage of oleic acid is about 67.5%, and the phenolic content ranges from 364 to 414 mg/kg oil
- Basically, all the qualitative parameters of the oil meet the IOC trade standards for extra virgin oil. The only exception is represented by Δ -7-stigmastenol, which sometimes has values higher than 0.5%, the maximum value allowed by IOC trade standards



Photo by Milad El Riachy

Conclusions

- The olive tree is a typical Mediterranean species that can withstand long drought periods and high temperatures (above 40 °C)
- The production of olive oil is important in the Mediterranean region, agriculturally, economically, and even culturally
- Recent studies have showed that this crop can be strongly affected by climate change. The expected increase in temperatures may increase the growing season's length. This will also lead to changes in the phenological timings, particularly in flowering, with potentially detrimental impacts
- Higher temperatures and evapotranspiration also accelerate fruit ripening, invoking the need for early harvests, though at lower maturity levels
- Insufficient chilling results in a low fruit setting, with detrimental consequences for final yields, as some olive varieties produce deformed floral buds and fruits under these circumstances

Conclusions

- To better prepare for the impact of climate change, the following efforts should be undertaken:
 - Breed tree cultivars with lower chilling requirements
 - Use management practices such as sparse planting and heavy pruning to avoid severe water stress
 - Plan interventions that improve connections between cooperatives and stakeholders in their area, in order to ensure transparency, effectiveness and clarity of vision
 - Invest in innovations and technology that can improve the sector on several levels, such as disease detection, crop analysis, increased awareness, and marketing

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