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Olive oil market: economic aspects and impact of *Xylella fastidiosa*



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Summary

The object of this thesis is to analyse the olive oil market. The thesis starts from a global view of the state and goes into the details of the Italian case.

The work starts with a general overview of the product, describing the characteristics of the plant and its origins. This first part is fundamental to understand the type of product to be analysed, its importance and its richness from all points of view for Italy.

In the next chapter the olive oil market will be analysed: demand and production will be investigated from a quantitative and qualitative economic point of view. We will start from the world situation and then go specifically to the Italian one, in order to have a clear picture of the world situation and Italy's role in it.

The import and export of this product at world level and the central role of Italy will be reported.

Finally, an economic analysis will focus on the phenomenon of *Xylella Fastidiosa*, which has affected and is still affecting the Italian olive oil market, especially in the Apulia region, and on all those variables that affect national production and consequently consumption, imports and exports.

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1. Olive Oil

1.1. Definition

Olive oil is a liquid fat obtained from the fruit of *Olea europaea*, of the Oleaceae family, a traditional arboreal tree from the Mediterranean basin, obtained by pressing olives and extracting the oil.

Pure olive oil is widely used for various purposes in the agricultural and food industry, for example in the preservation of foods. This component is also used in the textile industry for wool, in the manufacture of products and cosmetics, in the pharmaceutical industry for the manufacturing of soap of high castile and as a lubricant.

1.2. Origins: History and Legends

The olive has its origins in Asia Minor, but it spread from Iran, Syria, and Palestine to the rest of the Mediterranean basin about 6,000 years ago.

Olive is among the oldest known cultivated trees in the world, being grown before the written language was invented. It was being grown on Crete by 3,000 BC. and olive oil production and trading were also set out in the famous Babylonian Hammurabi Code. The Phoenicians spread the olive to the Mediterranean shores of Africa and Southern Europe. Olives have been found in Egyptian tombs from 2,000 years BC. and olive branches adorned the tombs of the pharaohs to accompany them in the afterlife as symbol of eternal life and fertility.

Legend states that Zeus offered a contest between Athena and Poseidon for the possession of Athens. Poseidon raised up his three-pronged trident, smashed it upon the hard rock of the

Acropolis and out a salt spring sprang. Athena on the other hand produced an olive tree, its rich fruits bountifully dangling from the branches.

The Athenians chose Athena's gift, and the olive tree has remained a central part of Greek life ever since for all its profound qualities.

The leaves have been used to crown the heads of victorious athletes, generals and kings, the wood used to construct useful tools, the oil used to give fuel to lamps, rubbed into the bodies of athletes and warriors, added to all food dishes and to the olives themselves. It became a staple in the Mediterranean diet and a valuable export throughout antiquity and today.

The olive culture was spread to the early Greeks then Romans. As the Romans extended their domain, they brought the olive with them, introducing its cultivation in every occupied territory and promoting its growth in Spain, North Africa and in the whole Mediterranean area. Olive oil thus became one of the hubs of the Roman economy, as demonstrated by the existence of the "arca olearia" a sort of olive oil commodity exchange.

First to classify the oils according to their characteristics, the Romans were also precursors in the definition of the technical and theoretical principles that are still at the base of the production of a high-quality oil. In the writings of the most famous Roman authors, a deep knowledge on the theme had been collected, of which we are now the proud heirs. An edible oil should be good, pleasant to the taste, but also both healthy and nutritious; all these qualities can be achieved only by respecting a strict "product specification", like the one included by Cato in his treatise "De Agricultura". In this opera Cato explains that, among the olive harvest and the extraction of the oil, the shortest time as possible should pass is exemplary. He states: "Olea ubi lecta siet, oleum fiat continuo, ne corrumpatur" wrote the Censor, that can be translated in: "When the harvest is accomplished, you must crush the olives as quickly as possible so that the oil not spoil". Then he continues admonishing: "Si in terra et tabulato olea nimium diu erit, putescet, oleum foetidum fiet : ex quavis olea oleum viridius et bonum fieri potest, si tempori facies" that means that if the olives will stay a long time in the ground or on the boards, the oil will be fetid and it

will stink: a very green and good oil can be obtained from every variety of olives if you do it in time.

The roman cultivation and extraction techniques remained nearly unchanged until the first years of twentieth century. In the ancient Rome the crushing of the olives was performed thanks to the trapetum, a large mortar carved in stone, inside which one or two vertical millstones spun around a vertical axis, or by means of a mola olearia. This machinery consisted of a fixed circular base with the arm of a wheel millstone fixed to a central axis. The vertical distance between the millstone and the base could be regulated so that olive stones would not be smashed. The olive paste obtained by means of trapeta or molae oleariae was spread on vegetal fiber disks (fiscula) which were stacked up and pressed with the torcular. These presses were operated by lever, winch, or screws. The pressing surface was made of stone or of little clay bricks. On its border there was a channel carrying the oil mixed with water into a container. The oil-water mixture was then poured into another wide mouth earthenware jar where the separation was gradually obtained due to the floating of the oil above the water.

With the fall of the Roman Empire and the barbarian invasions, olive cultivation and olive oil trade in the Italian peninsula slowly started to decline, but a strong impetus was given by the hard-working and tenacious monks of various religious orders. During this period the ideal center of gravity of the olive oil tradition moved from the Roman to the Christian Civilization.

1.3. Plant Characteristics

The olive, botanical name *Olea europaea*, meaning "European olive", is a species of small tree in the family Oleaceae, found traditionally in the Mediterranean Basin. Now a day, various species are cultivated in all the countries of the Mediterranean, as well as in Australia, New Zealand, North and South America and South Africa.

Olea europaea is the type species for the genus *Olea*. The olive tree, *Olea europaea*, is an evergreen tree or shrub native to Mediterranean Europe, Asia, and Africa. It is short and squat, and rarely exceeds 8-15 m in height. The silvery green leaves are oblong, measuring 4-10 cm long and 1-3 cm wide. The trunk is typically gnarled and twisted.

The small, white, feathery flowers, with ten-cleft calyx and corolla, two stamens, and bifid stigma, are borne generally on the previous year's wood, in racemes springing from the axils of the leaves.

The fruit is a small drupe 1-2.5 cm long when ripe, thinner-fleshed and smaller in wild plants than in orchard cultivars. Olives are harvested in the green to purple stage. Canned black olives have often been artificially blackened and may contain the chemical ferrous gluconate to improve the appearance.



Figure 1: Olives at the green to purple stage Source: <https://bellapugliasrl.weebly.com>

The olive tree goes through a period of vegetative rest that coincides with the coldest period, for an interval that depends on the severity of the climate. When the vegetation starts, which is usually in February, flower differentiation also takes place. From May to the first half of June, depending on the variety and region, an abundant flowering takes place. However, the percentage of flowers that will bring fruit is very small, generally less than 2%. After the first fruits are born there is an initial phase of fruit growth, which stops when the lignification of the endocarp begins. This phase, known as “hardening of the kernel” and can occur in July and lasts until approximately the beginning of August.

When the endocarp is completely lignified, the fruit starts to grow again, more intensely depending on the weather. Considering a non-irrigated condition, both growth and the accumulation of oil in the lipovacuoles is deeply influenced by rainfall from mid-August to the end of September. In fact, in dry conditions, the olives remain small, may undergo intense dropping, and will give a very low oil percentage per unit area. On the contrary, in favorable humidity conditions, the olives reach full development in September. Finally, late rains (late September to October) after a strong summer drought can increase the size of the olives considerably in a few days, but the oil yield will be very low because the olive accumulates mainly water.

There are hundreds of cultivars of the olive. As one of the oldest and more important domesticated crops raised by humans, the olive tree has diverged naturally and with the assistance of man into many varieties. Olive cultivars are, on a first analysis, divided into their location of origin, in fact most cultivars names come from place names. Secondarily, olives may be preferred for olive oil production or for eating as table olives, though many cultivars are dual-purpose.

Cultivars are classified into three groups:

- Oil cultivars,
- Catering cultivars,
- Dual purpose cultivars.

Oil' cultivars are characterized by a high lipid content and good oil percentage; the fruit is small to medium sized. The 'table' cultivars, on the other hand, have a lower oil yield but are larger and are sold for direct use. Cultivars can vary in color, ripening time and fruit size, as well as oil content.

Among the most important species cultivated in Italy for quality and quantity we find:

- Cerignola, originates from the south-eastern Italian province of Apulia, are very large, mild in flavor, and may be served either green or cured red or black.
- Coratina, one of the most important Italian varieties, especially appreciated in Puglia, the largest olive growing area of Italy, is also available in Argentina, Australia, and Northern California. This olive has a naturally high level of polyphenols, which yield a robust olive oil taste.
- Dritta, a variety of olive tree typical of the DOP area known as Aprutino Pescararese in the province of Pescara (Abruzzo). Its olives yield an extra virgin olive oil that presents extraordinary chemical and organoleptic qualities.
- Nocellara del Belice is a large green olive cultivar primarily grown in Sicily. They are also known as Castelvetro olives in the United States and thanks to their mild, buttery flavor they are popular table olives, though they are also used to produce olive oil.
- Leccino olives, along with Frantoio cultivars, with their mild sweet flavor, are the principal raw material for Italian olive oils from Tuscany.

1.4. Olive oil production

1.4.1. Olive harvest

Olives are traditionally harvested on nets, in some regions by beating the branches with flexible sticks, so as to cause the fruit to detach, or in others, by waiting until they are fully ripe and then falling naturally from the tree. In Italy it is harvested from mid-October to the end of December. A more modern technique involves the use of mechanical harvesters that shake the branches and cause the olives to fall onto a net set up on the ground; this method allows them to be harvested more quickly and with less effort.

Harvesting by hand, with combs and shoulder bags on long wooden ladders, is still practiced in many areas of Italy. This technique is surely the most expensive and time-consuming, but it gives the possibility of a more careful selection of the fruits, allowing to pick fruits intact and at the right degree of ripeness. It is still preferable for preserving olives, but it is the first of the fundamental elements in obtaining a fragrant extra virgin olive oil free of unpleasant odors.

There are fully mechanized harvesting methods using shaking machines with umbrella-shaped olive interceptors. In modern olive groves cultivated for this purpose (super-intensive), harvesting is also carried out using shaking machines that are also suitable for mechanical grape harvesting.

1.4.2. Extraction

Major olive oil production is based on exclusively mechanical extraction processes. This distinguishes "virgin" oils from those obtained by processes based on physical and chemical methods (seed oils, rectified and refined olive oils, pomace oils).

The process is generally as follows:

1. The olives are ground into paste using large millstones (traditional method), hammer, blade, or disk mill (modern method).

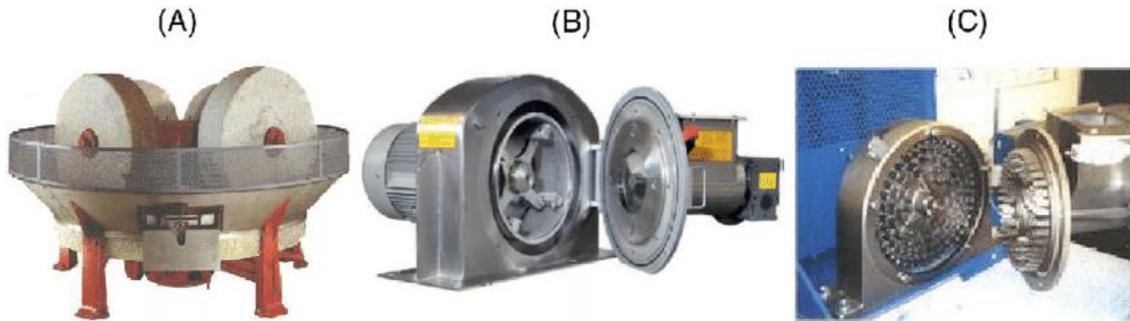


Figure 2: (A) millstones, (B) disk mill, (C) hammer. Source: <https://www.researchgate.net>

2. When ground with millstones, the olive paste generally stays under the stones for 30 to 40 minutes. After grinding, the olive paste is spread on fiber disks, which are stacked on top of each other in a column, then placed into the press. Pressure is then applied onto the column to separate the vegetal liquid from the paste. This liquid still contains a significant amount of water. Traditionally the oil was separated from the water by gravity (oil is less dense than water). Today this very slow separation process can be replaced by centrifugation, which is much faster and more thorough. The centrifuges have one exit for the (heavier) watery part and one for the oil.
3. Modern grinders can reduce the olives to paste in few seconds. After grinding, the paste is stirred slowly for additional 20 to 30 minutes in a particular container (malaxation), where the microscopic oil drops aggregate into bigger drops, in order to facilitate the mechanical extraction. The paste is then pressed by centrifugation. The water is thereafter separated from the oil in a second centrifugation process like the one described before. The oil produced by only physical (mechanical) is called virgin oil. Extra virgin olive oil is virgin olive oil that satisfies specific high chemical and organoleptic criteria: low free acidity and no or very little organoleptic defects.

The grade of extra virgin olive oil is highly dependent on favorable weather conditions; a drought during the flowering phase, for example, can result in a lower quality (virgin) oil. It is worth mentioning the fact that olive trees produce well every couple of years, so greater harvests occur in alternate years (the year in-between is when the tree yields less). However, the weather is still a critical factor in determining the oil quality. Sometimes the produced oil will be filtered to eliminate remaining solid particles that may reduce the shelf life of the product. Labels may indicate the fact that the oil has not been filtered, suggesting a different taste. Fresh unfiltered olive oil usually has a slightly cloudy appearance and is therefore sometimes called cloudy olive oil. This form of olive oil used to be popular only among small scale producers but is now becoming "trendy", in line with consumer's recent preference for products that are perceived to be less processed. In general, however, if the oil is not tasted or consumed soon after production, filtered olive oil should be preferred.

1.4.3. Bottling

The final part of the production chain involves bottling the oil. This is certainly one of the most delicate phases because it is necessary to reduce contact with air (the oil's enemy) during decanting.

Packaging is carried out by specific equipment that allows the oil to be poured into suitable containers immediately after milling.

The operation can be preceded by a filtration phase to eliminate opalescence, an effect that, as said before, is not always appreciated by the consumer. Immediately after this stage, the oil is bottled and hermetically sealed to avoid altering its organoleptic properties.

The containers must be made of dark glass to protect the oil from contact with light, one of the possible causes of deterioration. As an alternative to glass, tinfoil containers, which have been previously treated with antioxidant materials, can be used.

The overall time of the operation is an additional critical factor during the bottling phase. The operation must be quick to preserve the taste and flavor of the freshly pressed olive. As a rule, the equipment available for bottling deals with sizes ranging from 250ml to larger sizes of up to 5 liters.

1.5. Nutritional properties and product characteristics

Extra virgin olive oil is one of the cornerstones of the Mediterranean diet. Thanks to its composition of 'good' fatty acids and other beneficial substances, it has important properties: it reduces blood cholesterol levels, fights hypertension, prevents diabetes, osteoporosis, and cardiovascular disease.

The composition of extra virgin olive oil consists of numerous vitamins and substances with important nutritional properties that give it an antioxidant nature³, such as:

- tocopherols, which include vitamin E,
- sterols,
- polyphenols,
- pigments, such as carotenoids (beta carotene) and chlorophylls (which give olive oil its characteristic green colour).

Extra-virgin oil, being a food of vegetable origin, consists mostly of fatty acids. Of these, 75% are unsaturated fats, the most abundant being oleic acid, the quantity of which, according to the standards laid down by the International Olive Oil Council 1, must be between 55% and 83% of the total fats present in the oil itself.

NUTRIENTS	AMOUNT 100g
Water	traces
Carbohydrates	0
Proteins	0
Fats	99.9 g
Cholesterol	0
Vitamin A	36 µg
Vitamin E	22.4 mg
Polyphenols	50 mg

Table 1: Amounts of some nutrients contained in EVO olive oil

Extra-virgin oil due to his high percentage of fat, is undoubtedly a caloric food: a single tablespoon of the product contains 89.9 Kcal.

The nutritional values of extra-virgin oil also depend on its composition, which is not always constant or univocal, but can depend on:

- type of cultivar
- the production area,
- the degree of ripeness of the olive,
- the method of oil extraction.

One parameter used to categorize an oil is its acidity. In this context, "acidity" is not intended as chemical acidity (measured by pH), but it is the percent (measured in weight) of free oleic acid. Measured by quantitative analysis, acidity is a measure of the hydrolysis of the oil's triglycerides: as the oil degrades, more fatty acids are freed from the glycerides, increasing the level of free acidity, and thereby increasing hydrolytic rancidity.

Another measure of the oil's chemical degradation is the peroxide value, which measures the degree to which the oil is oxidized by free radicals, leading to oxidative rancidity. Phenolic acids present in olive oil also add acidic sensory properties to aroma and flavor.

The grades of oil extracted from the olive fruit can be classified as:

- **Virgin.** This term indicates that the oil was produced by the use of mechanical means only, without any chemical treatment. The term virgin oil with reference to production method includes all grades of virgin olive oil, including Extra virgin, Virgin, Ordinary virgin and Lampante virgin olive oil products, depending on quality.
- **Lampante virgin oil** is olive oil extracted by virgin (mechanical) methods but not suitable for human consumption since does not receive further refining; “lampante” derives from “lampa”, the Italian translation of “lamp”, referring to the earlier use of such oil in oil lamps. Lampante virgin oil can be used for industrial purposes or can be subsequently refined to make it edible.
- **Refined olive oil** is the olive oil obtained from any grade of virgin olive oil by refining methods which do not lead to alterations in the initial glyceridic structure. The refining process is aimed at removing color, odor, and flavor from the olive oil. The result is a very pure form of olive oil that is tasteless, colorless, and odorless and extremely low in free fatty acids. Olive oils marked with the grade of Extra virgin olive oil and Virgin olive oil therefore cannot contain any refined oil.
- **Crude olive pomace oil** is the oil obtained by olive pomace, that is the leftover paste after the pressing of olives for virgin olive oils. The raw material is treated with solvents or other physical treatments in order to obtain the exclusion of oils by re-esterification processes. Finally, it is then further refined into a refined form of olive pomace oil and once re-blended with virgin olive oils for taste, is then known as Olive pomace oil.

1.6. Label

1.6.1. Compulsory indications

The indications that must be compulsorily reported on the label of olive oil are the following:

- The sales denomination:

The sales denominations that may be used are:

- "EXTRA VIRGIN OLIVE OIL".
- "VIRGIN OLIVE OIL".
- "OLIVE OIL - COMPOSED OF REFINED OLIVE OILS AND VIRGIN".
- "OLIVE-POMACE OIL".

- The designation of origin only for extra virgin and virgin olive oil:

The origin of the oil depends on both the state in which the olives have been harvested and by the state in which the mill is located. Therefore, when label reports that the oil origin is "State x " or "the European Union", it means that both the phases (harvesting of the olives and the subsequent milling) have taken place in that Member State or in the European Union. Therefore, if the label declares that an oil is "Made in Italy", this means that the olives have been harvested in Italy and Italy is the location of the mill.

It can be also happening that the olives have been harvested in a member state or a third country other than that in which is located the mill in which the oil was extracted: in this case the circumstances must be clearly highlighted.

- Information about the category of oil:

It must be specified as follows

- for extra virgin olive oil: "superior category olive oil obtained directly from the olives and solely by mechanical means".

- for virgin olive oil: "olive oil obtained directly from olives and solely by mechanical means".

- for olive oil composed of a mixture of refined oil and virgin oil: "oil containing exclusively olive oils that have undergone a process of refining and oils obtained directly from olives".

- for olive-pomace oil: "oil containing only oils derived from the processing of the product obtained after the extraction of the olives".

- The net quantity:

This may be expressed, at the option of the operator, in liters (symbol L or l), in centiliters (symbol cl) and in milliliters and must be indicated with a numerical value and followed by the unit of measure chosen.

- Minimum Shelf Life:

This date is preceded by the words "Best before end". This is an important parameter because it represents the date until which the product maintains its specific properties, if conserved under appropriate conditions.

- Special storage conditions:

Because of the previous point, it is important that the label reports the information about the correct conservation of the product. The statement declares that the olive oil is to be consumed by the end of the year and indicates the preservation condition of the product; In particular, the olive oil must be kept away from light and heat.

- The name or business name and address of the person in charge of marketing the product:

The name or business name of the person responsible for marketing the oil must be indicated on the label.

- Batch

A batch is as a set of sales units that have been packaged in practically identical circumstances. The batch number is determined by the producer or packager of the oil or the first seller established in the European Union and is affixed under their responsibility. The batch code, preceded by the letter "L", must appear on label in such a way as to be easily visible and must be marked in an indelible way. The indication of the lot is not required when the minimum term of the indication of the lot is not required when the minimum term of conservation is indicated with the day, month and year.

- The nutrition declaration:

The "nutrition declaration" or "nutrition labeling" is information regarding energy value, fats (saturated, monounsaturated, polyunsaturated), carbohydrates (sugars, polyols, starch), salt, fiber, protein, vitamins and minerals, and since December 13, 2016, is generally a mandatory claim for each food item.

- Vintage:

Under certain conditions, European Union legislation provides that the label of extra virgin olive oil and virgin olive oil may show the indication of the harvest year. However, this is valid only if 100% of the oil contained in the bottle is produced from the same harvest. The harvest year, therefore, can never be indicated if the oil packaged comes from a mixture of oils from two or more campaigns.

1.6.2. Other regulated indications

- Indications that bear the indication "at cold":

Extra virgin olive oil and virgin olive oil may present this name when the condition that bring to the oil have been maintained at temperatures lower than 27°C.:

- "first cold pressing" if the oils are obtained at temperatures less than 27°C by a system of traditional extraction system with hydraulic presses.

- "cold extracted" if the oils are obtained at less than 27 °C by a process of percolation or centrifugation of the olive paste.

- Indication of acidity:

The indication of acidity or maximum acidity on the label may appear only if it is accompanied by the words, in characters of the same size and in the same field the peroxide value, wax content and ultraviolet absorption, determined in accordance with Regulation (EEC) No 2568/91.

- Indication of organoleptic characteristics:

It is possible to indicate on the label of extra virgin olive oil or virgin olive oil the following organoleptic characteristics relative to taste and/or smell. In order to do so, companies must have subjected the oil to the "panel test" according to the method laid down in Reg.2568/91 which certifies that that lot of oil has that particular organoleptic characteristic. Among these indications include words such as: fruity oil, green fruity, ripe fruity, bitter, spicy, balanced and sweet oil.

1.6.3. Optional indications

Optional information is not regulated by current legislation and must be proven on the basis of objective elements and supporting documents. The producer may pay attention in order to avoid any risk of abuse to the detriment of consumers and distortion of competition in the market for the oils in question. An example of label indications' abuse is attributing to the foodstuff effects or properties that it does not possess or by suggesting that the food possesses particular characteristics, when in fact all similar foods possess the same characteristics.

- Indication of cultivar:

On the label may be indicated the variety (or varieties) of olive tree grown from which they were obtained the olives from which the oil has been produced.

- Indication of the place of packaging:

After the entry into force of EU Reg. No. 1169/2011, it is no longer required to indicate the location of the of packaging on the label. However, if the company wants to indicate it, it is necessary to make sure that the expression is written in such a way that can not to be confused with the commercial manager of the product.

1.7. Certifications

The consumers' demand for excellence in agricultural products has led to the introduction of certification labels. Among others, the European Commission enforces two types of certification labels: protected designation of origin (PDO) and protected geographical indication (PGI). Olive oil, as a typical high-value agricultural product, is included in PDO/PGI labeling.

The EU quality scheme is known as PDO and PGI, and it identifies agricultural products and foodstuffs farmed and produced to exacting specifications. This scheme was established in 1992 in order to allow producers to take advantage and underline the added value of their products and to protect the names of their products. These certification wants to provide consumers with clear information on the product origin or specialty characteristics linked to the region and enables them to make more informed purchases. The implementation of the above legislative initiative particularly enables farmers in disadvantaged areas switch to forms of integrated countryside development and improve their income due to better prices. In addition, consumers can buy quality-guaranteed products, based on origin.

1. The Protected Designation of Origin (PDO): is the European recognition for an agricultural product or food whose entire production cycle, from raw material to finished product (processing and packaging), is carried in the territory. The specific combination of natural factors (raw materials, environmental characteristics, and location) and human (production and traditional craft), make this particular product unique and not reproducible elsewhere. The production rules are often quite strict, in order to ensure the utmost quality and increase the value of the product



Figure 3: PDO certification

2. The Protected Geographical Indication (PGI): is the European recognition for an agricultural product or food, produced and processed in a specific geographic area. The link with the geographical area of reference may also be limited to a single phase of production (production of raw materials and/or processing of olives).



Figure 4: PGI certification

These products meet strict production rules that regards different aspects of the product and the production process: characteristics of the product, geographic area, methods of cultivation and processing, varieties of olives. This is a self-regulatory code, whose compliance by operators in the olive is constantly monitored by a third party recognized by the competent authorities.

3. Organic Olive Oil – complies with the method of production governed by community regulation EC Regulation 834/07, which certifies and monitors all stages of production of food. In particular, the organic farming requires the cultivation without the use of synthetic chemicals (artificial, made in chemical laboratories) and GMO (genetically modified organisms), rotation of crops for protection and prevention from pests, diseases, weeds and fertilizing the soil with only natural organic matter and minerals.



Figure 5: Organic Olive Oil certification

1.7.1. Consumer behavior

Factors that influence consumer behavior may be divided into three groups: Properties of foods, individual related factors (e.g., biological, psychological, and demographic) and environmental factors (i.e., economic, cultural factors, and marketing aspects).

Trust and good knowledge of the product are important factors for consumers, since they reduce complexity and uncertainty when it comes to making a purchasing decision. This effect is even stronger with high quality products: the impact of trust and its correlation to the willingness to pay is higher among consumers of PDO/PGI products.

The results of a choice experiment for consumers preferences in extra virgin olive oil in Italy showed that information on origin, in terms of the adoption of PDO or PGI certification and labeling of the origin, production method and organoleptic characteristics, play a crucial role in shaping consumer preferences. Market segmentation shows that there are consumers who are particularly sensitive to origin and organic certification, as well as labeling clarity.

However, despite the fact that customers are strongly motivated to buy PDO/PGI products, many surveys indicate that most consumers only have a vague knowledge of the definition and characteristics of PDO/PGI.

1.7.2. Verification of PDO/PGI

An effective control mechanism of PDO/PGI labeling is of vital importance for the protection of a high-quality olive oil, from unfair competition with similar, but lower value, products. Thus, a verification of origin is the key factor in establishing the authenticity of a PDO/PGI olive oil. The verification of the authenticity of a product is, however, a difficult challenge in analytical science. A valid strategy to approach the problem can consist of the consideration of the product as a complex entity, rather than in the measurement of a simple property.

It should be noted that olive oil composition may vary a lot based on soil characteristics, vegetal variety, growing conditions, climate, and/or fertilization. Systems of comparative indicators should be developed, and perhaps the most suitable explanation for the objective of investigations lie in the “discrimination” between original and fraudulent products rather than real “identification” of the geographical origin. This approach explains to a large extent the multivariate methods used very often to classify chemicals and physicochemical properties related to the geographical origin of olive oils.

Numerous approaches have been developed and proposed for the identification of the traceability of olive oils. Classical chemical analysis, particularly determination of moisture content and peroxide index as well as quantification of volatile compounds, fatty acids, sterols, and triterpenic alcohols combined with an appropriate chemometric pattern recognition strategy or neural networks have been proven to be, among others, effective tools for the recognition of the geographical origin of olive oils. However, this approach has major drawbacks since the work require extensive high-skilled labor resources and leads to the destruction of the sample, while the results may take time to arrive. As alternatives, a wide range of other instrumental methods of analysis have been proposed: these methods permit rapid screening of olive oils under investigation. The geographical identification of olive oils can be performed by studying their phenolic profile by means of liquid chromatography coupled to mass spectrometry and multivariate analysis tools. A lower-cost photo-diode array detector can also be used for the simultaneous detection of the eluted phenolic compounds at different wavelengths and results

should be submitted to chemometric techniques in order to create a chromatographic fingerprint.

2. Olive oil market demand

The objective of this chapter is to analyze the olive oil market in Italy from different points of view, from the number of the companies in the territory to the quantity of imports of the same, and then analyze the demand of the Region. Therefore, before analyzing the situation of the Italian olive oil market, a quick overview is given of what concerns the current situation in the world with respect to the number of companies and their major concentration, as well as the import and export situations of some countries, in order to better clarify Italian position in the worldwide market, by providing a general picture.

2.1. Olive oil world demand

World demand for olive oil grew slowly - an average of 1% per year - but steadily until 2012. Since then, world consumption has also stabilized below the threshold of 3 million tons until 2018 when it steadily returned above that threshold. Olive oil in total represents only 4-5% of world consumption of fats and this implies a good margin of market growth especially in countries where there is not yet a tradition of consumption.

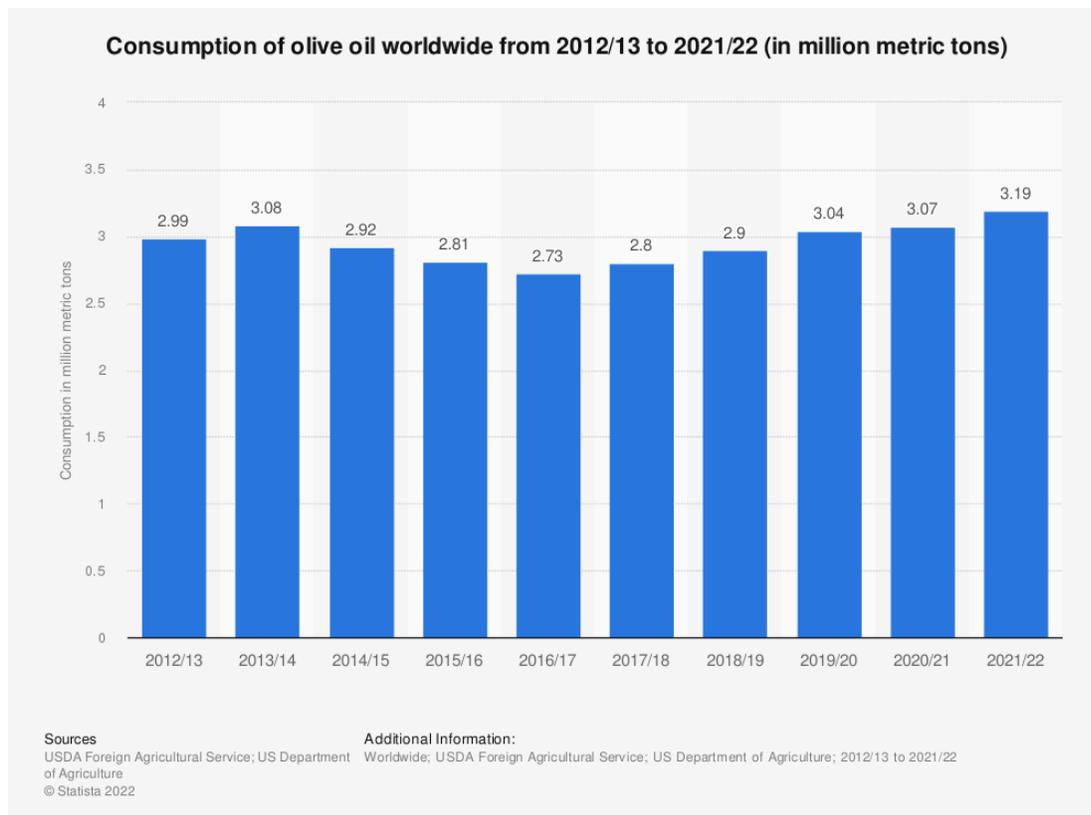


Figure 6: Graph of consumption of olive oil

The global olive oil market size was USD 7,67 billion in 2020 and was expected to continue to grow. In reality, COVID-19 has changed the dynamics and this sector, like many others, has been affected by this phenomenon in many regions of the world.

The market is experiencing robust growth primarily due to the increasing demand for olive oil across the foodservice and retail channels. This oil is an integral part of a Mediterranean diet owing to its several health benefits. One of the major factors supporting the growth of the market is the growing interest in natural, raw, and cold-pressed oils attributed to their safer and healthier counterparts. Vegetable oils sold under such claims are perceived to be healthier as they are free from any chemicals as well as retain their complete nutritive value. Consumers are more inclined towards buying virgin and extra-virgin olive oil owing to their minimal processing and stable fatty acid profile. Furthermore, the rising concerns related to environmental sustainability are projected to drive the demand for natural, minimally processed olive fruit oils in the forthcoming years. Also, the growing interest in trying out exotic cuisines has mainly contributed to the increased popularity of oil across various regions in the world.

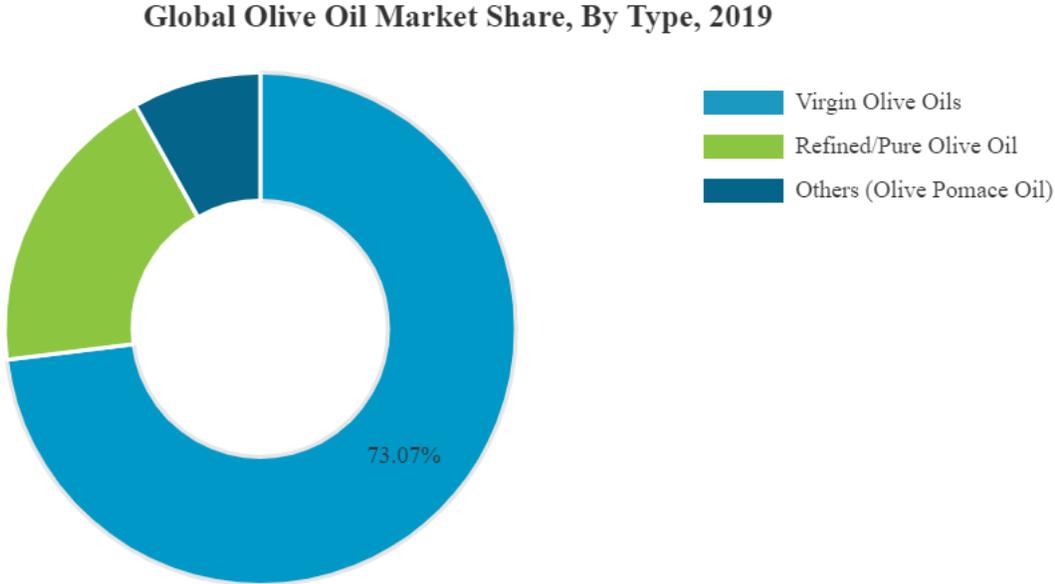


Figure 7: Global olive oil market share. Source: www.fortunebusinessinsights.com

Based on the type, olive is segmented by virgin pure/refined olive, and other olive oils such as olive pomace oil.

Virgin olive oils are expected to witness strong sales performance owing to their rising popularity among consumers attributed to the growing awareness regarding their health benefits. Emerging processing techniques and technological advancements that enable manufacturers to efficiently process virgin oils that retain the highest amount of nutrients further drive market growth.

The refined/pure segment is projected to exhibit substantial growth due to its rising utilization in pharmaceuticals, dietary supplements, and the cosmetics industry. The increasing demand for nutrient-enriched animal feed has significantly amplified the requirement of olive fruit oil to manufacture high-value animal feed.

The demand and sale of olive fruit oil have experienced a sudden slump because of the outbreak of the COVID-19 pandemic. Nationwide lockdown in various countries has resulted in the disruption of trade activities, which has slowed the growth of this industry.

However, the increased concerns related to immunity and overall health have re-established the demand for healthy oils, which is expected to continue during and after the pandemic. The growing interest in home cooking due to the rising concerns related to food safety has increased the oil sale in Mediterranean countries. For instance, sales in Italy have increased by 22% in 2020 as compared to the previous year.

As it can be guessed from the type of product and its use, olive oil is more successful in the European region. From the chart below, it can be seen that in 2021/22 about 1495 thousand metric tons will be consumed in the EU, more than in the rest of the world.

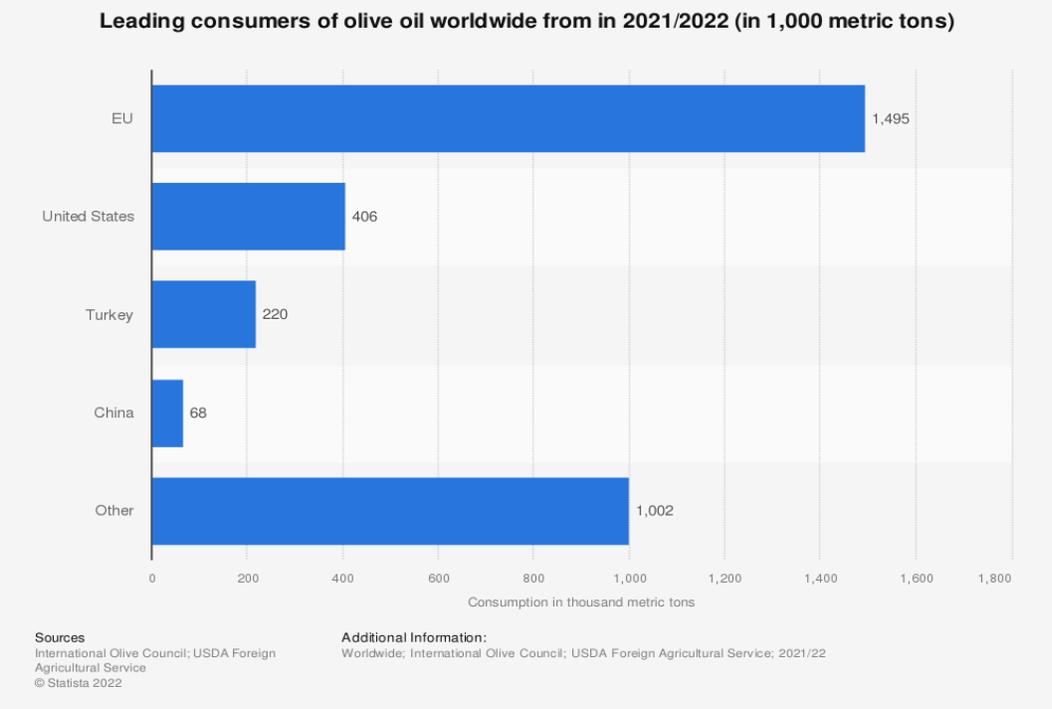


Figure 8: Graph of consumers of olive oil worldwide

2.2. Worldwide Import

One-third of the olive oil market depends on trade with various countries and not on "home" production. As can be seen in the chart below, about one million metric tons for consumption worldwide is imported. This is a phenomenon that can depend on many factors, such as the search for quality olive oils for the consumer who is looking for something sought after, but also for example the search for olive oils from countries with lower labor costs that allow them to be competitive on markets around the world. The trend of importation is slightly positive in recent years, as can be seen from the trend in the graph.

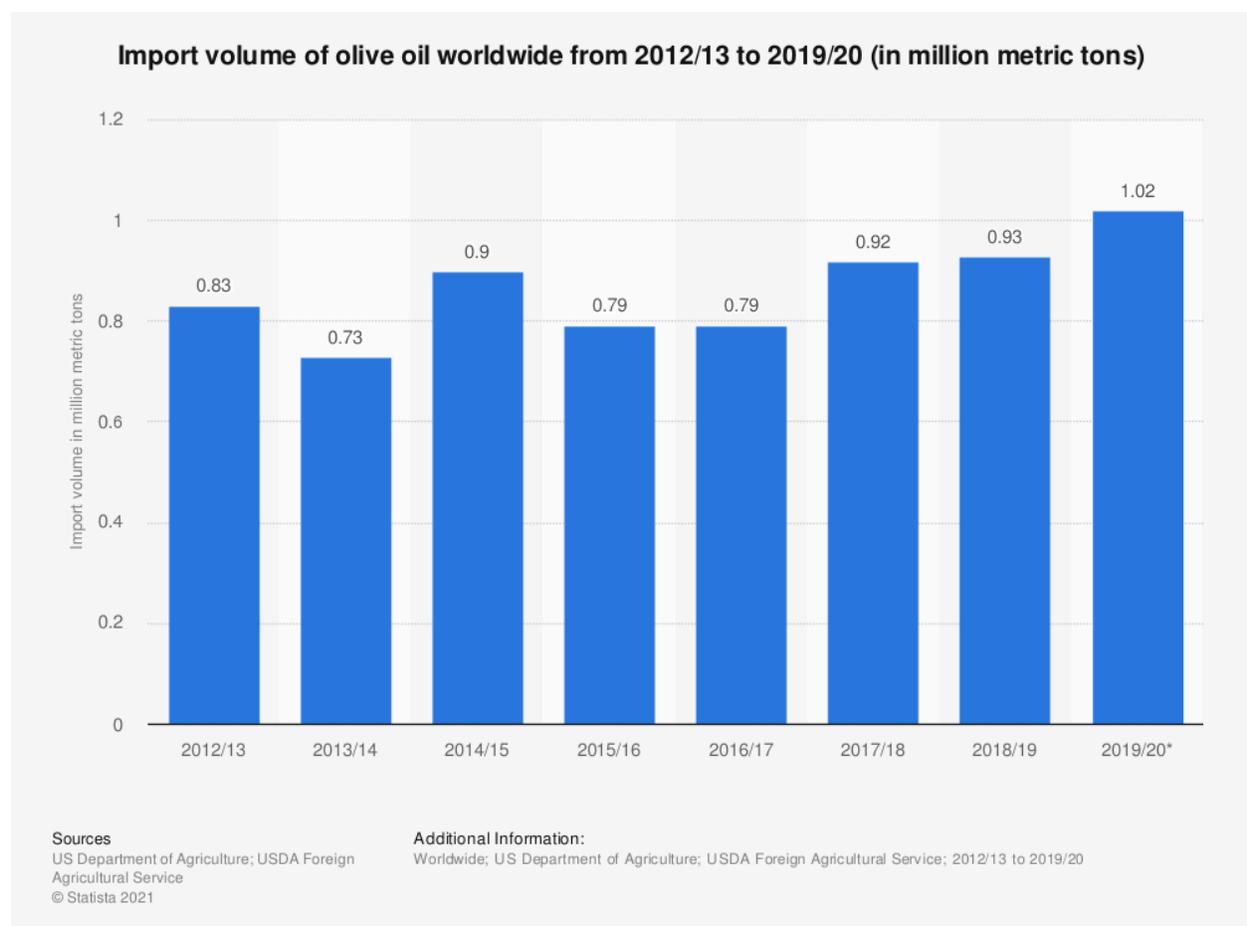


Figure 9: import volume of olive oil worldwide

In 2020, the world imports of Olive oil and its fractions, whether or not refined, but not chemically modified exceeded \$7.67 billion.

In the following chart you can see the value of imports made by the top ten states by share in olive oil imports in the last 4 years.

In first place is Italy with a share of about 20% of world imports by value. Italy is followed by the United States and Spain, respectively with 1.37 and 0.54 billion dollars in value. These 3 countries together with France are responsible for practically 50% of world imports.

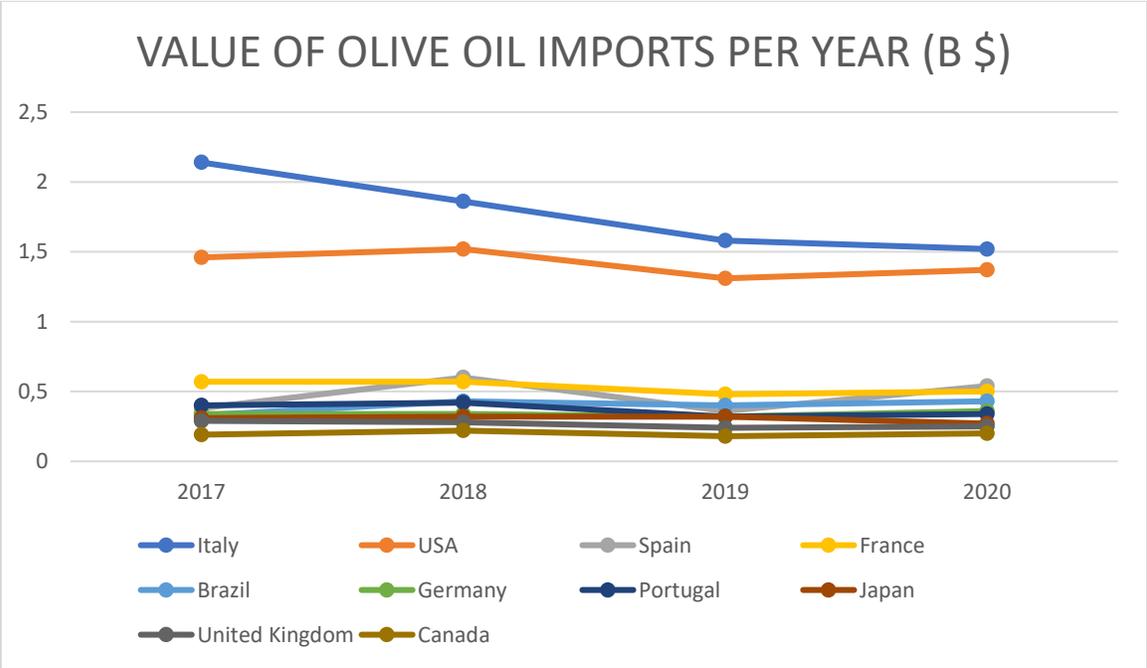


Figure 10: Value of olive oil imports per year. Source: www.trendeconomy.com

2.3. Worldwide Export

Greece, Italy, Portugal and Spain are the world's major exporting players. These 4 players together are responsible for about 90% of the world's olive oil exports. However, in first place is Spain, which has almost 50% of exports.

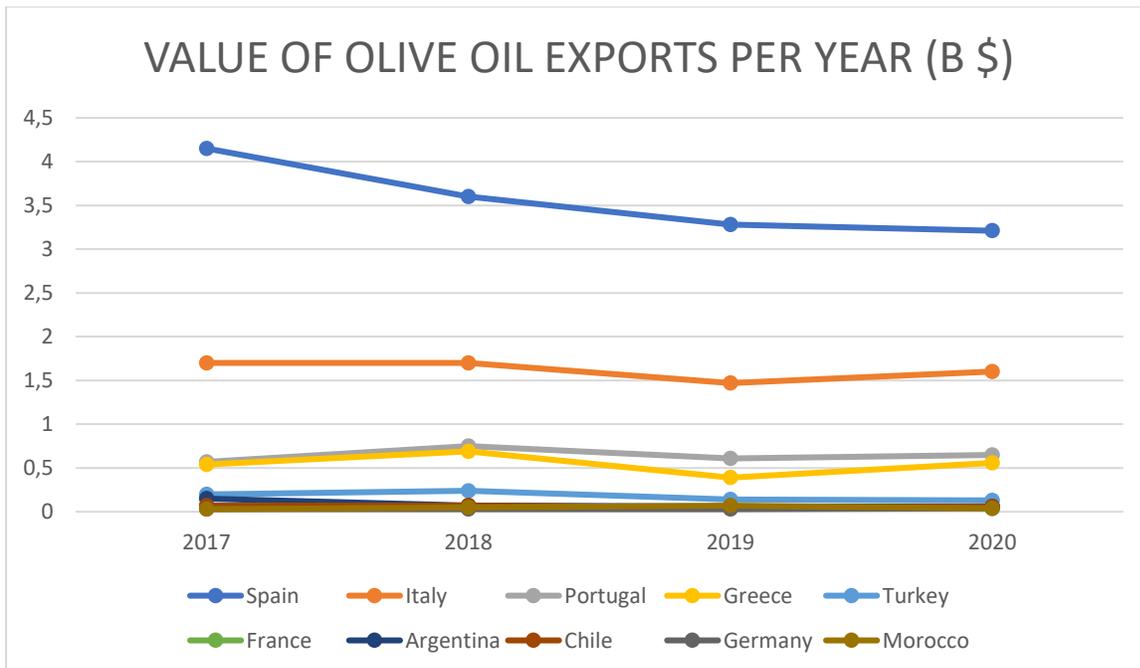


Figure 11: Value of olive oil exports per year. Source: www.trendeconomy.com

2.4. Olive oil Italian demand

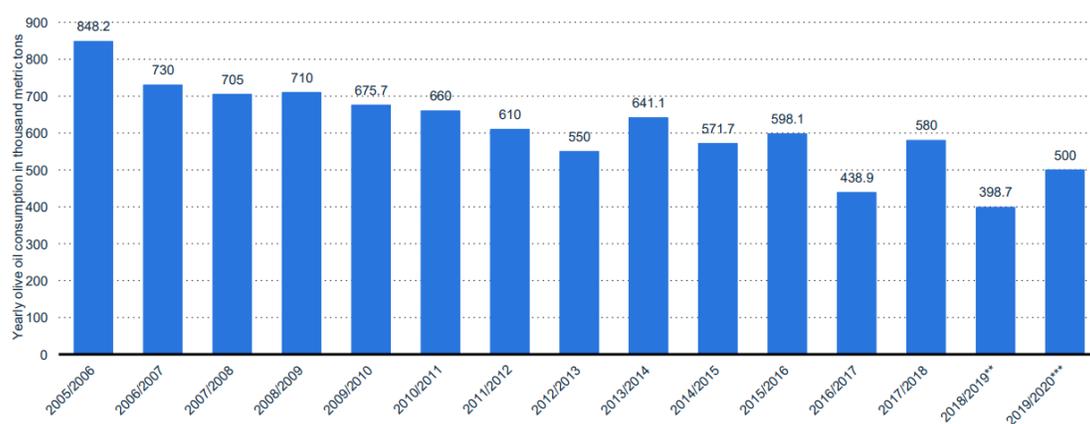
Italy is among the largest consumers of olive oil in the world. Between 2019 and 2020 it can be read from the graph below that about 500 thousand metric tons of olive oil was consumed, which compared to the world consumption in the same year (about 3000 thousand metric tons) makes it clear that in Italy oil represents a product of great economic-social value.

In Italy, the demand for oils with well-defined organoleptic, nutritional, and commercial characteristics has recently reassessed the role of the cultivar as an element that contributes to the qualification of olive productions.

From the graph representing the trend of Italian olive oil consumption from 2005 to 2020, it can be seen that the market is experiencing a negative trend which, however, in the last year has gone through a vigorous recovery. In fact, the consumption of olive oil in 1000 metric tons rose from 398.7 to 500, that represents an increase of about 20%, although far from the consumption of 2005/2006 where a peak of 848.2 thousand metric tons was recorded.

Yearly* olive oil consumption in Italy from 2005 to 2020 (in 1,000 metric tons)

Olive oil consumption in Italy 2005-2020



Note(s): Italy, 2005 to 2020
Further information regarding this statistic can be found on [page 41](#)
Source(s): International Olive Council; [ID710901](#)

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Consumption **statista**

Figure 12: yearly olive oil consumption in Italy

An important factor in shaping this panorama is represented by the increasing sensitivity of the average Italian consumer towards quality, preferring extra virgin olive oil and the tendency to prefer local products. A trend that reflects the average customer's growing sensitivity to quality products and demonstrates increasing attention to their health.

From the graph on the value of organic olive oil sales in Italy by product, it can be seen that in 2020, Italian extra virgin olive oil with quality brands reported the highest sales value, with 30,496 thousand euros.

From the graph it is interesting to analyze, however, a substantial value of sales of imported quality olive oil, a phenomenon that can have two main causes: on the one hand the high Italian demand that cannot be satisfied by domestic production, and on the other hand a probable lower cost of labor in other countries such as Tunisia that allows these products to have an excellent quality-price ratio and find their own share in the Italian market.

It can also be analyzed the value of sales of Italian products with labels PDO / PGI, which although substantial with almost 2000 thousand euros, still has the smallest slice of the market for quality oils.

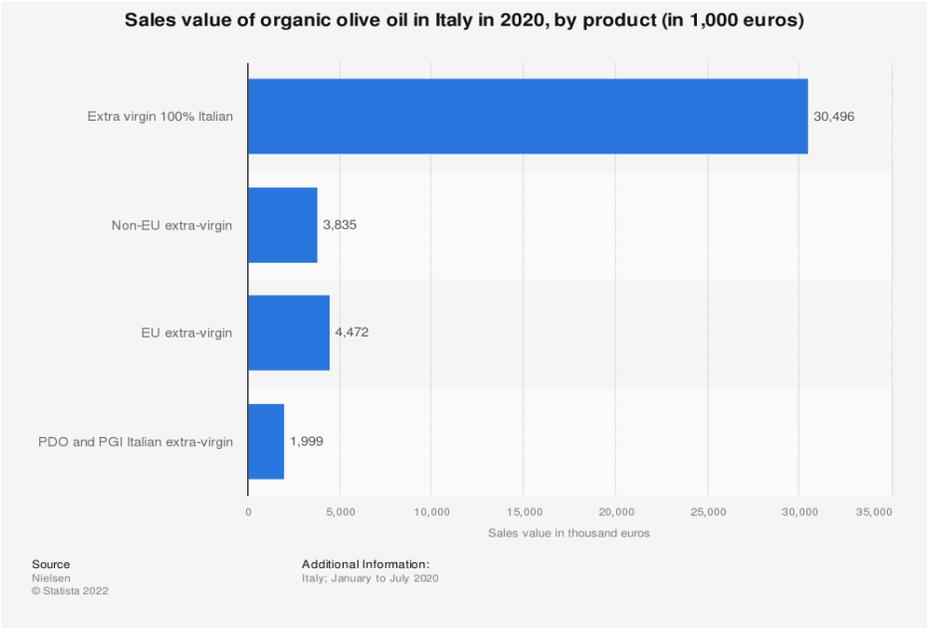


Figure 13: Sales value of organic olive oil in Italy

2.5. Italian customers habits

In Italy the total consumption of olive oil fluctuates between 500,000 and 600,000 tons per year with an average consumption per capita that in recent years has undergone a reduction of about 30% from 12 kg to just over 8 kg. In fact, in recent years, Italy, which represented the largest consumer of olive oil in the world in terms of volume, has seen its consumption begin to fall, reaching the levels of Spain. Coldiretti, based on an Ismea survey, claims that nine out of ten Italian families consume olive oil every day according to a dietary style based on the Mediterranean diet. Italy, moreover, does not have enough oil to cover its internal demand: the data presented by Ismea show that Italy has a self-supply index (production/consumption) that fluctuates between 35 and 85% depending on the production trend. To grow, however, is the indecision of consumers, who do not yet have enough knowledge to support them at the time of choice. According to a survey by Ismea presented at Sol&Agrifod during the talkshow "Evoluzioni del gusto: punti di vista sul consumatore di olio di oggi e domani", 59% of consumers stay in front of the shelves from 2 to 5 minutes before making a decision.

From this survey it emerges that there is still a gap between the information provided and the demands of consumers interested in learning more about oil. The attention of the market research is mainly focused on millennials as they will be the ones to shape and influence the market in the next years.

From what emerges from the Report n°1/2020 of Ismea Mercati, in 2019, the expenditure of Italian families on food products grew by 0.4% compared to 2018 with a marked slowdown in household consumption in the second half of the year. The stagnation of food home consumption is no longer a cyclical fact as more rational purchasing patterns, capable of containing waste and the increase in meals outside the home, determine the dynamics of household consumption. For the "vegetable oils and fats" segment, 65% of which is made up of EVO oil, a 3.9% drop in spending was confirmed. As a result of one of the worst production campaigns in terms of volumes harvested, oil has suffered a contraction in sales through direct sales channels, which,

on the other hand, has boosted sales through Modern Distribution, where the industrial product has been sold on the shelves at extremely low unit prices, competitive even with seed oil.

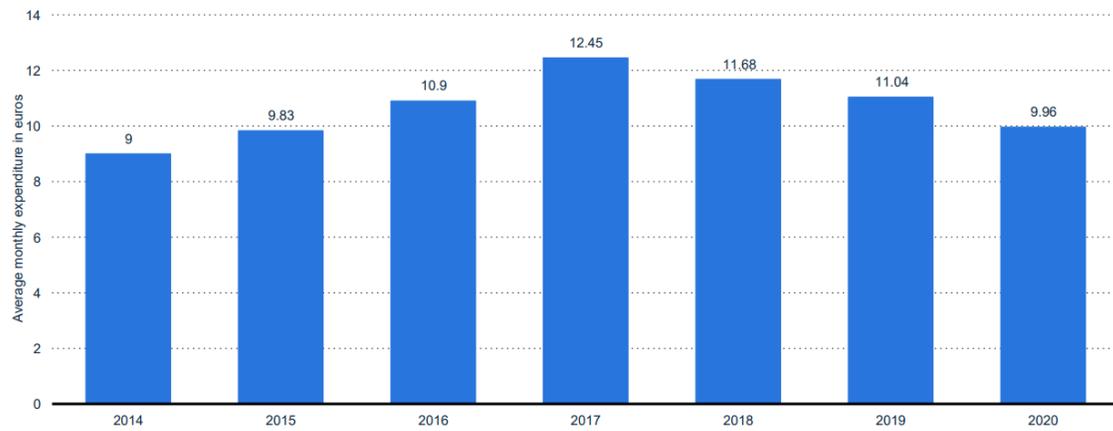
Therefore, despite an increase in volumes sold through large-scale distribution (+6.4%), overall spending was down compared with the previous year. The second analysis Report n°2/2020 by Ismea Mercati relative to the first quarter of 2020 report a 7% growth on an annual basis in the expenditure of Italian families on food products. This is the strongest variation in the last ten years and is a consequence of the restrictions imposed to face the spread of the Coronavirus.

The stagnation of household food consumption, which has now become a structural phenomenon, has been completely disrupted by the outbreak of the Coronavirus. Restrictions such as the limitation of travel and smart working have forced Italians to consume all meals at home, inevitably triggering an increase in expenditure for domestic purchases and a disruption in purchasing habits. In the first few weeks of the lockdown, there was a trend towards the procurement of conservable products (pasta, rice, canned fish, canned tomatoes, etc.) in order to create household stocks. After -7.6% in 2018 and -4% in 2019, the "vegetable oils and fats" segment registered an 8% expansion in spending in this first quarter of 2020 with a growth in EVO oil spending by 6%. Olive oil consumption in Italy per capita in 2020 was around 8.33kg which corresponds to about 8 liters.

Obviously, the search for quality products is reflected in the average expenditure per household. The graph below represents the average monthly household expenditure on olive oil in Italy from 2014 to 2020. According to the data, the average expenditure on olive oil increased gradually from nine euros in 2014 to 12.45 euros in 2017. In 2019, the value was reported to decrease again to 11.04 euros. In 2020, it fell to less than ten euros. This is not a sum to be underestimated as even though it is declining, it is among the highest in the world and demonstrates the average consumer's quest for quality.

Average monthly expenditure on olive oil in Italy from 2014 to 2020 (in euros)

Average monthly household expenditure on olive oil in Italy 2014-2020



Note(s): Italy; 2014 to 2020; 28,000 respondents; households;
Further information regarding this statistic can be found on [page 42](#)
Source(s): Istat; [ID: 780844](#)

Consumption **statista**

Figure 14: Average monthly expenditure on olive oil in Italy

2.6. Italian Import and Export

Italy represents, to date, the second exporting country and also the first importer of olive oil in the world. Having in fact a production capacity insufficient to meet the overall demand, Italian country is forced to import significant quantities of oil making it record every year, to the sector, a trade deficit.

Italian country has for years lost the primacy in the production and export of olive oil in favor of Spain, which in the 2018/2019 season has led the export ranking with 1,015,100 tons, marking an increase of 15% over the previous season. Italy, on the other hand, recorded, in the same period, an export value of 338,537 tons for a total value of 1.47 billion euros information, this, which translates into a growth in volumes of 1.2% compared to the previous year, but to a decrease of 8.2% in terms of consideration in euros. Going into greater detail, it can be seen that, in both the import and export basket, not all the different categories of oil behaved in a homogeneous manner.

On the front of imports of olive oil and pomace, Italy exceeded 600 thousand tons recording, in 2020, an increase of 4,8% over the previous year for an amount of 1.35 billion euros.

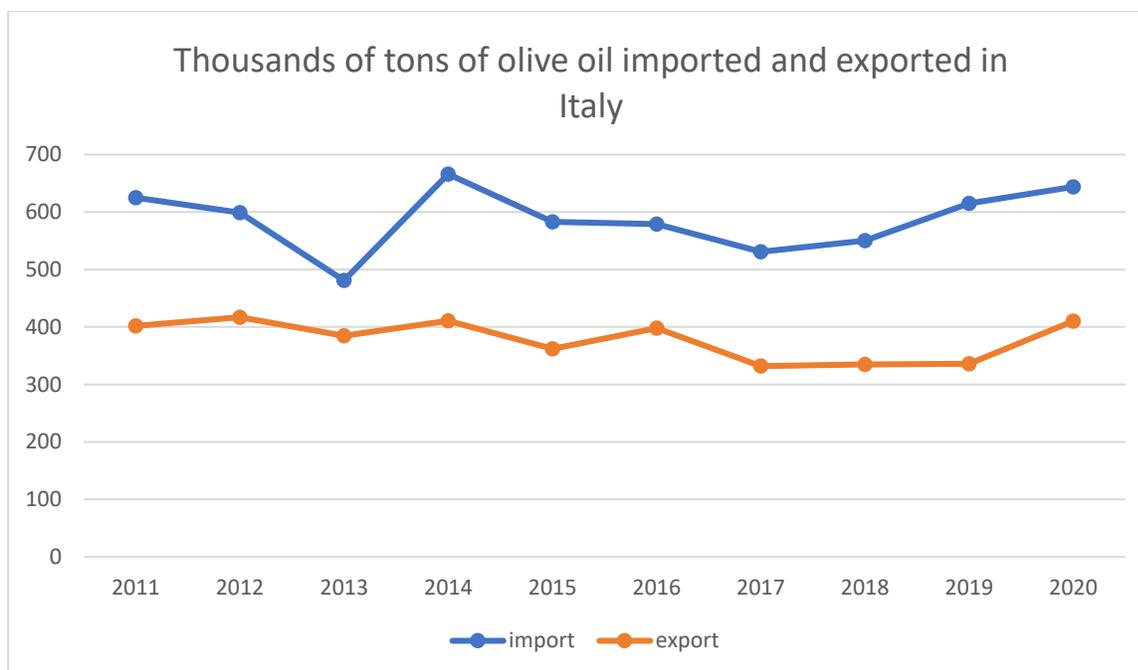


Figure 15: volumes of olive oil tons imported and exported. Source: www.ismeamercati.it

ITALIAN IMPORT OF OLIVE OIL AND POMACE: COMPOSITION BY SEGMENT

Olive oil type	TONS			THOUSAND EUROS		
	2019	2020	Var. %	2019	2020	Var. %
Extra virgin oil	458.687	490.957	7,0%	1.181.522	1.132.218	-4,2%
Virgin oil	13.960	12.117	-13,2%	30.487	22.479	-26,3%
Lampante oil	63.718	62.586	-1,8%	124.688	100.637	19,3%
Refined olive	33.889	42.723	26,1%	73.676	74.983	1,8%
refined of pomace	29.996	14.003	-53,3%	40.244	14.001	65,2%
Crude pomace oil	14.522	21.912	50,9%	12.394	13.768	11,1%
TOTAL	614.771	644.297	4,8%	1.463.011	1.358.085	-7,2%

Table 2: Italian import of olive oil and pomace: composition by segment. Source:

www.ismeamercati.it

ITALIAN EXPORT OF OLIVE OIL AND POMACE: COMPOSITION BY SEGMENT

THOUSANDS EURO

<i>Olive oil type</i>	2019	2020	Var. %
<i>Extra virgin oil</i>	1.181.522	1.132.218	-4,2%
<i>Virgin oil</i>	30.487	22.479	-26,3%
<i>Lampante oil</i>	124.688	100.637	19,3%
<i>Refined olive</i>	73.676	74.983	1,8%
<i>refined of pomace</i>	40.244	14.001	65,2%
<i>Crude pomace oil</i>	12.394	13.768	11,1%
TOTAL	1.463.011	1.358.085	-7,2%

Table 3: Italian export of olive oil and pomace: composition by segment. Source:

www.ismeamercati.it

Italian demand was primarily directed to Spain from which 73% of the entire imported volume arrived, even though volumes are down 16.3% this past year. Implicit in this decline in Spanish import volumes is the increase in imports from the other three major players, namely Greece, Tunisia and Portugal. Interesting to note is the increase in extra-EU imports of 16.3% in EUROS compared to 2019, mostly due to trade with Tunisia, which can count on cheap labor and excellent product.

Two-thirds of Italian olive oil exports go to non-EU countries and the rest to European Union countries. The largest importer of Italian olive oil is the USA, which in 2020 imported 123,018 tons (increasing by 29.5% compared to 2019) for a value of 459,921 thousand euros.

ITALIAN IMPORTS OF OLIVE OIL AND POMACE: MAIN SUPPLIERS

	TONS			THOUSAND EURO		
	2019	2020	Var. %	2019	2020	Var. %
<i>Spain</i>	445.733	372.962	-16,3%	1.063.118	801.577	-24,6%
<i>Greece</i>	76.128	155.404	104,1%	169.519	309.669	82,7%
<i>Tunisia</i>	46.897	73.914	57,6%	109.117	138.629	27,0%
<i>Portugal</i>	30.250	37.451	23,8%	86.512	97.924	13,2%
<i>Turkey</i>	3.257	2.330	-28,4%	6.246	4.007	-35,8%
<i>Morocco</i>	2.970	903	-69,6%	6.407	2.228	-65,2%
<i>Germany</i>	2.396	187	-92,2%	7.592	673	-91,1%
<i>Argentina</i>	336	200	-40,5%	903	527	-41,6%
<i>Syria</i>	360	275	-23,7%	752	426	-43,4%
<i>France</i>	139	125	-10,4%	396	397	0,2%
<i>Others</i>	6.305	547	-91,3%	12.448	2.029	-83,7%
EU	560.367	566.530	1,1%	1.337.629	1.211.451	-9,4%
EXTRA-EU	54.404	77.767	42,9%	125.382	146.634	16,9%
WORLDWIDE	614.771	644.297	4,8%	1.463.011	1.358.085	-7,2%

Table 4: Italian imports of olive oil and pomace: main suppliers. Source:

www.ismeamercati.it

ITALIAN EXPORT OF OLIVE OIL AND POMACE: MAIN CUSTOMERS

	TONS			THOUSAND EURO		
	2019	2020	Var. %	2019	2020	Var. %
<i>USA</i>	94.962	123.018	29,5%	424.514	459.921	8,3%
<i>Germany</i>	39.439	48.765	23,6%	171.851	183.719	6,9%

<i>France</i>	25.595	36.219	41,5%	95.250	117.268	23,1%
<i>Japan</i>	22.059	19.987	-9,4%	105.839	81.921	-22,6%
<i>UK</i>	14.449	18.041	24,9%	61.600	72.841	18,2%
<i>Canada</i>	17.183	20.685	20,4%	67.661	70.673	4,5%
<i>Switzerland</i>	6.991	9.299	33,0%	39.943	50.966	27,6%
<i>Russia</i>	6.905	8.295	20,1%	27.323	31.240	14,3%
<i>Spain</i>	11.276	21.575	91,3%	18.365	27.875	51,8%
<i>Netherlands</i>	5.095	5.323	4,50%	21.193	21.298	0,50%
<i>Belgium</i>	3.600	4.282	19,00%	16.450	18.282	11,10%
<i>Sweden</i>	3.997	4.509	12,80%	18.551	18.215	-1,80%
<i>South Korea</i>	4.458	5.263	18,00%	16.476	17.900	8,60%
<i>Taiwan</i>	4.368	4.725	8,20%	17.041	16.958	-0,50%
<i>Australia</i>	5.369	4.748	-11,60%	19.193	16.896	-12,00%
<i>Brazil</i>	4.287	4.438	3,50%	17.527	16.168	-7,80%
<i>Austria</i>	3.366	3.700	9,90%	15.992	15.922	-0,40%
<i>Poland</i>	3.368	4.966	47,40%	11.529	14.884	29,10%
<i>China</i>	6.164	4.417	-28,30%	22.419	14.712	-34,40%
<i>Denmark</i>	2.861	3.189	11,40%	12.057	12.138	0,70%
<i>Others</i>	50.245	55.053	9,6%	175.161	174.979	-0,1%
EU	113.405	149.795	32,1%	431.860	482.657	11,8%
EXTRA-UE	222.632	260.702	17,1%	944.074	972.118	3,0%
WORLDWIDE	336.037	410.497	22,2%	1.375.934	1.454.775	5,7%

Table 5: Italian export of olive oil and pomace: main customers. Source:

www.ismeamercati.it

3. Olive oil market supply

3.1. Worldwide production

The 2020/21 worldwide production stand at the threshold of three million tons, slightly down on the previous year (-6%). This figure is probably the result of a difficult world situation related to COVID-19 and in fact already for 2021/2022 a recovery in world production is expected, which should reach 3.28 million metric tons.

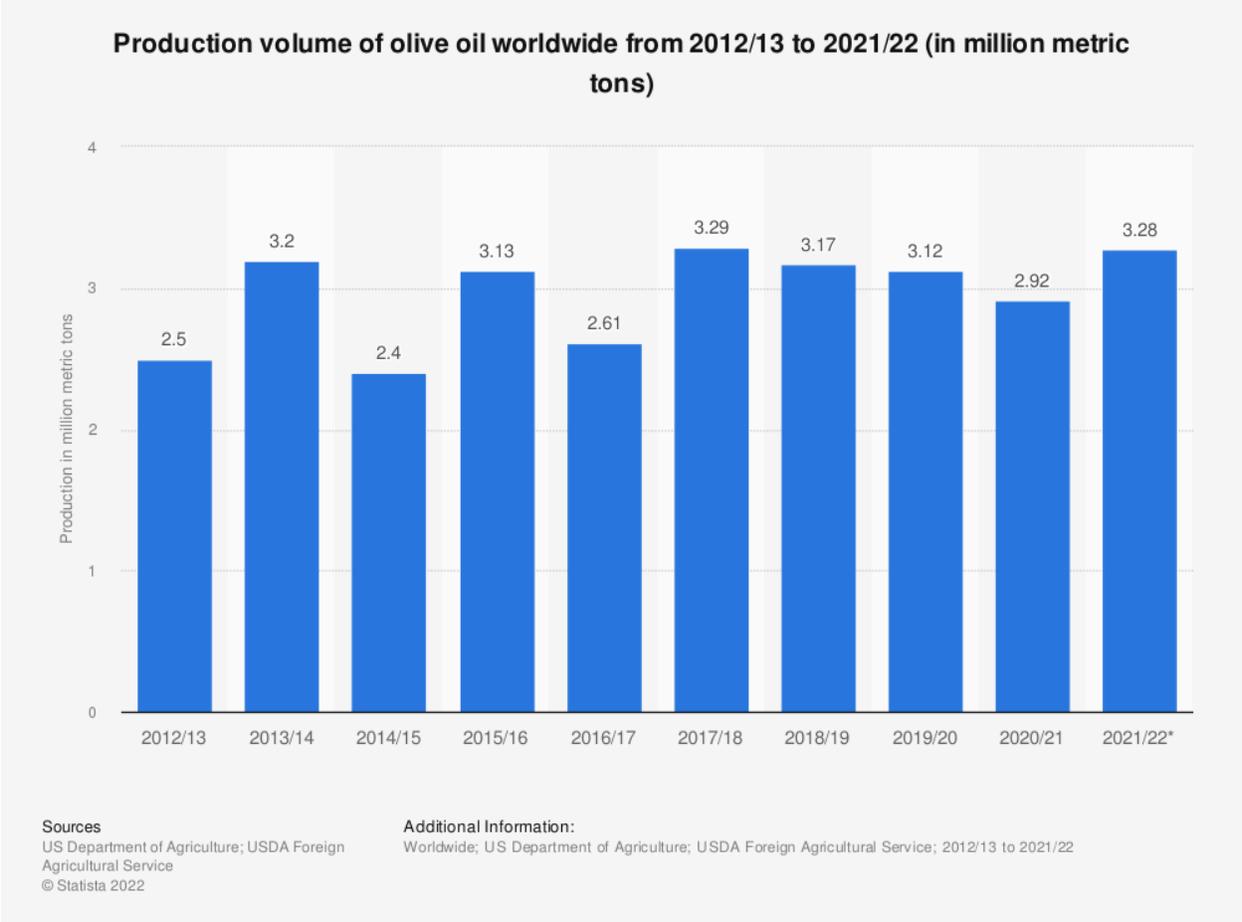


Figure 16: Production of Olive oil Worldwide

3.2. Main producer countries

The cultivation of olives and the production of olive oil are spread mostly in the Mediterranean area. The European Union as a whole accounts for 80% of world production of olive oil. The largest European producers are Spain, Italy, Greece and Portugal, with minority shares of France. In these countries olive growing has a great importance not only for the rural economy, but also for the cultural and environmental heritage, if we consider that in the sector work about 2.5 million producers, about one third of farmers in the European Union.

Outside the European Union, the main producers also face the Mediterranean Sea and are Tunisia, Turkey, Syria and Morocco. Minority shares are produced in the American continent, Australia and Japan.

The following table shows the change in production over the past three years for the major producing states. Spain has by far the largest slice of production in the world (almost 50% of world production). In 2020, the year of the covid-19, there was a powerful growth of Spanish production, contrary to Italy and Tunisia that have seen a sharp decline. In 2021 just passed instead we can see a slight decline, about 6%, of Spanish production and a sharp recovery of Tunisia that has seen an increase in production of olive oil even about 71%.

COUNTRIES WITH THE LARGEST PRODUCTION OF OLIVE OIL

THOUSANDS OF TONS

	2019	2020	2021
<i>Spain</i>	1125	1389	1300
<i>Italy</i>	366	273	315
<i>Greece</i>	275	275	225
<i>Turkey</i>	230	210	215
<i>Tunisia</i>	440	140	240

Table 6: Countries with the largest production of olive oil. Source: www.ismeamercati.it

3.3. Italian production

Italy has always represented one of the main world players in the olive oil sector and an important crossroads of international trade. The national production has recorded, however, volumes tend to decline, with an average in the last four years of 315,000 tons and volumes that in the last 6 years have fallen below 200,000 tons twice so much so that in 2018 has been touched the historical minimum with a production of 175,000 tons, a reduction of 59% on an annual basis. Compared to 2013, in fact, there has been a contraction of the olive-grown area of 4% and a significant decrease in the number of farms (-22%, approximately). Production is one of the areas on which most of the attention of the sector is focused. Only three regions - Apulia, Sicily and Calabria - concentrate 55% of the companies and 65% of the olive-grown area and if we add Campania, Lazio, Abruzzo and Tuscany we arrive at explaining 82% of the companies and 88% of the area.

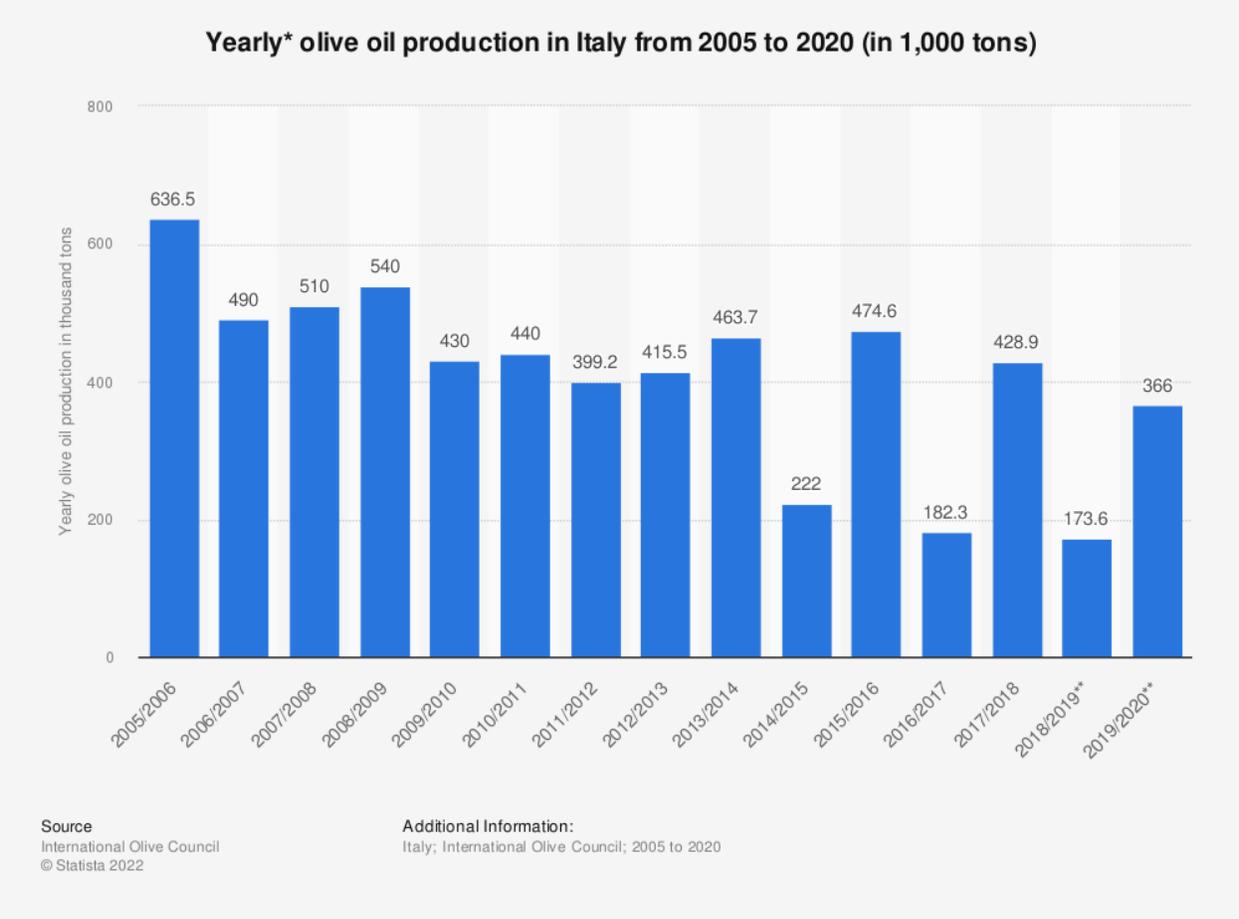


Figure 17: Yearly olive oil production in Italy

ITALIAN PRODUCTIONS OF OLIVE OIL BY COUNTRY

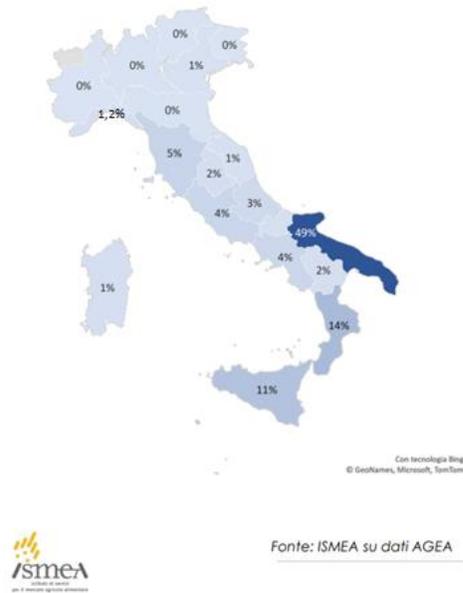


Figure 18: Italian productions of olive oil by country

	SHARE	AVERAGE PRODUCTION IN TONS (2017-20)
<i>Piedmont</i>	0,0%	14
<i>Lombardy</i>	0,3%	854
<i>Trentino Alto Adige</i>	0,1%	377
<i>Veneto</i>	0,7%	2.037
<i>Friuli Venezia Giulia</i>	0,0%	109
<i>Liguria</i>	1,2%	3.882
<i>Emilia Romagna</i>	0,4%	1.202
<i>Tuscany</i>	5,3%	16.585
<i>Umbria</i>	1,7%	5.410
<i>Marche</i>	1,1%	3.435
<i>Lazio</i>	4,5%	13.854
<i>Abruzzo</i>	3,1%	9.613

<i>Molise</i>	0,9%	2.923
<i>Campania</i>	4,1%	12.814
<i>Apulia</i>	49,0%	152.283
<i>Basilicata</i>	1,5%	4.685
<i>Calabria</i>	13,6%	42.402
<i>Sicily</i>	11,1%	34.373
<i>Sardinia</i>	1,3%	4.099
<i>Italy</i>	100,0%	310.952

Table 7: Italian productions of olive oil by country. Source: www.ismeamercati.it

A problem is represented by the low "economic" of olive groves, especially in particular areas of Italy, and the age of landowners or managers of the fund. While having a landscape and cultural value, the olive grove must, however, also be attractive from an entrepreneurial point of view, attract new investment and, therefore, produce income. Unfortunately, often farmers in the face of low profitability, respond with low investment and low commitment in agricultural production (no pruning, fertilization, treatments, processing, etc..) and this behavior generates, in turn, a further reduction in yields and profitability. On the "mass" oil, Italy is not able to compete with the Spanish production systems characterized by mechanized systems and therefore less expensive and by flatter lands. Therefore, the sector needs a new push and the modernization of plants, where possible, is an almost obligatory way to recover competitiveness at international level. Moreover, the wide national production and varietal panorama, which thanks to almost 500 olive cultivars, makes Italian olive oil the richest in terms of aromas, flavors and fragrances, of the entire world panorama, highlights the existence of different business models each of which needs its own strategy. In fact, in addition to the success of large companies that have focused on a more standardized production, our country can also boast successful cases of small and medium-sized companies that have focused on high-end olive growing, with prices well above average.

3.3.1. Italian olive oil companies

The study of Ismea, published in one of its sector plans, entitled "Olive farms in the 6th General Census of Agriculture: an analysis of the types of companies" using Istat data from the last Census of Agriculture in 2010, has made it possible to divide olive farms into six clusters. For the description of each cluster were adopted the following criteria:

- The size of "small", "medium-large" and "large" farms is attributed by looking simultaneously at the physical size and economic size, in comparison with the values assumed by these variables in the entire universe of olive farms.
- The specialization referred to olive growing defined as "low", "medium-low", "medium-high", "high" by comparing the percentage of area under olive trees on the UAA of the group, compared to the average percentage of the entire universe, which is equal to 25%.
- The market orientation defined by looking at the variables self-consumption and share of revenues from the sale of farm products or vice versa from direct payments;
- The work commitment of the farm manager and family members assessed on the basis of the variable average hours of work per day and / or number of average days of work per year.

This information can be used to classify companies according to their competitive potential. This processing is extremely important because it has important consequences for public decision-makers both at national and local level are called to identify specific economic policies and to perform the most challenging task of assessing the sustainability of olive growing in the medium to long term.

Most of Italy's agricultural activities, about 63%, are considered marginal or at least have little potential. This group includes:

- Medium-large farms, with medium-low olive specialization, self-consumption and dependence on direct payments (i.e., low market orientation), low work commitment of the farm manager.

- Small family farms, with high olive specialization, part-time.
- Family farms-small, with olive specialization medium-high, market-oriented, high work commitment of the farm manager and his spouse.

The 26% of Italian companies are considered to have a competitive potential, but which is not yet so because of the production volumes that move. These have the following characteristics:

- Companies-small businesses, olive specialization high, market-oriented, with related activities and business area not used (multifunctional).

The percentage of Italian companies that instead have a great competitive potential is 11%. This percentage includes companies with different sizes and different characteristics:

- Large companies, with medium-low olive specialization, market-oriented, high work commitment of the farm manager, attentive to the agrarian environment.
- Medium-large enterprises, with low olive specialization, market-oriented and high work commitment of the farm manager.

OLIVE OIL COMPANIES COMPETITIVE POTENTIAL SHARE

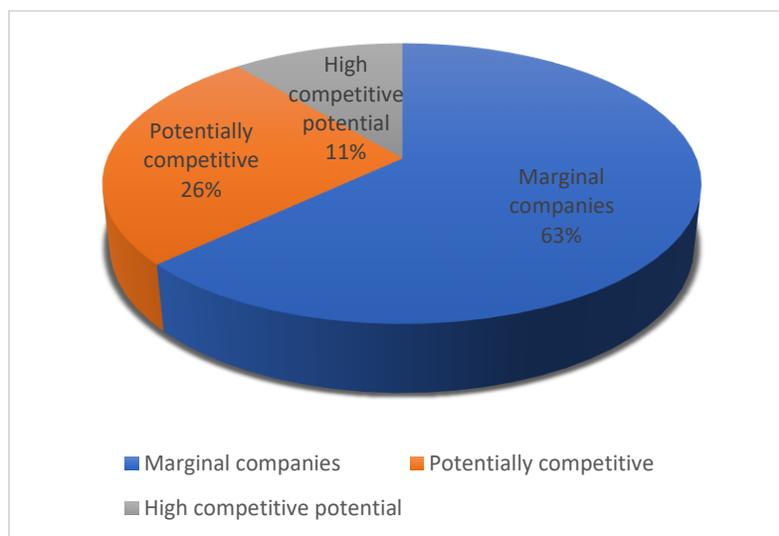


Figure 19: Olive oil companies competitive potential share. Source: www.ismeamercati.it

3.4. The olive oil supply chain in Italy

The Italian oil industry is characterized by a pronounced dualism of size, with many small companies, more strictly agricultural located mainly in the South, in areas suitable for olive growing, and a few large companies, concentrated, however, purely in Central and Northern Italy. It is created, therefore, a significant flow of bulk oil from the production regions of the South is sent in the Centre-North to be bottled and marketed.

While many small and medium sized companies are vertically integrated, the large companies in the sector present a marked specialization, typical of industrial enterprises in the strict sense: they purchase oil, possibly mix it, bottle it, usually far from the places where it is produced, and then market it. Therefore, the characteristics of the actors operating within the olive oil sector and the dynamics of the market are different.

The direct supply by private individuals from the producer is still very rooted, feeding the important sociocultural role of the sector and its historical link with the territory. Large-scale industry, on the other hand, needs critical mass, a more standardized product in terms of quality and segments its production more on the organoleptic characteristics of the oil than on its origin.

ITALIAN OLIVE OIL COMPANIES STRUCTURE

	udm	2017	2018	2019	2020	Var.% 2020/19
<i>Farms</i>	(n)	646.326	-	-	-	-
<i>Area</i>	(ha)	1.170.157	1.164.067	1.164.568	-	-
<i>ha/farms</i>		1,81	1,8	1,8	-	-
<i>Active oil mills</i>	(n)	4.870	4.056	4.480	4.475	-0,1
<i>Industrial companies</i>	(n)	220	220	220	220	0

Table 8: Italian olive oil company's structure. Source: www.ismeamercati.it

Analyzing the essay "Yearbook of Italian agriculture 2018", published in 2020 by CREA (Council for research in agriculture and analysis of agricultural economics), it shows that the average size of national olive farms is quite low, reaching just 1.8 ha/farm.

The 55% of farms have a size of less than 1 hectare and a further 26% have a size between 1 and 2 hectares, only 0.3% of farms have an area greater than 30 hectares. In terms of area, the first two classes, insist on 38% of the national olive-growing area, while the classes above 30 hectares occupy only 9% of the area. In Puglia, Calabria and Sicily is located more than half of the companies with a size of less than 2 hectares, but even those equal to or larger than 30 hectares are more present in Puglia (48% of the total) and Calabria (27%). At the national level, almost all companies (97%) take the form of individual enterprise, a percentage, sometimes even higher, which is found more in almost all regions of central and southern Italy, while in northern regions assume a certain importance of companies, reflecting a more entrepreneurial olive growing.

3.4.1. Agricultural production and primary processing industry

The characteristics of the Italian territory are particularly favorable. The production of olive oil accounts for about 7% of total Italian agriculture. About 85% in value comes from the southern regions and in particular from Puglia, Calabria and Sicily. The fragmentation of producers and the small size of the companies, together with the poor spread of mechanization and irrigation and a lack of attention to technological innovation are responsible for a fluctuating production both in terms of quality and quantity. This situation makes olive growers little influence in terms of bargaining power, and also the influence of the new EU policy, creating higher costs related to quality and certification, contributes to the gradual erosion of average margins.

Following the harvesting, within a few hours, the olives pass to the oil mill, where the extraction of the oil takes place, which is then stored in special tanks. This phase is represented by oil mills which produce the different types of oil according to more or less traditional technologies (pressure, centrifugation, percolation).

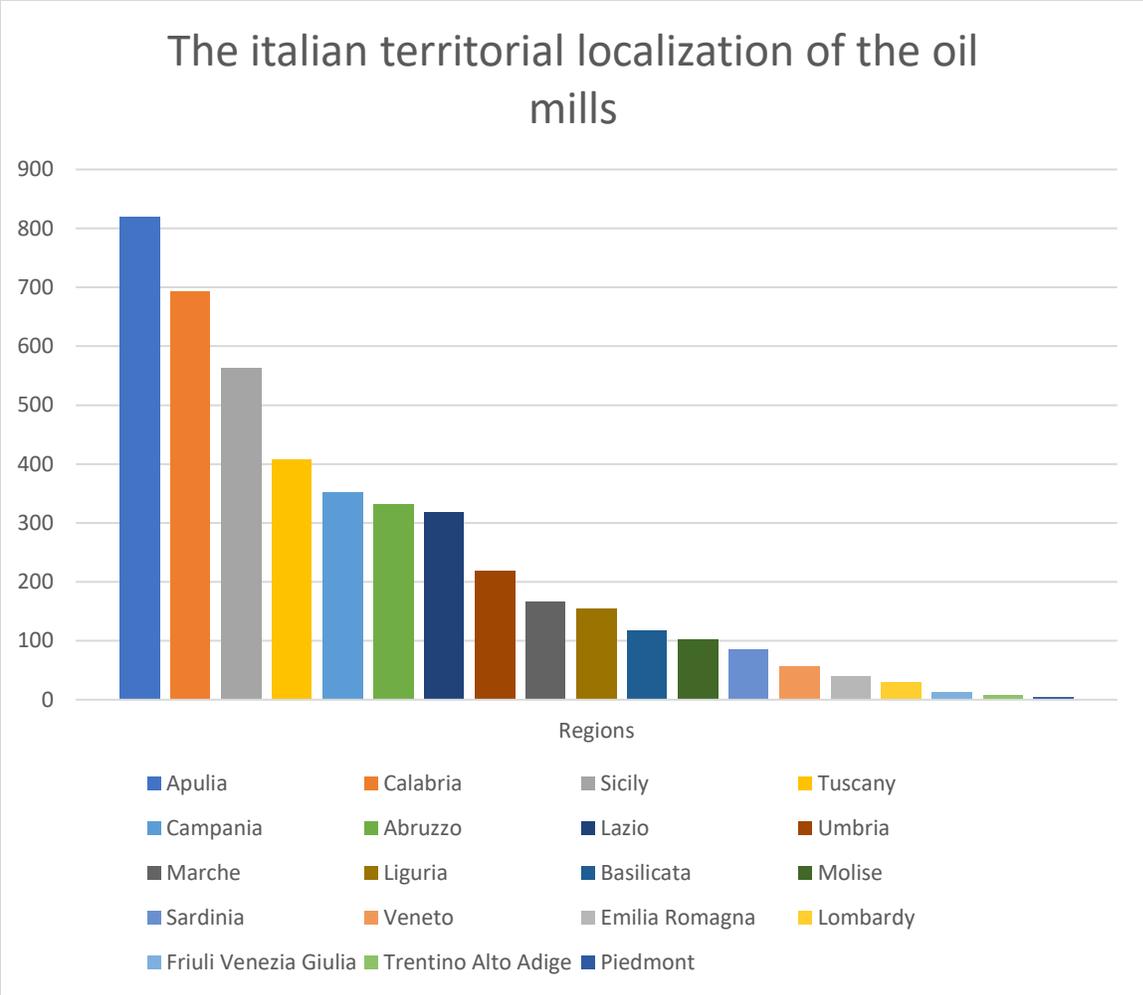


Figure 20: The Italian territorial localization of the oil mills. Source: www.ismeamercati.it

The extreme fragmentation of the Italian production is also evident by the number of oil mills: it is enough to consider that in Spain the number of oil mills varies between 1600 and 1700, however the Iberian production considerably exceeds one million tons. Of the approximately 4,470 mills operating on average in the last 4 years, 18% are in Apulia, 15% in Calabria and 13% in Sicily. Tuscany follows with a 9% share. It is evident, by comparing the weight of regional production, that Apulia has larger mills than the rest of Italy. Of the whole national production, only a share of about 20% can be attributed to cooperative oil mills, mainly present in Apulia and Tuscany.

The 76% of Italian mills use less than 500 tons of olives. The large number of mills, if on the one hand increases the costs of the system, on the other represents a guarantee of quality. The proximity of the mill to the place of production ensures milling within 24 hours, an essential requirement for quality.

BREAKDOWN OF MILLS BY PRODUCTION CAPACITY – AVERAGE FROM 2017 TO 2020

<i>olives milled class</i>	% number of oil mills	milled olives (%)	Production of oil (%)
< 100 t	29,60%	2,40%	2,50%
100-300 t	32,80%	12,50%	12,10%
300-500 t	14,00%	11,00%	10,50%
500-1000 t	13,60%	19,00%	18,50%
1.000-5.000 t	8,80%	32,50%	33,20%
5.000-10.000 t	0,90%	11,40%	11,90%
10.000-15.000 t	0,10%	3,50%	3,30%
15.000-25.000 t	0,10%	5,40%	5,80%
50.000-100.000 t	0,00%	2,20%	2,30%
TOTAL	100%	100%	100%

Table 9: Breakdown of mills by production capacity. Source: www.ismeamercati.it

3.4.2. Second processing industry

The second processing industry includes the typical activities of bottling, refining and “sansifici”.

- The packaging industry is represented by large industries, including those belonging to international groups, which package mainly products purchased on the market, both domestic and foreign, and is concentrated mainly in the Centre-North. The characteristic activities of these companies are the selection and analysis of the raw material, the

formation and filtration of the blend, that is, the creation of characteristic tastes of the oil through the mixing of different qualities and the packaging and sale of the oil.

The industrial enterprises that base their activity essentially on the packaging and subsequent marketing of the oil are about 220. These are large/medium sized companies operating mainly in the center north, often with diversified activities, for example seed oil but also sauces and readymade sauces. Packaging means the application of labels and brands and the implementation of marketing and communication strategies aimed at both distribution and the end consumer.

- Upstream of the secondary processing industry is the figure of the wholesaler. Operating in Italy just over 20 major companies of this type, which are mainly involved in selecting and purchasing oil both in Italy and abroad and then make the blends to be resold to the processing company. Blending consists in selecting oils with different characteristics and combining them in the right balance, to obtain a result that exceeds in quality every single part. It is estimated that about 80% of the total are located in the Southern regions, but as these companies are medium-small, half of the sector's turnover is, therefore, produced in the Centre-North. The figure of the wholesaler is crucial for the formation of the "critical mass" without which the packaging industry would be forced to deal with an extremely fragmented production.
- Pomace factories: they are also part of the industrial phase and extract crude pomace oil from virgin pomace. If equipped with a refining plant, they can also transform raw pomace oil into refined pomace oil.
- The refining industry which is represented by the companies mainly operating in the refining of lampante oil and pomace oil. The products of refining are then blended with different percentages of virgin oil to obtain the categories commercially called "olive oil" and "olive pomace oil".

3.4.3. Olive oil distribution channels

Oil can reach the final consumer through different types of distribution channels whose different use depends on factors such as the size and organization of companies, the type of product treated and the target audience. The distribution channels used for this product are essentially three:

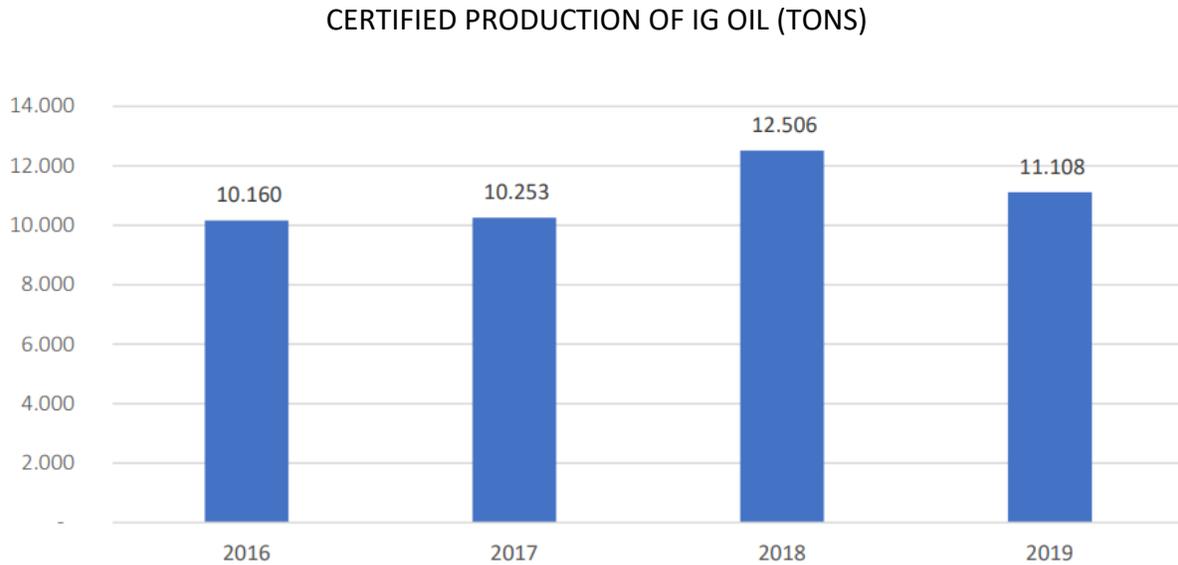
- Direct channel: used by small companies, local or regional, which very often integrate the bottling phase, having high quality standards and operating in niche markets. Direct sales, in which the consumer is served directly by the producer, are typical of southern Italy.
- Short indirect channel: used by medium-sized companies and foresees that the oil reaches the consumer through large-scale distribution, retail outlets and cooperatives without the intervention of an intermediary.
- Long indirect channel: used by large companies with standardized quality products and foresees the presence of one or more intermediaries, usually wholesalers, between the producer and the distributor.

Online sales are still marginal, and even though the spread of e-commerce in this sector is increasing, many sites remain only a showcase where the company, the brand and the products are presented, but without the possibility of purchasing them.

3.4.4. Certified olive oils: GI and Bio

The Italian olive sector has many strengths, however, among which stands out the enormous varietal heritage, consisting of over 500 cultivars, about 40% of those known worldwide. In second position is Spain with less than 200 cultivars surveyed, but in fact those really productive are a few tens. Such a wide biodiversity is due to the geographical complexity of the national territory, where the cultivation of the olive tree is historically present in extremely diverse

climatic areas and territories ranging from the hills of Garda to Sicily and from the mountains to the coastal plains.



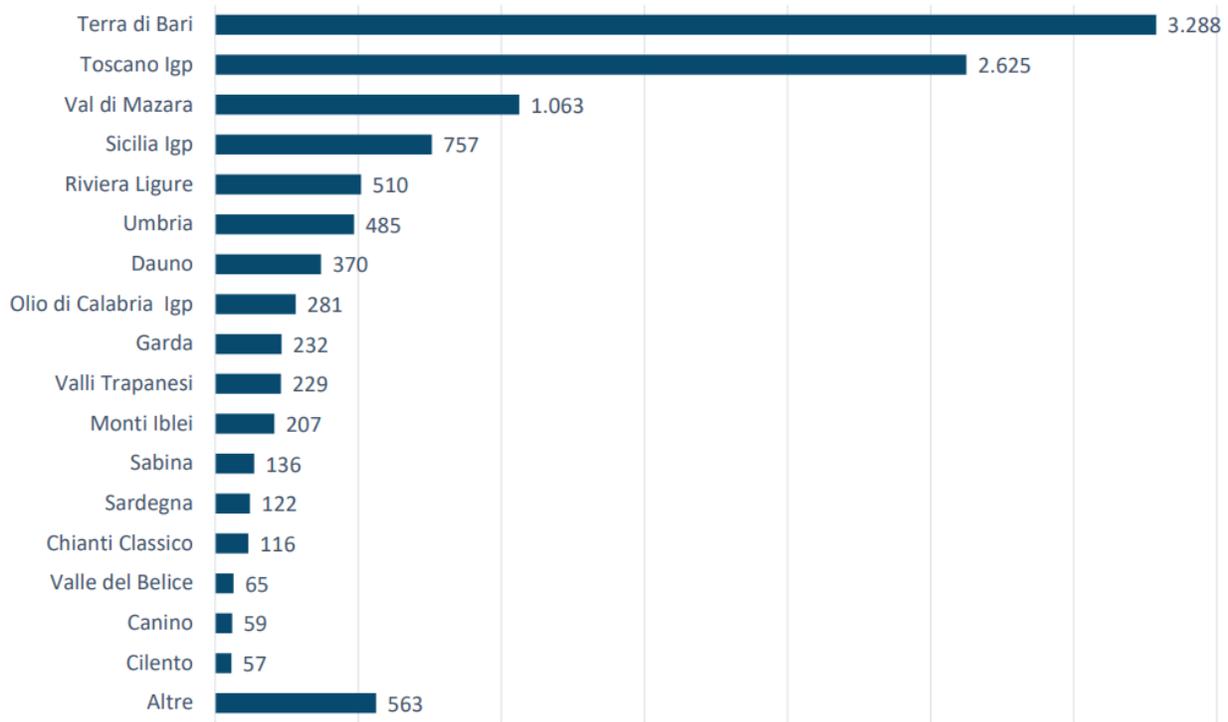
Fonte: RRN-ISMEA su dati ODC

Figure 21: Certified production of ig oil

This wealth is expressed in the high number of oils with EU recognition of quality (42 PDO and 6 PGI), which together represent an average of 2-3% of total national production (in 2019 11 thousand tons), a percentage that rises a few points if we reason in terms of value. The export value in 2019 came to 56 million euros, while the consumer value is estimated at 134 million euros.

It should be noted that, in many areas, the price of the certified product does not differ significantly from the "conventional" one and this discourages many producers who do not see the economic convenience to complete the certification process and to bear the related costs. Moreover, the selling prices of GI oils have a very high variability whose motivation often escapes the consumer.

THE MAIN IG PRODUCERS IN ITALY IN 2019 (TONS)



Fonte: ISMEA OdC

Figure 22: The main ig producers in italy in 2019 (tons)

In the last ten years, despite the great number of recognitions and the attention given to IG products for their quality and strong link with the territory, the certified volumes have not grown as hoped. The recent recognition of IGP Puglia could give impulse to the sector, given that the region is the one which adds up to half of the national production and that until now had not expressed a particularly high IG certified production. After the 20-year success of the Toscano PGI, also the southern regions, starting from Sicily, have adopted this path of the regional PGI which is leading to good results both in terms of volumes and market. The production, however, is still very concentrated on a few denominations: the first five absorb, in fact, 74% of the entire national production. A production segment that is growing is organic. The areas in 2019 exceeded 200 thousand hectares to which are added the 40 thousand hectares in conversion, reaching 20%

of the total area under olives. The regional distribution sees Puglia with 31%, followed by 28% of Calabria, 16% of Sicily and 7% of Tuscany. The production of organic oil, however, is estimated at about 11% of the national total, while in value the share is close to 15% thanks to the most profitable prices on the market.

ORGANIC OLIVE GROWING AREA (HECTARES)

	2016	2017	2018	2019	Var.% 2019/18
<i>Total olive tree</i>	222.452	235.741	239.096	242.709	1,5%
<i>To eat</i>	799	979	967	1.267	31,0%
<i>To make oil</i>	221.653	234.762	238.129	241.442	1,4%

Table 10: Organic olive growing area (hectares). Source: www.ismeamercati.it

4. Xylella fastidiosa

4.1. Definition

Xylella fastidiosa is one of the most dangerous phytopathogenic bacteria known worldwide.

It's suitable to populate the xylem vessels of a wide range of host plants, causing their inhibition and consequent desiccation in the most severe cases.

The typical and most frequent symptoms due to Xylella fastidiosa infections are splint scorch, with desiccations in the apical and/ or borderline part of the lamella, and more or less expansive desiccations of the leafage, originally affecting insulated branches and also entire branches and the whole factory.

Plants that are vulnerable to the bacterium are called host plants. The bacterium of Xylella fastidiosa is transmitted through small insects called vectors and they do not contain this bacterium at birth, but they acquire it by feeding on infected plants. There are currently three vectors identified, the most important of which is the Philaenus spumarius vulgarly known as sputacchina. Xylella is carried by these insect-vectors into the xylem of the plant and causes an infection which, by obstructing the xylem vessels, prevents nutrients from flowing to the extremities, thus causing rapid desiccation (CoDiRO) and the death of the plant.



Figure 23: Adults and early neanidal forms of *X. fastidiosa pauca* CoDiRO vectors source: <https://olivoelio.edagricole.it/>

The complaint linked as Complex of rapid-fire drying of the olive tree (CoDiRO) affects olive trees with a complex of symptoms closely associated with the homonymous strain of the subspecies *pauca*, which plays a crucial part in causing the complaint. Especially in aged samples, the part played by other factors, frequently attendant, similar as attacks by naiads of the leopard moth (*Zeuzera pyrina*) and fungal infections of some species is only borderline as an aggravating factor of the complaint.

The symptomatology affects with particular inflexibility the oldest samples, with total desiccation of centuries-old olive trees, while frequently on youngish shops the revision is limited to terminal desiccation that, grounded on the compliances available in 2015, don't feel to spark the generalized decline of the entire factory. Some studies have begun to show discriminational situations of vulnerability to microbial aggression among different olive cultivars. These studies tend to identify factors that induce lesser resistance/ forbearance to microbial aggression.



Figure 24: trees affected by Xylella source: <https://www.italiaolivicola.it>

EFSA maintains a database of known hosts presently conforming of 563 factory species, belonging to 82 botanical families. Still, not all listed shops are susceptible to all "types" (species or strains) of *Xylella fastidiosa* and it's possible that shops with the bacterium are asymptomatic. In addition, indeed shops belonging to the same species may express different situations of vulnerability depending on variety and growing conditions. Relating asymptomatic host species is critical, as they can serve as asymptomatic vectors of the bacterium to new, more susceptible areas and crops.

4.2. Expansion

To date, European areas infected with *Xylella fastidiosa* affect the European states of Corsica (2015), France (2015), Balearic Islands (2016), Spain (2017), and Portugal (2019).

According to a study conducted by scientists in Italy, France, and the United States, the *Xylella fastidiosa* bacterium first arrived in Italy in 2008, on a coffee plant, and later adapted to olive trees in the southern region of Puglia, eventually killing millions of plants.

It was on October 21, 2013 that the Italian State officially blazoned that it had ascertained the presence of the bacterium in Apulia in the home of the province of Lecce, where the first outbreak was linked. Latterly, the situation in Salento has been rigorously covered and has led to the identification of outbreaks, further and further multitudinous and wide. This situation soon led to the need for the mandatory preface of constraint measures and thus the delimitation of the infected area. Within a veritably short time, there has been a progressive and rapid-fire expansion of the area affected by the infection, which in fact moment includes all the businesses of Lecce and Brindisi, part of the fiefdom of Taranto and now also the southernmost homes of the fiefdom of Bari.

In order to contain the bacterium, it came necessary to introduce zoning for the home affected by the complaint. With this action the home has been divided by distinguishing the infected zone, now considered compromised, the constraint zone, a strip of the infected zone conterminous to the buffer zone in which monitoring must be carried out and constraint measures must be enforced through the eradication of shops plant to be infected and the fight against the vector, the buffer zone is the area girding the infected zone and is an uninfected zone in which monitoring must be carried out and, in case of discovery of an outbreak, "eradication measures" must be applied, conforming in the elimination of the infected factory and of all the shops of the host species, anyhow of their state of health, present within 100m.

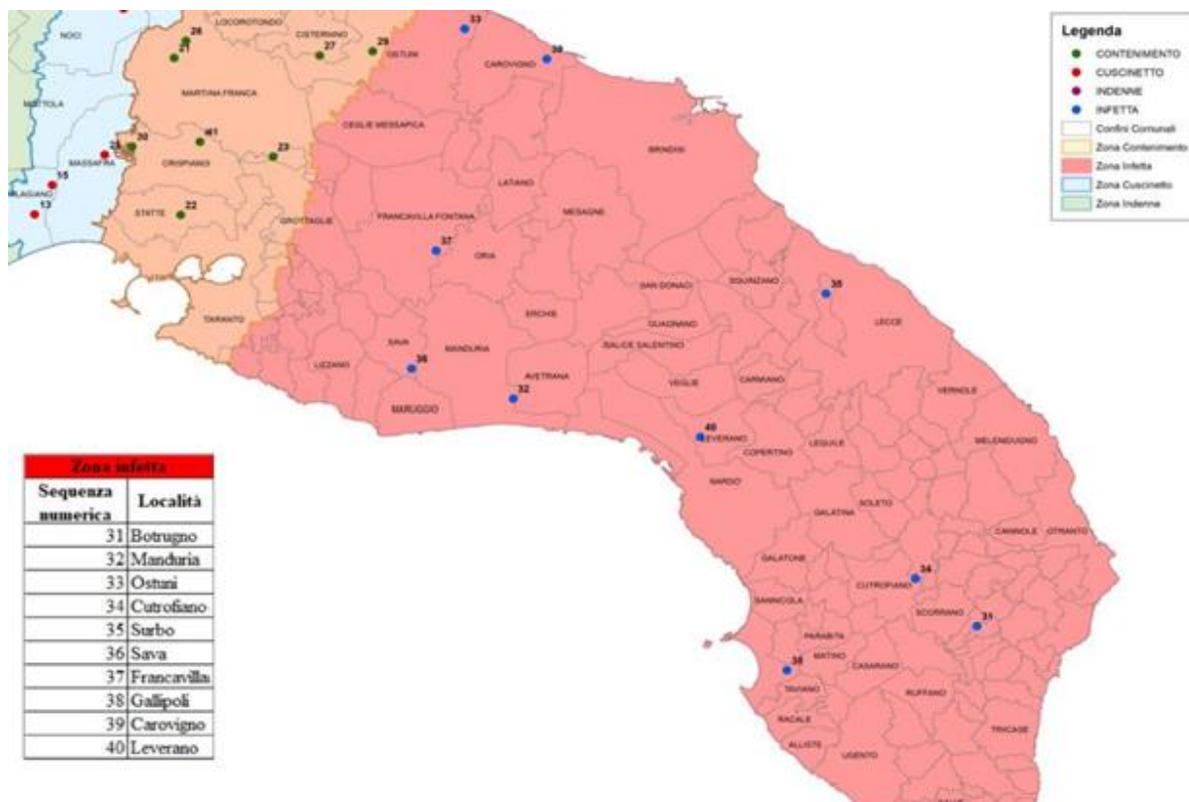


Figure 25: Vector monitoring - current demarcated areas

As confirmed by EFSA in 2019, to date there is no cure to eradicate the bacterium, but research has taken new and fundamental steps forward. "Compared to the speed with which it spread in the past, the race of *Xylella fastidiosa* is now slowing down, thanks to multiple actions: control of the vector insect, with plowing and insecticide treatments carried out between May and June; monitoring and more timely culling.

4.3. Care and recovery of compromised plants

4.3.1. The cure against xylella fastidiosa

The resources that have been put in the field for the crisis of the olive tree are in the field and see as main promoters the European Union and the Puglia Region, but also the Italian Ministry of Agriculture.

Good results have been obtained that all go in the direction of living with the disease as, to date, the final cure seems unattainable.

Research has shown that working the soil in the olive groves at the most suitable time to combat insect vectors, is the most effective way to prevent the emergence of adults responsible for the spread of the bacterium.

Other means that have been tested, such as the use of herbicides, burning of weeds, seeding of grasses and mulching, were considered to be more or less similar in effectiveness but with a much higher environmental impact and less sustainable over time.

Another solution still in the testing phase would allow the treatment of the plant through desiccation, lowering the bacterial load and allowing the plant itself to produce. This could be possible through "Dentamet" a foliar fertilizer based on zinc, copper and citric acid which must be accompanied by regular ploughing and frequent pruning, it seems to reduce the appearance of symptoms in olive plants diagnosed as infected. The treatment on the olive tree is carried out by nebulization. To enhance this experiment is the report built by Efsa from which it is clear that in treated trees compared to control trees was recorded a significant decrease in the severity of the disease.

4.3.2. The recovery of compromised plants

When the olive tree is affected by the bacterium *Xylella fastidiosa* needs an action that allows the recovery of the plant or, if the state of the disease is now too advanced, the eradication of the infected plant and the planting of a new olive tree of one of the species considered resistant. These two different ways of trying to recover the productivity of the plant have a different impact because they occur with a different timing and allow the complete productivity in very different times.

The eradication and planting of resistant species has a very high impact on the sociocultural aspect due to the heavy change in land morphology. The eradication of the infected plant allows to avoid the spread of the disease, but the planting of a new olive tree has a heavy impact on productivity. The olive tree, in fact, has a unique peculiarity: its fructification process begins very slowly, so that the first sporadic fruits begin to appear around 3/4 years after planting. Only after 9/10 years, the plant begins the phase of full productivity, whereas its senescence phase, that is the aging process of the crop, comes around 40/50 years.

Grafting an infected olive plant is subject to experimentation. In 2016 there were the first grafts in the Salento area of olive trees infected with the bacterium that were understood and grafted with the two known resistant varieties, Leccino and Favolosa. During the following years the new foliage has developed and three years later there was the first production of olives. Experiments continued and proved that the possibility of grafting is the procedure which allows the lowest impact on productivity, in fact in three years a good percentage is recovered. The effectiveness of this technique has been tested only on relatively young plants and at an early stage of advancement of the disease. There is not yet a scientific evidence that grafting is effective on plants already compromised by the development of the bacterium and the disease.

4.4. The impact of Xylella on the market

Although Xylella Fastidiosa only affected the southern area of Apulia, it objectively has had a economic impact at National level. The area affected by Xylella Fastidiosa involves around 21 million plants, concentrated between Lecce, Brindisi and Taranto, most of which are compromised and, since no longer productive, have abandoned by their owners. These are a considerable number of plants compared to the Italian total existing trees, in fact in around 50% of the total volume of oil produced in the country comes from Apulia. From these considerations it is easy to deduce that the phenomenon has surely impacted on the total Italian production: however, the exact effects of the Xylella is not so easy to evaluate on an aggregate level.

It is a phenomenon that can also have its indirect impact on national consumption, since self-production and the sale of the bulk product is very widespread in this sector, it is easy to assume that it can have a more or less relevant impact on this too. Obviously, imports and exports are consequently conditioned since the variation in product availability leads to different needs that can be compensated by trade with other countries.

If the reader considers Italy as a closed market, it can be clear that a phenomenon such as xylella fastidiosa, would lead to a shock in the production curve, which, considering a stable demand, would raise prices. However, in a globalized world like the one in which Italy finds itself at this moment in history, it is difficult for such deep change in the production curve to occur. The data found on the topic show how the retail price of the olive oil during these years has remained more or less stable; this result has been made possible by the competitive import price which smoothes out the depression in production in Italy.

The graph below shows Italian production, consumption, import and export data.

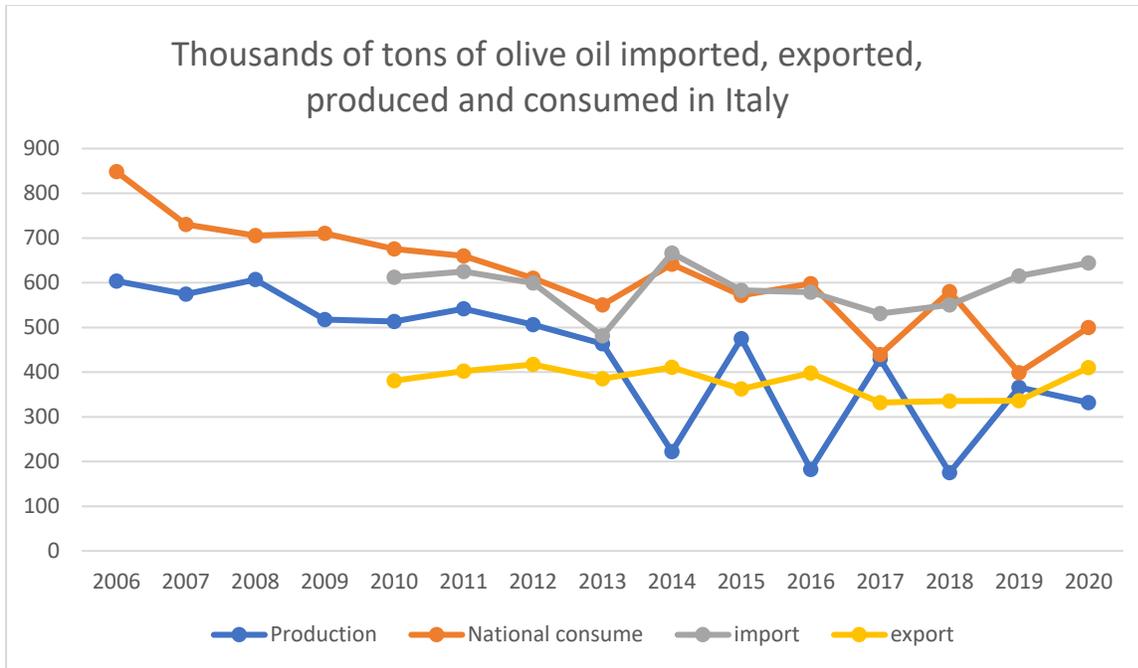


Figure 26: macro-variables of the Italian olive oil sector source: ISTAT and IOC

The data on the main variables of the sector immediately highlight its characteristics of instability:

- Production has tended to fall and in recent years it has been subject to high variability;
- Consumption always exceeds production, demonstrating that Italy is not self-sufficient;
- Imports are always higher than exports, which makes the trade balance structurally negative in volume but also in value;
- Imports are also necessary to satisfy domestic demand.

4.4.1. Olive oil production

The production of olive oil in Italy in recent years has been characterized by a strong variability that goes beyond the traditional trend that characterizes this sector and that, also due to climate

change, is likely to become an almost structural feature of the system. This represents a problem for the Italian market and for the economic stability of producers who will always have to raise the level of attention, professionalism and entrepreneurship in the management of the olive grove.

From the graph it is easy to estimate the negative trend of Italian production; the peculiarity that stands out most is the great variability, which has led even to have a peak production of 222,000 tons and to have twice a national production below 200,000 tons, reaching its lowest point in 2018 with 175,000 tons.

The 600,000 tons hoped for by the Olive Sector Plan seem, with the current conditions, very distant and Italy is increasingly dependent on the import of foreign oil.

It is not objectively easy to identify all the variables that make production so unstable.

In 2014 there was the first collapse of national production, after years of negative trend but tendentially stable, which had seen production go from 603.5 thousand tons in 2006 to 463.7 in 2013, which is equivalent to 20 tons per year less oil produced (about -4% annually). 2014 was a disastrous year for the sector; in this period, it experienced more than a halving of production (-52%) with many factors that have worsened the yield and the quality and quantity of the product. The phenological phases of blossoming and fruit setting did not have the expected course and were mainly hindered by climatic adversities. The summer was too rainy and has favored the attacks of pathogens, above all the oil fly, which is present in all areas of cultivation of the olive tree and performs the first activity of oviposition on small olives from June until July and after only three days the egg hatches and the larva feeds on the fruit, making it inedible. These have had the opportunity to occur in several generations significantly affecting important olive-growing areas of the peninsula, causing damage both in terms of quantity and quality. Despite these adverse conditions, in the olive groves conducted in a professional manner and where producers have intervened promptly to combat attacks of fly, not easy to fight because of the speed of proliferation and attack of the plant, the production was quite satisfactory, especially in

terms of quality. In many cases it was decided not to proceed with interventions, in view of the high costs, which would not be covered by the uncertain production results.

During 2014 Puglia has had a drop in production of about 35% and among the other factors already explained, the advance of Xylella, which recently appeared in Salento, has played a crucial role in creating this situation.

The 2016 was a bit of a repeat of 2014. Climatic conditions allowed for a proliferation of insects and pests that not even the strict and timely application of defense protocols was able to properly curb. The 2016 was one of the hottest years on record, which in itself is not a problem, but due to the concomitant high humidity, an almost paradoxical situation arose, and the pests were able to spread without the growers being able to fight them.

The 2018 represented the negative record year for Italian oil production. A production of 175 thousand tons was marked, 60% less than the previous year. To heavily affect the production, in fact, were the snowfalls in March that have affected a large olive-growing area of northern Apulia and in some areas the frosts have created damage that the plants could be affected by for years to come. To worsen this already critical situation, the problems related to the olive fly, a disease quite common in these areas. Its impact in 2018 has been more incisive because of the difficulty to enter the field for the distribution of pesticide products precisely because of the persistence and frequency of rains.

Xylella in 2018 had affected more than 4million trees making them completely unproductive. This is a significant number, corresponding to about 5% of national plants. Despite Xilella effect alone does not explain a reduction in Apulian production in that year, that marked less than 100 thousand tons, it certainly contributed to make 2018 a record year.

In the last three years, production has relatively stabilized at nearly 400 thousand tons. They have been basically positive vintage, which did not present specific climatic criticalities. Despite this, it can be noticed that on average production is inferior to the first decade of 2000.

The forecast for the 2021/22 vintage is positive, despite the fact that the northern regions have suffered large reductions in production potential due to adverse weather conditions. This

situation is more than compensated by the southern regions, which hold the majority of national production. In addition, during 2022 the market will observe, for the first time in Salento, the production of olive trees resistant to the virus *Xylella Fastidiosa*.

Summing up the reasons that have led to the worst years of oil production in the recent past, the reader can come to the conclusion that the olive tree is very subject to random factors and it is conditioned by climate and parasites. Since most of the companies are small, they find it hard to support all the costs necessary to combat all the variability that the vintage faces them. Furthermore, trees are often not the primary source of livelihood for these entrepreneurs, and this does not allow them to react promptly and timely to adversity. Poor "entrepreneurship" is a problem closely linked to the low returns of the olive groves and the progressive aging of the landowners. Very often, to dealing with the low profitability, the response consisted in reducing the investments and the commitment in agricultural production (absence of pruning, fertilization, treatments, processing, etc.) which inevitably generated a further reduction in yields and profitability. For standard oil, Italy hardly competes with Spain, which has decidedly lower production costs thanks to a larger and orographically less complex territory than the Italian one. The modernization of the plants, where possible, is an obligatory way to maintain competitiveness at an international level. Some particularly suitable areas, such as the north of Puglia, are already carrying out these restructuring of olive groves to encourage production and at the same time reduce unit costs.

4.4.2. National consume

Italy is the world leader in olive oil consumption, with about 500 thousand tons per year. As happened in production, Italy's per capita consumption of olive oil has followed a downward trend since 2010.

According to supply balance data, per capita consumption reached 7.6 kg per year in 2019, showing a drastically reduction from the 12 kg recorded in 2012.

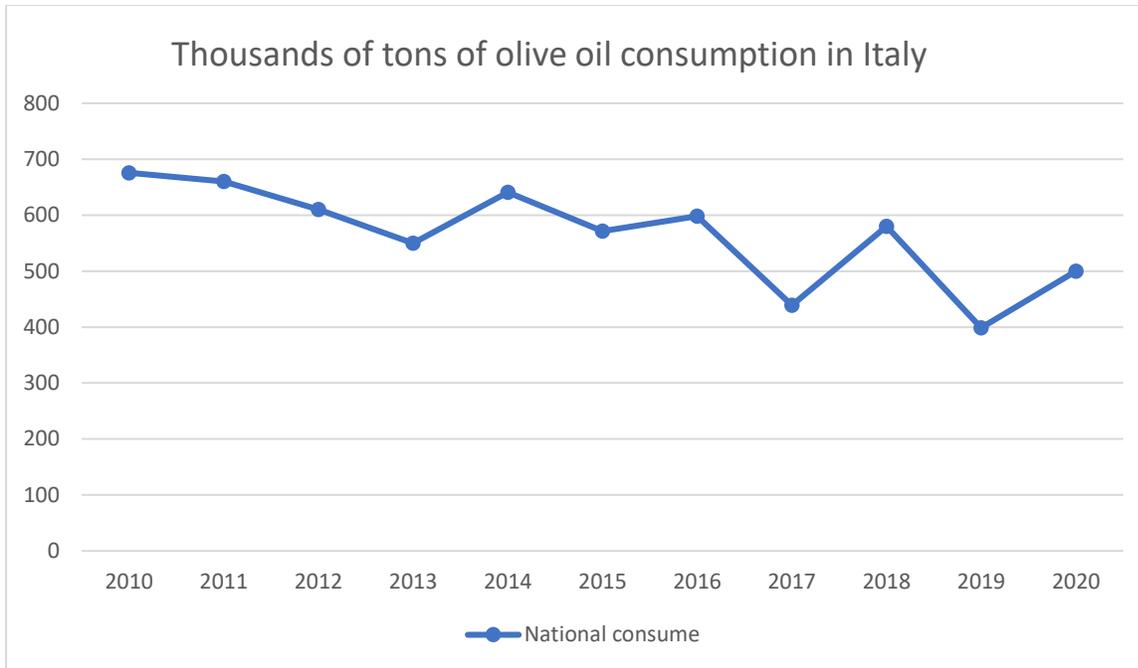


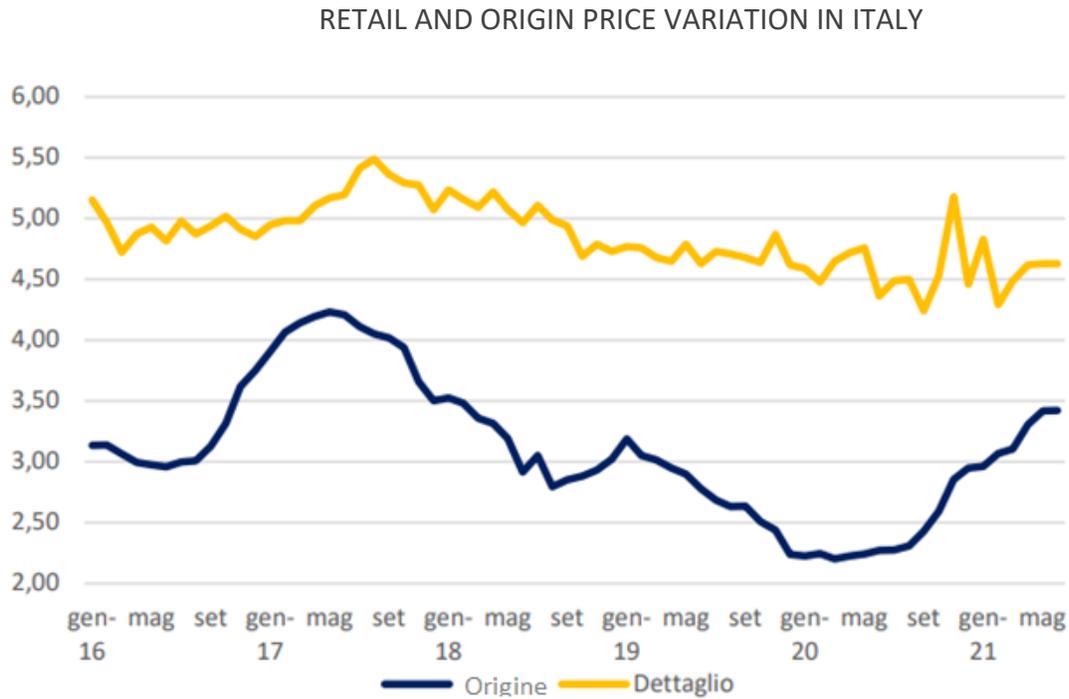
Figure 27: Thousands of tons of olive oil consumption in Italy

The consumption of olive oil takes place mainly within the home, while 30% is consumed through the Ho.re.ca. channel. If only the extra virgin segment is considered, according to ISMEA, consumption within the home is close to 80%. The monitoring of oil sales in Italy is very complex, due to the relevance of bulk products in household consumption. Much of the flow of this type of product escapes detection. These are self-productions by households or purchases at oil mills or directly from farms, especially in areas where olives are traditionally grown.

The Italian market is a mature one, whose demand curve can therefore be considered relatively stable.

The great variability of consumption in recent years is undoubtedly the result of an unstable price due to the instability of production. In fact, from the graph of macro-variables in the sector, it can be seen that in the year following a disastrous year for production, there follows a year of falling consumption. This is due to the fact that since the harvest and production of oil are concentrated at the end of the year, low production leads to an increase in prices and a fall in

consumption in the following year, especially for those consumers who buy through the direct channel with the producer and not from shop shelves, products which thanks to the large scale and imports manage to be more stable in price.



Fonte: ISMEA su dati AGEA

Figure 28: retail and origin price variation in Italy

Despite consumption being steadily higher than production, a fact that makes Italy a non-self-sufficient country and therefore dependent on imports, in 2017 and 2019 there were negative consumption peaks of 438 and 398 thousand tons, with a reduction in consumption compared to the previous year of 26% and 31% respectively, against a 12.2% increase in shelf prices. Important numbers that make this sector unattractive from an entrepreneurial point of view.

4.4.3. Import and export

Italy is certainly one of the most important players in the world of olive oil. It is the first country for imports and the second for exports.

If we look at the quantities imported and exported from 2010 to 2020, we can see that the volumes of olive oil imported are clearly higher than those exported. In 2014, some 666 thousand tons of oil were imported, about 62% more than the 411 thousand tons exported.

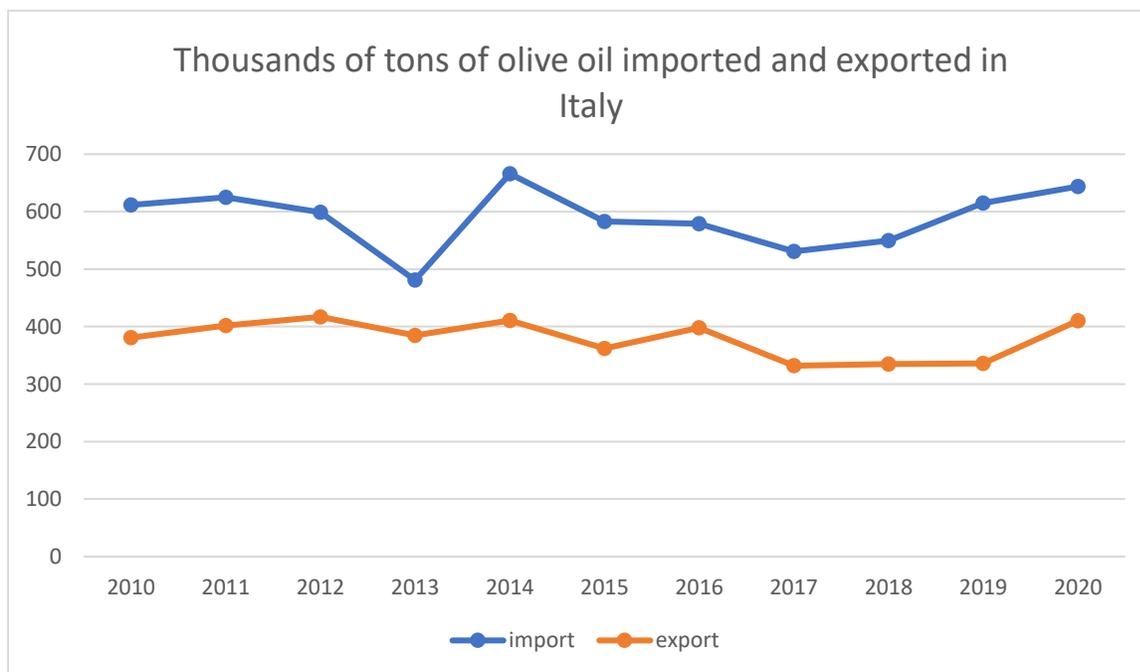


Figure 29: Thousands of tons of olive oil imported and exported in Italy

The table below shows that the delta of imports minus exports is always positive, which means that we import much more oil than we export.

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
<i>Import</i> (thous. tons)	612	625	599	481	666	583	579	531	550	615	644
<i>Export</i> (thous. tons)	381	402	417	385	411	362	398	332	335	336	410
<i>Delta</i> (thous. tons)	231	223	182	96	255	221	181	199	115	279	234

Table 11: volume of the Italian import-export of olive oil and delta

Italy is not a self-sufficient nation, so it is only natural that it imports much more than it exports. But the question is: is the oil we import the same type as the oil we export?

To answer this question, it is important to look at Italian imports and exports in value from 2010 to 2020. From the graph it can be immediately seen that, compared to the value in volume, these two breaks are much less distant. In fact, in 2011, 2012, 2013 and 2020, the value of exported oil exceeded the value of imported oil, albeit by a small margin.

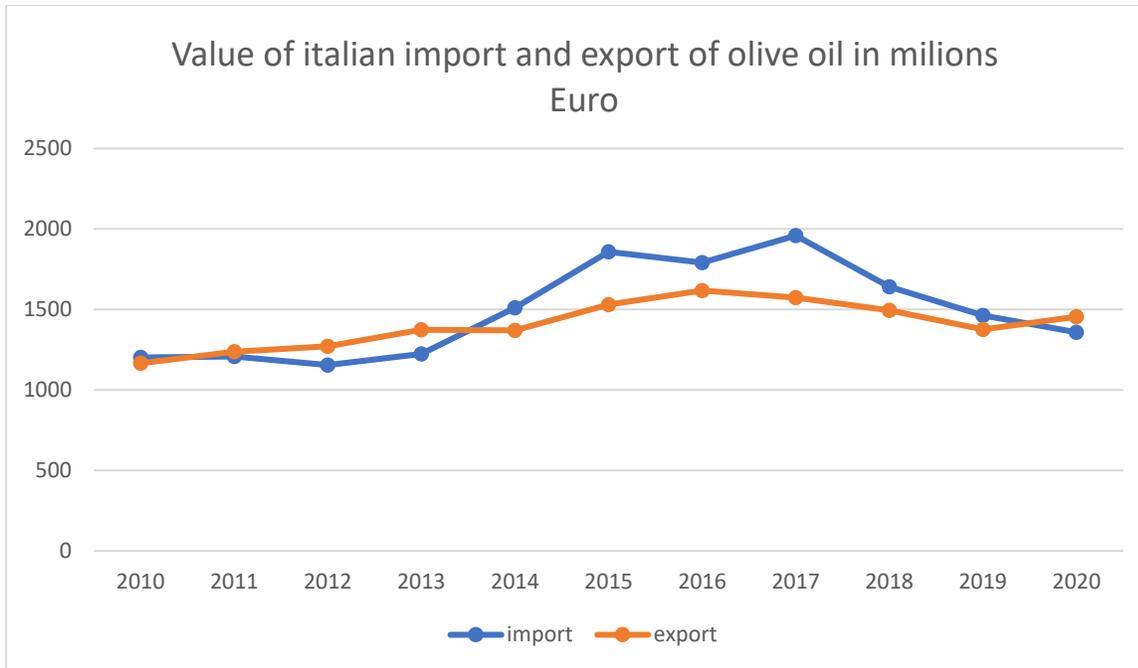


Figure 30: value of the Italian import-export of olive oil source: ISTAT and IOC

It is a significant value that shows the profound difference between the quality and market value of imported and exported oil.

In 2014 and 2019 from the point of view of volume there was the greatest delta of about 60%, but if we look at this difference in millions of euros, the import is only 10% greater than the export for 2014 and 6% for 2019.

If we take a closer look at the development of imports and exports in relation to domestic production in the same years, we can see that there is a correlation between imports and the drop in production. This is a normal phenomenon since a fall in domestic production is compensated by an increase in imports. In fact, it can be seen that oil imports increased from 2014 onwards: exactly in this year Italian production fell, for the first time, to around 200 million tons.

Exports, on the other hand, seem to be much more stable, both in terms of volume and, above all, in terms of value. The most significant drop was in 2017, when exports fell from 398 million tons in the previous year to 332, a drop of 16%.

5. Conclusion

The aim of this thesis is to provide an overview of the situation of the olive oil market in Italy. What has emerged is that olive oil in Italy is, without any doubt, a very important product both from a socio-cultural and economic point of view. At a global level, Italy is a big player, in first place for imports and second place for exports: “made in Italy” oil is recognised worldwide as a guarantee of quality. However, the data of the last decade should have already set off alarm bells.

While exports have always remained more or less constant in terms of both volume and value, production, domestic consumption and imports have values and trends that should not go unnoticed.

Italian production is subject to a fluctuating trend due to random variables, such as atmospheric agents and parasites, which from year-to-year cause variations of up to 50% compared to the previous year. If we add to this a catastrophe for the Salento area such as *Xylella Fastidiosa*, the situation can only get worse.

A production sector that is at the complete mercy of random agents is undoubtedly a backward-looking one, which is unable to systemize harvests and scale up costs. A sector that is the child of tradition, where land is fragmented among many landowners of a few hundred trees. Most aim to produce oil for themselves and sell the remaining delta for a quick buck. Obviously, such a system guarantees the quality that the whole world admires, but it does not stand up to comparison with the Spanish colossus, which over the years has invested in this sector and thanks to its super-intensive olive groves is able to move volumes around the world that far exceed those of Italy.

Obviously, the renewal process of Italian olive growing cannot faithfully follow the model used in Spain, which is characterized by high product volumes and a medium/low positioning. In order to regain competitiveness, Italy must be able to adopt this models, but always keeping the road of quality and differentiation, and puts the emphasis on traditional know-how by insisting on the PGI, PDO and Organic designations.

After this, reaching the lowest point in Italian production in recent history may be the driving force that allows Italian producers to look reality in the face and change the structure of this sector, and a catastrophic phenomenon such as Xylella may paradoxically be that extra quid that allows money to flow in and revive these lands with an eye to progress.

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