Promoting sustainable production and consumption patterns: the example of olive oil

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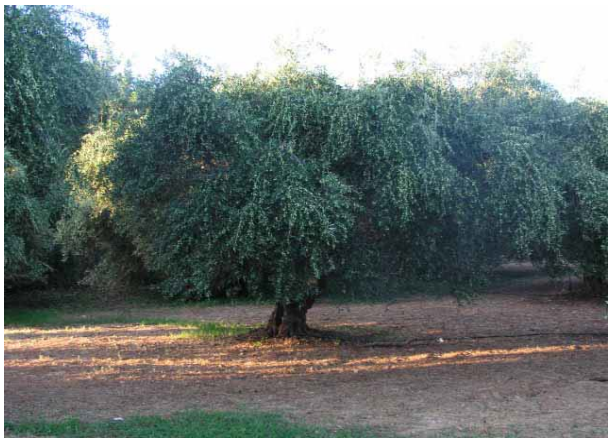
Criteria of ecological production of olive oil / Oil quality criteria (Summary)



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ELGO DEMETER -

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OLIVE OIL ECOLOGICAL PRODUCTION CRITERIA

Olive oil ecological production criteria constitute the main topics, included in the management cycle of an olive orchard during the cultivation period, which are based on the protection of the environment and natural resources. The aim is to combine economic yield of the crop with the health of the producers and consumers, ensuring at the same time the quality of life of next generations.

Below is a concise list of ecological olive oil production criteria, some of the basic characteristics of which are described concisely later on.

Concise list of ecological olive oil production criteria	
s/n	**Criteria**
1.	Propagation material management
2.	Soil management
3.	Fertilization
4.	Water resources management
5.	Pruning
6.	Pest management
7.	Biodiversity preservation
8.	Management of olive mill wastewater and other pollutants

Selection of propagation material

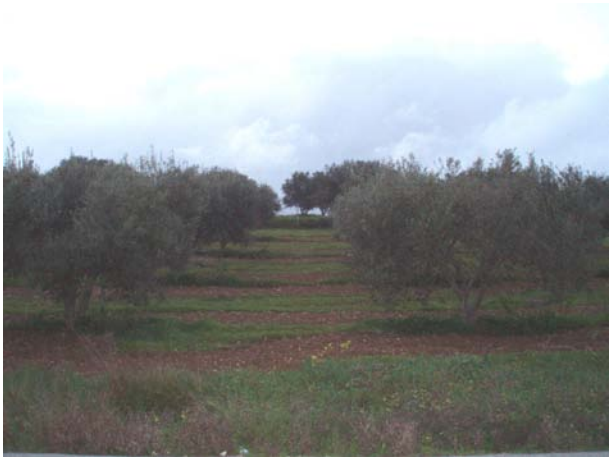
The vulnerability of an olive cultivar to enemies or diseases, to which a particular area is prone to, should be taken into consideration when setting an orchard, as it will inevitably result in increased cost of crop control, greater burden of chemicals and downgrading of the quality of the products. Furthermore, the use of healthy propagation material is obligatory.

Soil management

A decrease in the frequency of cultivation on sloping soil and the preservation of vegetative cover will result in the protection of the soil from erosion and the increase in rainwater infiltration. Tillage is recommended once a year (usually late in the winter).

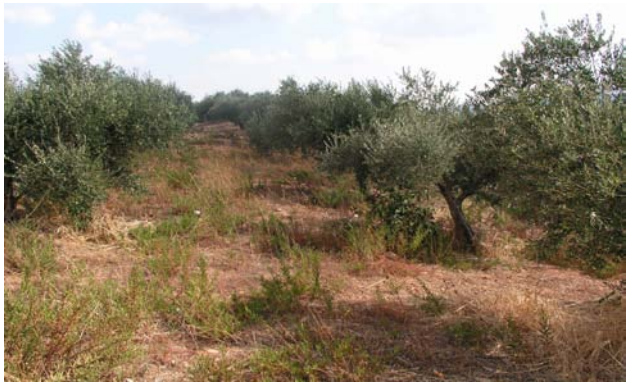
No-tillage combined with mowing or chemical weed control is encouraged; where this is not possible, reduced mechanical soil tillage is recommended.

Tillage in strips on sloping areas is recommended to be used in the autumn once a year, whereas the vegetative residue should be either destroyed by herbicides or incorporated in the soil, early in the spring before it begins antagonizing the crop for water and nutrients.



Tillage

Tillage in strips



No-tillage

Vegetative cover

Fig. 1. Different soil management systems

An important measure against erosion is the construction of terraces along the contour lines or the maintenance of old terraces that already exist in many olive orchards. (Fig.2).

Fig.2. Terraces in an olive orchard

Nutrients and irrigation water management

Securing nutrients and fertility of the soil in Environmentally Friendly Management Systems is achieved by applying organic fertilization (manure, compost, vegetative residue, green manure etc) or by the use of chemical fertilizers as little as possible, depending on the particular characteristics of every region.

Within the framework of Environmentally Friendly Management of olive orchards, the following measures are proposed:

- Soil analysis & plant diagnosis prior to fertilization
- Tillage & use of compost made from vegetative residue, olive leaves, animal manure etc, for the preservation and improvement of the organic matter and the soil fertility.
- Green manure and vegetative residue incorporation in the soil.

Green manure is mainly made from leguminous plants such as clover, broad beans, vetch etc. However, it can also be made based on a crop rotation programme that includes leguminous and graminaceous plants. The selection of the species included in the crop rotation programme is based on the soil type and the climatic conditions. Crop rotation with leguminous plants constitutes one of the oldest methods of natural fertilization of a field with nitrogen.
The efficiency of irrigation in Environmentally Friendly Management Systems requires rational use of water resources and can be increased by proper programming of irrigation according to the real needs of the olive trees.

Drip irrigation must be applied where deemed necessary, whereas it is also deemed necessary to examine the possibility of applying deficit irrigation. Deficit irrigation is a technique to save water without significant losses in production, by which plants develop under a minimum supply of water, either for a specific period of time or during the whole cultivation period, and yields are slightly smaller.

Pruning

The proper pruning of trees contributes in maintaining the crop's yield, good status of health and a decrease in the risk of the development of diseases and therefore in the use of pesticides.

The shape and the size that are given to the trees are dictated by the cultivar, the climatic conditions, the soil type, the cultivation technique that is applied, the harvesting method etc.

Crop control

High inputs of agrochemicals have led to important problems such as environmental stress (biodiversity, soil pollution, water contamination etc.)and to the presence of residue in products.

The control and successful management with insects and other pathogens in the olive crop, can be made with ecological management and combination of cultivation practices with integrated control, when this is necessary (ecological insect traps, pheromone traps, beneficial insects, approved products for spraying, soil solarization etc).

A more systematic observation of the population of insects through an appropriate network of traps and use of approved pesticides with fewer side-effects to the environment, constitute strategic choices in the upgrading of the efficiency and the decrease of risks to human health and ecosystems. The use of selected pesticides.

Protection of biological balance and preservation of the biodiversity of agroecosystem

Very often, fires are set in pastures in order to renew the biomass, putting in danger the flora and fauna of those areas. High density of grazing during the summer when vegetation is limited favours the further decrease in vegetation cover, thus increasing the risk of erosion and desertification.

Moreover, overgrazing can lead to a drastic limitation and also the extinction of certain vegetative species from the area, downgrading biodiversity and upsetting the biological balance of the ecosystem.

The preservation of natural vegetation around the margins of farms or in the dry stone-walls contributes in the indirect protection of olive trees from polyphagous insects. Olive trees constitute secondary hosts to these insects and are damaged by them mainly in intensive management systems, where total herbicide control is applied, which results in the extinction of primary hosts.

Olive mill wastewater

Evaporation in open evaporation tanks/ponds is the most common technique applied in Crete for handling pollution problems caused by olive mill wastewater, mainly because of its low cost of installation.

Also, after proper processing, liquid wastewater can become an excellent soil improvement amendment or can be used for partial replacement of fertilizers, due to their high bio load and nutritional value. Solid by-products of olive mill wastewater can be used for the production of fertilizing compost. Pilot units for the processing of wastewater have been built in many areas. There are many different methods to cope with this specific problem. However, the cost for their implementation has been a prohibitive factor for many of these methods.

OLIVE OIL QUALITY CRITERIA

Olive oil quality criteria are mentioned below in the following concise list. Some of them are described in a concise manner later on.

Concise list of olive oil quality criteria	
S. N.	**Criteria**
1a.	Cultivar, climate, soil
1b.	Pre-harvesting treatments (Conventional olive oil, Organic farming product, Integrated Management System product)
1c.	Harvesting and post-harvesting treatments: Harvesting (maturity stage – green olive oil etc, bruising during harvesting – Transportation – Storage of the olive fruit (storage duration and conditions) – Olive oil extraction at the olive mill (type of olive mill, hygiene conditions) – Storage of olive oil
2.	Marketing quality types of olive oil (Extra virgin olive oil, Virgin olive oil, Olive oil and Olive-pomace oil).
3.	PDO-PGI Products (Protected Designation of Origin, Protected Geographical Indication)
4.	Organoleptic assessment of virgin olive oil (aroma, flavour: fruity, bitter, spicy, mould, sediment, metallic, rancid)
5.	Olive oil alterations (Hydrolysis caused by humidity, temperature, ferments, micro-organisms, Oxidation - smell, bad flavour, caused by air, high temperature, light, metals)
6.	Risks for olive oil quality (olive oil unsuitable for consumption: residues of pesticides, heavy metals from the olive mill machinery, environmental pollutants etc).
7.	Food safety and hygiene (measures for mandatory implementation, control procedures, HACCP – Method for ensuring the production of healthy products – ISO International organization of quality standards)
8.	Traceability (detection for control from the point of origin of the raw material until the shelf and the plate of the consumer).
9.	Selection of raw materials (packaged olive oil quality, supplementary materials, packaging materials)
10.	Olive oil authenticity (blending with other oils such as seed oils etc)
11	Labelling of olive oil at the stage of retail commerce: mandatory (country or community of origin, quality type, area of origin only for PDO and PGI) and optional (cold pressing, cold extraction, organoleptic characteristics) labelling indications.

Cultivar, climate, soil

Pre-harvesting factors affecting the quality of olive oil

Harvesting-transportation-storage-olive oil extraction & quality

Quality affects in particular the organoleptic characteristics (aroma, flavour). The koroneiki cultivar, which is dominant in Crete, is believed to provide olive oil of top quality characteristics.

Olive oil organoleptic characteristics are also affected by the climate and the soil of the cultivation area. There are more aromatic ingredients in areas with long periods of sunshine. This becomes even more important for the quality certification of olive oils of Protected Designation of Origin (PDO) and Protected Geographical Indication (PGI).

The olive oil that is produced from olive trees in dry-limestone soils has more aromatic ingredients than the one produced in moist-clay soils.

In general, insect and fungal attacks create the conditions for the alteration of the quality of olive oil. Consequently, proper pesticide control contributes in the production of quality olive oil.

To produce good quality olive oil, producers must take the following precautions during harvesting and post-harvesting:

- The olive fruit must be in perfect maturity stage during its harvesting (yellow-violet colour). Unripe olives produce olive oil with green colour and bitter flavor (green olive oil). From an over-ripe olive fruit usually is produced an olive oil with increased acidity, less aroma, total phenols and altered colour.
- The bruising of the olive fruit during harvesting downgrades the quality of the olive oil, particularly in the event that the extraction of the olive oil is delayed. For this reason, it is recommended that the olives collected from nets after they have dropped naturally must not be left lying on the nets for more than 15 days.
- The transportation of the olive fruit and its storage for many hours before the extraction at high temperature and insufficient ventilation affects negatively the quality of the olive oil. Yucca sacks provide relatively good ventilation as opposed to plastic sacks, which must not be used. More sufficient airing is provided in crates, which constitute the best means of transportation and storage of the olive fruit. Sacks must be kept in a cool and properly ventilated place and the extraction of the olive oil must be completed as soon as possible (in less than 24 hours).

Basic types of standardized olive oil

Standardized olive oil is supplied for consumption in four basic types, the names of which correspond to their physicochemical and organoleptic characteristics that are determined by Regulations of the International Olive Council and the European Union:

- extra virgin olive oil
- virgin olive oil
- olive oil composed of refined olive oils and virgin olive oils
- olive-pomace oil

Organoleptic assessment – classification of olive oil

The organoleptic assessment is the detection and description of qualitative and quantitative characteristics of smell and flavor of olive oil.

Positive qualities include: fruity, bitter, spicy.

Negative qualities include: atrojado/sediments, mould/damp, winey-vinegary/acid-sour, metallic, rancid etc.

Olive oil alterations

The main alterations that olive oil will incur are hydrolysis and oxidation.

Hydrolysis or hydrolytic rancidity occurs mainly before the extraction of olive oil from the crop, while oxidation or oxidative rancidity occurs mainly after the production of olive oil and more particularly, when olive oil is stored under inappropriate storage conditions.

Hydrolysis is linked to an increase in acidity and change in the flavour. Humidity, temperature, ferments and various microorganisms are some of the factors affecting hydrolysis of the olive oil.

Oxidation or oxidative rancidity results in an alteration of the olive oil organoleptic qualities (smell, flavour) and a change in its physical qualities such as its viscosity. The main factors affecting oxidation are oxygen (air), high temperature, light and metals.

Risks for olive oil quality

In this case, danger is considered the condition or the factor that may render olive oil unsuitable for consumption or have a negative effect on the consumer’s health.

The types of dangers that may affect, downgrade or even alter the olive oil are:

a. Chemical dangers, among which the most important are:

- Pesticide residues.
- Heavy metals, the presence of which in the olive oils is due to their contact with the metallic

parts of the olive mill machinery, tanks, storage and transportation containers or their cross-contamination during the production stage.

- Environmental pollutants
- Dangerous substances from packaging materials

b. Natural dangers, which mainly involve the presence of foreign objects such as glass fragments, plastic and metal pieces, hair, dust, dirt, impurities etc.

Food safety and hygiene

The European Union, in order to make sure that the products produced or transferred among its member states are healthy and safe for the consumers, takes measures with mandatory implementation in all food industries and businesses and issues regulations for inspection authorities of every member state. Food safety is based on two axes:

1. HACCP studies (Hazard Analysis Critical Control Point)
2. Guides (manuals) of Proper Hygiene Practices, which describe food hazards and relevant hygiene regulations.

There is also the International Organization for Standardization (ISO), where many national standardization organizations from corresponding countries participate (Greece: ELOT).

Traceability

Traceability in food is a new field for the Food Industry and aims to control and certify the quality of the whole chain of production and commercialization of food products in every step of their production, from the point of origin of the raw material until the shelf and the plate of the consumers.

Selection of raw materials (olive oil, supplementary materials, packaging materials)

The supply of safe raw materials, packaging materials and supplementary materials with recorded and agreed upon specifications is of great importance.

Olive oil authenticity

Olive oil authenticity is determined by modern methods of molecular biology.

Olive oil labelling

Mandatory labelling specifications include:

-Mandatory designation of origin (solely for extra virgin olive oil and virgin olive oil)

-Quality category designation with descriptions on the category of the oil: extra virgin olive oil, virgin olive oil, olive oil composed of refined olive oils and virgin olive oils, olive-pomace oil.

The identification of the origin in regional and local level is allowed only in the cases of PDO and

PGI products.

Optional labelling indications include:

- first cold pressing
- cold extraction
- indications of organoleptic properties referring to taste and/or smell (fruity, bitter, spicey etc)
- indication of the acidity

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