

## Improvement of the productivity and quality of the oil used for Terra Alta Protected Designation of Origin (PDO) Olive Oil

### Summary

The 'Improvement of the productivity and quality of oil used for Terra Alta Protected Designation of Origin (PDO) Olive Oil' project will implement an experimental design to obtain extra virgin oil of maximum organoleptic and physical and chemical quality in line with the preferences and needs of the various consumers in each sector.

Current agronomic practices (related to irrigation, fertilisation and harvesting) and individualised production methods at oil mills (using different extraction conditions) do not produce extra virgin oil with the requisite levels of consistency and quality. The aim of this study, which includes the participation of Terra Alta PDO olive oil cooperatives, is to control and optimise the majority of the aforementioned conditions in order to obtain extra virgin oil with the quality level required by the market.

### Objectives

The level of concern shown by the olive oil producers most representative of the 'Terra Alta PDO' justifies the need for a rural agriculture project designed to improve the olive oil sector in their geographical area.

The development model needs to be more profitable, environmentally sustainable and capable of not only recovering traditional agricultural practices, but also improving them with modern technology in order to optimise all the product harvesting, transportation, production and marketing processes. The ultimate aim is to recover a high-value extra virgin olive oil that is more homogeneous and presents the organoleptic and physical and chemical properties required by current quality standards.

The innovative work done to increase the proportion of oil considered to be high quality with respect to the entire production of Terra Alta may constitute a benchmark for other areas as well as a step forward in olive oil production methodology.

### Description of the actions carried out in the project

The experimental design consisted of the following activities:

- Market research to determine at first hand consumers' preferences in relation to the organoleptic and physical and chemical qualities of extra virgin olive oil. This study consisted of two parts: in the first phase we carried out a sensory assessment of several samples of Terra Alta extra virgin olive oil and established the sample most liked by a group of participants, in order to determine or characterise consumers' sensory preferences. In the second phase, the study was complemented by consumers' sensory assessment of different oils obtained in the pilot project, from olives with varying degrees of ripeness, in order to determine the most highly rated oil.

- Selection of plots representative of the regional scope of each cooperative participating in the project and located in different municipalities, with the Empeltre and Arbequina varieties. In addition, dry and irrigated plots will be selected. Different harvesting periods will be established for each plot in accordance with the maturation of the olives. Representative samples will be harvested in three periods of maturation and then transported as quickly as possible to the oil mill.
- The physical and chemical properties of the olives of each batch will be analysed prior to their arrival at the oil mill and the pressing characteristics that are most suitable to improve the quality of the oil will be studied, taking into account different oil extraction and purification variables and analysing the oil obtained. The organoleptic properties and the physical and chemical characteristics (acidity level, peroxide index, K270 index, humidity, impurities...) of the different oils will be studied to determine their quality. In addition, more complex analyses will be performed using innovative nuclear magnetic resonance profiling ( $^1\text{H-NMR}$ ). This extremely useful analysis identifies and quantifies a wide variety of lipid species present in olive oil. In olive oil it is also possible to analyse typical compounds like fatty acids and triglycerides, sterols, volatile compounds, phenolics, phospholipids and trace metals. Fingerprint or profile analyses can also be conducted to determine, without any prior knowledge of which compounds are to be analysed, the characteristics of a sample in order to certify its identity. It is especially worth noting that the  $^1\text{H-NMR}$  analysis can also be used to monitor oxidation of vegetable oils and their derivatives, a major problem for quality that can cause greater deterioration of the oil, and to detect primary oxidation products, such as hydroperoxides, and secondary oxidation products, such as aldehydes.
- The results of the project will be used to draft a protocol of good agronomic, transportation, extraction and purification practices to improve Terra Alta PDO olive oil.

## Final results and practical recommendations

### In relation to market research:

According to participants in the tastings, the perfect oil is markedly fruity (6.73/10) and sweet (5.56/10), but not very spicy (4.39/10) and not very bitter (4.01/10). Mature oil comes closest to the perfect oil. This is oil obtained from olives at an optimal state of ripeness with a maturity index (MI) of 4. However, in relation to the fruity character, green oil, obtained from unripe olives with an MI of 2.5, has a fruitiness level that most closely matches the perfect oil.

### In relation to agronomic and mill protocols:

When establishing an optimal harvesting time, the intended goals should be clear. The aim is to obtain an oil with the following characteristics:

- Fruity oil
- Stable
- Balanced in the mouth

A fruity oil will be provided by green olives or those with an MI of 2.5-3. We know that with fruitiness and other parameters beneficial to the quality of the oil drop at higher MIs.

The oil should also be stable and balanced in the mouth. This is provided by polyphenols. The riper the olive, the fewer polyphenols it has, thus reducing its stability.

Practical recommendations regarding the harvest of olives and their MI:

- The above data suggest that harvesting should start in early October. This is early but essential.
- The other goal that should not be forgotten is that the oil should be or have the organoleptic classification of Extra Virgin. And in the Empeltre variety this comes from olive oils with an MI of around 2.5.
- Overripe olive oils are not classified as Extra Virgin either organoleptically or chemically. When the oils are overripe, the  $\Delta 7$  stigmastenol is outside the regulatory range.
- Another false belief is that olives harvested in February have more oil, as they have less water, so apparently the yield is higher.
- As we have seen, it is essential to harvest olives at an MI of 2.5

Practical recommendations regarding the mill:

- Sieve diameter of 6, as 5 increases emulsions and lowers extractability.
- Maximum pressing time 1 hour
- Pressing temperature under 30°C, and if it is to be labelled as extracted cold, the temperature should not exceed 27°C during the process.
- The oils must also be filtered a week after production. Nothing is gained by keeping murky oils; they are better kept clean. If not, transfers must be carried out very carefully and methodically.
- Cleanliness is basic. Nothing should be left uncleaned, especially if ripe olives are involved. That is why, when new installations are built or modifications made it is essential to remember they must be easy to clean, otherwise it does not get done.
- It is also important to use the best available technology, (BAT), which incorporates automatic self-cleaning elements, thereby shortening working hours and increasing profits.

## Conclusions

The actions carried out allowed us to determine the most highly valued type and characteristics of extra virgin olive oil from Terra Alta while also establishing the optimum MI and time of harvest for the olives and the main parameters for oil extraction in the mill to obtain the oil most highly valued by consumers.

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**Subject area(s) of application**

- Agricultural production system
- Agricultural practice
- Agricultural equipment and machinery
- Livestock farming and animal welfare
- Vegetable production and horticulture
- Landscape / Territorial management
- Pest and disease control
- Fertilisation and nutrient management
- Soil management
- Genetic resources
- Forestry
- Water management
- Climate and Climate Change
- Energy management
- Waste and by-product management
- Biodiversity and environmental management
- Food quality/processing and nutrition
- Supply chain, marketing and consumption
- Competitiveness and agricultural and forestry diversification
- General

**Geographical area(s) of application**

PROVINCE/S	REGION/S
Tarragona	Ribera d'Ebre Terra Alta

**Dissemination of the project (publications, seminars, multimedia, etc.)**

- Meetings with cooperative directors
- Informative seminars for the producer partners responsible for the project's experimentation plots
- Informative seminars for the partners of the cooperatives taking part in the project.
- Informative seminars on the results of the studies and the project.

**More information on the project**

PROJECT DATES	TOTAL BUDGET
Start date (month-year): June 2018	Total budget: €209,340.00
Completion date (month-year): September 2020	DARP funding: €85,544.46
Current status: Executed	EU funding: €64,533.54
	Own funding: €59,262.00

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