TIRSAV PLUS Project

New technologies for husks and waste water recycling

Compost | waste management | recovery of waste | organic waste

PROJECT DESCRIPTION

The olive sector is an essential part of the agricultural sector of the European Union, especially in the Mediterranean countries' economies where 11 million tons of olives are produced every year (Eurostat 2016) from which over 1.740.000 tons of olive oil are obtained and in which about **12 thousand oil mills** operate. One of the main environmental problems associated with the olive production chain is the management of the olive mill solid waste and especially the vegetation waste waters. This by-product has an intrinsic polluting charge both for the organic matter content (whose chemical or biological oxidation reduces the oxygen content in surface waters) and, above all, for the excessive content of polyphenols (whose biodegradability is low). In particular the polluting load of the waters is due to the high values ??of **COD** (Chemical Oxygen Demand) (50-200 g/l) and **BOD5** (Biochemical Oxygen Demand) (28,7-90,2 g/l) present in the wastewater which determine a high phyto-toxicity.

OBJECTIVES

The general objective of the TIRSAV PLUS project was the recovery for agricultural purposes of the by-products of the oil processing. The specific objectives of TIRSAV PLUS were to:

- make TIRSAV Plus technology applicable to individual mills regardless of the production volume and technology used;
- develop a more efficient oil waste management system through the construction of a composting center, capable of improving the production performance of the reference olive growing area;
- improve the quality of the final product in order to achieve more advantageous economic objectives;
- create new and valid agronomic products, with low environmental impact, easy to use and to sell;
- facilitate the adaptation of sector regulations for the reuse of oil waste and support the proposal for the authorization of innovative technologies in the field of eco-sustainable management of oil mill wastes.

The project was based on the results achieved within the first TIRSAV project (LIFE00 ENV/IT/000022) which tested the effectiveness of the oil waste recovery process with a small-scale demonstration prototype.

PROJECT PHASES

The technological solution developed is based on a composting method calibrated on the efficiency of the bio-digestive process, on the quality of the compost to be obtained and on the ability to adapt the process to the various chemical-physical characteristics of the waste generating from olive processing: two- and three-phase plants, virgin and pitted pomace, waste water and washing water. The innovation and transferability of the solution created within the LIFE TIRSAV PLUS consists in the **possibility of processing together waste water and virgin pomace coming from different extraction systems within the same olive oil extraction process**. The oil waste management system adopted by TIRSAV PLUS also allows to solve problems

related to the mills' production capacity (olive mills with less than 1000 t/year working capacity) and to recover an important source of organic substance as fertilizer for agricultural soils.

In addition to the development of recovery technology and the construction of the industrial plant, TIRSAV PLUS focused its actions on the chemical-physical and microbiological analysis of the composting process and on the agronomic efficacy of the produced fertilizing compost. Both actions represent two fundamental phases of the project aimed at understanding and improving the efficiency of the composting process and the agronomic use of the produced compost. During the pretreatment phase consisting in mixing virgin pomace with the vegetation waste water, in addition to the elimination of the stone (through a different manufacturing process), structuring materials - such as, for example, pruning and mowing waste and raw wool - were added to obtain a homogeneous compound. The choice and dosage of these materials were fundamental to obtain a homogeneous mass that facilitated air penetration and avoided degrading reactions.

PROJECT RESULTS

The main project result was the construction of a pilot industrial plant, the **Experimental Composting Center** through which the effectiveness of the technical solution was tested, with reference both to the process and management, in order to verify its **suitability in other European olive oil production contexts regardless of the production dimension and the extraction technology**. Being a modular system that adapts to different production contexts (two or three phase extraction plants; small plants; medium or large plants) the composting process adopted makes this solution easily applicable, **enabling companies in choosing the best treatment strategy, facilitating them in optimizing the investment**, and ensuring compliance with current regulations and a high quality standard in the production of compost.

In order to value the compost produced, and thanks to the flexibility of the developed recovery process, specific fertilizing composts have been developed for the different uses. In the case of use in open field crops, the most requested and therefore most relevant parameters are: organic substance (O.S.), nutrients, pH, C / N ratio and conductivity; while in the case of the specialized crop sectors the most relevant parameters are pH, salinity, hygroscopic characteristics, and content of nutrients in soluble form. Based on these needs, taking into account the organic starting matrices (oil waste, wool waste and forestry and crop waste), **four types of compost** were developed, registered in the register of fertilizers (RFF n ° 01192/11 of the Ministry of Agricultural, Food and Forestry Policies) as fertilizing compost and acknowledged as suitable for organic agriculture: Green-Life (green composted soil conditioner-ACV), Eco-Life (mixed composted soil conditioner-ACM), Natur-Life (ACV), Bio-Life (ACM).

The Experimental Composting Center has been configured to operate using a common primary production line, which carries out the pre-treatment phase, and two subsequent secondary, parallel and alternative lines, capable of carrying out the maturation phase (see the figure below). Depending on which of the two secondary lines is activated and what production rate is set on the primary line, the plant is able to operate at two different operating regimes:

- **low production capacity regime**, capable of producing accordingly to the authorized limits: 2.450 t/year of fresh substrate, corresponding to about 20 t/day and about 2.610 t/year of incoming oil waste;
- **high production capacity regime**, that allows to reach the production rate set out within the project as one of the initial objectives: 9.450 t/year of fresh substrate, corresponding to about 96 t/day and about 12.240 t/year of incoming oil waste.

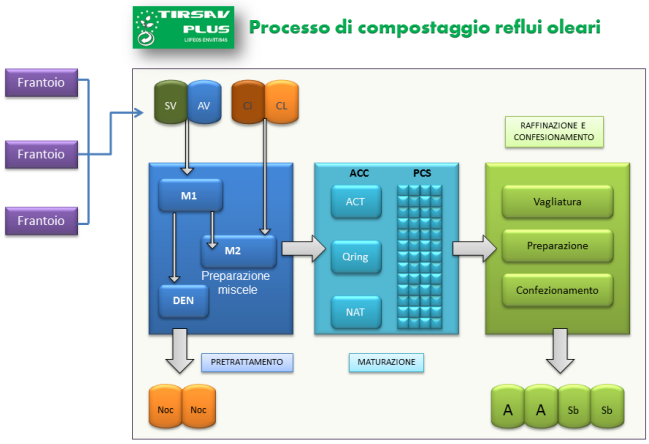

Figure 2 – ***AV*** *acqua di vegetazione –* ***SV*** *sansa vergine –* ***CI*** *cippato –* ***CI*** *lana grezza* ***Noc*** *nocciolino -* ***A*** *ammendante compostato –* ***Sb*** *Substrato di coltivazione.*

The main phases of the process are three:

1. Pretreatment phase: mixing of virgin pomace (VP) and vegetation waste water (WW) coming from the mills in the three-phase extraction systems located in the plant's catchment area. After mixing, stones are separated, and sent to be bagged. Then the pitted mixture undergoes a tritomixing process with the addition of appropriate structuring materials (ASM), and is sent to the next phase;

Due to the unpleasant odor emissions, the system has been equipped with an internal air intake system in order to ensure 3 air changes per hour for the treatment of exhausted air. The intake system, consisting of suction pipes installed on the roof of the shed, conveys the exhausted air, thanks to an electric fan located outside the shed, towards the biofilter, which allows the reduction of bad smell.

2. Maturation phase: the choice to bring the prepared mixtures to maturity through **two alternative maturation lines** is mainly based on the optimization of the production process and consists of two methods, called **"ACC - Active Composting Composite Line"** and **"PCS - Passive Composting Simplified Line"**, which are based on two different process methods. In the "ACC Line", which has in common with the PCS line an identical pre-treatment phase; part of the mixture goes through an accelerated bio-oxidation phase in a Biocontainer, and continues its maturation on a blown bed before being sent to the maturation phase, under canopy and without air ventilation; in the "PCS line", part of the mixture is sent directly to the maturation phase in bins and/ or big bags without air ventilation, and then sent to a shredder. The matured compost is then sent to the refining process.

3. Refining and bagging phase: at the end of the maturation there is the refining phase of the material, which consists in sieving the compost eliminating the coarser pieces in order to obtain the desired size and a homogeneous granulometry that is suitable for being bagged and then used for agronomic purposes. Residuals can be reused as structuring. The compost coming from the ACC line is screened to obtain a homogeneous granulometry so as to be suitable for being bagged. While the compost of the PCS line, being more compact, undergoes a further tritomixing phase, once bagged it still remains for 3 to 4 weeks before being marketed. Also pomace stone is subjected to bagging without undergoing the screening operation.

The tested technical solution can adapt to the different needs that an olive-growing area may require, without neglecting the two main objectives, i.e. reduction of the environmental impact of the extractive activity and recovery of organic substance for agricultural uses. In summary, the environmental benefits of the TIRSAV PLUS strategy is reflected in the reduction of mill processing waste, recovery of organic matter and conservation of the fertility of agricultural soils. In quantitative terms, spreading of the TIRSAV PLUS composting technologies and a 50% recovery of the European olive wastes would allow the production of about 3.6 million t/y quality compost that could be returned to the agricultural soils.

The **Guidelines** drawn up within the project are aimed to support agricultural enterprises in the sustainable management of oil mill waste, providing the sector operators with useful indications concerning the efficient management and recovery of virgin pomace and vegetation waste waters.

-

Acronym
TIRSAV PLUS

Number of reference
LIFE05 ENV/IT/000845

Reference Programme
LIFE

Beneficiary Coordinator
Ente Parco Nazionale del Cilento e Vallo di Diano

Contacts
Antonio Feola

EU contribution
944.208

Call Year
2005

Start Year
2008

End Year
2012

Beneficiary headquarters

Piazza S. Caterina, 8
84078 Vallo della Lucania SA
Italy

Region
Campania

Description

Parco Nazionale del Cilento e del Vallo di Diano, Regione Campania