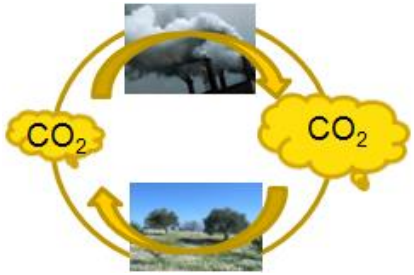
"Introduction of new olive crop management practices focused on climate change mitigation and adaptation - oLIVECLIMA"



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LIFE11 ENV/GR/942– oLIVE CLIMA

- One of the most important problems of agricultural soils in Greece and in Mediterranean region is the low percentage of organic matter

- Olive groves may be considered as a significant C sink. During olive growth a large quantity of plant residues are produced, while high loads of both liquid and solid olive mill wastes are also produced during the extraction of olive oil.

- Optimizing carbon balance in olive groves using “carbon” cultivation practices may improve soil quality and productivity and the need for weed control measures is reduced. This contribute to climate change mitigation

- The implementation of alternative olive cultivation techniques (*reduced/no tillage*, plant *residue and weed management, tree pruning*, etc) in Greece has not been systematically tested under the prevailing Mediterranean conditions. A LIFE+ project was initiated (oLIVE-CLIMA; LIFE 11/ENV/000942).

➢ Project management practices in a nutshell:

- Introduction of no soil tillage/reduced tillage.
- Organic matter removed during olive production to be returned and spread on the soil either raw or composted.
- Enrichment of indigenous weed flora by sowing a mix of selected seeds.
- Adaptation of tree pruning to maximize the capture of CO_2 through photosynthesis.

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ADMINISTRATIVE DATA:	
PROJECT REFERENCE	LIFE11 ENV/GR/000942
DURATION	01-OCT-2012 to 30-SEP -2017
TOTAL BUDGET	3,649,473.00 €
EU CONTRIBUTION	1,822,436.00 €
PROJECT LOCATION	Kentriki Makedonia,Peloponnisos,Attiki,Kriti,Basilicata

➢ BENEFICIARIES:

❖ COORDINATOR

✓ Development Agency of Eastern Thessaloniki's Local Authorities, ANATOLIKI

❖ PARTNERS

✓ NAGREF - ELGO DEMETER
✓ RodaxAgro Ltd Environment & Quality, Athens, Greece
✓ University of Basilicata, Italy
✓ Agriculture Press Publishing (AGROTYPOS), Greece
✓ NILEAS Farmer Group, Greece
✓ Agricultural Cooperative of Peza, Greece
✓ Agricultural Cooperative of Mirabello, Greece

- The project LIFE11 ENV/GR/942 – oLIVE CLIMA was designed to show the potential of olives to mitigate climate change by a number of measures aiming to increase carbon uptake from the atmosphere and storage of a considerable part of it in the soil and in the wood of the olive trees.

- The project focuses specifically on olive-producing areas in Greece, investigating the potential of these areas to increase carbon sequestration by soils and to reduce greenhouse gas emissions.

- ✓ 3 olive growing areas
- ✓ 120 parcels (3 x 40)
- ✓ Irrigated – rainfed parcels
- ✓ Different soil-climatic conditions
- ✓ Different type of wastes (OMW): 3-phase or 2-phase olive mills

➢ Main objectives of Oliveclima:

- ✓ **To determine farming practices that lead to increased carbon dioxide uptake by plants from the atmosphere.**
- ✓ To take measures to reduce GHG emissions and other environmental impacts during crop production processes.
- ✓ **To reverse the trend of soil organic matter losses, erosion and desertification by measures that increase the rate of soil organic matter build up.**
- ✓ To improve the biodiversity and sustainability of the olive grove ecosystem.
- ✓ **To lower the olive oil production cost and to create added value from the standardization of a climate beneficial product.**

Action B1. Returning of olive tree organic matter to the parcel soil










Short description: Organic matter removed during production to be returned and spread on soil as is (chipped, shredded branches) or after composting.

- ✓ Training farmers groups for implementation many times every year.
- ✓ Difficulty to find enough organic materials for drastic carbon storage.
- ✓ Compost maturation takes time.
- ✓ Application of OMW under certain guidelines.

Action B2. Introduction of new cultivation practices to increase carbon sequestration

Short description: **(a)** Introduction of zero tillage/reduced tillage on a permanent basis, **(b)** enrichment of indigenous flora (weeds) by sowing a mix of selected seeds, **(c)** adaptation of pruning to achieve maximum carbon storage.

- ✓ Training farmers groups for implementation.
- ✓ Difficult to change farmers' mentality in pruning + long term tree response.
- ✓ Weed flora modification is highly depended on climatic factors.

Action C2. Carbon return to the olive groves through organic material recycling

Soil water

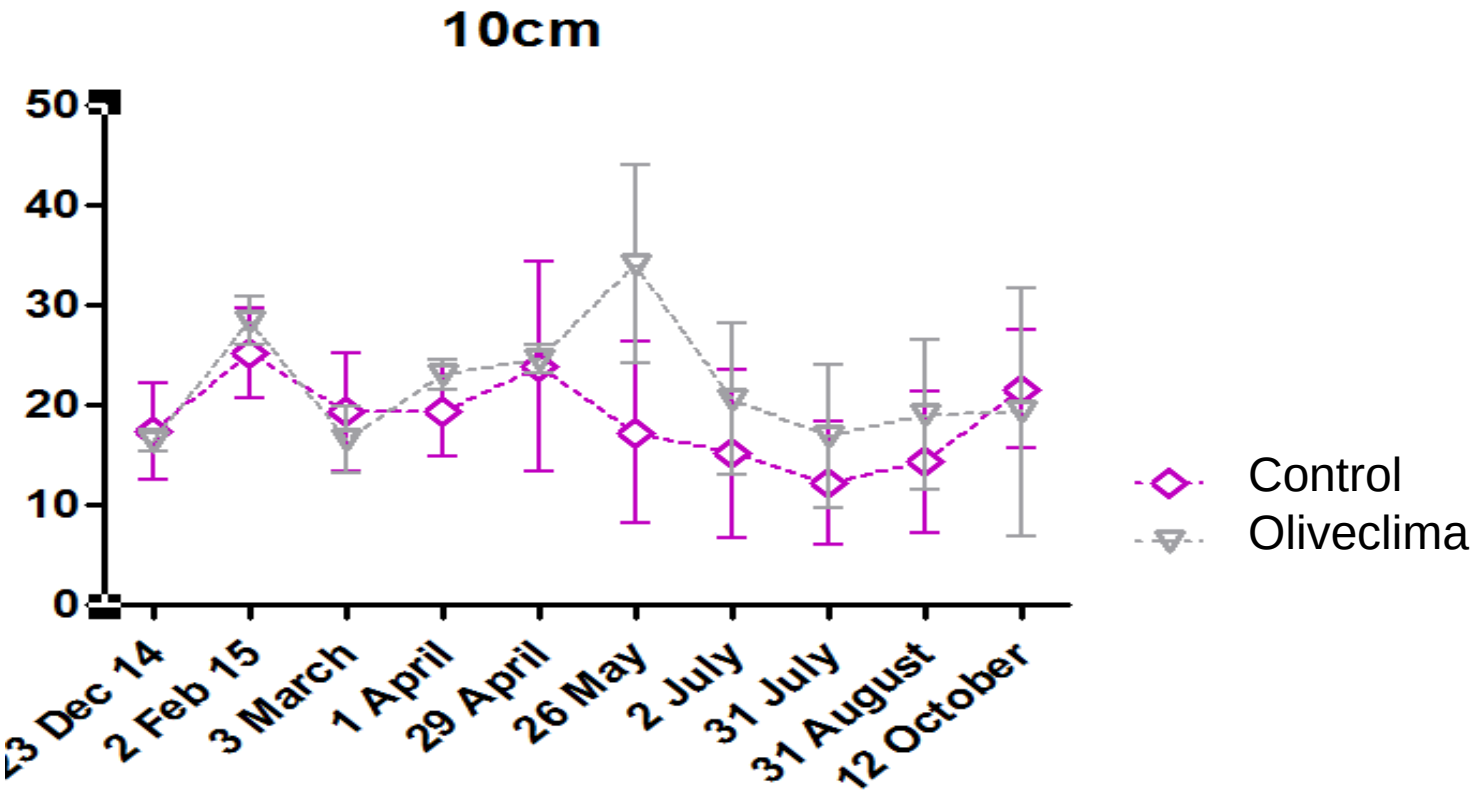
Soil sampling

OMW sampling

Short description: monitoring of carbon return to the olive groves through the recycling of organic materials: field measurements & laboratory analyses (soil, soil water, plant tissue, compost, olive mill waste).

Action C2. Carbon return to the olive groves through organic material recycling

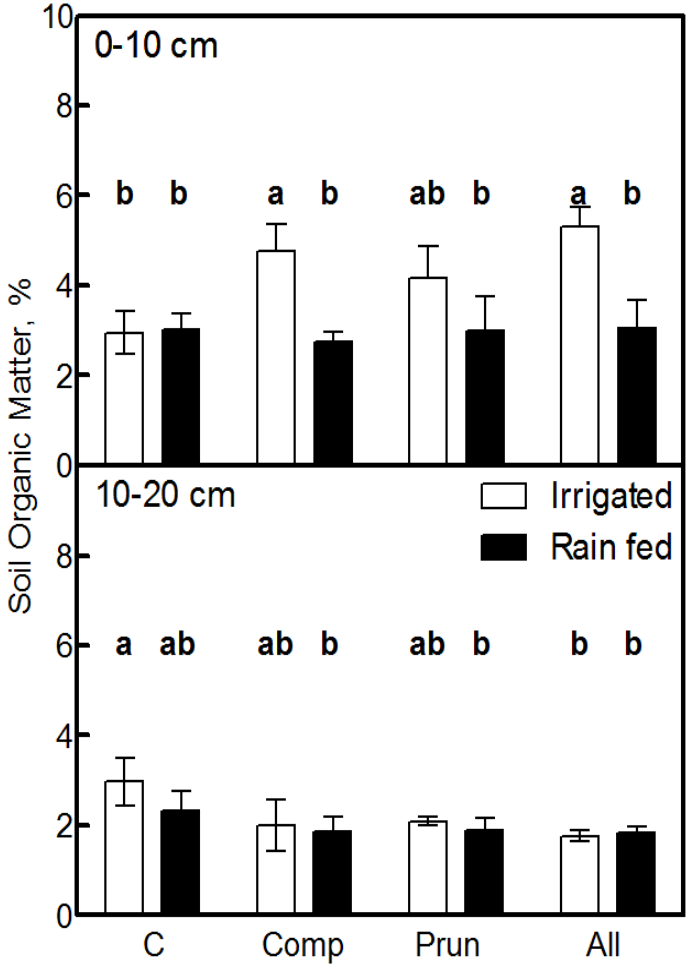
Impact of Oliveclima practices on soil water of the top soil layer (0-10 cm) in the pilot farm



Study areas

Action C2. Carbon return to the olive groves through organic material recycling

Carbon return to the olive groves through organic material recycling (Carbon inputs,CI)



CI had significant impact on SOM content in the top layer of irrigated soil

Highest values were observed in "ALL" followed by "COMP" and "PRUN"

Irrigation increased SOM of the superficial layer in all CI treatments and this effect was statistically significant in "COMP" and "ALL"

SOM was significantly higher in the superficial compared to the deeper soil layer

Action C3. Cultivation practices impacts on carbon sequestration in olive groves

Weed sampling

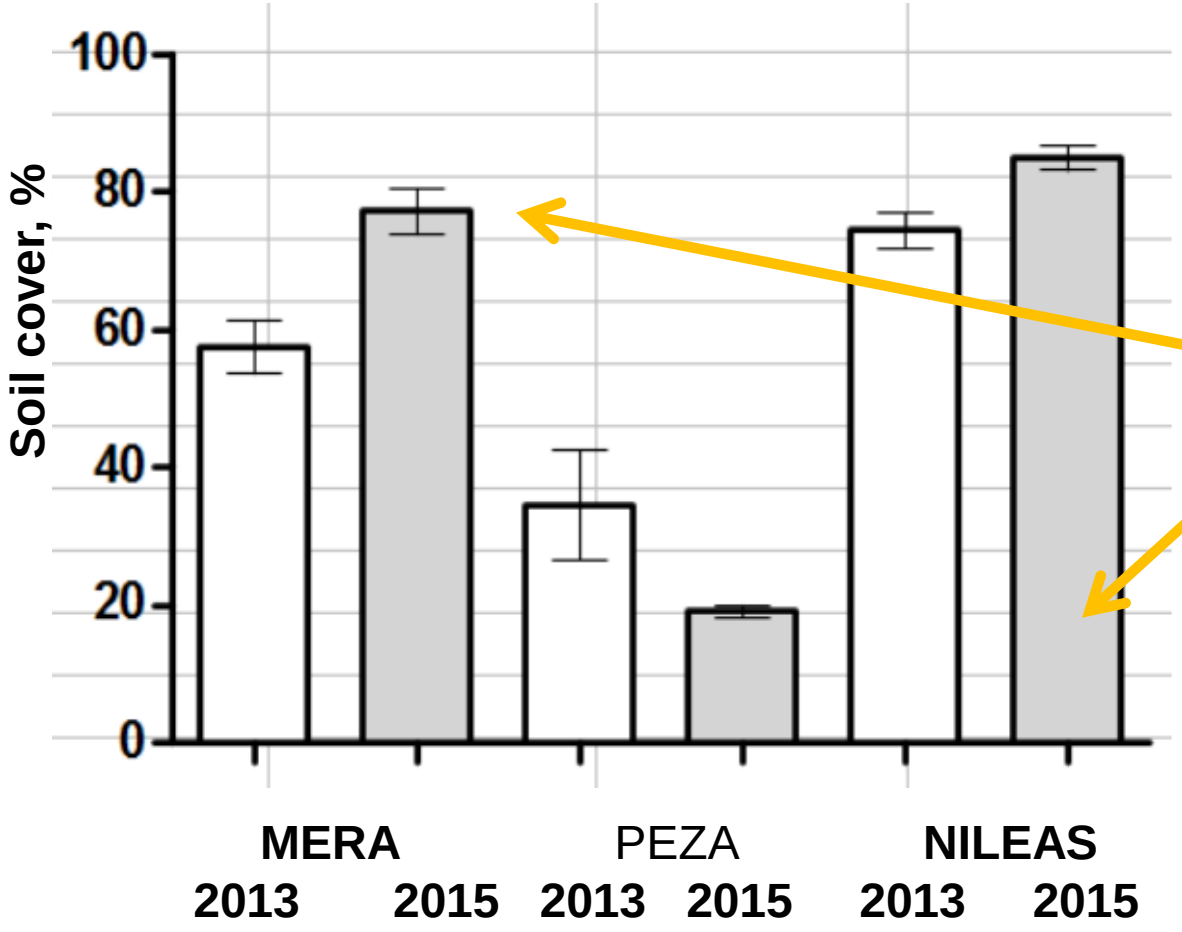
Measurements of soil CO_2 emissions

Measurements of Leaf Area Index

Short description: monitoring impact of three new cultivation practices on carbon sequestration: field measurements & laboratory analyses (tree canopy, Leaf Area Index, GHG fluxes, plant tissue, soil cover)

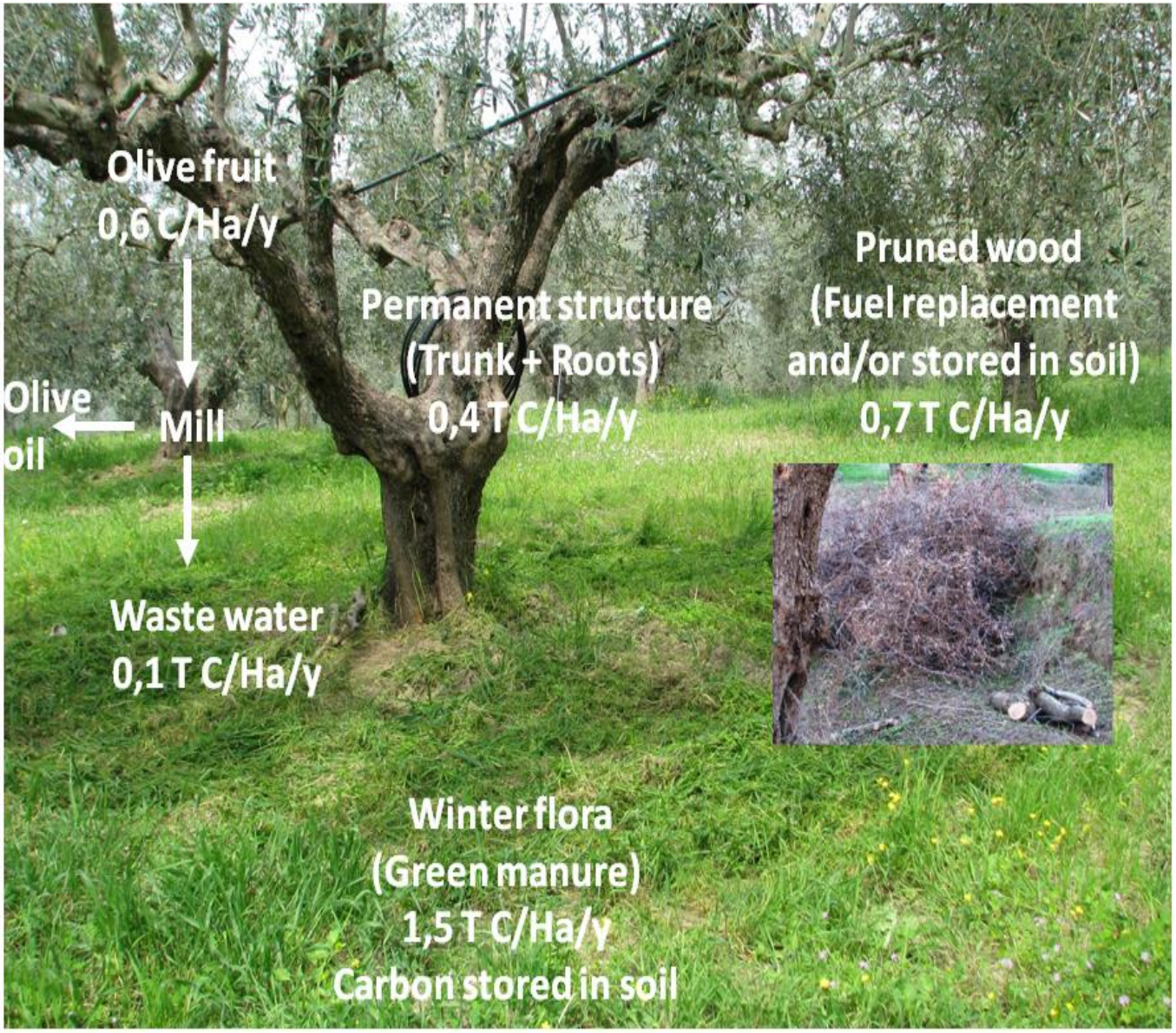
Action C3. Cultivation practices impacts on carbon sequestration in olive groves

➢ Impact of weed flora modification on soil cover of olive groves

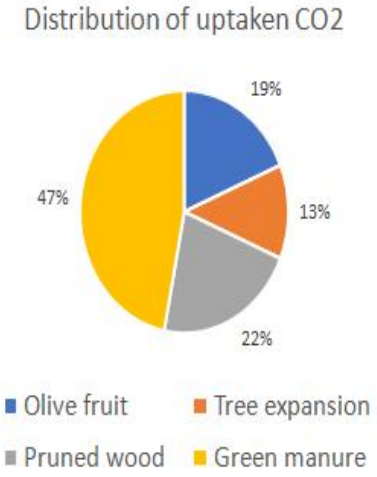


- ✓ Increased soil cover contributes to increased carbon storage in weeds
- ✓ Further optimization is feasible

Action C4. Determination of CO_2 balance in olive ecosystems



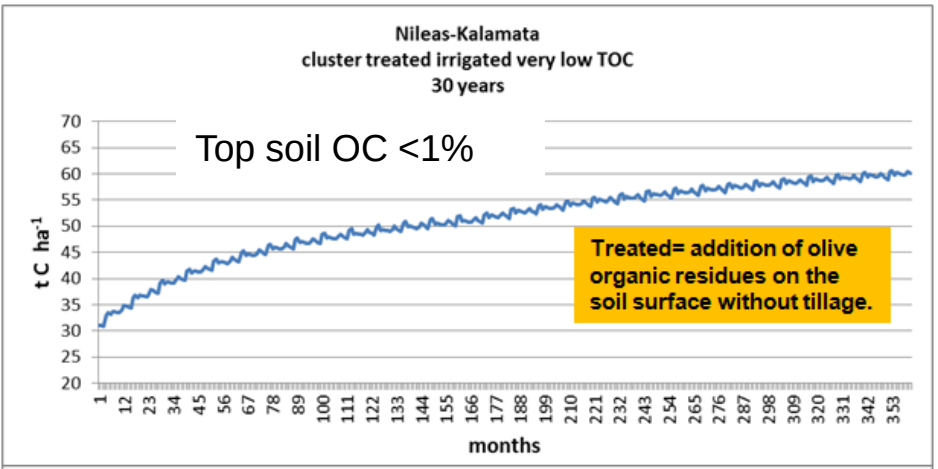
Every year a Ha of olive grove uptakes CO2 from atmosphere, equal to at least ~ 3,2 T C

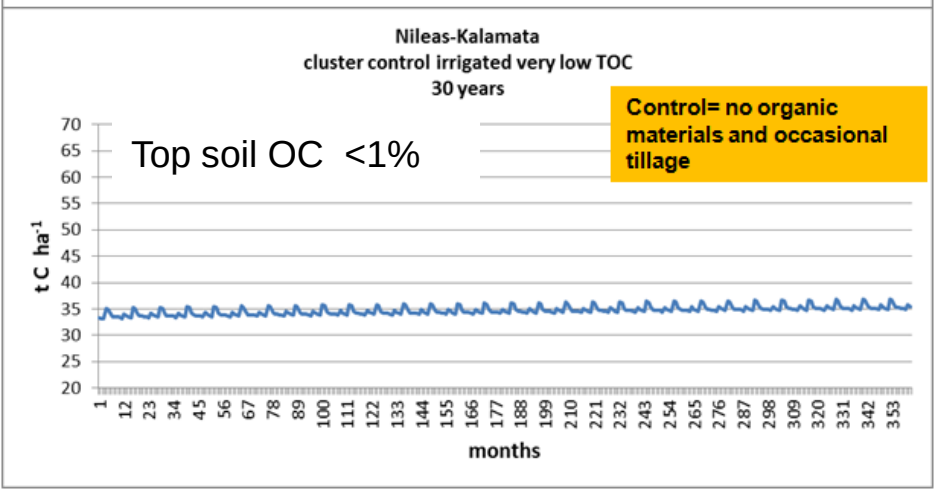


Apart from the c. 0,4 T C/Ha/y stored in the permanent tree structure, a variable part of C in green manure, oil mill waste water and in shredded wood ends up in soil, increasing SOM. oLIVE CLIMA practices enhance this storage.

Note: Numbers are to be finalized by Sept. 2017

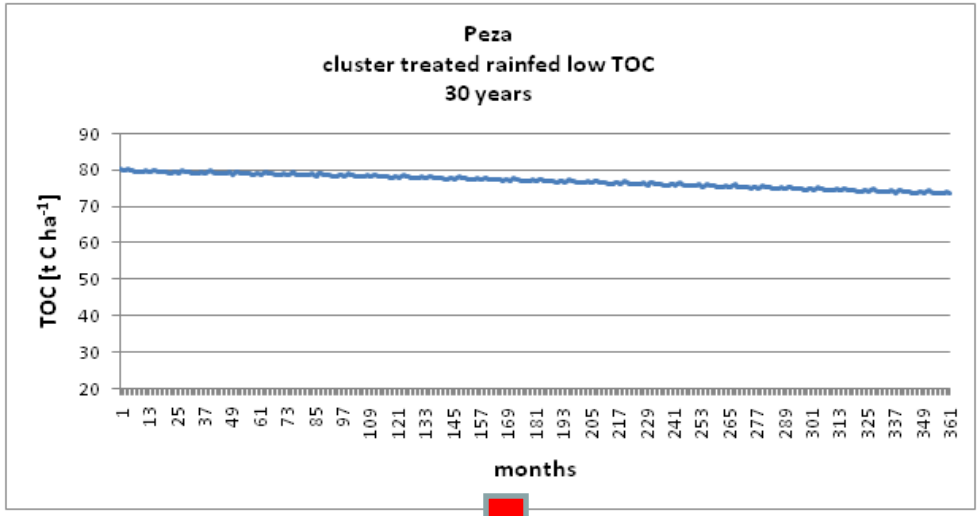
Action C4. Determination of CO_2 balance in olive ecosystems





The version of Roth C 10_N adapted to region with semi-arid climatic conditions (Farina et al 2013) has been used.

▪ The simulations (for the soil carbon changes as affected by management and water supply highlight the beneficial effect of the introduction of sustainable practices.



✓ **Significant carbon storage in the soil is projected in the case of treated olive orchards (top graph) as compared to the control olive orchards (lower graph).**

• Simulations show that in some cases, despite the adoption of the sustainable practices, a decline in SOC is expected suggesting that the import of organic raw material should be increased.

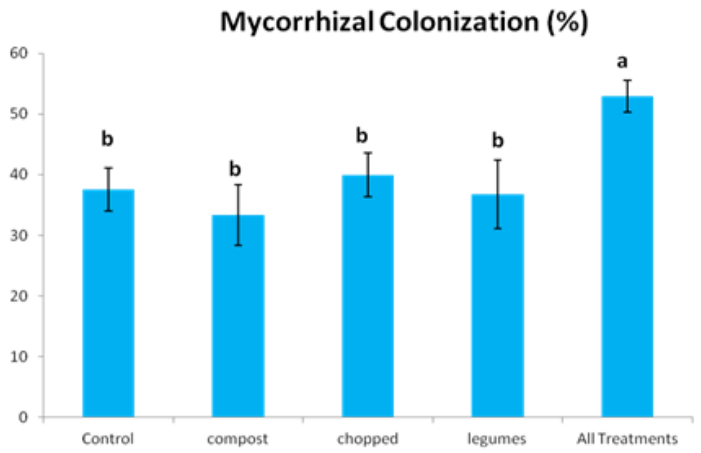
Action C6. Side effects of the implementation actions

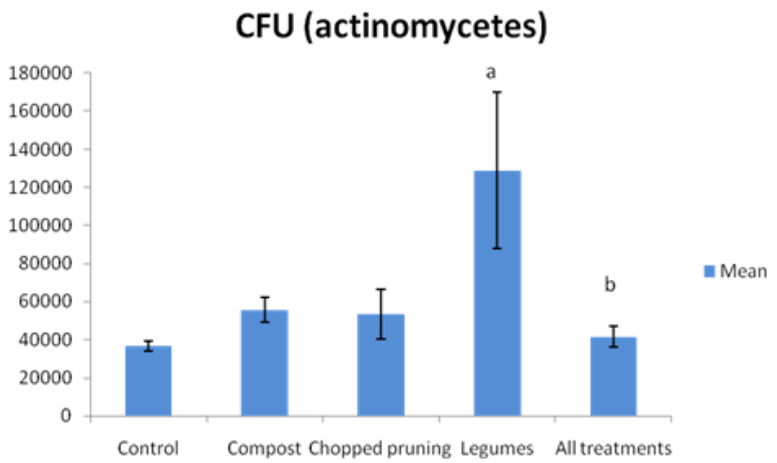
Short description: Field visits and laboratory analyses to ensure no side-effects of the proposed practices on olive trees and the environment.

Field monitoring was realized to verify that recycling olive tree residues did not cause disease spread in the olive orchards.

- ✓ **Regular training of agronomists for field survey**
- ✓ **Analysis of organic materials to verify pathogen-free**
- ✓ **Analysis of suspect trees to exclude from recycling**

➢ **Soil quality indicators**





➢ **Mycorrhizal colonization and Actinomycetes increased in the treated soil and this is an indicator of soil biological quality and health**

EU policies related directly or indirectly to oLIVECLIMA

Summarizing the added value of oLIVE CLIMA to EU Policies

- Increase Soil Organic Matter
- CO_2 removal from atmosphere: Store carbon in soil
- Reduce nitrogen related emissions by farming
- Offer a way out for local organic waste and oil mill waste water.
- Contribute significantly to erosion control
- Increase soil biodiversity
- Facilitate organic farming
- Facilitate marketing of products by PEF (*Product Environmental Footprint*) through operational groups

EU policies related directly or indirectly to oLIVECLIMA

➢ **The role of European agriculture in climate change mitigation SEC(2009) 1093** The role of European agriculture in climate change mitigation (Working Document

✓*Optimisation of mineral and organic nitrogen application; Overall reduction of external inputs which also contributes to a reduction of emissions from the usually very GHG-intensive manufacturing of fertilizers and other chemical products;*

➢ **Single Market for Green Products Initiative –Measure environmental performance throughout the lifecycle, Product Environmental Footprint (PEF)**

-The project LIFE11 ENV/GR/942 – oLIVE CLIMA participates -via its partner RodaxAgro- in the EU effort for the Product Environmental Footprint (PEF)
-An important decision was taken by the Technical Advisory Board of PEF: olive and cork trees are recognized in their long-term carbon storage.
-The decision is based on the fact that carbon proven to be stored for more than 100 years deserve a discount in the carbon footprint of all products related
-Reduction of carbon footprint based on carbon storage in the soil of olive groves was also proposed for carbon footprint credits, but not accepted, due to inadequacy of data to prove permanence of carbon in soil for more than 100 years
-We currently (in the context of oLIVE CLIMA) make an attempt to radio-date the organic matter in subsoil

EU policies related directly or indirectly to oLIVECLIMA

✓ **Soil Thematic Strategy (COM/2006/0231) / Soil Framework Directive** (COM/2006/232)

➢ **COM(2012) 46** The implementation of the Soil Thematic Strategy (Comm. Report)

✓*Protecting soil from organic matter decline, erosion, desertification*

➢ **A Roadmap for moving to a competitive low carbon economy (2050COM(2011) 112)**

✓ *By 2050 the agriculture sector can reduce non-CO2 emissions by between 42 and 49% compared to 1990.*

➢**Rural Development Strategy**

Supports environmentally-friendly farming techniques that must go beyond the cross-compliance standards as well as minimum requirements for fertiliser and pesticide use

➢ **Waste Framework Directive (2008/98/EC)**

Recycling and rules on hazardous wastes

➢ **Urban Waste Water Treatment Directive (91/271/EEC)**

Collection, treatment and discharge of urban wastewater and the treatment and discharge of wastewater from certain industrial sectors

➢ **Regulation on organic production (834/2007/EC)**

-Plants should preferably be fed through the soil eco-system and not through soluble fertilisers added to the soil.The essential elements are: soil fertility management, choice of species and varieties, multiannual crop rotation, recycling organic materials and cultivation techniques.

➢ **EU Biodiversity Strategy (SEC(2011) 540 final} & {SEC(2011) 541 final)**

Achieve more sustainable agriculture and forestry – Target 3

www.climate2017.eu

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ΔΙΚΑΙΟΥΧΟΙ Έργου

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Thank you for your attention

Questions?