



Taste it, enjoy it. it's olive oil.

| 24

MADRID, SPAIN
26-28 JUNE 2024

**Spanish National
Research Council (CSIC)**



Olive orchards facing climate change



Organiza:



Colaboradores institucionales:



#alimentosdespaña

EL PAÍS
MÁS RICO DEL
MUNDO





ELGO - DIMITRA
HELLENIC AGRICULTURAL
ORGANIZATION - DIMITRA



HELLENIC AGRICULTURAL ORGANIZATION ELGO-DIMITRA in Greece, Southeastern Europe



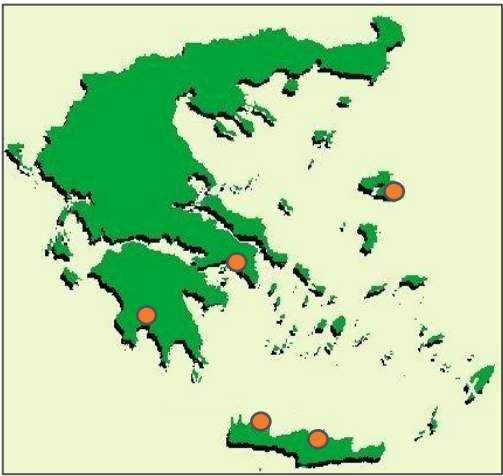
- Over 700 employees
- Specialized laboratories and germplasm banks

- Agricultural Research
- Farmers training
- Certification in agriculture



<http://www.elgo.gr/>

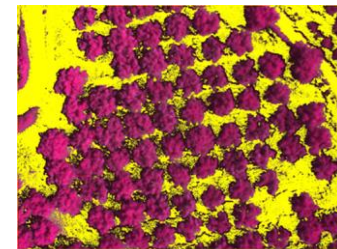




Institute for Olive Tree, Subtropical Crops and Viticulture



- National Germplasm Banks for olive
- Labs for all chains of olive growing (irrigation, fertilization, pest management, etc.)
- 3 ISO-accredited labs for olive oil quality chemical analyses and sensory evaluation
- Collaboration with farmers



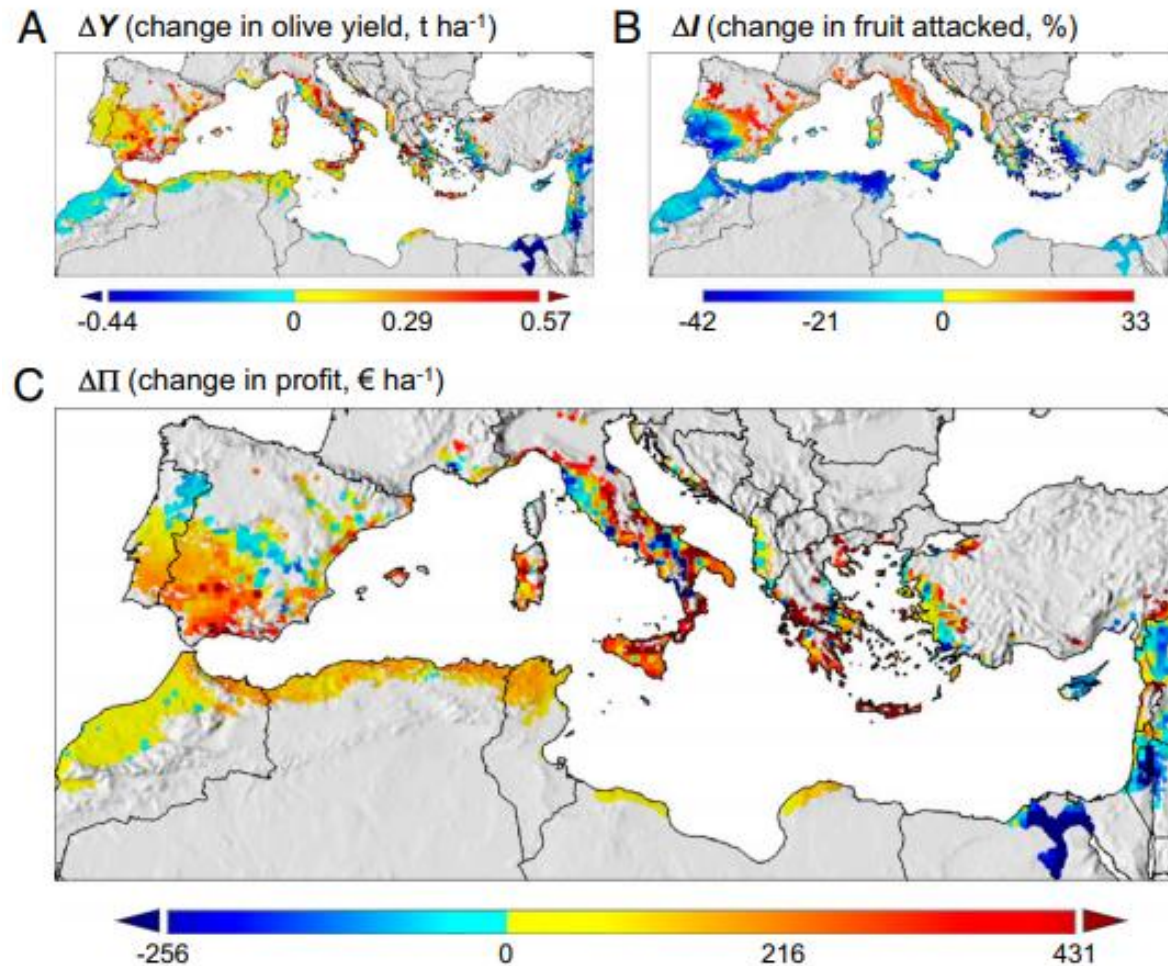
Climate change challenges olive cultivation



- **Water shortage**
 - Flood
- **Extreme temperature**
 - UV-B radiation
- **Soil degradation**
- Biodiversity decline
- **Pests and diseases**



Expected impact of climate change on olive growing



(A) Predicted changes in olive yield ($t\ ha^{-1}$); (B) change in infestation by olive fly (% olive fruit attacked by the fly); and (C) change in profit ($\text{€}\ ha^{-1}$)

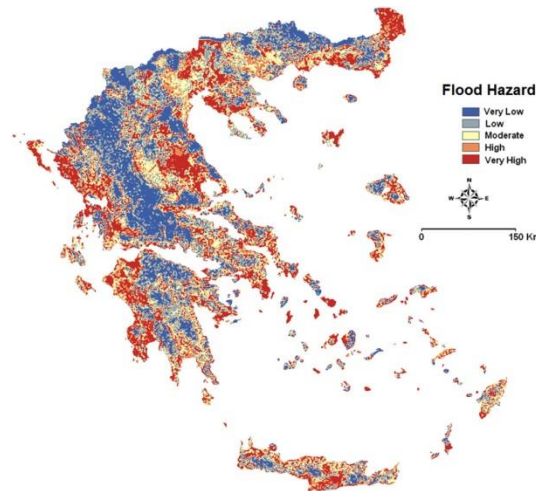
Ponti et al. 2014. www.pnas.org/cgi/doi/10.1073/pnas.1314437111

Risk maps in Greece

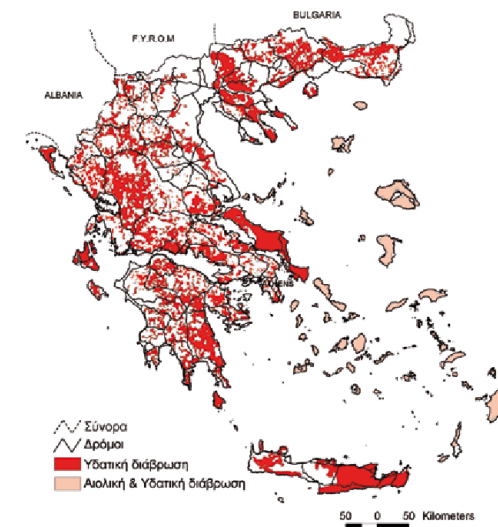
Drought



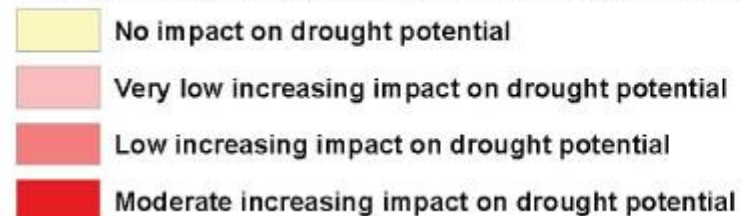
Soil erosion



Flood



Change of dry spell length affecting drought potential



Origin of the data: © EuroGeographics Association for the administrative boundaries
ARIDE final report (2001)
The Prudence project model database
Source: ESPON Data Base

This map represents the connection between change of dry spell length (The Prudence project model database) and drought potential, based on precipitation deficit recordings 1904-1995.

Kourgialas, N.N., Karatzas, G.P. (2017) Science of the Total Environment, 601-602, pp. 441-452

What can we do?

- Mitigate climate crisis



- Adapt olive grove management



- Select/breed resilient olive varieties



Use of tolerant varieties

Targeted traits for olive

We examine existing cultivars for tolerance to stress

and

we try to develop new cultivars by crossing traditional cultivars with desired traits

Abiotic stress	Heat on flowers
	Flowering
	Drought
	Salinity
Biotic stress	Olive fruit fly
	Verticillium wilt

Greece

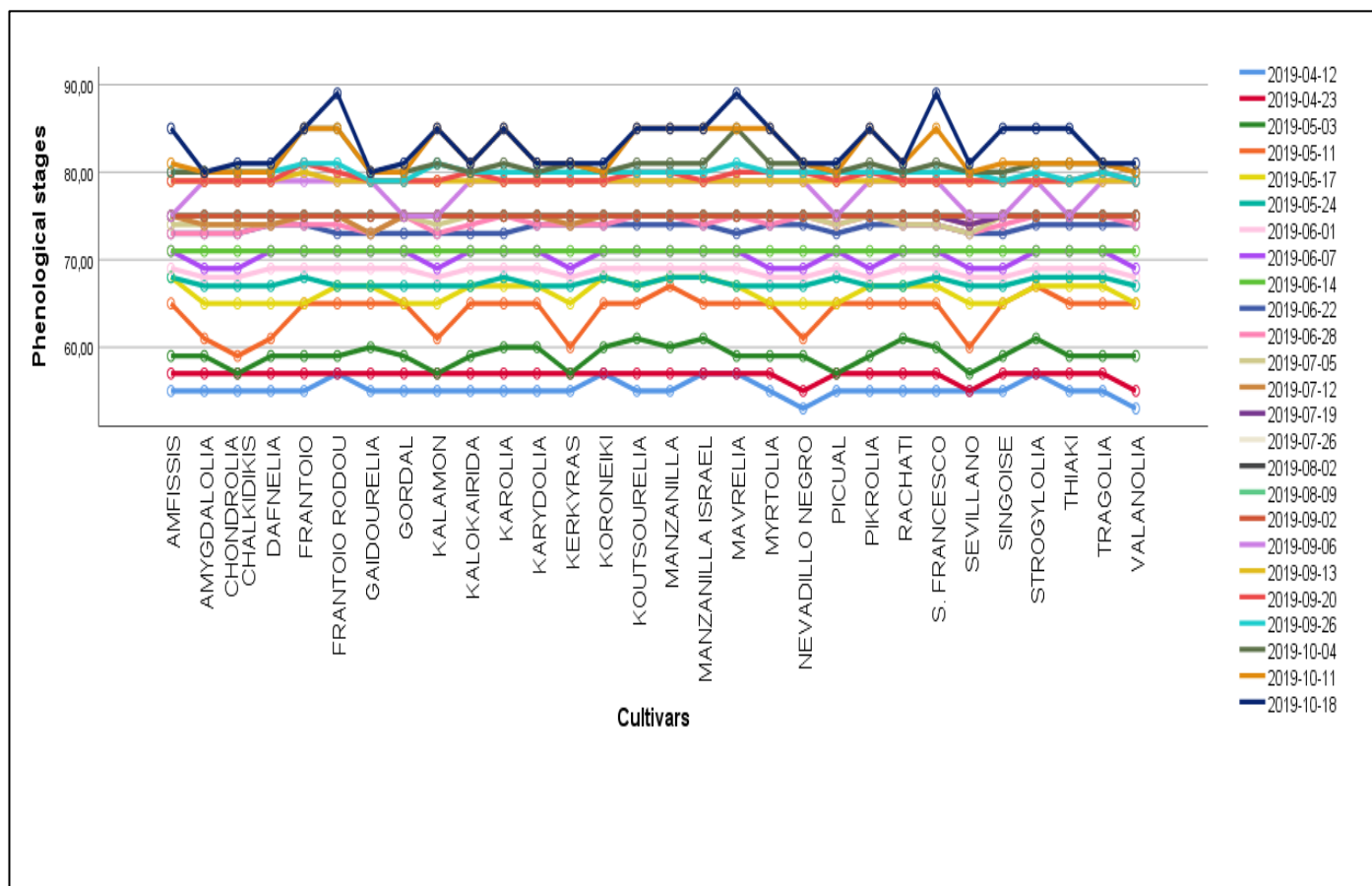
Morocco

Algeria

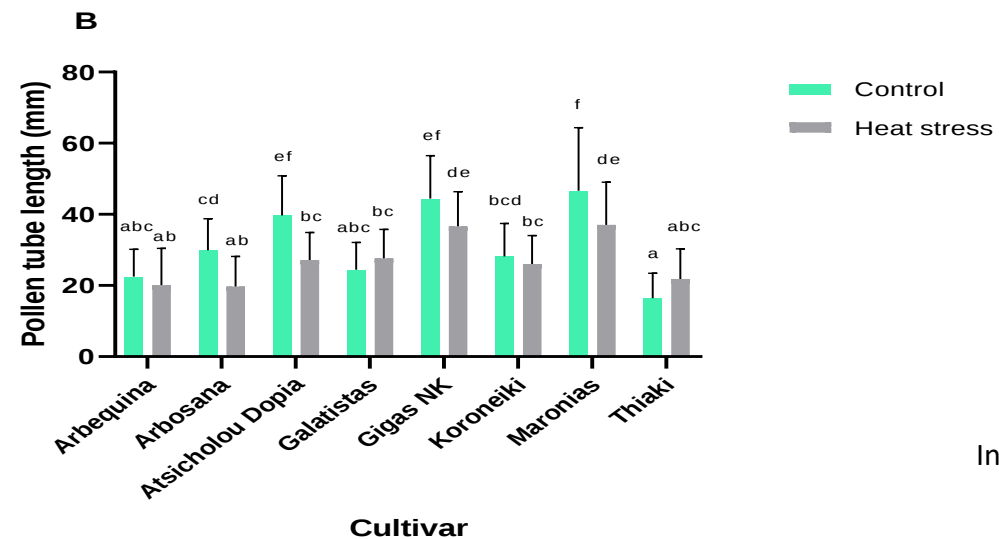
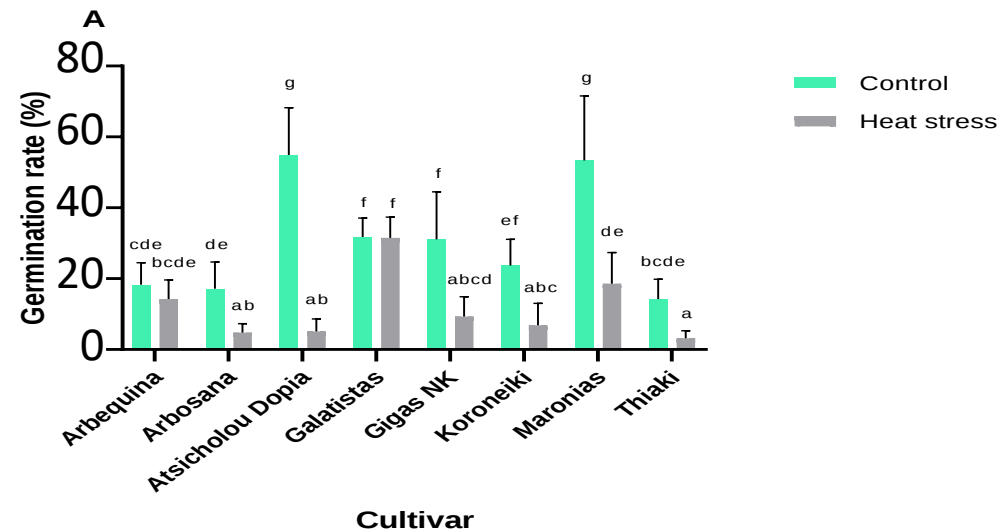
Tunisia

Targeted trait: Early flowering to avoid heat stress

Earliness of flowering of olive cultivars in 2019, 2020, 2021



Flowering heat tolerance of 8 olive varieties

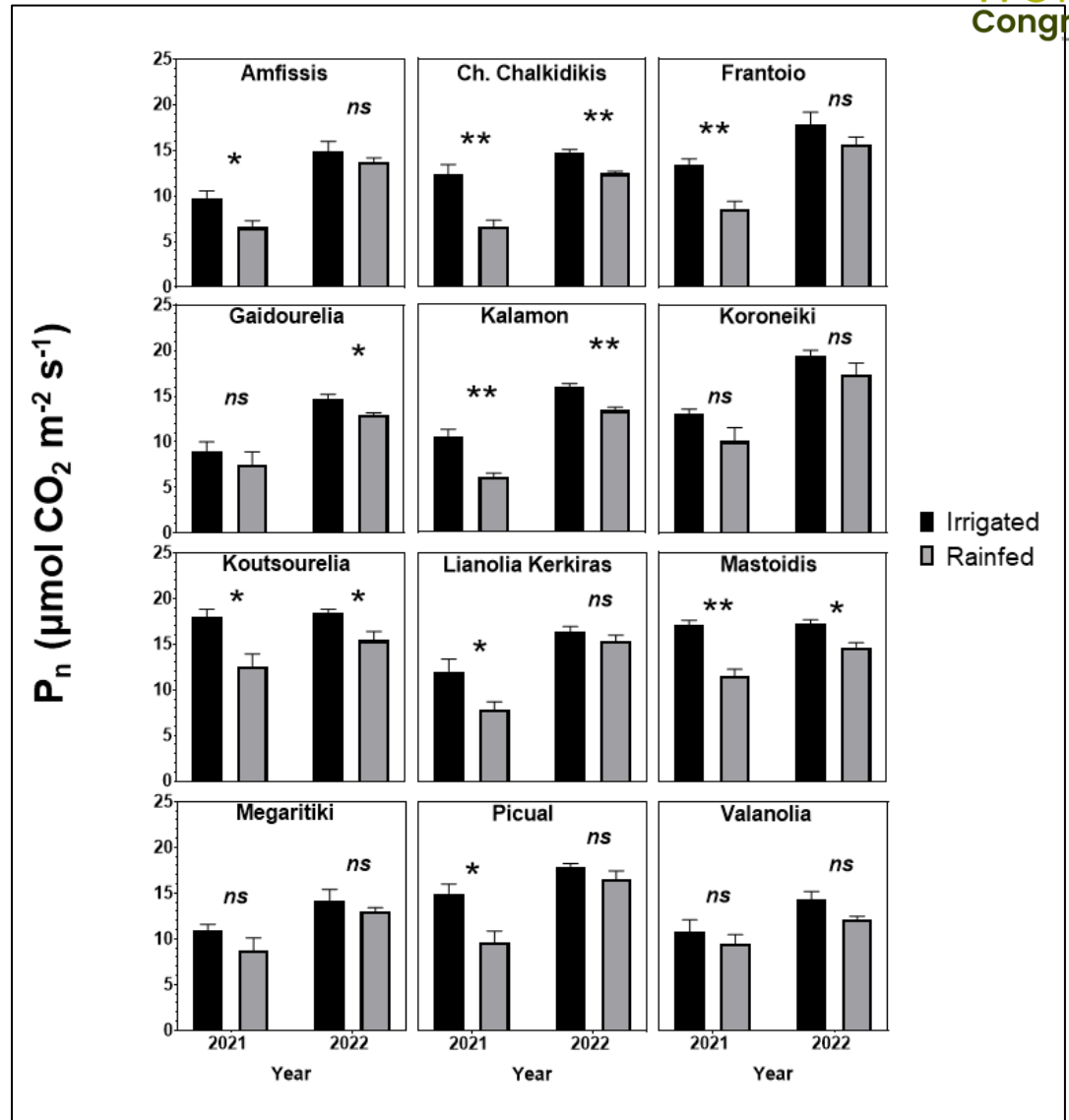
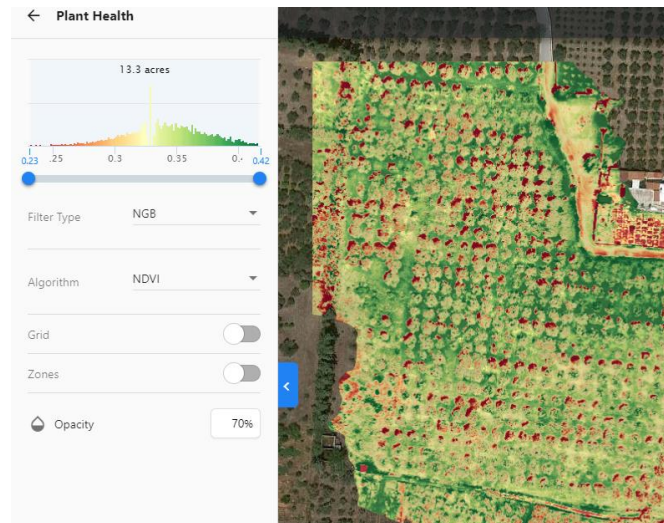


In collaboration with Kostelenos plant nursery

Drought tolerance of 12 olive varieties

☐ **Tolerance to drought: 2 years (2020, 2021)**

1. Photosynthesis, stomatal conductance, sub-stomatal CO₂ concentration (Ci)
2. Leaf relative water content
3. Multispectral images (Drone).
4. Air temperature, RH, wind, solar radiation, precipitation (daily mean from a nearby station)
5. Soil moisture content

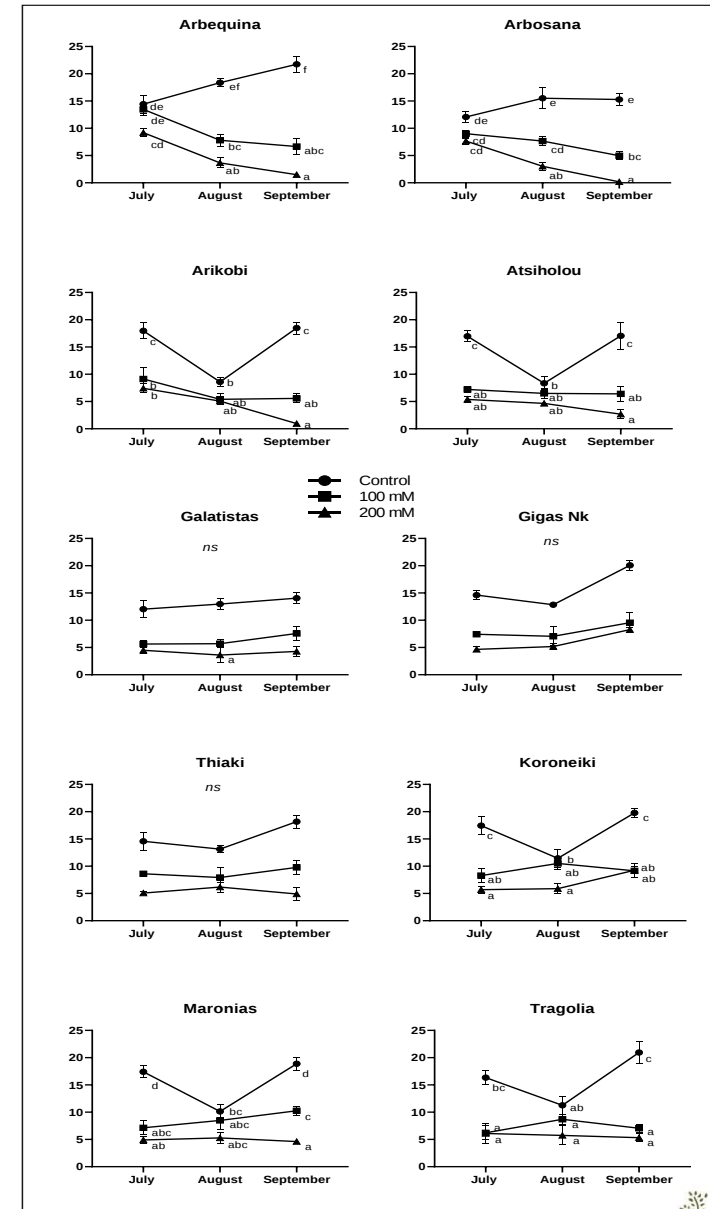


Salinity tolerance of 10 olive varieties

1. Visual observation of symptoms **every 3 days** (score: 0=no symptoms, 1=few, 2=moderate, 3=many, 4=total decline or death). Also, record qualitative observations (yellowing, browning, shoot tip death, leaf fall, flowers browning, etc).
2. Photosynthesis, stomatal conductance, sub-stomatal CO₂ concentration (Ci). Leaf relative water content.
3. Total plant height, stem diameter at 10 cm from the soil.
4. Total fresh and dry weight of aerial part and of underground part.
5. Air temperature, RH, wind, solar radiation, precipitation
6. Mineral content of leaf, stem and root tissues for Na, Cl and Ca.



Pn (μmol CO₂ m⁻² s⁻¹)



Time

In collaboration with Kostelenos plant nursery

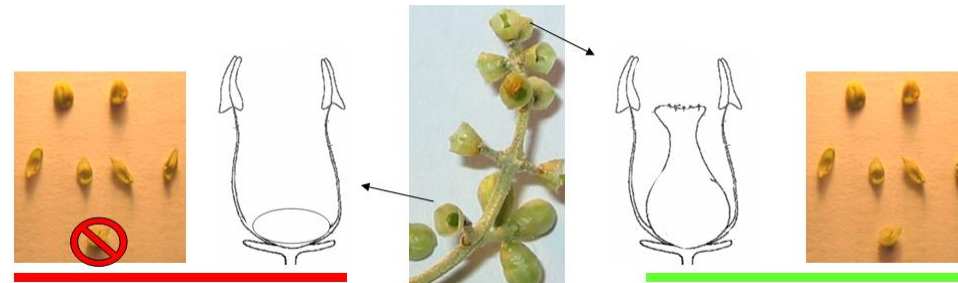
Mild winter temperature poses risk to subsequent olive flowering

Olive needs accumulation of winter “cold”: + 7-12 °C

Olive cultivars from Northern Greece require more “cold”



- Reduced inflorescence
- Reduced flowers
- Increased ovary abortion



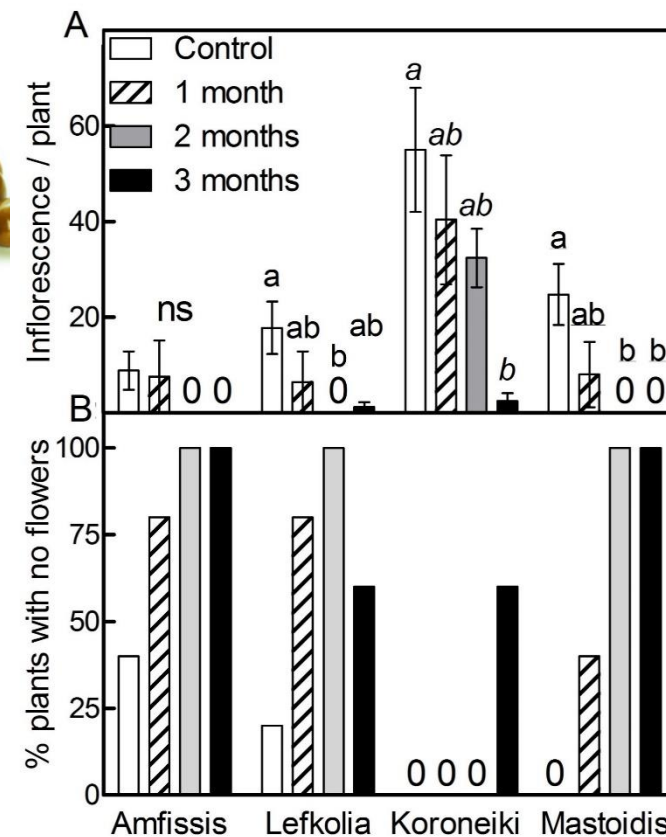
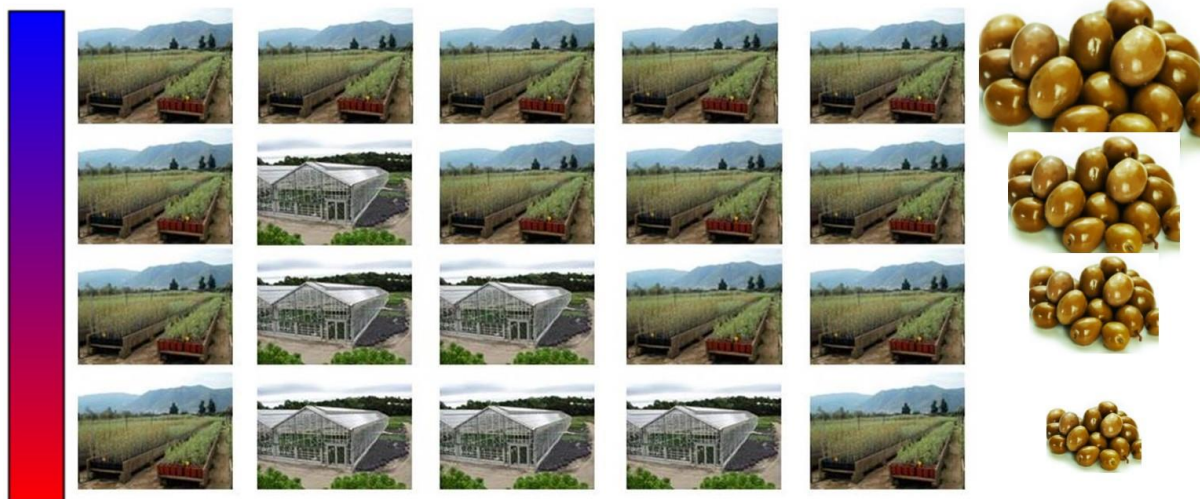
TEST BEFORE MASSIVE PLANTING



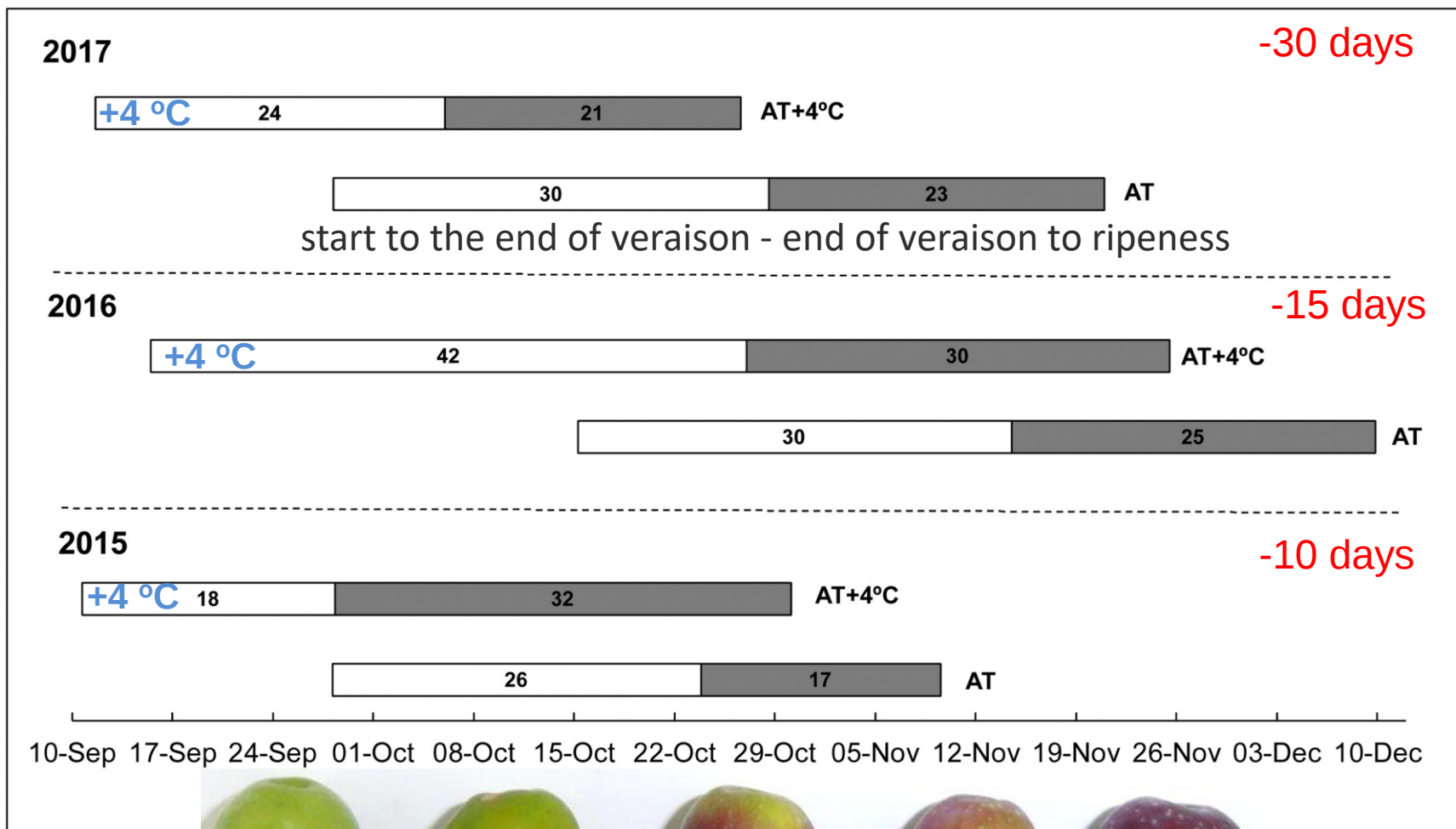
ΕΛΓΟ-ΔΗΜΗΤΡΑ

ΕΛΛΗΝΙΚΟΣ ΓΕΩΡΓΙΚΟΣ
ΟΡΓΑΝΙΣΜΟΣ - ΔΗΜΗΤΡΑ

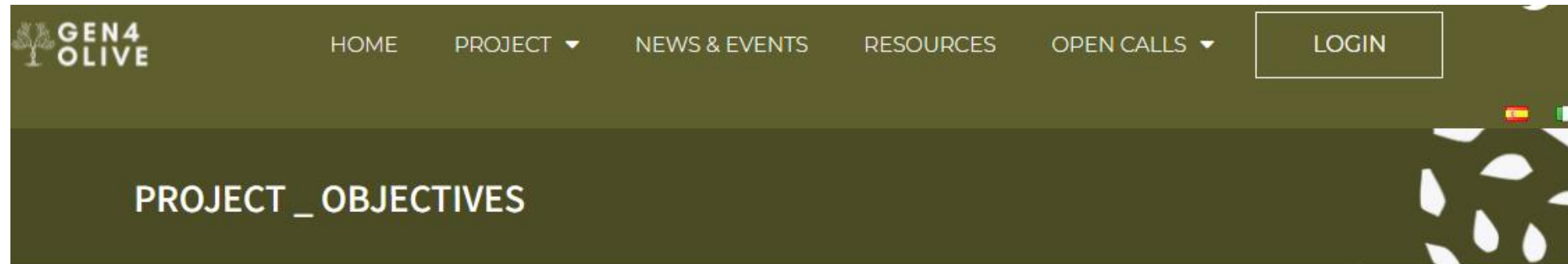
Reduced flowering after mild winter temperature



Fruit ripening response to temperature



Genetic resources for adaptation to climate change



The overall objective of GEN4OLIVE project is to accelerate the mobilisation of Olive GenRes and enhance olive pre-breeding activities through a multi-actor approach, by:

- 1. Developing easy-to-use tools to leverage the information collected through a smart user-friendly interface that will implement big data and machine learning utilities.**
- 2. Involving SMEs through the launching of specific calls and financial support.**



Sustainable olive grove management

Consumers
care about
the environment



Atmos. Chem. Phys., 13, 8797–8811, 2013

www.atmos-chem-phys.net/13/8797/2013/

doi:10.5194/acp-13-8797-2013

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Burning of olive tree branches: a major organic aerosol source in the Mediterranean



Project management practices

- C removed during olive production to be returned through byproducts spread on the soil either raw or composted
- Enrichment of indigenous weed flora by sowing a mix of selected seeds
- Minimum or no soil tillage
- Adaptation of tree pruning to maximize CO₂ capture through photosynthesis

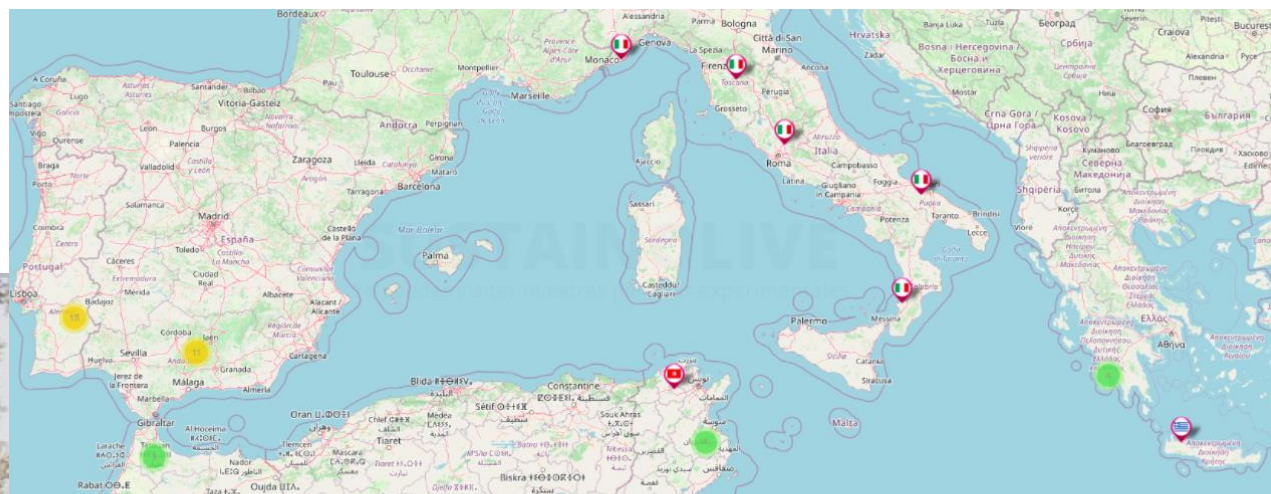


Project LIFE Oliveclima

- 5 years
- 4 olive growing areas
- 120 parcels
- Irrigated – rainfed
- Conventional or organic farms
- Different soil types & management



Awarded as the best project in Europe for climate action. E.C. 2019



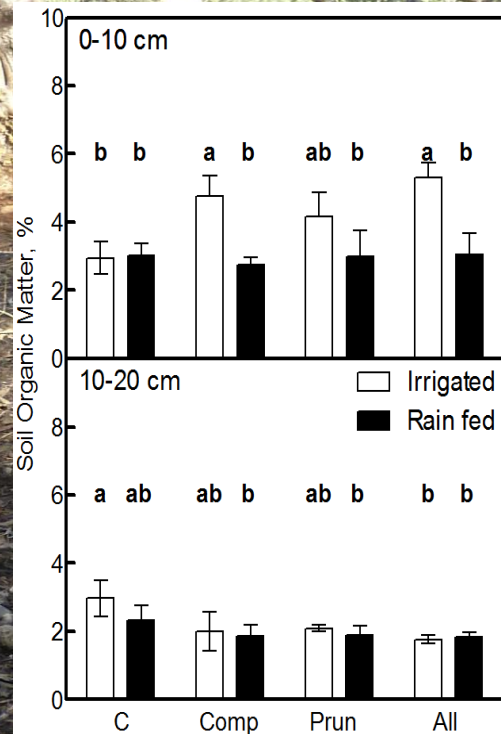
PRIMA **SUSTAINOLIVE** GREECE

Sostenibilidad del olivar mediterráneo

ÉCHALE UN OJO
A LA NUEVA
VENTANA DE
RECURSOS

SUSTAINOLIVE

Carbon return to the olive groves through organic material recycling

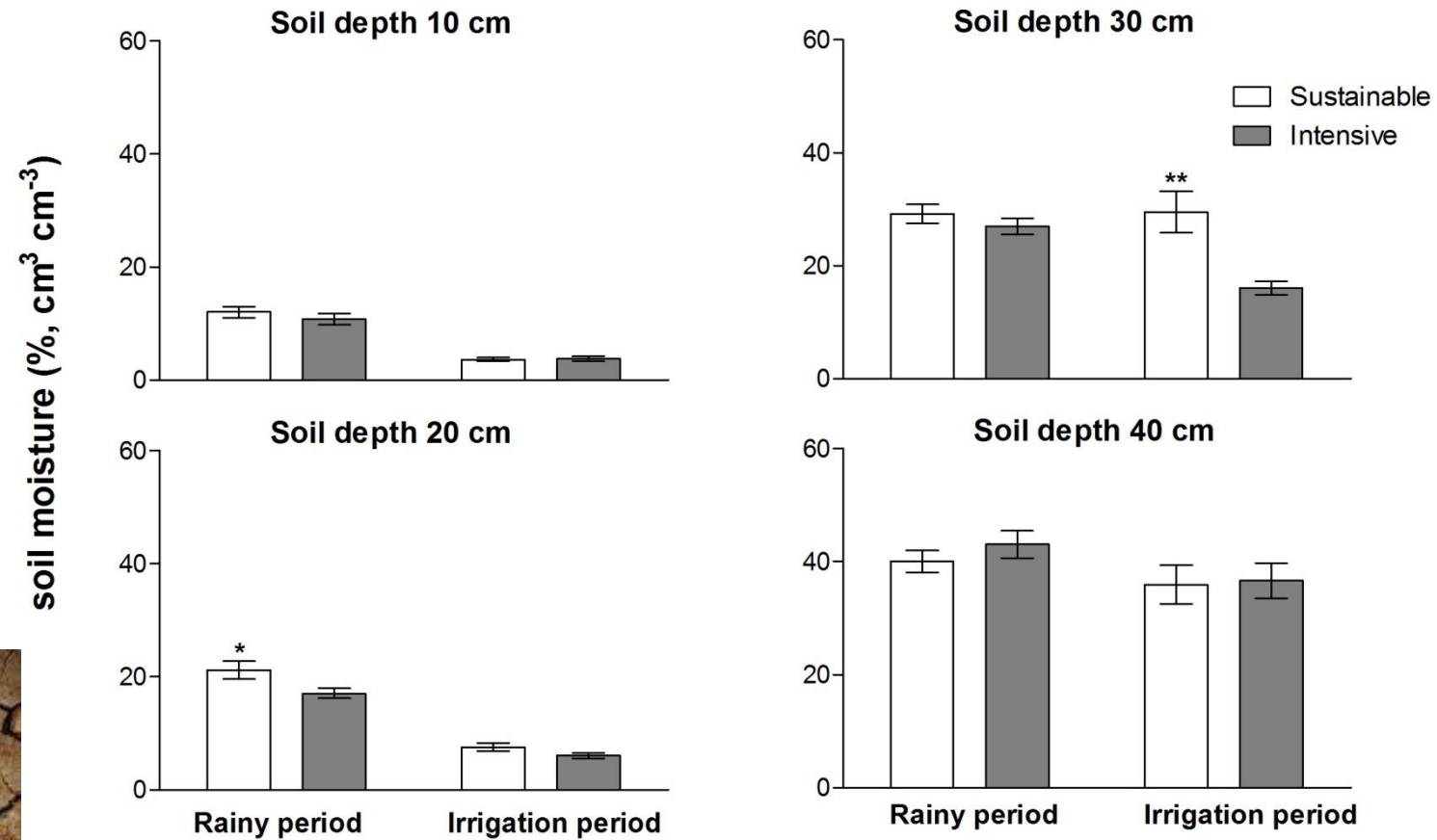


CI had significant impact on SOM content in the top layer of irrigated soil

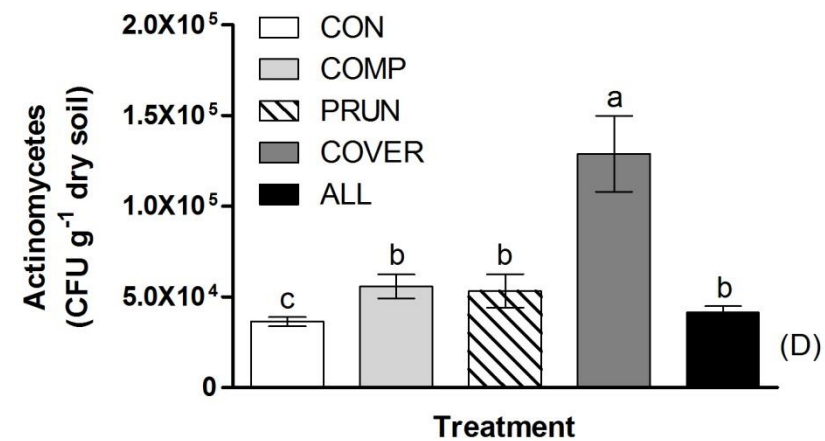
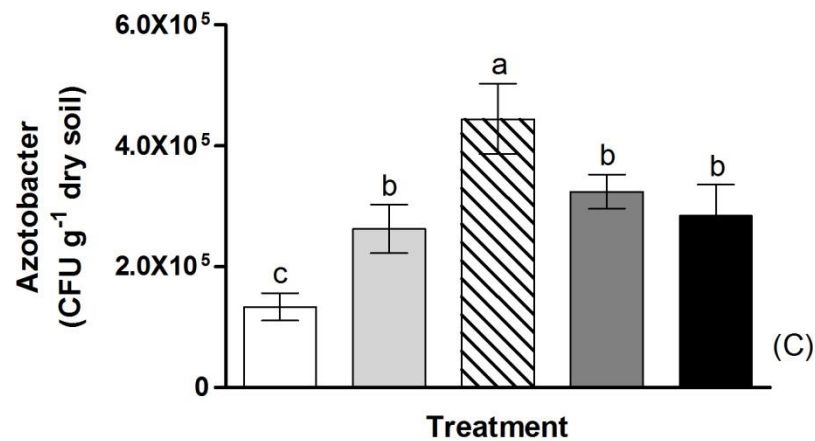
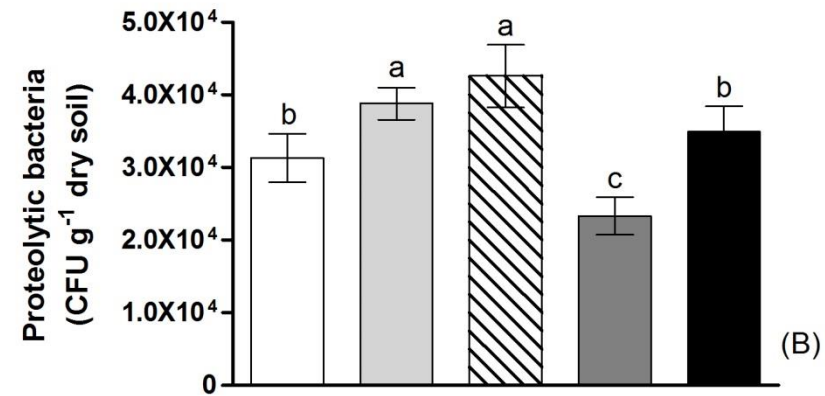
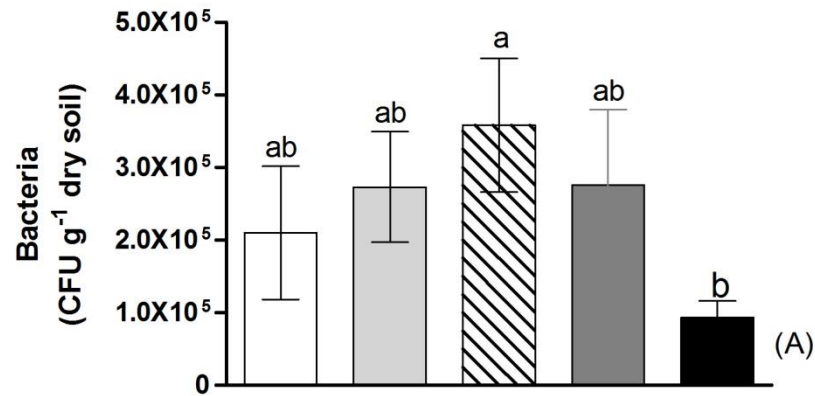
Highest values were observed in “ALL” followed by “COMP” and “PRUN”

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

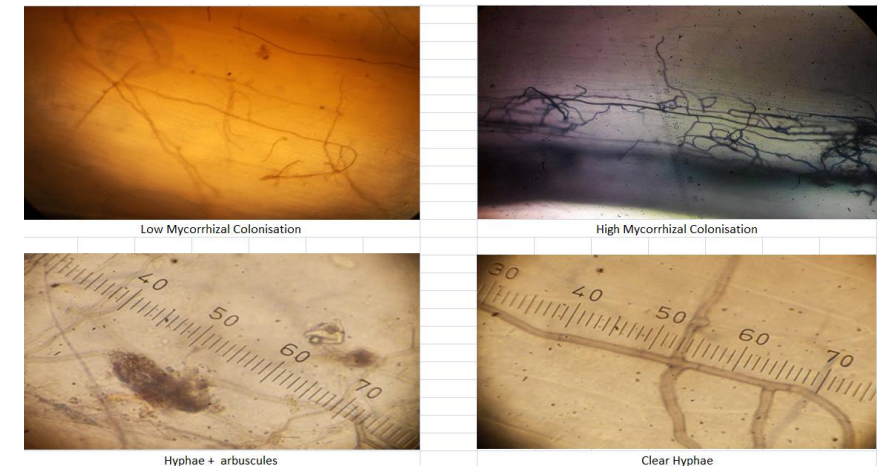
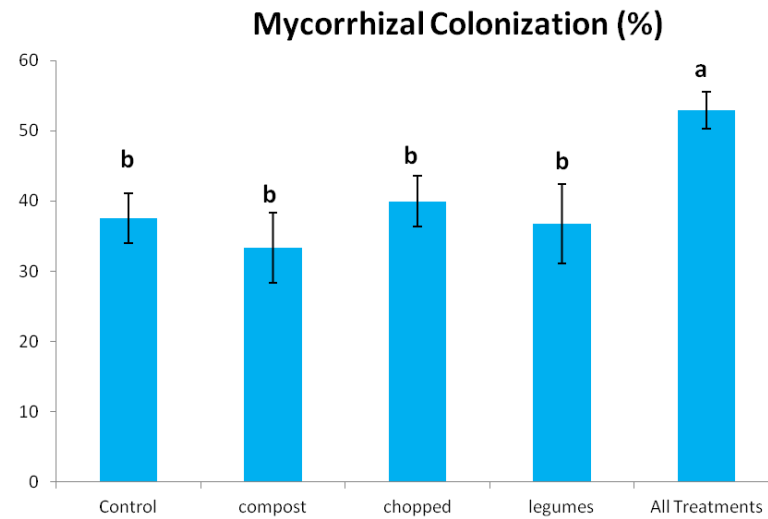
Addition of organic materials on the soil improved water retention



Soil microbial properties are improved by sustainable management



Soil quality indicators show positive effects



Olive oil yield is stabilized through pruning and soil enrichment

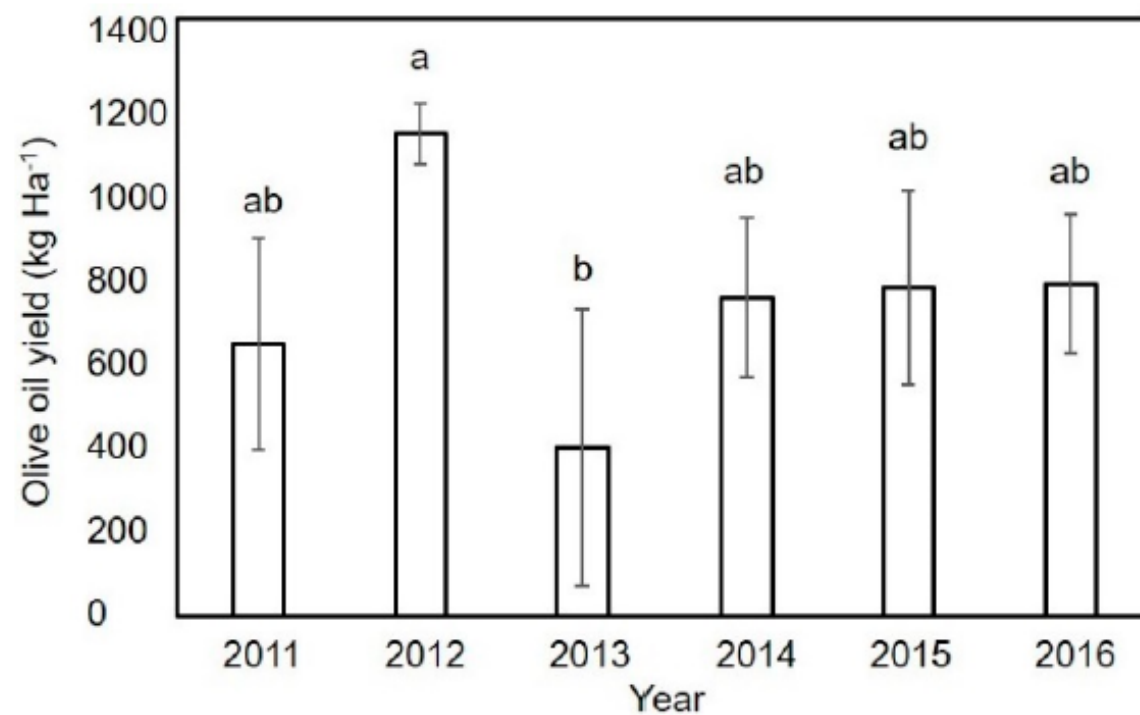
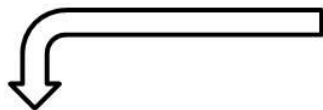


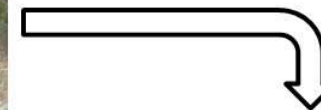
Figure 3. Evolution of olive oil production (Kg Ha⁻¹) per year during 2011–2016 in the three study areas in Greece (Nileas, Peza, and Mirabello). Bars present means of 60 replicates with standard errors. The means of the three study areas were analysed. Bars with different letters have statistically significant difference (LSD test, 0.05).

Recycling pruning residue

Chipper shredder



Flail lawn mower



Decomposition rate
faster slower

Nutrient recycling
faster slower

Carbon storage
short term long term

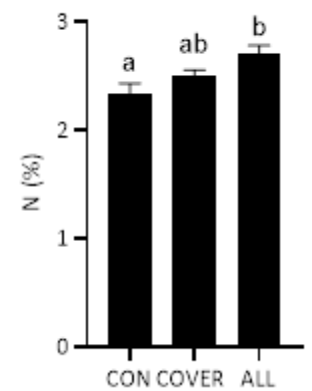
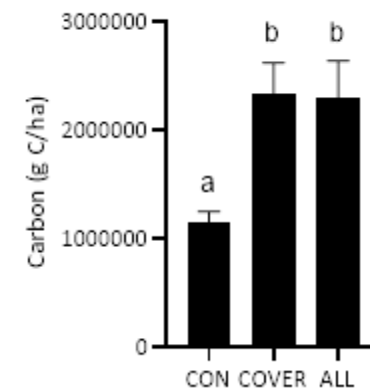
Compost amendment improves soil fertility



Cover crops in olive groves



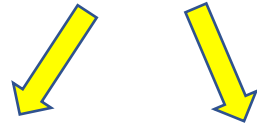
Single species
Low carbon storage



High diversity
Higher carbon storage
Nitrogen fixation by legumes

Biodiversity plays key role in agroecosystem resilience

Wrong weed management resulted in
single species dominance



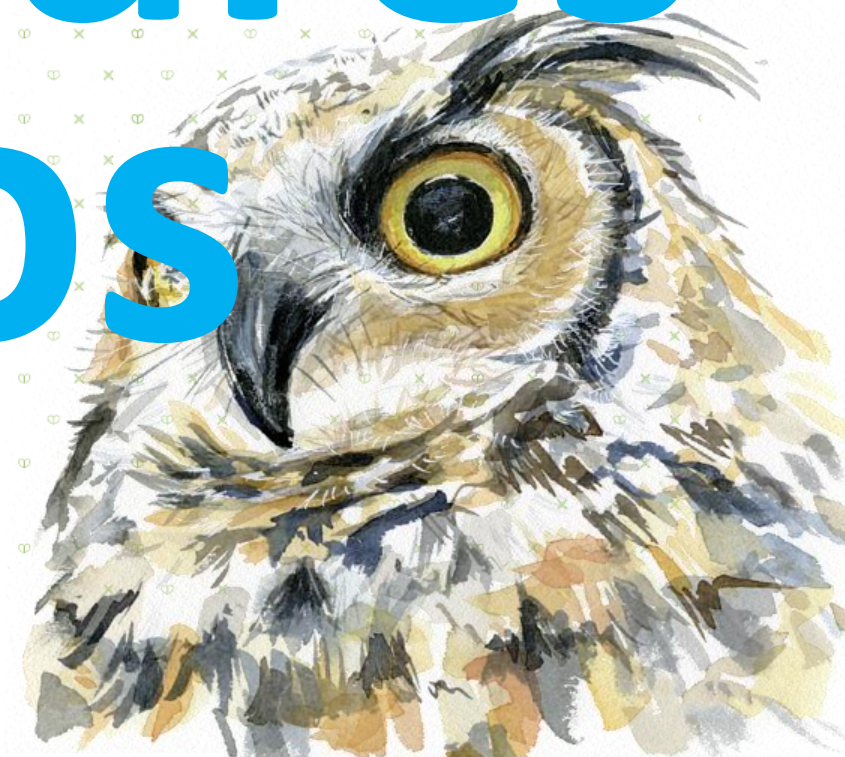
Multispecies soil cover



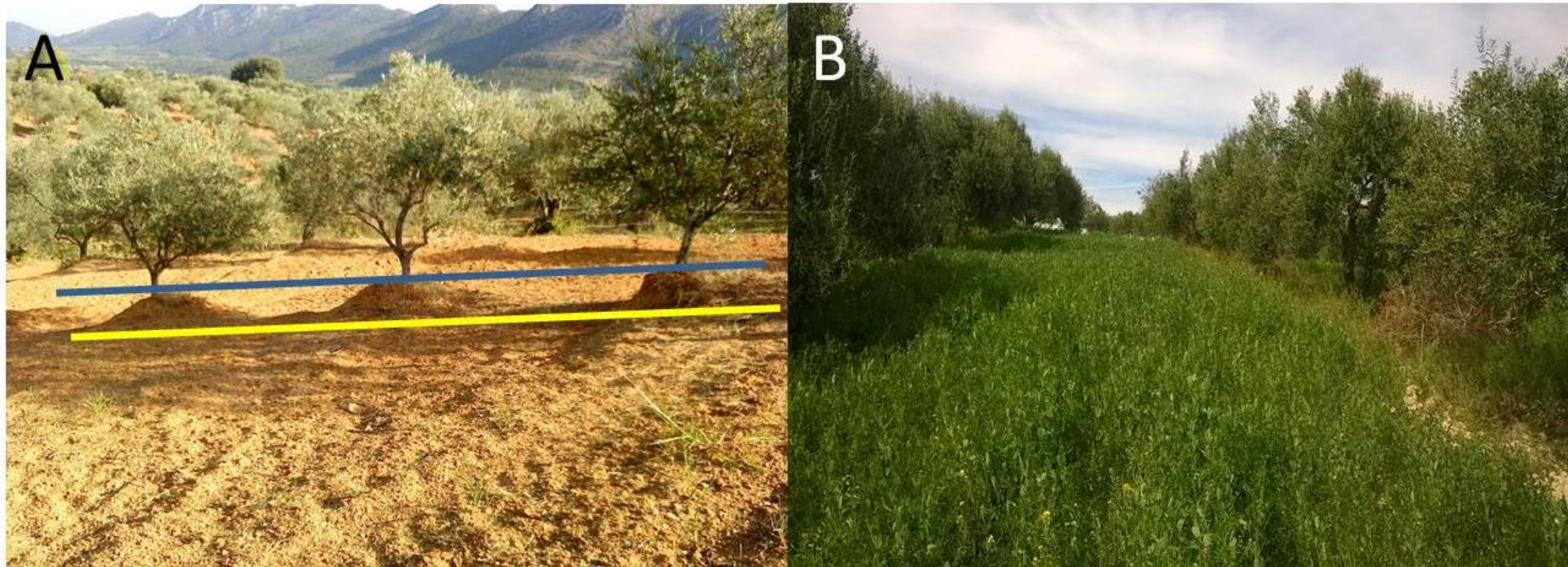


Olivares Vivos

**BIODIVERSITY FROM THE
FIELD TO THE AGRARIAN INCOME**



Tillage induced soil erosion



Natural soil cover
during winter



Intensive herbicide use

- + Rain water storage
- + Biodiversity

- Water + fertilizers run-off
- Soil erosion

Effect of olive mill wastewater on earthworms

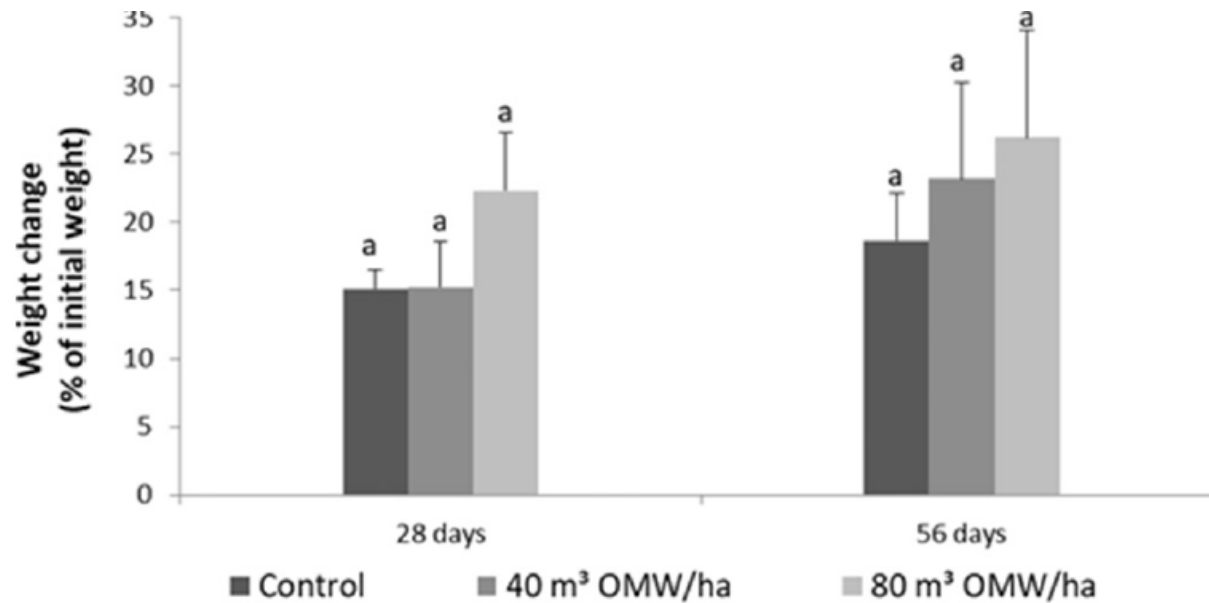


Fig. 1. Body weight change (% $\pm$ SE) of earthworms after the application of OMW onto the culturing substrate at doses of 40 m³ ha⁻¹ and 80 m³ ha⁻¹, after 28 and 56 days. In the control deionized water was added to the substrate. Columns followed by the same letter are not significantly different ($P < 0.05$, Tukey HSD test).



Commercial exploitation

www.mcmua.com/docs/CompostHomeSalesflyer2016.pdf

Page: 1 of 1 Automatic Zoom

MORRIS COUNTY
mua
MUNICIPAL UTILITIES AUTHORITY

**WOOD MULCH
COMPOST
FOR SALE/DELIVERY**

The Morris County Municipal Utilities Authority offers home deliveries of **SCREENED COMPOST** and **DOUBLE-GROUND WOOD MULCH** from mid-April through the end of September to Morris County residents only.

To order, call 973-285-8389 or 973-285-8383.
Please be patient when placing your order (April

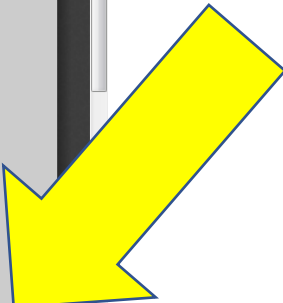


Using wood mulch can reduce weeds, save water, moderate soil temperatures, and make an attractive groundcover throughout the home landscape.

DELIVERY OPTIONS

SCREENED COMPOST
5 Cubic Yards = \$135.00
10 Cubic Yards = \$200.00

WOOD MULCH
5 Cubic Yards = \$130.00
10 Cubic Yards = \$190.00





Irrigation based on sensors

Increased soil organic matter

Nutrition based on leaf and soil analysis

Resilient olive trees

Reduced soil tillage

Yearly light pruning

Early harvest

Pest and disease management



Recent projects in Greece by ELGO-DIMITRA

The **PRIMA FREECLIMB** project is built to match topic 1.2.1 of the PRIMA (Sect. 2) framework in developing smart and sustainable farming systems in Mediterranean countries, to preserve natural resources (water and land use) by increasing production efficiency. <https://sites.unimi.it/primafreeclimb/>

GEN4OLIVE is an EU-funded Innovation Action that aims at increasing olive GenRes mobilisation and encouraging pre-breeding activities to adapt to Climate change and emerging diseases that threaten olive production. <https://gen4olive.eu/>

The main goal of **PRIMA SUSTAINOLIVE** is to improve the sustainability of the olive oil sector, through the implementation and promotion of a set of innovative sustainable management solutions, based on agroecological concepts, as well as in the exchange of knowledge and participation of multiple associates and end users. <https://sustainolive.eu/?lang=en>

The **LIFE oLIVECLIMA** project is an effort to guide the agricultural sector in order to face these challenges by converting olive cultivation to a climate change management tool. <https://oliveclima.eu/>

The **LIFE AgroClimaWater** project's main objective is to promote water efficiency and support the shift towards climate resilient agriculture in Mediterranean countries through the development of water management adaptation strategies in Farmers' Organizations. <http://www.lifeagroclimawater.eu/>

'Olivares Vivos', the profitable olive growing model that recovers biodiversity and can be replicated in other woody crops. [Home - Olivares Vivos](#)

Olive Roads is the promotion of the cooperation of the country's human resources and infrastructures, in order to highlight the qualitative characteristics of Greek varieties and olive oil and adapt to Climate change and emerging diseases that threaten olive production. <https://dromoielias.gr/>

The aim of this EU-funded project **OLIVEMIRACLE** is to provide accurate tools to test the effectiveness of adaptation/mitigation management strategies to support long-term investment decision making on olive-tree cultivation across the Mediterranean under current and future climate. <http://olivemiracle.eu>

Freeclimb





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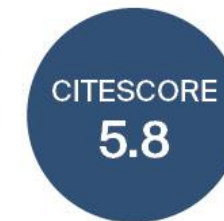




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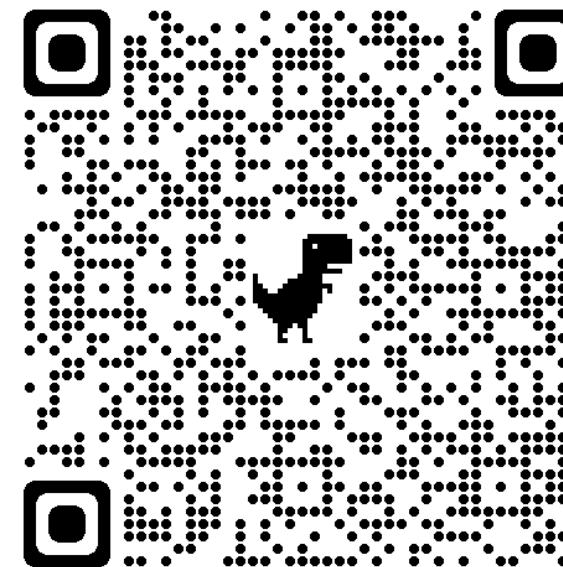
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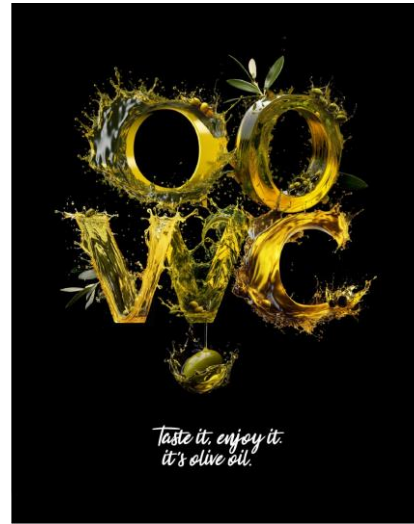


Videos in YouTube by LIFE OLIVECLIMA

1. Pruning olive tree
2. Fertilization of olive groves
3. Weed management during winter
4. Composting olive residues
5. Holistic olive grove management



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#FARMTHEFUTURE



Thank you!

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- Olive Alarm
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Olivares Vivos **REGION OF CRETE** **περίοδος Κρήτης**



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