Improving the water efficiency of olive trees under proper agricultural interventions
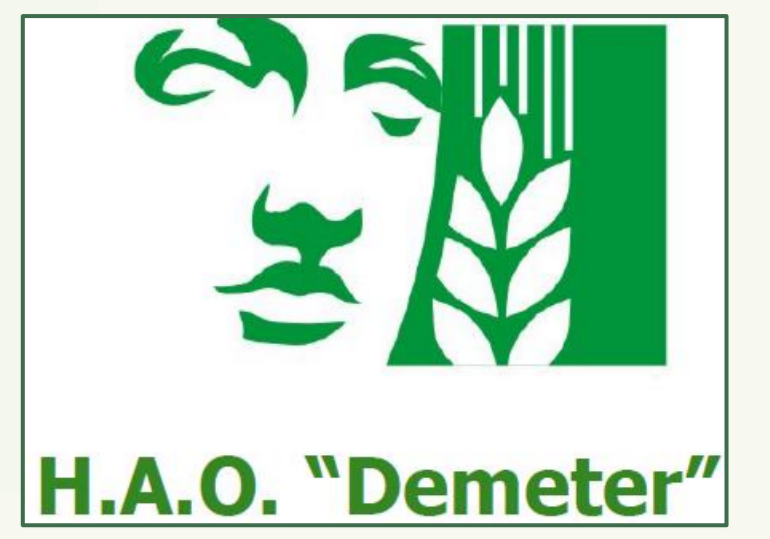
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1. Introduction

The objectives of this work were to improve the water efficiency of tree crops and save water, in a pilot farm, in eastern Crete – Greece, under proper agricultural interventions. The study is a part of LIFE AGROCLIMAWATER project, which aims to develop a climate change adaptation strategy for agriculture and prepare the agricultural sector for adapting to climate change.

2. Study Area

The selected pilot farm represents the most typical crop in eastern Crete (olive trees). The pilot farm has been divided in two parts, the first one is used as a control part, while the other one as the demonstration part where the interventions are applied.

Overview of the pilot farm (red polygon) with the polygon of demonstration plot (yellow)
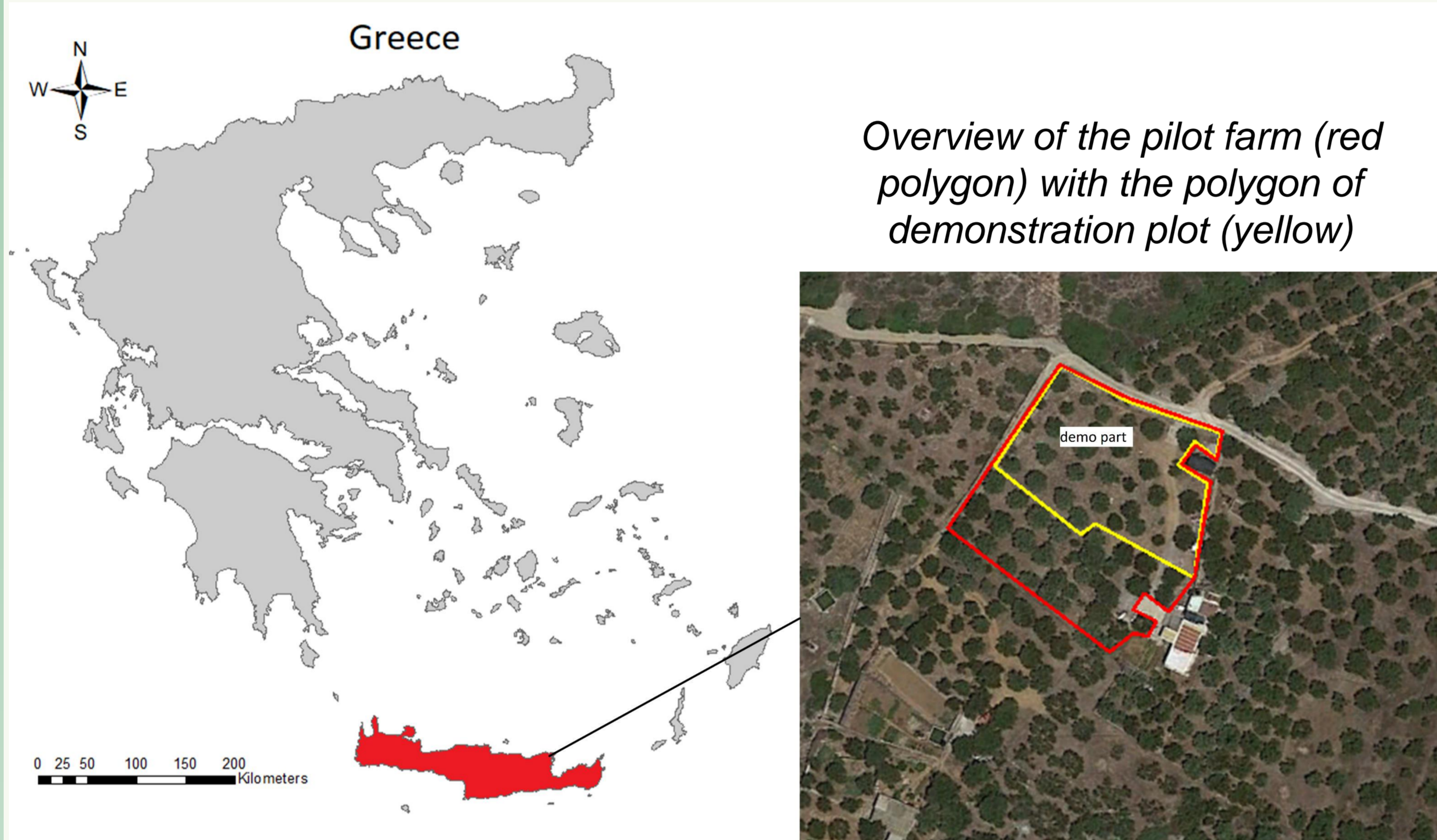
3. Materials and Methods

The interventions applied in order to improve water efficiency are:
a) reduction of water evaporation losses from soil surface through soil mulching and cover crops,

b) reduction of transpiration water losses through proper pruning (and summer pruning) and application of kaolin,

c) application of organic materials i.e. plant residue,
d) reduction of deep percolation water and nutrient losses and
e) irrigation according to the water crop needs.

In order to evaluate the results after the 1st year of implementation of proper agricultural practices for saving water, the following performance indicators were estimated for both the demonstration and the control plot:

➢ **Water Use Efficiency (WUE)** on a fruit yield basis
$$WUE_I = Y/I \ [kg\ m^{-3}]$$
Y = yield [kg/ha]
I = Total water volume (Effective rainfall + Irrigation volume) [m³ /ha]

➢ **Economic Water Productivity (EWP)**
$$EWP = PM*Yoil/I \ [€\ m^{-3}]$$
PM = Price of marketable product (olive oil) [€/L]
Yoil =Y * Oil content (%) [L/ha]
I = Total water volume (Effective rainfall + Irrigation volume) [m³ /ha]

➢ **Water Footprint (WFblue)**
$$WF_{blue} = IR/Y \ [m^3\ tn^{-1}]$$
IR = annual irrigation records [m³ /ha]
Y = yield [tn/ha]

4. Results

The results of this work show that the demonstration part has appreciable values of WUE, EWP and WFblue higher than the traditional part (control).

TRADITIONAL			DEMONSTRATION		
WUE [kg m⁻³]	Yield [kg ha⁻¹]	Total Water Volume [m³ ha⁻¹]	WUE [kg m⁻³]	Yield [kg ha⁻¹]	Total Water Volume [m³ ha⁻¹]
2.41	5400.00	2236.49	3.40	6260.87	1842.55

TRADITIONAL				DEMONSTRATION			
EWP [€ m⁻³]	Yield [kg ha⁻¹]	olive oil [%]	Total Water Volume [m³ ha⁻¹]	EWP [€ m⁻³]	Yield [kg ha⁻¹]	olive oil [%]	Total Water Volume [m³ ha⁻¹]
2.50	5400.00	30.43	2236.49	3.90	6260.87	33.77	1842.55

TRADITIONAL			DEMONSTRATION		
WFblue [m³ t⁻¹]	Yield [tn ha⁻¹]	Irrigation Volume [m³ ha⁻¹]	WFblue [m³ t⁻¹]	Yield [tn ha⁻¹]	Irrigation Volume [m³ ha⁻¹]
295.65	5.40	1596.50	192.08	6.26	1202.56

5. Conclusions

After the 1st year of implementation of proper agricultural practices, positive trends in demonstration part as compared to the traditional one have been achieved.

The 1st implementation year results of performance indicators will be used as a baseline of the efficiency of agricultural practices applied in order to make comparisons with the 2nd and 3rd year of their implementation.

More years of agricultural interventions will show the improving of the management techniques on water use (increasing crop yield and saving water).

This work is a part of LIFE + AGROCLIMAWATER project