LIFE+ Climagri: Best Agricultural Practices for Climate Change: Integrating strategies for mitigation and adaptation (Conservation Agriculture case study)

E.J. González-Sánchez[1,2,3](emilio.gonzalez@uco.es), R. Ordóñez-Fernández[4], J. Gil-Ribes[1], A. Holgado-Cabrera[3], J.F. Robles del Salto[5], R. Carbonell-Bojollo[4], F. Márquez-García[1], M. Gómez-Ariza[2], P. Tiviño-Tarradas[3], O. Veroz-González[2]

1. Departamento de Ingeniería Rural. Universidad de Córdoba. GI AGR 126 Mecanización y Tecnología Rural. Córdoba (Spain), 2. Asociación Española Agricultura de Conservación. Suelos Vivos. IFAPA centro "Alameda del Obispo". Avda. Menéndez Pidal s/n. 14004 Córdoba (Spain), 3. European Conservation Agriculture Federation. Brussels (Belgium), 4. Área de Producción Ecológica y Recursos Naturales. AGR-244 Conservation of Agriculture Ecosystems. Instituto de Investigación y Formación Agraria y Pesquera. Junta de Andalucía. Córdoba (Spain), 5. Asociación Agraria Jóvenes Agricultores ASAJA Sevilla. Sevilla (Spain).

Introduction

The LIFE+ Climagri project presents a holistic approach to the climate change concerns for the agricultural sector, more specifically for the irrigated regions of the Mediterranean Basin. Through improved farming practices based on Conservation Agriculture, LIFE+ Climagri addresses the mitigation of climate change in the geographical area of study, and also favor the adaptation of crops to the future agro climatic scenario, which is likely to happen due to the expected climatic variations in the southern regions of Europe (increase of temperatures, increase of extreme weather events and reduction of rainfall). To this end, the project has implemented adaptation and mitigation measures in irrigated crops, based on a decalogue of Best Management Practices (BMPs), including the three principles of CA: Minimum soil disturbance, maintenance of permanent soil cover, and crop rotations.

Material and Methods

In order to mitigate climate change and make crops adapt better to its effects, a series of Best Management Practices (BMPs) have been established. They have been grouped into a decalogue (Table 1). Some of these BMPs have been established at two work scales, a pilot scale in the Guadalquivir Valley and a transnational scale in countries of the European Mediterranean basin (Portugal, Spain, Italy and Greece) (Figure 1). The sustainability of the management system used in the plots has been evaluated through the 25 indicators defined in the project (Table 2). Each indicator is rated from 1 to 10 according to the results obtained in the analyses associated with each indicator.

Table 1. Best Management Practices decalogue of LIFE + Climagri.

	Best Management Practices (BMPs)	Mitigation (M) Adaptation (A)
1	Permanent soil cover (No-till)	M, A
2	Minimun soil disturbance practices (No-till)	M, A
3	Crop rotation/ diversification (No-till)	M, A
4	Optimisation in the use of agrochemicals	M
5	Appropiate management of agrochemicals products	M
6	Use of advanced technologies (Precision Agriculture)	M
7	Optimum and deficit irrigation strategies	A
8	Optimised agricultural, technical and financial practices to improve irrigation water management	A
9	Multifunctional field margins	M, A
10	Measures for the promotion of biodiversity	A

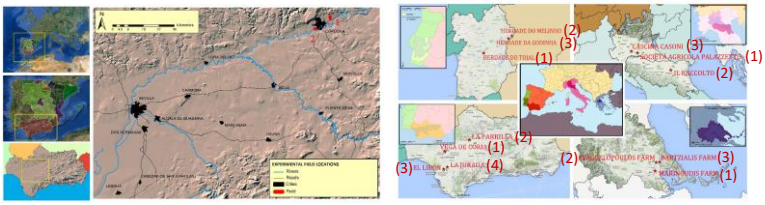

Figure 1. Pilot scale (left) (Rabanales farm (1) and Alameda del Obispo farm (2)). Transnational scale (right).

Table 2. Sustainability indicators.

Indicator	BMP evaluated
Net income per ha	2 to 8
Net income per annual work unit	2 to 8
Production costs	2 to 8
Yield/ha	2 to 8
Full-time equivalent working hours	2, 3, 6
SI – Satisfaction Index	1 a 10
Soil Tillage Index	1, 2
Annual soil cover rate	1 a 3
Organic matter level	1 to 3, 7, 8
Crop rotation	2
N efficiency rate	2 to 8
N productivity rate	2 to 8
Energy balance	2 to 8
Energy productivity	2 to 8
Surface for energy production	3
Biodiversity surface area	9, 10
Ratio between natural vegetation surface and total surface of the farm	9
Farm's connection with environmental networks and schemes	10
Biodiversity structures (nests, hives, spider-nets, etc.)-habitats	9, 10
Use of PPPs in some farms close to the water streams	9
GHG level	2 to 8

Results

Pilot scale

- Reduction of GHG emissions from the ground: Plots with a greater number of implanted BMPs have reduced CO_2 emissions by 48% and N_2O emissions by 2 to 10% compared to plots without BMPs.
- Increase in carbon sequestration: Soils in plots with a greater number of implanted BMPs (Best Management Practices) have increased their carbon content by 8% compared to conventionally managed plots (1.16 t ha^{-1} of C)..
- Reduction of CO_2 emissions linked to energy consumption: The plots in which a greater number of BMPs have been implemented have achieved annual reductions of up to 35% compared to the plots in which no BMP has been carried out, so the average annual reduction in this case was 32%, after 4 seasons. This means that, after four agricultural campaigns, in the plots with a greater number of BMPs, 15.11 t CO_2 ha^{-1} less have been emitted than in the plots with a conventional management system.

Trasntional scale

Most of the DFN (Demonstration Farm Network) farms have experienced an increase in the value of the indicators, which indicates that the greater degree of implementation of the BMPs has had a positive impact on the sustainability of the farm. These increases have ranged from 6% in the case of the 'Herdade do Melinho' farm to 71% as is the case of 'Evaggelopoulos farm'. The only case in which the indicator grade has dropped, has been the so-called "Il Racolto" (Rarm 2 Italy) (Figure 2).

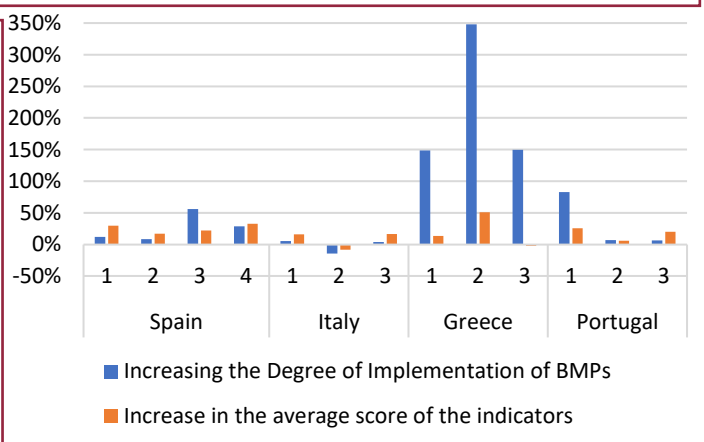

Figure 2. Relation between the increase the degree of Implementation of BMPs and the increase in the average score of the indicators.

Acknowledgements

The authors would like to thank the LIFE Financial Instrument of the European Union for co-financing the LIFE+ Climagri project (LIFE13 ENV/ES/000541).