LAYMAN REPORT

IRRIMAN
implementation of efficient irrigation management for a sustainable agriculture

IMPLEMENTATION OF EFFICIENT IRRIGATION MANAGEMENT FOR A SUSTAINABLE AGRICULTURE
LIFE13 ENV/ES/000539
2014-2017

LIFE+ PROGRAM

LIFE program is the EU's financing instrument for actions related to the environment and climate action. The general objective of LIFE program is contribute to the implementation, updating and development of EU environmental and climate policy and legislation by co-financing projects with European added value.

In this context the IRRIMAN LIFE+ (Implementation of efficient irrigation management for a sustainable agriculture LIFE13 ENV/ES/000539) project appears, whose objective is to put into practice, demonstrate and disseminate a strategy for sustainable irrigation based on controlled deficit irrigation to promote its widespread acceptance and large-scale use in woody crops of Mediterranean agri-ecosystems, characterised by water shortages, without affecting the quality standards demanded by exterior markets.

IRRIMAN is a project in which the Technical University of Cartagena participates as partners, which acts as coordinator of the project, the Center for Edaphology and Applied Biology of the Segura, the Ministry of Agriculture of the Community of Murcia, the University of Cordoba (UCO), the Community of Irrigators Genil-Cabra and the Federation of Communities of Irrigators of the Mediterranean.

PARTNERS

Universidad Politécnica de Cartagena

CSIC Consejo Superior de Investigaciones Científicas

Universidad de Córdoba

Región de Murcia

Federación Nacional de Comunidades de Regantes de España FENACORE

Comunidad de Regantes Genil-Cabra

Colectividad de Santaella

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CLIMATE CHANGE & AGRICULTURE

Research and innovation contribute to the development of a Sustainable and Competitive Agriculture, which are challenges that Europe must face up to, since estimations suggest that in the year 2050, the world population will reach 9,100 million people (UNO). Logically, such an increase in population will lead to an associated increase in the demand for food, which will oblige an improvement in crop yields. In this sense, irrigated crops play a vital role, since it is not possible to achieve high yields in dryland farming.

In Spain, the agricultural sector consumes around 80% of the total water resources, so a small saving in irrigation as a whole can represent an important volume of water that can be used for other sectors. In the Mediterranean basin, the scarcity and irregularity of precipitations, coupled with the high evaporation demand, are the causes for the development of major seasonal water deficits. In these conditions, irrigation water is the principal production factor. Today, two thirds of Spain is in risk of desertification and with a rainfall rate which, since 2014, has remained considerably below the mean, causing the worst drought in the last 20 years

- Currently two thirds of Spain are at risk of desertification and with a range of rains that, since 2014, are well below of the average, the worst drought of the last 20 years. One of the alternatives proposed to increase the efficiency in the use of irrigation water is the establishment of deficit irrigation strategies checked. In this way it is possible to reduce irrigation contributions during the periods phenological called "non-critical", without affecting negatively to the productive parameters and harvest quality, and even get others beneficial aspects of crop, such as improvements in the quality of the harvest..

OBJETIVES

Principal Objetive

The dissemination of this knowledge is fundamental in order to achieve a greater repercussion in agriculture. The project has gained the implication of farmers, irrigation communities, agronomic and industrial engineers, consultants, associations and the public administration, as well as the social awareness for sustainable irrigation.

Specific Objectives

1.- Implement sustainable irrigation in demonstration plots of different woody crops, using different types of water and paying special attention to the reuse of treated waste waters..

2.- Select different soil, water and environmental indicators to define the irrigation strategy and increase productivity.

3.- Characterise the agronomic and physiological response of the crops by means of accurate tools to measure the soil and the plant water status and the incidence of controlled deficit irrigation on the crop yield and the fruit quality.

4.- Validate the decrease in water use by means of measurements such as: water consumption, water leaching, soil and water contamination by nitrates, CO_2 released in the soil and energy consumption.

5.-Elaborate control models for the self-regulation of the different deficit irrigation treatments according to the established irrigation instructions.

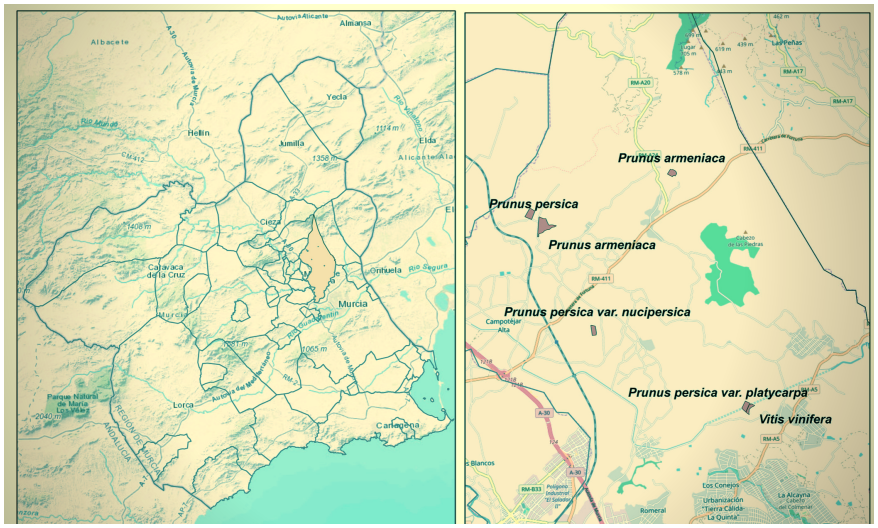
6.-Disseminate and transfer knowledge and technologies generated at regional, national and European level through public information adapted to the different interested parties.

LOCATION OF DEMOSTRATIVE PLOTS

3 IRRIGATION COMUNITIES

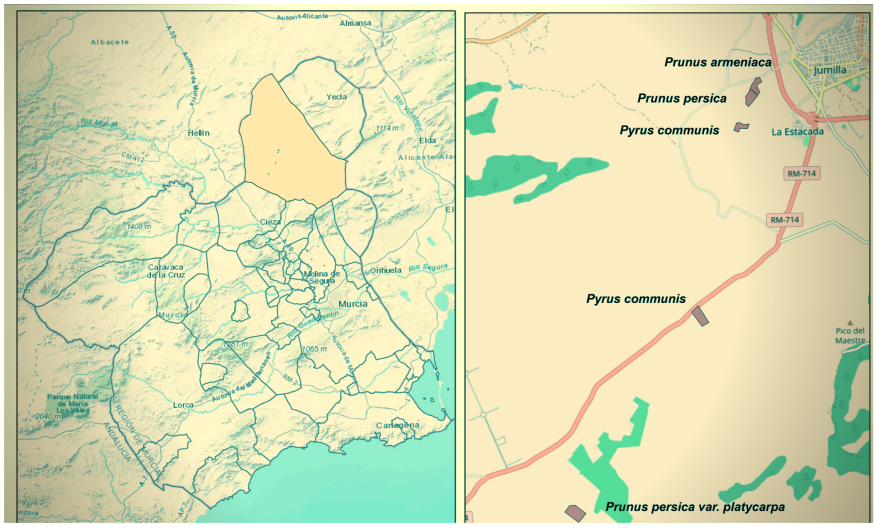
IR CAMPOTÉJAR
IR MIRAFLORES
IR GENIL-CABRA
COLECTIVIDAD DE SANTAELLA

DESCRIPTION OF THE PLOTS



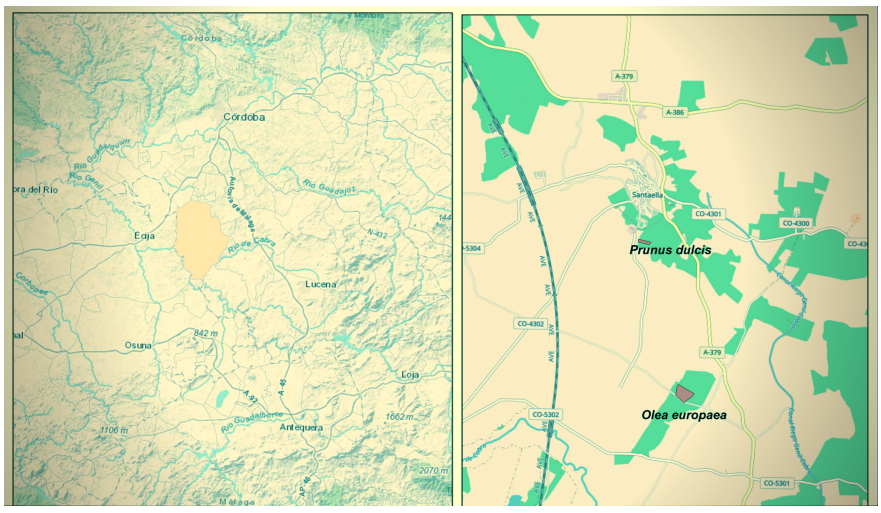
- IR Campotéjar

With a cultivated area of 3356ha major present crops are: 55% nectarine and peach, 35% citrus and 8% table grape. In this irrigation community, three farms were chosen and established five demostrative plots: flat peach var. Carioca, Peach tree var. Catherina, Apricot tree var. Búlida, Nectarina var. Viowhite and table grape var. Crimson.



- IR Miraflores

With a cultivated area of 1329ha main crops are: 45% pear, 32% peach, 12% apricot, 5% olive, 3% plum, 2% wine grapes and 1% almond. The most representative farms were chosen and established 5 demonstration plots: Apricot tree var. Pepito, Peach tree var. Baby gold, Flat peach variety UFO3 and two Peral var. Ercolini plots



-IR Genil Cabra Colectividad de Santaella

This irrigators community is located in the Province of Cordoba, with an area of 15184 ha occupied by olive trees (30%) and almonds (1%). Three demostrative plots were established: Almond var. Antoñeta, two plots of Olive var. Picual.

TECHNICAL DESCRIPTION

Implementation actions

- Configuration of demonstrative plots.
- Implementation of sustainable irrigation.
- Environmental assessment.
- Crop response to irrigation regime.
- Definition of decision tools.

Monitoring of the impact of the project actions.

- Monitoring the environmental impacts of irrigation management.
- Monitoring the socioeconomic impact of the project.

Communication and dissemination actions

- Communication and Dissemination plan.
- Public website.
- Press office and publicity material.
- Training curses.
- Seminars.
- Attendance to fairs and conferences.
- Technical visits.

The initiative is not part of the limited study of an experimental farm, but is based on its actual application in up to 15,000 hectares of irrigated land in Jumilla, Córdoba and Molina de Segura.

Main Results

Production, applied water and efficiency in the use of water irrigation are represented in figure 1. In allnthe crops studied the productionndid not show significant differencesnbetween treatments (Figure 1-A). Instead, the irrigation applied was a 28, 11, 31, 12, 34 and 25% lower in TRDC (Irrigation deficit tratament) for the nectarine crops, peach tree, Búlida apricot tree, Apricot red Carlet, flat peach and table grape (Figure 1-B). Therefore, efficiency in the use of water increased significantly in the deficit treatment that reached average values around 5 kg · m-3 in front of the 3 kg · m-3 of the treatment control (Figure 1-C).

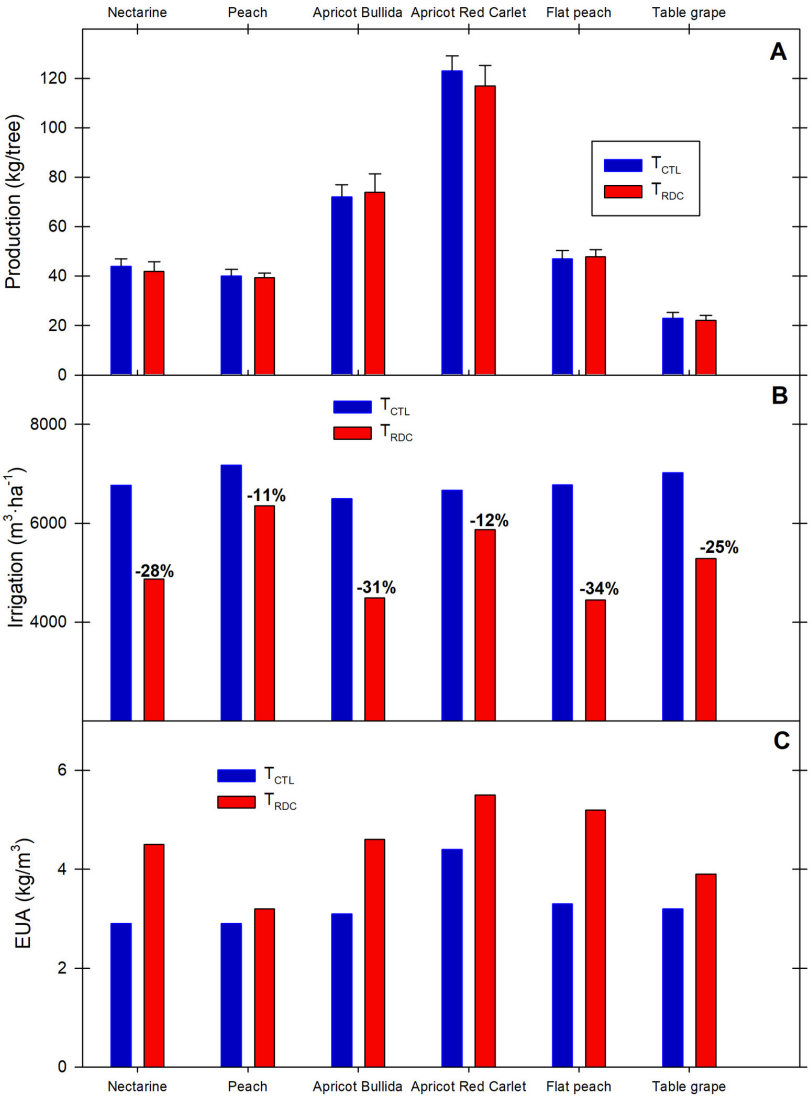


Figure 1 - Values referring to the crop productions in the project demonstrative plots (A), irrigation applied (B) and efficiency in the use of water irrigation (C) referring to the harvest of 2016 year.

- Reduction of 30% of water irrigation

After the adoption of the new irrigation strategies, it has been achieved a decrease of 6500 m3 / (year ha) to 4000 m3 / (year ha). These data are referred to those obtained in the Irrigation Community of Campotéjar, because in the other two, due to the young age of certain crops and the high salinity of the irrigation water, it has been difficult to reduction of water in crops, but in its increase in application efficiency.

- Reduction of 30 - 40% of CO2 emmisions

As a result of the decrease in energy consumption and the CO2 emission from agricultural soil from 0.2 to 0.7 Tn /year ha

- Reduction of 30% of the nitrate leaching

Reducing aquifer contamination

- Reduction of energy consumption

Due to the pressurization of irrigation systems from 2400kW year-1ha-1 to 1700 kWyear-1ha-1

- Reduction of fertilizers in 15%

Fertilizers that accompany the irrigation water. In some of the experimental farms where deficit irrigation estrategies are handle it also reduces in the same proportion the amount of fertilizers.

- Quality harvest improvement

Organoleptic quality improvements have been obtained, more uniform fruit color and soluble solids more abundant (increase of 10%)

- Neuronal network algorithm based

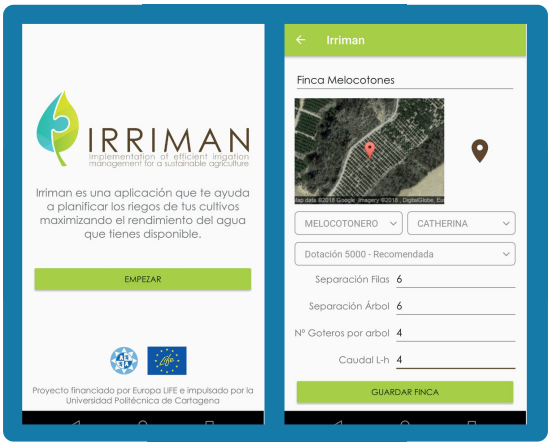
Capable of predict the irrigation deficit to apply depart from the air temperature and the early contraction of the trunk.

COMMUNICATION

Many activities have been worked to reach to the interested segments and make an effective dissemination of the results of the project. They stand out:

- **Website**: (www.irrimanlife.eu), monthly receiving more than 2500 visits.
- **Training Courses and Seminars**: with a total of 22 activities carried out in the three irrigation communities participants in the project, in various training centers such as the UPM, UPV, Administration (Ministry of Water, Agriculture and Farming of the Region of Murcia), centers of R&D or CIFEAS.
- **Exhibition Fairs and Congresses**: participation in 13 national and international fairs and congresses, among which we can highlight the National Congress of Irrigation, the EGU International Conference (European Geosciences Union) or the ISHS International Society for Horticultural Science Congress.
- **Video and media**: where the problem, objectives and results are exposed. Numerous interviews in national media have given the possibility to know IRRIMAN.
- **Scientific papers**: 5 articles in Q1 journals.
- **Networking**: Participation in Networking meetings organized by IRRIMAN or by other LIFE + projects such as REWIND, IRRILIFE, REGADIOX or WINDRO.
- **APP:** A mobile application has been developed for android and ios to calculate the needs of irrigation with all the results obtained in the project IRRIMAN Life + APP is free download.

SINCE THE BEGINNING OF THE PROJECT, IT HAS ALWAYS BEEN TAKEN INTO ACCOUNT THAT THE TRANSFERENCE OF KNOWLEDGE IS ESSENTIAL AND NOT ONLY TO THE AGRONOMIC SECTOR, WHICH IS THE PRINCIPAL INVOLVED, BUT THINKING IN THE YOUNGEST AND IN ITS IMPLICATION IN THE MIDDLE IN A SHORT PERIOD OF PROJECT TIME.



DECEMBER 12, 2017, A SEMINAR WERE ORGANIZED IN THE TECHNICAL UNIVERSITY OF CARTAGENA FOR THE PRESENTATION OF FINAL RESULTS, WHICH NUMEROUS PUBLIC ASSISTED AND MEDIA, VERY INTERESTED IN THE PROJECT SUBJECT.

REPLICABILITY, DEMONSTRATION, TRANSFER AND COOPERATION

The solutions proposed are not uniques, but it is about technologiy integrated solutions and multidisciplinary strategies that applied in combined form must have a synergistic and beneficial effect.
All the solutions applied are easily describable, and reproducible at the commercial level, they are economically viable and pose as the only limiting factor the difficulty that usually exists in the agricultural sector to introduce innovative solutions in production systems. With the diffusion plan and communication applied, along with the publication of the APP and its presentation to the sector (farmers, technicians, etc.) It has been overcome this difficulty by giving know the end users the existence of this strategy and adequate resources to implement it. Therefore, an algorithm were designed based on neural networks, and others statistical tools, whose objective is that from a climate variable easy to measure, as the average temperature of the air, and another variable derived from plant water status, as it is the early daily contraction of trunk, coming from the fluctuation of the diameter of the trunk, the farmer can plan every week a deficit irrigation strategy for its cultivation, and thus be able to adapt its water availability on demand of the crop.

Although the agricultural sector has always been reluctant to introduce solutions and innovative technologies in production systems, especially when those solutions involve significant investments and raise doubts as to their degree of profitability, it has achieved a good reception of the proposed measures, such as the weekly recommendations of irrigation under different scenarios of water availability, uploads on the web project (http://irrimanlife.eu/), design of the algorithm mentioned above and the APP that will be distributed by the Administration of the Region of Murcia, is getting the confidence of the sector, clearly demonstrating the benefits that derive from the modernization and introduction of innovative technologies in their irrigation systems. In addition to demonstrating the technical viability as affordable solutions developed in the project, the surveys made to course assistants and seminars held, where the results of the project have been shown to technicians, farmers and researchers, reveal a high potential for the dissemination of sustainable irrigation strategies that can replace the conventional practices, although this requires additional efforts of dissemination and communication and, specially, a training and adequate technical advice.
Once the limitation of the initial opposition of farmers to adopt new strategies be overcome, due to the demonstration of quantifiable real benefits, both environmental as well as economic replicability and transfer is expected be quick. Deficit irrigation controlled strategies implemented and demonstrated in IRRIMAN are easily replicable in any agricultural field, under semi-arid conditions or even arid, with woody crops under irrigation, from the use of the algorithm and the APP, and together with documents that can be downloaded from the project website.

Project information

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Name: IMPLEMENTATION OF EFFICIENT IRRIGATION MANAGEMENT FOR A SUSTAINABLE AGRICULTURE

Reference: LIFE13 ENV/ES/ 000539

Acronym: IRRIMAN

Duration: 01/09/2014 to 31/12/2017

Total budget: 1.702.604 euros

EU Financial Contribution: 840.193 euros

Website: www.irrimanlife.eu