SENSOREG: Integration of sensing and remote sensing for efficient irrigation management in vineyards through continuous monitoring of soil, plant and microclimatic conditions

Summary

The wine sector is a major consumer of water, with each bottle of wine requiring a water footprint of 720 litres of water. Catalonia is an area that suffers from drought episodes that make dryland wine growing difficult. This is why wineries choose to apply support irrigation to the vineyards to improve the quality of the grapes. The problem lies in the scarcity of water resources, so there is a need to implement technological solutions and systems that contribute to saving water in the irrigation process.

In the case of vines, fertiliser and water are the essential factors that contribute to their production. Therefore, the supply of manure or fertiliser to the soil also depends on the rainfall conditions at any given time. For this reason, irrigation control is essential to guarantee the quality of the fruit. Regardless of the year's rainfall, the crops can be irrigated by means of a support irrigation system to guarantee the ripening of the grapes or to achieve the oenological objectives pre-established by the winegrower. Consequently, a good irrigation system is required and a programme that is adapted to the characteristics of the crop and the soil, since these are the two pillars that support vine production.

Digital transformation and Industry 4.0 are key factors for optimising irrigation water management in vineyards. In this regard, the automation of irrigation systems should guarantee significant savings in terms of time, water and money.

This operational group aims to implement the potentially most efficient technological solutions for vineyard irrigation in order to help winegrowers in their decision making.

To achieve this, the project will involve learning about the water content of the crop, understood as a whole: plant + soil + meteorology + actions of the winegrower, proposing an irrigation strategy, applying it and carrying out long-term monitoring, obtaining agronomic and oenological information.

Objectives

The main objective of the project is to **optimise water management** in vineyard cultivation through the **digitalisation and optimisation** of all production processes, with **criteria for efficiency and savings** in its use defined in a **decision-making protocol/strategy** that ensures annual production and improves the quality and oenological potential of the grape harvest.

The following specific objectives are proposed to achieve the general project objective satisfactorily:

a) Sectorise farms to optimise water management according to the microclimatic, soil and agronomic characteristics of the different plots.

b) Optimise water management in vineyard cultivation, through the application of technology that provides clear decision-making support in the following aspects:
   - Soil management for maximum utilisation of soil water reserves.
   - Timing, dosage and overall irrigation strategy.

c) Correlate plant development, soil moisture sensor data, plant water stress data, and remotely sensed images to the conditions of the farms where they are installed, as a process for determining algorithms useful in process automation.

d) Introduce and validate "Saturas" technology, which enables the monitoring of the water content of the plant.

Description of the actions planned in the project

A work plan has been defined in several phases:

Phase 0. Project coordination.
Phase 1. Preparatory work: includes the selection of plots, determination of sensor installation points and soil characterisation of the plots in question.
Phase 2. Hardware and software installation. That is, the installation of sensors in the field and the creation of a database searchable by all participants in the operational group.
Phase 3. Monitoring of vineyard development and cultivation actions. It encompasses two complementary actions: on the one hand, the monitoring of vegetative, production and agronomic parameters in the vineyards where the monitoring is carried out, and on the other hand, the obtaining of remote sensing data as a measure of the vigour and productive potential of the vineyard.
Phase 4. Assessment of grape quality. Basic factor in the viability of the project.
Phase 5. Data processing and creation of algorithms, with the aim of moving towards system automation.
Phase 6. Analysis of technical, economic and environmental feasibility.

Expected results and practical recommendations

The implementation of the project is expected to improve the efficiency of water use in wine production. This improvement will be based on the digitalisation of the processes in order to obtain the maximum information to support decision-making for technical teams of the wine growers in question.

The project will follow the criteria of water saving, energy saving, grape and wine quality throughout. These criteria will shape the project and, consequently, will be reflected in the final results.

In addition to the overall result of maximising the use of rainwater and optimising irrigation, other results are expected:

- Observation of the effects of work on the soil on the dynamics of the water it contains, by relating the tasks carried out to the data collected by the sensors.
- Establishing relationships between remote sensing images and actual vigour and water stress levels, under the conditions of the studied farms, as a basis for precision viticulture.
- Incorporation and validation of Saturas technology in Catalonia. This is a very new technology with good prospects for success.

Leader of the Operational Group

ORGANISATION: EDETARIA, SL

Coordinator of the Operational Group

ORGANISATION: INNOVI Association of Innovative Companies

Other members of the Operational Group (grant recipients)

ORGANISATION: ALTA ALELLA, SL

Other members of the Operational Group (not recipients of the grant)

ORGANISATION: CATALAN INSTITUTE OF VINES AND WINES

Subject area(s) of application

☐	Agricultural production system
☐	Agricultural practice
☐	Agricultural equipment and machinery
☐	Livestock farming and animal welfare
☐	Vegetable production and horticulture
☐	Landscape / Territorial management
☐	Pest and disease control
☐	Fertilisation and nutrient management
☐	Soil management
☐	Genetic resources
☐	Forestry
☒	Water management
☐	Climate and Climate Change
☒	Energy management
☐	Waste and by-product management
☐	Biodiversity and environmental management
☐	Food quality/processing and nutrition
☐	Supply chain, marketing and consumption
☐	Competitiveness and agricultural and forestry diversification
☐	General

Geographical area(s) of application

PROVINCE(S)	REGION(S)
Tarragona, Barcelona	Terra Alta, Maresme

Dissemination of the project (publications, conferences, multimedia, etc.)

News on the progress of the project will be published on the INNOVI.cat website and posted on the social media of INNOVI and the Cluster members.

Project website

https://www.innovi.cat/sensoreg/

More information on the project

PROJECT DATES	TOTAL BUDGET
Starting date: July 2021	**Total budget:** €152,004.00
	DACC funding: €70,294.68
Current status: Under way	**EU funding:** €53,029.32
	Own funding: €28,680.00

With funding from:

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Order ARP/113/2021 of 20 May, approving the regulatory bases for grants for cooperation for innovation by promoting the creation of European Association for Innovation operational groups in the areas of agricultural productivity and sustainability and the execution of innovative pilot projects by those groups, and Resolution ACC/1660/2021, of 27 May, announcing the call for the grant.

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