



# Progetto LIFE - WINEgROVER 2020-2023



Precision Agriculture System to limit the impact on the environment,  
on health and on air quality of grape production.



# OBJECTIVE

Decrease the environmental impact related to grape production by introducing new technologies for Precision Agriculture and validate them in two vineyards, in Italy, and in Spain. The novelty is to quantify the vine health status through a prototype system consisting of 5 components: Aerial Drone, Terrestrial Rover, Ground Station, Ground Sensors Platforms, and IoT platform.



Total Project Budget	2,188,137 €
Total Eligible Project Budget	2,188,137 €
EU Financial Contribution	1,203,475 € (55%)





# PARTNER INVOLVED



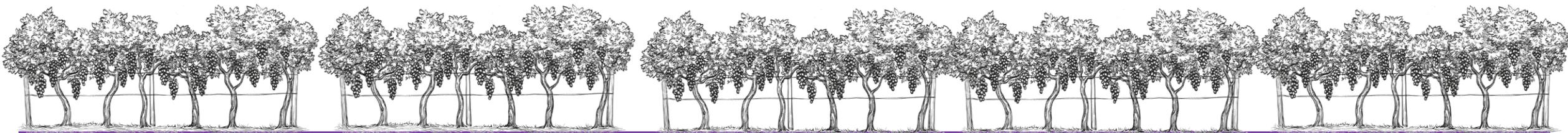


# Precision Agriculture System to limit the impact on the environment, on health and on air quality of grape production.



## *The project intends to:*

- 1.** Demonstrating the potential of Precision viticulture in terms of pesticides and energy reduction and fuel-saving.
- 2.** Applying such techniques in 2 viticultural contexts in Italy and Spain through the development of a full prototype.
- 3.** Comparing the results with traditional methodologies.
- 4.** Assessing the threshold of economic convenience and environmental benefits through analytical models based on LCA.
- 5.** Spreading LIFE WINEgROVER in other vineyards in EU (targeted countries: Portugal, France, Romania, Greece, Germany) and extra-EU (Cina).
- 6.** Define and disseminate standards for the application of Precision viticulture in the various phases of the grape production cycle and in all production systems (conventional, organic and biodynamic) and replicable at the EU and International level.
- 7.** Improve consumer health protection.
- 8.** Develop an open IT tool for assessing the benefits deriving from the adoption of precision farming techniques to be used by farmers.
- 9.** Enter the market with a new product.





Precision Agriculture System to limit the impact on the environment, on health and on air quality of grape production.



## EXPECTED RESULTS

**Up to 85%**  
Reduction of pesticides

**Up to 30%**  
Reduction of fungicide

**2**  
Pilot plants in 2  
EU countries

**1 OPEN IT TOOL**

**100%**  
Reduction of fuel  
and PM from tractors

**20-30%**  
Production  
costs reduction



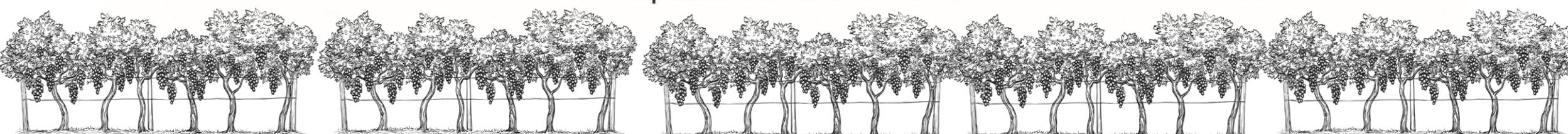
**90%**  
Reduction of  
irrigation water

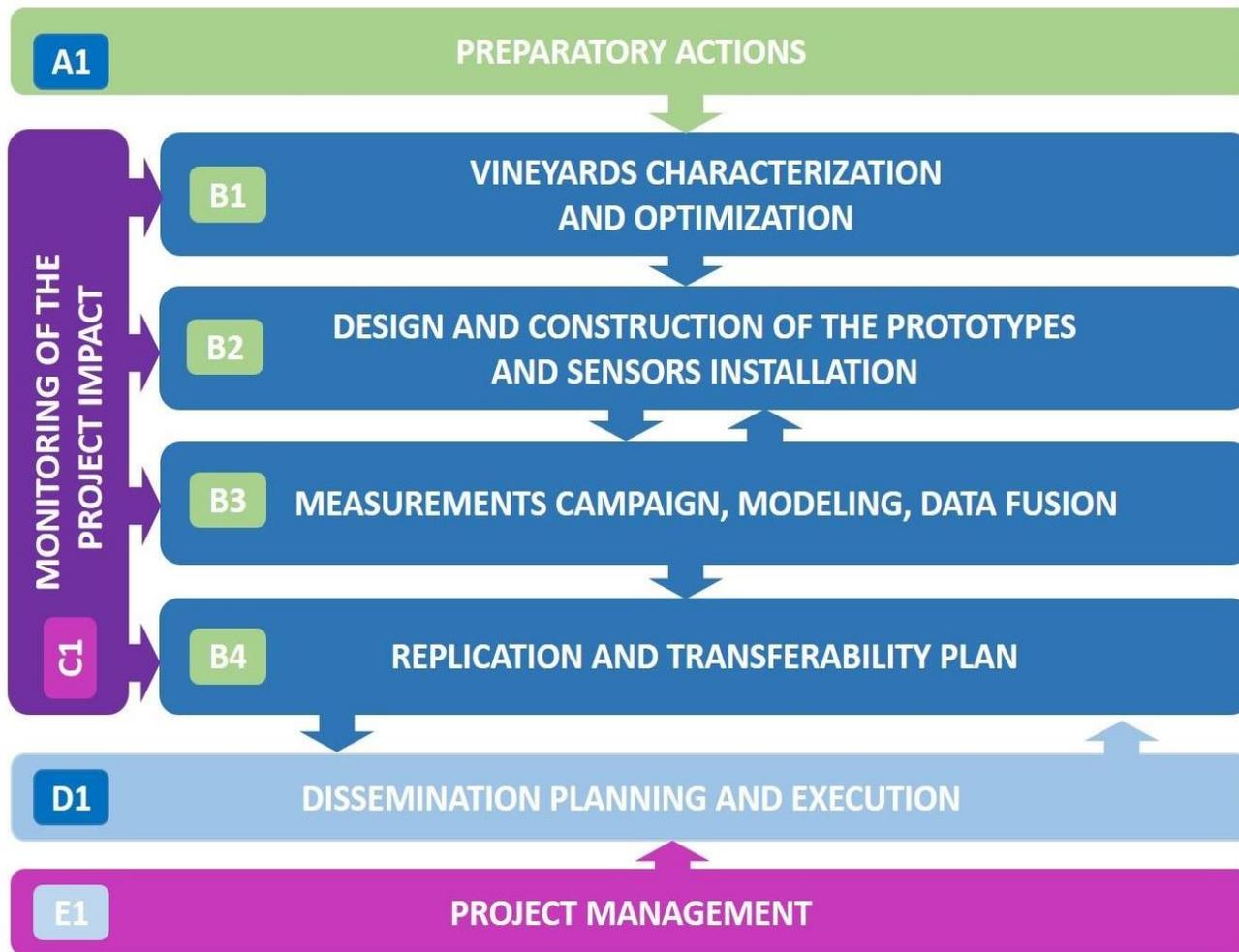
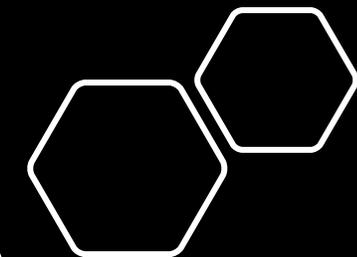
**25%**  
Reduction of  
KgCO<sup>2</sup> eq/Ton grape



**6**  
Replication/Transfer sites

**GO TO MARKET**  
Strategy







ACTION

B – Implementation Action

B1- Vineyard Characterization and Optimization

Task B1.1 - Italian Vineyard



Deliverable	D3 - Technical document on characterization of the Italian pilot site
Action	B1 – Vineyard Characterization and Optimization
Partner involved	UNITUS - Elena Brunori, Federico Valerio Moresi, Mauro Maesano CREA – Pasquale Cirigliano

Italian pilot vineyards: microclimate zonation

The first step of climate assessment was studied historical climate data to assess the vulnerability of territories to abiotic stressors and to analyse the potential to produce wine of a certain quality and with certain typical features.

This second step related to climate zonation focus on zoning of the potential relative earliness (vine development and grape ripening kinetic) on optimisation of technical management by adaptation of growing practices, on territorial management of crop protection risks and of potential water resources, on carry out land parcel selection and on zoning the risks and strong climate constraints. Viti-viniculture zoning on a climate level is done based on various indices derived from analysis of climate data obtained by ground sensors (temperature, radiation and humidity of soil and canopy) Figure 1.



Figure 1. Wheatear sensors in Italian pilot vineyard.

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## Pedological survey

Soil profile pits were opened to characterize the soil composition in each of the three agronomic strategies and in the control row.



The soil was described according to the methodology established by the Soil Taxonomy (USDA) contextually to the World Reference Base (WRB) method.



Beneficiary responsible for implementation:





ACTION

B – Implementation Action

B1- Vineyard Characterization and Optimization

Task B1.2 - Spanish Vineyard



LIFE 2019 Environment and Resource Efficiency code: LIFE19 ENV/IT/000339  
Coordinating beneficiary: University of Tuscia  
Project title: Precision Agriculture System to limit the impact on the environment, on health and on air quality of grape production.  
Project acronym: LIFE WINEGROVER



Deliverable	D4 – Technical document on characterization of the Spanish pilot site
Action	B1 - Vineyard Characterization and Optimization
Partner involved	WELLNESS - Jose Morales CREA- Pasquale Cirigliano UNITUS - Elena Brunori, Federico Valerio Moresi, Mauro Maesano, Andrea Rengo SCC - Olga Aguilera Ortega

**Project title:** "Precision Agriculture System to limit the impact on the environment, on health and on air quality of grape production - WINEGROVER"

**Code project:** LIFE19 ENV/IT/000339

**Spanish pilot vineyards: Climate zonation**

Climate characterization for the grape growing area of the Spanish pilot vineyard has been done through open data of weather stations of the Andalusian Agroclimatic Information Network (RIA). This Network provides information on the main meteorological variables, such as the temperature and relative humidity of the air, the speed and direction of the wind, solar radiation and precipitation in the form of rain. The RIA has been in operation since 1999 and currently has 100 automatic meteorological stations distributed throughout Andalusia and located in irrigable areas (figure 1).

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Beneficiary responsible for implementation:





ACTION

B – Implementation Action

B1- Vineyard Characterization and Optimization

Task B1.1 - Italian Vineyard



<b>Deliverable</b>	<b>D3 - Technical document on characterization of the Italian pilot site</b>
<b>Action</b>	<b>B1 – Vineyard Characterization and Optimization</b>
<b>Partner involved</b>	<b>UNITUS - Elena Brunori, Federico Valerio Moresi, Mauro Maesano CREA – Pasquale Cirigliano</b>

Italian pilot vineyards: microclimate zonation

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Viti-viniculture zoning on a climate level is done based on various indices derived from analysis of climate data obtained by ground sensors (temperature, radiation and humidity of soil and canopy)

Figure 1.



Figure 1. Wheat sensors in Italian pilot vineyard.

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## Soil Respiration Chamber (SRC) installation in vineyard.

Activation of CO<sub>2</sub> monitoring in the soil and starting to store the data. Useful data to assess LCA

The CO<sub>2</sub> emitted by the soil, including the microbiome one, is monitored by control units and special boxes/stations containing the specific sensors for CO<sub>2</sub> and soil T/UR.



**Italian Pilot Vineyard**

Precision Agriculture System to limit the impact on the environment, on health and on air quality of grape production

LIFE WINEGROVER

**Strategy 2: Organo-mineral Fertilizer (OMF)**

Partners: UNIVERSITÀ DELLA TUSCIA, DEPARTAMENTO PER LA INNOVAZIONE NEI SISTEMI BIOLOGICI, AGROALIMENTARI E FORESTALI, SaTeL, Luiss Business School, creaa, INOVA+, SmartCity Cluster, CURSA, Wellness TechGroup.

Life 2019 Environment and Resource Efficiency code: LIFE19 ENV/IT/000339  
 Coordinating beneficiary: University of Tuscia - DIBAF Department for Innovation in Biological, Agrifood and Forest System  
 Project title: Precision Agriculture System to limit the impact on the environment, on health and on air quality of grape production.  
 Project acronym: WINEGROVER  
 Associated beneficiary: CREA VG - Council for Agricultural Research and Agricultural Economy Analysis - Viticulture and Oenology, Innova+ - Innovation Services, S.A., Luiss - Libera Università Internazionale degli Studi Sociali Guido Carli, Associazione Multisettoriale Innovazione per la Capitale Intelligente, SaTeL, Servizi Tecnici Logistici Srl, Wellness TechGroup S.r.l.

Beneficiary responsible for implementation:





ACTION

B – Implementation Action

B3- Measurements Campaign, Modeling, Data Fusion

Task B3.1 - Prototype's measurement on vines performances



<b>Deliverable</b>	<b>D10 - Operation report on measurements on the Italian Pilot</b>
<b>Action</b>	<b>B3 – Measurements Campaign, Modeling, Data Fusion</b>
<b>Partner involved</b>	<p>CREA- Pasquale Cirigliano            UNITUS - Elena Brunori, Federico Valerio Moresi, Mauro Maesano            SETEL – Eduardo De Francesco, Paolo Rengo</p>

## Application of canopy and soil management strategies in Italian pilot vineyard.

Organo-mineral soil nutrition (OMN) was applied in pre flowering indicated for spring fertilisations on particularly vigorous vines



### EXECUTIVE SUMMARY

The following deliverable describes the activities that took place in the Italian Pilot. Canopy and soil management strategies applied in vineyard, ground monitoring of the main microclimatic parameters, vegetative parameters and berry quality monitored during the first season, the description of non-invasive sensing technologies (chlorophyll-based fluorescence, porometer, etc) used, the experimental design of measurement campaign in field and by prototypes (aerial and terrestrial drones) and the parameters measured and samples collected useful to vegetational indices determination, LCA and KPIs assessment.

#### Canopy and soil management strategies applied in vineyard.

The experimental design of the study consisted of four treatments: (i) control (standard agronomical and cultural practices applied by farm – no leaf removal no foliar nutrition, only shoot in pre and post- veraison – C), (ii) leaf removal at flowering (early leaf removal – ELR), (iii) foliar nutrition by the application of micronized basalt powder (FN), and (iiii) organic-mineral soil nutrition (OMN).

ELR consisted in manually removing six primary basal leaves per shoot, according to Poni et al. (2009) and no lateral shoots were retained because at flowering they were absent or just developed; it was performed at full flowering – BBCH 065, 50% of flower hoods fallen (Figure1).

Beneficiary responsible for implementation:





ACTION

B – Implementation Action

B3- Measurements Campaign, Modeling, Data Fusion

Task B3.1 - Prototype's measurement on vines performances



<b>Deliverable</b>	<b>D10 - Operation report on measurements on the Italian Pilot</b>
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<b>Partner involved</b>	CREA- Pasquale Cirigliano UNITUS - Elena Brunori, Federico Valerio Moresi, Mauro Maesano SETEL – Eduardo De Francesco, Paolo Rengo

## Vine performance in the field

Data collected by field survey through non-destructive tools (vegetative and productive data) useful to assess the influence of the three strategies on vines performance.

**Pre-dawn leaf water potential** At least weekly, before dawn, 3 leaves are taken for each strategy. These are immediately subjected to internal pressure analysis by inserting them into the hermetic cylinder of the Scholander pressure chamber with the petiole cut at the end protruding from the sample holder. Increasing pressure is applied to them, until the internal tension is overcome, and lymphatic material begins to emerge from the cut section. This stage will be the measure of leaf pressure expressed in Bar for each leaf.



Scholander's pressure chamber (model 3115)

### EXECUTIVE SUMMARY

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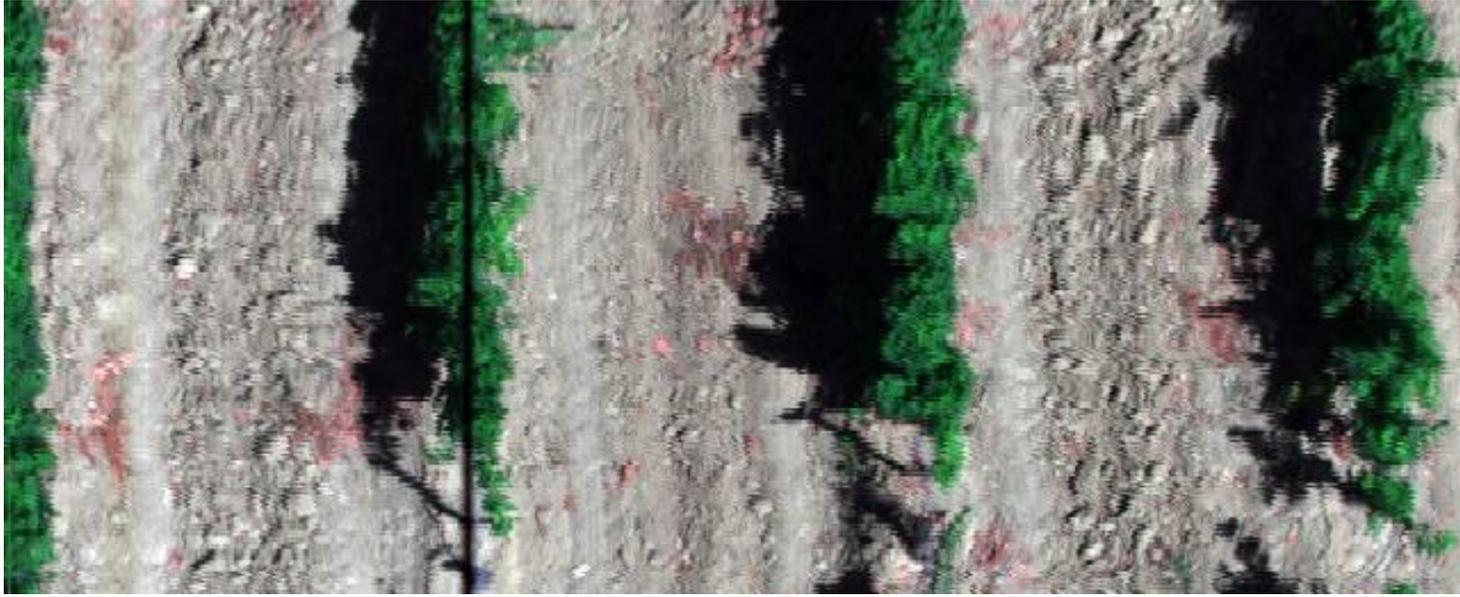
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Beneficiary responsible for implementation:









ACTION

B – Implementation Action

B3- Measurements Campaign, Modeling, Data Fusion

Task B3.2 - Prototype's campaign, modelling, data fusion



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 Associated beneficiary: CREA VI-Council for Agricultural Research and Agricultural Economy Analysis - Viticulture and Oenology; Innoova - Innovation Services, S.p.A.; Luiss Business School; Asociación Multisectorial Innovadora para las Ciudades Inteligentes; SETEL Servizi Tecnici Logistici Srl; Wellness Telecom S.L.



<b>Deliverable</b>	<b>D12 – Analysis and modelling of the results – Report Italian Pilot Season 1</b>
<b>Action</b>	<b>B3 - Measurements Campaign, Modeling, Data Fusion</b>
<b>Partner involved</b>	WELLNESS - Jose Morales CREA- Pasquale Cirigliano UNITUS - Elena Brunori, Federico Valerio Moresi, Mauro Maesano, Andrea Rengo SETEL - Ruggero De Francesco

**Project title:** "Precision Agriculture System to limit the impact on the environment, on health and on air quality of grape production - WINEGROVER"

**Code project:** LIFE19 ENV/IT/000339

**EXECUTIVE SUMMARY**

**Study Area**

During the season 2021 four agronomical strategies have been applied in Italian Pilot vineyard, as reported in D10:

- 1) treatment of control (standard agronomical and cultural practices applied by farm – no leaf removal no foliar nutrition, only shoot in pre and post veraison – denominated C);
- 2) leaf removal at flowering (early leaf removal – ELR);
- 3) foliar nutrition by the application of micronized basalt powder (FN);
- 4) organic-mineral soil nutrition (OMN).

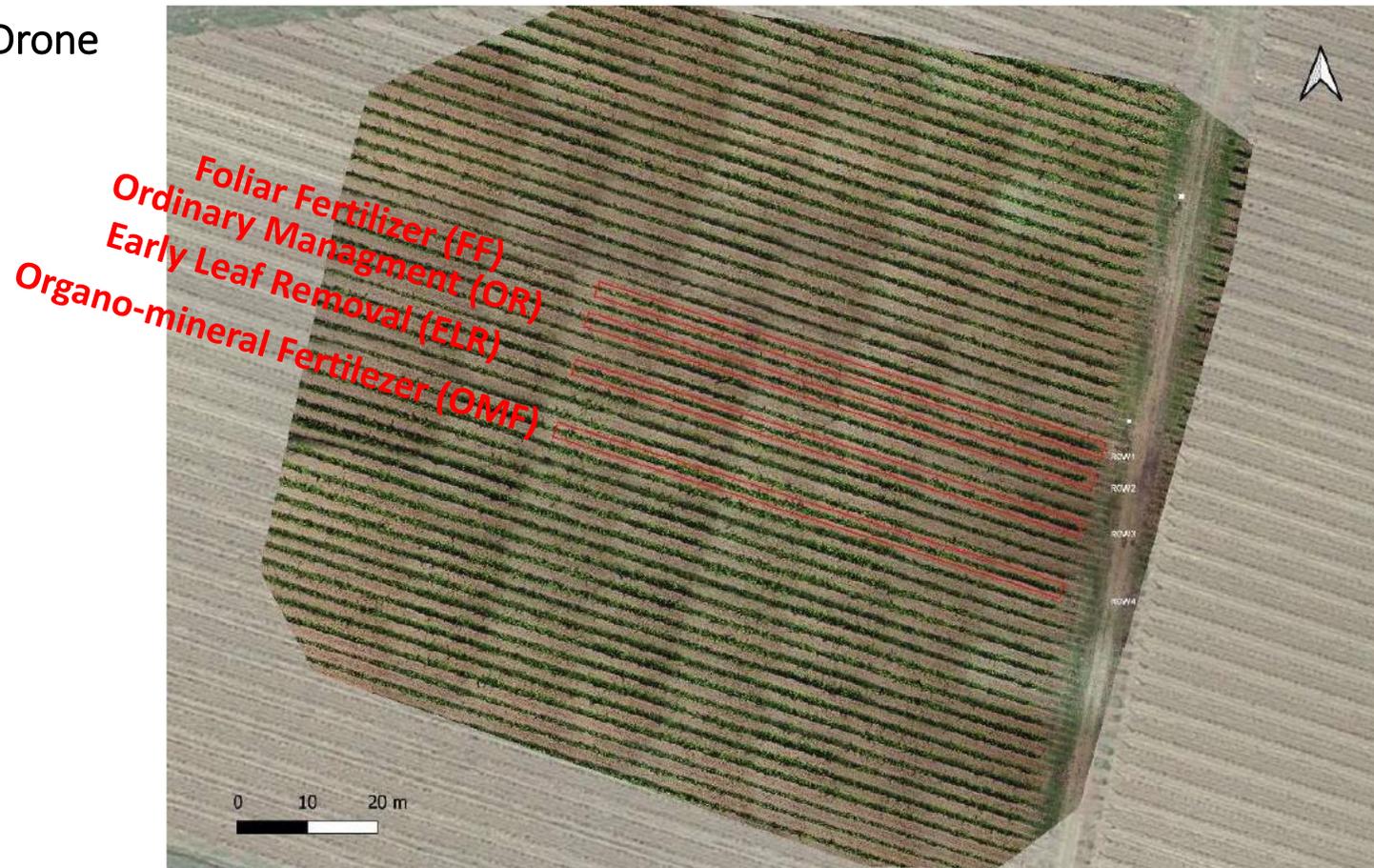
Main microclimatic parameters, vegetative traits and berry quality has been monitored throughout non-invasive sensing technologies used in field and by prototypes (aerial and

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Beneficiary responsible for implementation:



**Aerial Drone**



# DECREASING ENVIRONMENTAL IMPACT THROUGH PRECISION AGRICULTURE

Reducing the impact on the environment and on health of grape production



## EU IS THE LARGEST VINEYARD AREA IN THE WORLD

Vineyards can require lots of external inputs (water, pesticides and fertilizer) to reduce biotic and abiotic stressors and to ensure grape production.

WINEGROVER represents a solution based on Precision Agriculture System, which will allow:

- ✓ To monitor the vineyard throughout the whole vegetative cycle of the plants.
- ✓ To intervene in the phases of irrigation and application of pesticides and nutrients and optimizing the pesticides, fertilizers, water and fuel consumptions.

## OBJECTIVES OF THE PROJECT

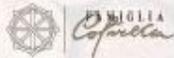
WINEGROVER will allow to reduce the use of pesticides, fertilizers, water, fuel consumption and also reducing CO2 emissions, ammonia, PM emissions and the risk of eutrophication.



## VINEYARDS

**Cantina Falesco** is a winery and vineyard established in Montecchio (Umbria region).

**Bodega Conrad** is a winery and vineyard situated 4 kilometres from the town of Ronda.



## PARTNERS



### DECREASING ENVIRONMENTAL IMPACT THROUGH PRECISION AGRICULTURE

Reducing the impact on the environment and on health of grape production

#### WE HELP YOUR FIRM REACH NEW HEIGHTS



EU is the world leading producer of wine and the environmental impacts of grape production come from:

- Intense use of pesticides.
- Variability of the amount of fertilizers.
- Energy consumption.

EU regulations highlight the strong need to reduce pesticides.

WINEGROVER represents a solution based on Precision Agriculture System, which will allow:

- To monitor the vineyard throughout the whole vegetative cycle of the plants.
- To intervene in the phases of irrigation and application of pesticides and nutrients and optimizing the pesticides, fertilizers, water and fuel consumptions.

### PROJECT OBJECTIVES

Under the guidelines of the general objective, the project intends to:

<b>01</b> Verify and demonstrate the effective Precision Agriculture for viticulture in terms of pesticides reduction, energy reduction and fuel saving.	<b>02</b> Analyze the efficiency of the system and comparing the results with traditional methodologies in 2 pilots: Italy and Spain.	<b>03</b> Assess the threshold of economic convenience and environmental benefits through analytical models based on LCA.	<b>04</b> Diffuse the WINEGROVER results in other vineyards in EU: Portugal, France, Romania, Greece, Germany.	<b>05</b> Define and disseminate standards of intervention for the application of Precision Agriculture in the grape production cycle and replicable at EU and international level.	<b>06</b> Improve consumer health protection, creating growth and development conditions.
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### EU IS THE LARGEST VINEYARD AREA IN THE WORLD

Viticulture faces new challenges and threats related to environmental and climate issues

#### EXPECTED RESULTS

Quantified expected results and impacts will be:

- Reduction of the use of pesticides up to 85% and of the use of fungicide up to 30%.
- To contribute to the implementation of UNECE Code of Good Practice limiting ammonia from the use of mineral fertilizers.
- 100% reduction on the use of diesel fuel.
- To reduce the water consumption for irrigation up to 90%.
- To lower production costs between 20 and 30%.
- To foster the deployment of the project at local and EU levels.
- To contribute to climate targets with a reduction of 25% kgCO2eq/ton per grape.

## VINEYARDS

**Cantina Falesco** is a winery and vineyard established in Montecchio (Umbria region).

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## PARTNERS

WINEGROVER is presented by a consortium of transnational partners from 3 different EU Member States:





PRECISION AGRICULTURE

# Decreasing Environmental Impact through Precision Agriculture

Reducing the impact on the environment and on health of grape production through Precision Agriculture.





ACTION

D – Public awareness and dissemination of results

D1- Dissemination Planning and Execution

Task D1.1 - Networking with other projects

Publication on “VVQ – Vigne Vini & Qualità”

