Layman's report

DRIVE

Drought Resilience Improvement in Vineyard Ecosystems

Co-funded by the European Union

The project

01.01.2021 – 31.12.2023

Total budget: 1.659.215 €

EU grant: 898.829 €

Project areas:

Colli Piacentini (PC)

Oltrepò Pavese (PV)

Partners

UNIVERSITÀ CATTOLICA del Sacro Cuore

UNIVERSITÀ DEGLI STUDI DI MILANO

UNIVERSITÀ DI PAVIA

ART-ER ATTRATTIVITÀ RICERCA TERRITORIO

CANTINA DI VICOBARONE VINI DA UNA TERRA ANTICA E GENEROSA

TERRE D'OLTREPÒ

Meet the project Team

visit the website

DEMO FARMS

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Background

"**Meteorological drought**" is defined in terms of precipitation deficiency, which may be exacerbated by poor soil management leading, in turn, to reduced water reservoir and high temperatures associated with high evapotranspiration.
According to EEA (2017), the fraction of the Mediterranean region under meteorological drought is projected to increase by the end of the 21st century by 50 % using the Supply/Demand Drought Index (SDDI). Such a scenario is aggravated by the current situation in Europe regarding the use of water resources that is effectively expressed by the water exploitation index (WEI). A WEI above 20% implies that a water resource is under stress. Cyprus, Bulgaria, Belgium, Spain and Italy have already reached such threshold and water consumption by the public, industry and agriculture sectors is forecast to increase by 16% by 2030 (EEA, 2009).

The three main E28 wine producing countries, Italy, France and Spain—accounting for about 67% of total world vine production (OIV, 2018)—are all facing the above threats.

Severe drought is known to be very detrimental to both grape yield and wine quality and, therefore, conducive to higher use o irrigation water.

In this context, the DRIVE LIFE project aims to address both the issue of drought and water scarcity by identifying and proposing management solutions geared toward improving the resilience of the vineyard ecosystem. This is done while maintaining a high level of product competitiveness, reducing the water footprint, and the need for irrigation interventions.

Project aims, activities, results

Objective

Develop an innovative **Monitoring Tool (MT)** for improved assessment and use of natural soil reserves and seasonal rainwater consumption able to guide farmers to:

i) define their specific water supply related problem(s);

ii) track seasonal soil water depletion and canopy/grass water use (s);

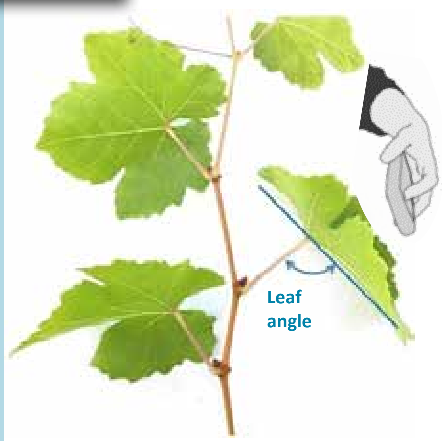
iii) identify and validate thresholds of significant water stress.

The PocketDRIVE app

The Monitoring Tool developed is based on the app **PocketDRIVE**, which allows farmers to **promptly detect water stress** in vineyards based on the **cultivar-specific relationships** - derived during the project - **between 3D canopy architecture and stomatal conductance**, the latter being the most reliable indicator of water stress.

How it works?

By keeping the phone parallel to the leaf lamina, in a couple of seconds **PocketDRIVE** makes a **3D scan of photosynthetic surfaces** and, after scanning around ten leaves randomly chosen in the mid section of the canopy, immediately provides a **diagnose of the occurrence of water stress and related intensity, moderate or severe.**



Objective

Test the MT in demo-vineyards and achieve increased storage and improved use of natural water resources in vineyard ecosystems prone to summer drought and with limited or no availability of supplemental water for irrigation.
These objectives will exploit, in each demo vineyard, comparisons between local practice and a "**water resilient management**" where one or more techniques suitable to improve rain water use efficiency as well as increase leaf and cluster tolerance to water, heat and light stresses will be demonstrated

The "water resilience tecniques"

SOIL MANAGEMENT

BETWEEN THE ROWS:

- GREEN MANURING
- BETWEEN-ROWS MULCHING
- "MOW AND BLOW" (Piling of grass under the row - subrow mulching)

UNDER THE ROW

- PERMANENT GRASSING

CANOPY MANAGEMENT

Canopy treatments with kaolin aims to reduce vine water "loss" preserve plant water status and limit overheating damage.

Kaolin rock powder is able to reflect solar radiation resulting in a cooling effect of canopies and clusters.

GREEN MANURING

This soil management technique implies mowing and subsequent burying in the soil of the biomass grown during the winter; the aim is promoting the release of nutrients and enhancing its water holding capacity. According to agronomical needs, a mixture with a different ratio of cereals, legumes and brassicas is used.

BETWEEN-ROWS MULCHING

This soil management technique requires a crimper roller to press biomass produced between the rows, creating a permanent mulching layer.
This technique is considered beneficial for saving soil water content due to the formation of a 'coating' that reduces direct evaporation and transpiration of the plot, as well as the growth of potential weeds in proportion to the amount of biomass produced.

"MOW AND BLOW"

This soil management technique is achieved with a special mulcher that conveys the residues under the vines, forming a localised mulch. In addition to maintaining moisture in the soil, weed growth is naturally controlled with minimal recourse to tillage over the remainder of the season.

for more information on the water resilince technique please scan the QRcode

soil management

canopy management

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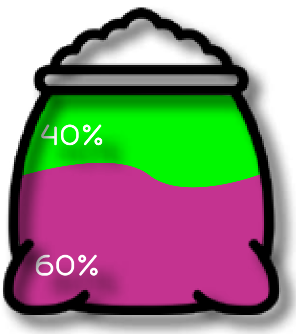
JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC

MAY: TERMINATION

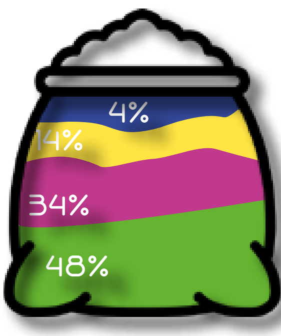
OCT: SOWING

SEED MIXTURES

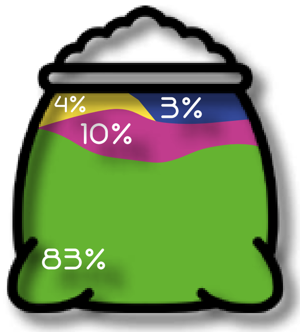
- LEGUMES
- CEREALS/GRASSES
- BRASSICA
- OTHER SPECIES



LEGUMES BASED
"N"
C/N <20



BALANCED
"B"
C/N 24



CEREAL BASED
"C"
C/N >28

SPECIES FOR UNDER THE ROW GRASSING

- *Glecoma hederacea*
- *Dichondra repens*
- *Trifolium subterraneum*
- *Hieracium pilosella*
- *Festuca ovina*
- *Festuca rubra rubra*

low water and nutrient competition

high colonization rate

high shade tolerance

low maintenance

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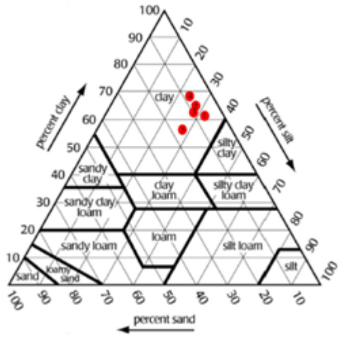
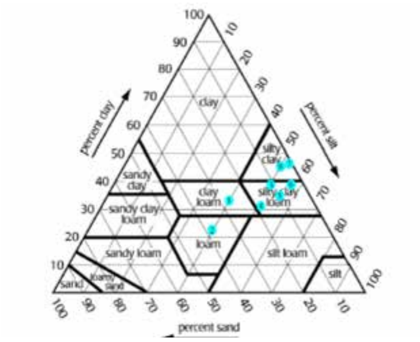
Different vineyards

Different soils

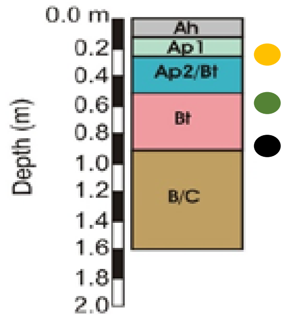


CLAYEY SOILS



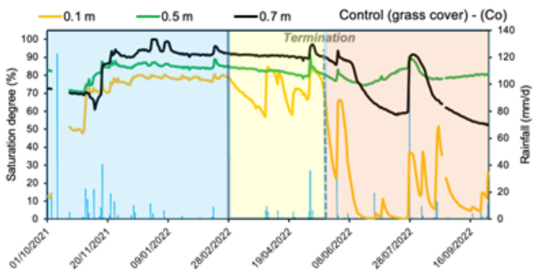
SILTY OR LOAMY SOILS

Slope elevation/aspect: 325-335°/NE
Bedrock geology: Sandy marls (S. Agata Fossili Marls)

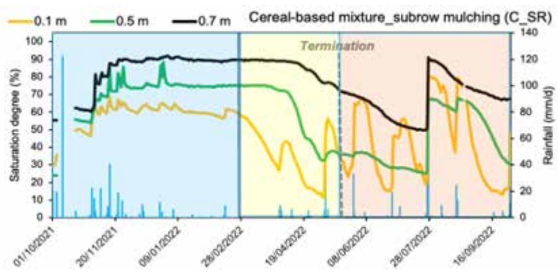


Water content monitoring

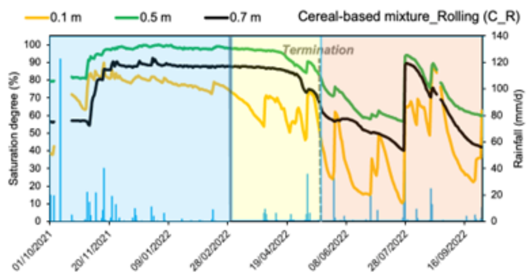
CONTROL (Co)



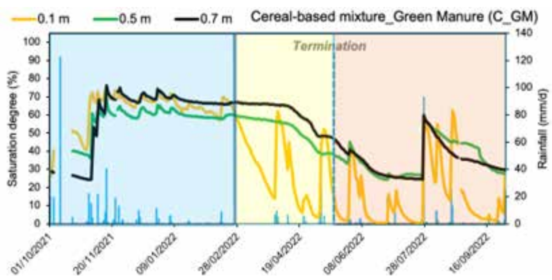
'MOW AND BLOW' (SR)



BETWEEN-ROWS MULCHING (R)



GREEN MANURING (GM)



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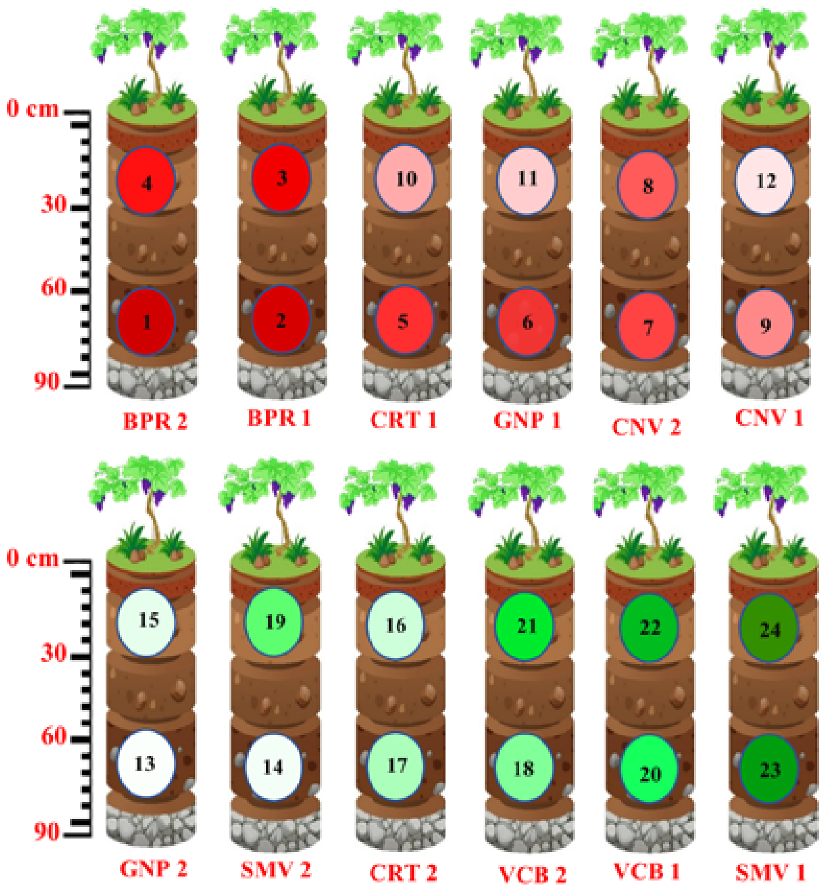
Prioritization of drought affected DEMO vineyards using soil main properties and Game Theory at depth of 0-30 and 30-60 cm

WHAT IS THE GAME THEORY?

It is a model for predicting people's decisions. It is a mathematical instrument for assessing and resolving issues involving goals that are in conflict

Game Theory 4 pillars

1. decision makers
2. potential options
3. choices
4. outcomes (benefits)



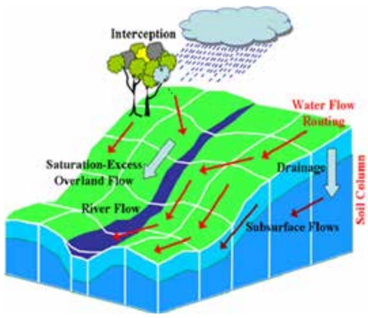
1 and 24 respectively show the worst most drought prone and the best minor drought stress-prone DEMO vineyard

BRP is the worst most drought prone DEMO vineyard

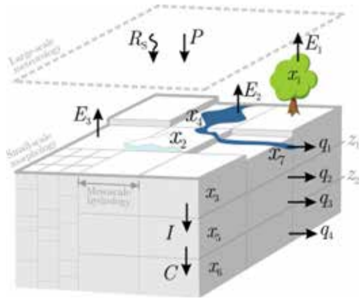
SMV 1 is the best minor drought stress-prone DEMO vineyard

Soil Water Content Modelling embedded in an Open GIS-Environment

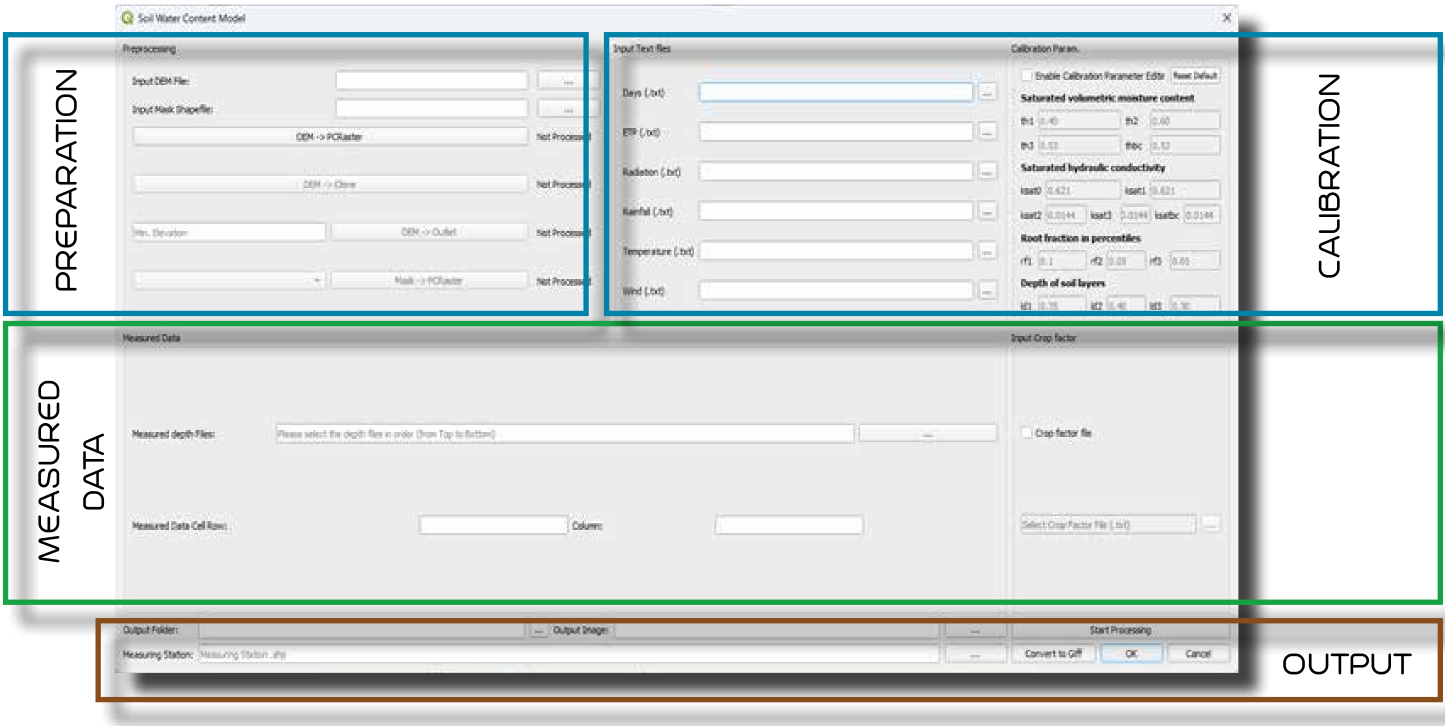
REALITY

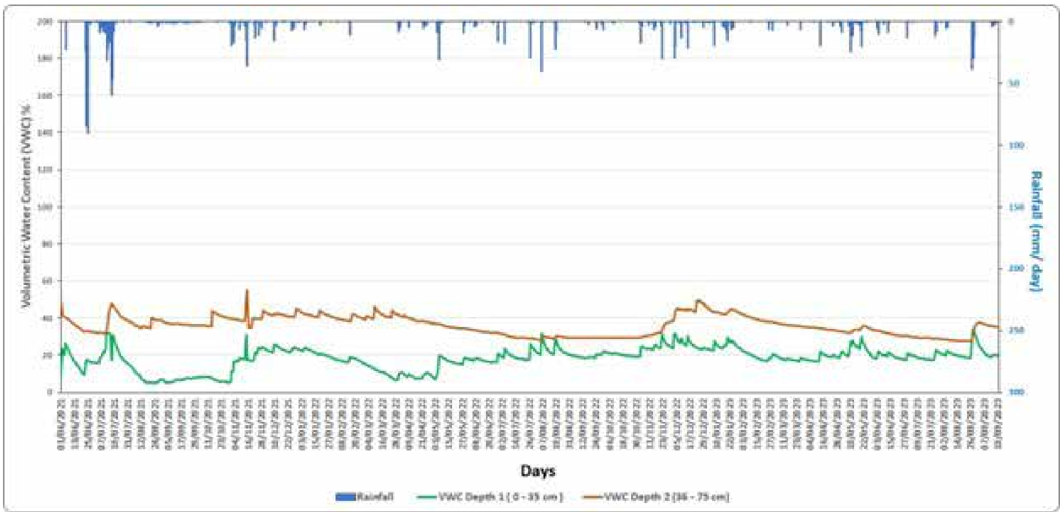


MODEL CONCEPT



QGIS PLUGIN





Volumetric Water Content (VWC)

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Main results

under-row mulching treatments resulted in water savings, while maintaining more positive leaf water potential, with good photosynthetic and transpiration rate during the season

The effects of cover crops on the grape composition are closely related to the plant species characterized the seeds mixtures.
Significantly higher sugar levels were recorded in the application of cereal grass (C_R), while the mixtures with a majority of legumes mixtures preserved nitrogen in the grapes (N_GM)

The use of kaolin allows the canopy of vines to reflect, especially in hot summer, the excess sunlight and to maintain a lower temperature than the untreated.
This ability of kaolin allows to preserve the entire canopy from stress phenomena especially against the photosynthetic system

Watch the project videos

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- Between rows management generally increase WWC in topsoli
- Interception storage and loss may reduce VWC compared to bare soil
- Subsoil VCM is less for all treatments expecially in dry years

Better use water resources, especially during periods of increased stress

Water storage and availabilty for plants

+10%

GREEN MANURING GM → CONTROL GM → MOW AND BLOW SR → BETWEEN-ROWS MULCHING R

- Grassing, B and N mixtures show generally higher VWC in topsoil and subsoil in respect of C

All the deliverables and project products are available in the website

LINK

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Objective

Define the effects of water resilient management in vineyards on the **environmental footprints** of the wine sector and on the related **ecosystem services**.
Valorize environmental benefits through market based tools for farmers and producers.

Main results

ECOSYSTEM SERVICES

	canopy management	mulching	green manuring	"mow and blow"	
soil water storage		●	●	●	+10%
plant water saving	●	●	●	●	
pollination		●	●	●	+20%
erosion protection		●		●	-50%
biodiversity preservation					
soil carbon sequestration		●	●	●	+10%
Carbon stock in plants	●				
soil fertility		●	●	●	
pest management		●			

For more details scan the QRcode

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Qualitative and quantitative evaluation of the impacts generated directly and indirectly by both the vineyard and the cellars

WATER FOOTPRINT

ISO 14024:2014

Water scarcity (liter of water)

2020	337
2022	115

−66%

Aquatic acidification (kg of SO_2)

2020	0,0066
2022	0.0052

−21%

Aquatic eutrophication (kg of P)

2020	0,000399
2022	0,000175

−56%

Results for a wine bottle (0.75 l)

- 2020
- 2022

VINEYARD	CELLAR	PACKAGING
40%	37%	23%

The project in a nutshell

7 PROJECTS INVOLVED IN NETWORKING

6 DEMO FARMS INVOLVED IN DEMONSTRATIVE ACTIVITIES

10 TECHNICAL ARTICLES PUBLISHED ON AGRONOTIZIE E-JOURNAL

4 WATER FOOTPRINT CERTIFICATIONS

LIFE19 ENV/IT/000035

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