

Precision irrigation at the service of the vineyard

Challenge

The increase in temperatures over the last 20 years is promoting more evapotranspiration, causing the vines to suffer from water stress phenomena.

Solution

Irrigation is a long-term solution to high water stress intensity. Precision irrigation is needed to optimize water use (due to scarcity, competition between users and cost) and to maintain high quality in wine production.

Benefits

A precision irrigation system makes it possible to maintain production and quality standards even in the most difficult years, by optimizing water use.

Applicability box

Theme

Climate change mitigation
Natural resources conservation
Water-use efficiency

Context

This technique can be applied in all the vineyards.

Application time

During water stress period

Required implementation time

One season with the occurrence of water stress is needed to design the irrigation system.

Period of impact

The impact will be seen at harvest.

Equipment

Expert external companies to study the variability in the vineyards.
Precision irrigation systems
Meteorological station
Decision support systems

Practical recommendation

To design the precision irrigation system, the following steps shall be applied:

- Carefully analysing soil characteristics and their variability within the vineyard using state-of-the-art technologies based on electrical resistivity strongly correlated with the main physicochemical parameters of the soil.
- The indications obtained allow the vineyard to be divided into homogeneous zones within which the hydrological properties of the soil are uniform. Each zone will eventually be characterized through a soil survey by specialized companies.
- Designing the variable-rate drip system involved the creation of two zones, achieved by laying a single dripline characterized by different pitches between the drippers, which is greater in the high vigour zone and lesser in the low vigour zone. This is done by applying Hydro clips to the drippers to close them and modulate the pitch.
- Using decision support systems to know when to use the irrigation systems, for instance, Irriframe by ANBI and Manna by Rivulis.

Pictures and visual information:

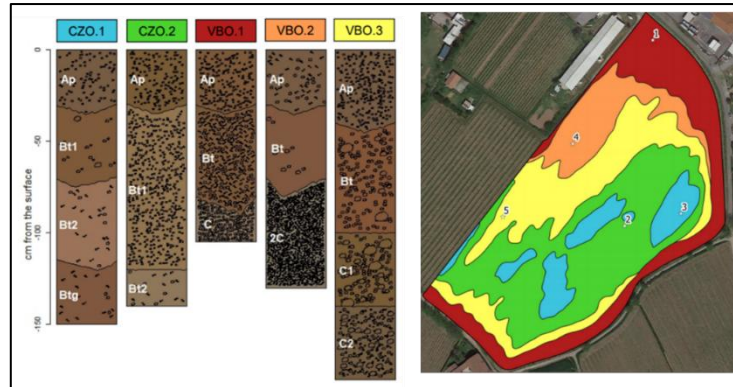


Fig 1. The vineyard can be divided into two macro areas, one less prone to water stress phenomena

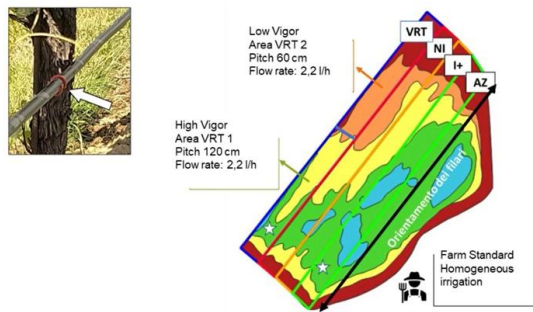


Fig 2. Example of a distribution of different irrigation theses and characteristics of a variable rate irrigation system



Fig 3. Hydro clips applied to the drippers to close them and modulate the pitch and obtain a variable-rate drip system

Further information

Videos

<https://youtu.be/9dRWHH6Gggw>

(short version): <https://youtu.be/zFtAw4XfHpU>

(detailed explanation): <https://www.youtube.com/watch?v=m7Cob6QmyoM>

Web links



https://www.infowine.com/en/technical_articles/application_of_precision_irrigation_systems_sc_21182.htm

https://www.infowine.com/it/video/irrigazione_di_precision_sc_21194.htm

Contact information

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Project website: www.climed-fruit.eu

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Simplified cost/benefit analysis

Irrigation 4.0 in the Vineyard

Introduction – presentation of ex-ante and ex-post situation

The practice aims to optimize the management of the multiple summer stresses while maintain the set production and quality standards even in the most difficult years, optimising the use of water, through precision irrigation.

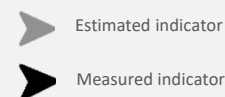
Ex-ante is a standard drip irrigation system.


Ex-post is a precision drip irrigation system, where vineyard portions with different vigor are subjected to different weather-dependent watering regimes.

Economical costs and benefits






The practice by better managing the summer's stresses aims to increasing the competitiveness of wineries. Moreover, water is a limited resource in the considered area of Northern Italy (Franciacorta) where the irrigation system was tested, as well as in many viticulture regions.

Legend



	Ex-ante	Ex-post
Variable costs		
Input		
Water	100%	85%
Installation (material + labour)	Standard Drip Irrigation System: 100 %	<i>Standard Drip Irrigation System</i> <i>Pitch Dripper used to modulate the water income.</i> <i>Mapping of the conductivity and hydric needs of the vineyard: cost / ha</i> <i>Decision-support system</i>
Services		Total costs (installation + services): 115%
Other equipment	-	<i>Meteorological station: 2000€</i>
Benefits	-	-
Yield in the low vigor area	100%	119%
Acidity in the low vigor area	100%	124%
COMPARISON	<p><i>The 15% increase of initial costs is balanced by the increase of yearly yield and grape quality obtained in the low vigour area receiving the exact amount of water needed, and by the reduction of variable cost for water consumption.</i></p> 	

Environmental costs and benefits

Energy	<p>No significant change estimated:</p> 
<p>There is no appreciable difference in terms of energy consumption.</p>	
Water	<p>Indicator improved by 15%:</p> 
<p>In the experimental vineyard in Franciacorta, water consumption per hectare was reduced by 15% with the precision irrigation system vs the standard irrigation system (from 722 to 600 m³/ha in 2022, from 300 to 250 m³/ha in 2021).</p>	
Soil	<p>Unmeasured impact:</p> 
<p><i>No direct relationship between the practice and the indicator in question</i></p>	
Air	<p>Unmeasured impact:</p> 
<p><i>No direct relationship between the practice and the indicator in question</i></p>	
Biodiversity	<p>Unmeasured impact:</p> 
<p><i>No direct relationship between the practice and the indicator in question</i></p>	

VIRECLI - Viticulture Resilient to Climate Change

Short description of the OG

Increase wine farms' competitiveness through the implementation of precision farming techniques. Test, in several wine production districts, new techniques to counteract the effects of climate change.

Introduce innovation management protocols suitable for the oenological objectives and respectful of the typicity of the territory.

Transmit economically sustainable soil management techniques able to promote productivity and hydrological slope stability.

Benefits

Less water used for irrigation; avoid soil erosion and less water use for irrigation; fewer inputs; fewer losses due to spring frosts.

Stage of implementation

Project completed.

Applicability box

Theme

Climate change mitigation - Digital technologies - Erosion control - Soil health - Water-use efficiency

Context

Mediterranean climate, tests in northern Italy (Lombardy)

Duration

3 years (2019-2022)

Partners involved.

3 independent winegrowers, 2 universities located in Northern Italy (Milan, Piacenza and Pavia)

Budget

800.000,00€

Main achieved or expected results

P1. Irrigation 4.0 guidelines: to explain steps to follow to design a precision irrigation system to maintain production and quality standards even in the most difficult years and to optimise water use. Uses variable rate technology that takes into consideration soil variability within the vineyard.

P2. Soil management practice guidelines: to increase vineyard resilience to extreme rain events or drought and to reduce the impact of superficial landslides and erosion phenomena to limit structural damage in vineyards and organic substance losses.

P3. Impact of new rootstocks to cope with water stress conditions.

P4. Guidelines on how to assess the effect of space variability in the vineyard on the fertility of the basal buds of a variety characterized by productive alternation and a low basal fertility such as Croatina.

P5. Guidelines on late winter pruning to postpone bud break to avoid damage due to spring frost and to obtain a better freshness of the grape if the initial phenological delay is maintained until ripening.

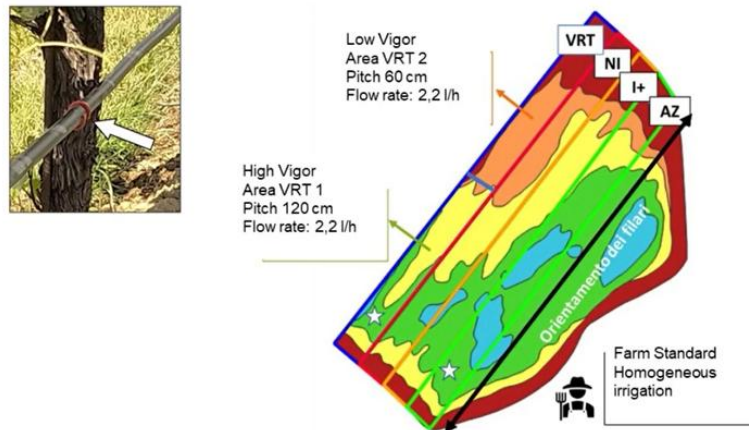


Fig 1. Example distribution of different irrigation theses and characteristics of a variable rate irrigation system

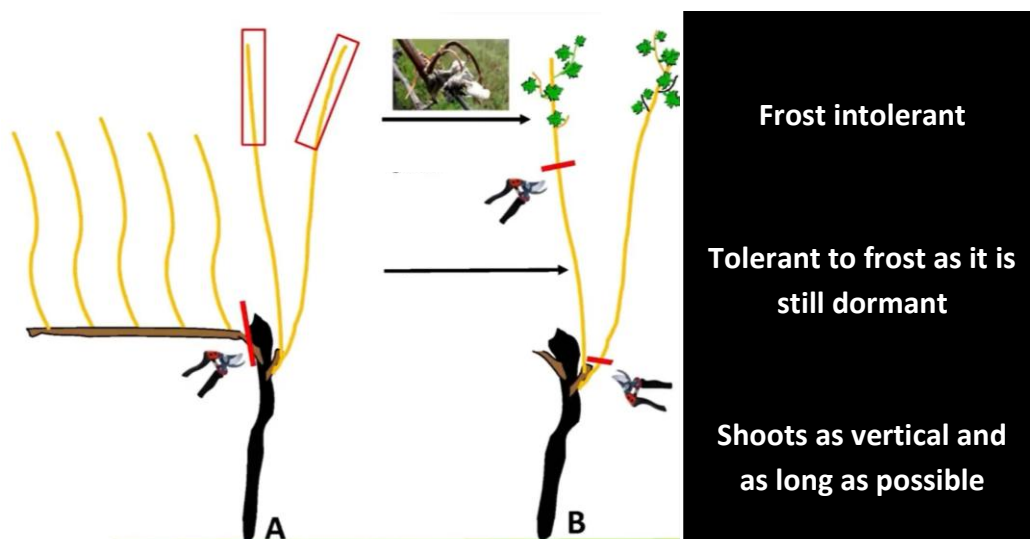


Fig. 2. Bud frost tolerance versus bud position on the shoots

Existing materials

Videos

P1. Irrigation 4.0 guidelines:

<https://youtu.be/9dRWHH6Gggw>

Short version: <https://youtu.be/zFtAw4XfHpU>

Detailed explanation: <https://www.youtube.com/watch?v=m7Cob6QmyoM>

P2. Soil management practice guidelines:

Short version: <https://youtu.be/u4rHy0o4k9A>

Detailed explanation: https://youtu.be/caQ2fXNJH_A

P3. Impact of new rootstocks to cope with water stress conditions:

 <https://youtu.be/sJCvDoTLIWg>

P4. Guidelines on how to assess the effect of space variability:

 Short version: <https://youtu.be/2Jzq4zk-vNg>

 Detailed explanation: <https://youtu.be/5QVrj5TaDek>

P5. Guidelines on late winter pruning

 <https://youtu.be/3DBISJ5o-jo>

 Short version https://youtu.be/AXao_SlrISs

 Detailed explanation: <https://youtu.be/9Yt4kt153wE>

Web links

P1. Irrigation 4.0 guidelines:



https://www.infowine.com/en/technical_articles/application_of_precision_irrigation_systems_sc_21182.htm


 https://www.infowine.com/it/video/irrigazione_di_precisioni_sc_21194.htm

P2. Soil management practice guidelines:



https://www.infowine.com/en/technical_articles/resilient_soil_management_techniques_sc_21195.htm

P3. Impact of new rootstocks to cope with water stress conditions:

 https://www.infowine.com/en/technical_articles/rootstocks_compared_sc_21183.htm

P4. Guidelines on how to assess the effect of space variability:

 https://www.infowine.com/en/technical_articles/intra_parcel_variability_sc_21193.htm

P5. Guidelines on late winter pruning:



https://www.infowine.com/en/technical_articles/late_winter_pruning_as_a_frost_damage_prevention_and_ripening_control_sc_21184



https://www.infowine.com/it/articoli_tecnici/potatura_ritardata_come_tecnica_di_prevenzione_dei_danni_da_gelate_e_di_controllo_della_maturazione_sc_21797.htm

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