SOS Popillia

Popillia japonica Conoscere il pericolo per evitarlo

Diffusione di un insetto di quarantena, impatto sugli agroecosistemi e possibilità di controllo

Innovations for the Sustainable Vineyards Management in the Langhe, Roero and Monferrato Unesco area Alberto Cugnetto

Formazione
Spring School 2025

PROGETTO ERASMUS+
2023-2-IT02-KA210-SCH-000178557

SOSPOPILLIA

Cofinanziato dall'Unione europea

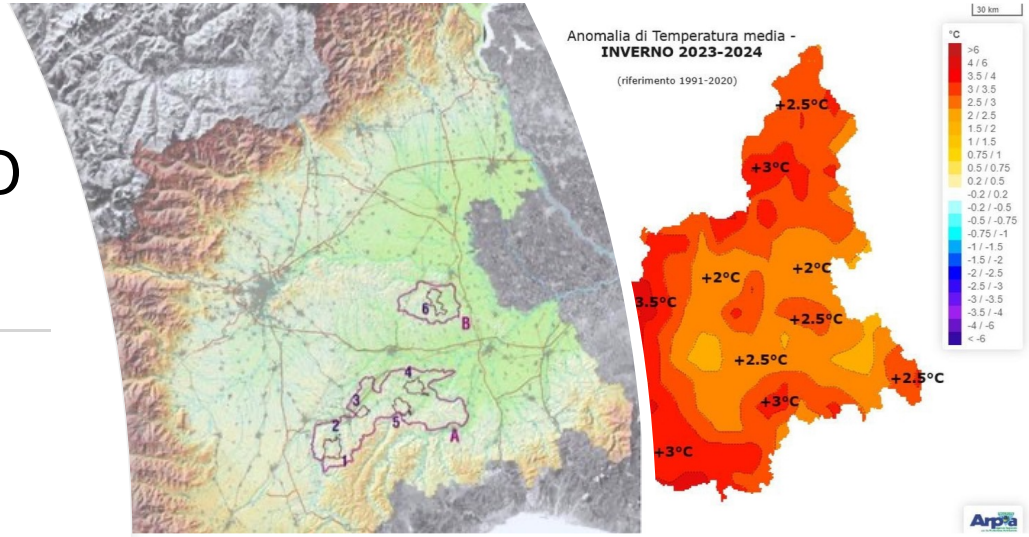
Accademia di Agricoltura di Torino
1785

UNESCO LANGHE ROERO AND MOFERRATO

- From 2014
- 10,789 hectares
- 29 municipalities
- larger protected area 101 municipalities.

- 11 DOCG
- 12 DOC

Areas heavily affected by climate change

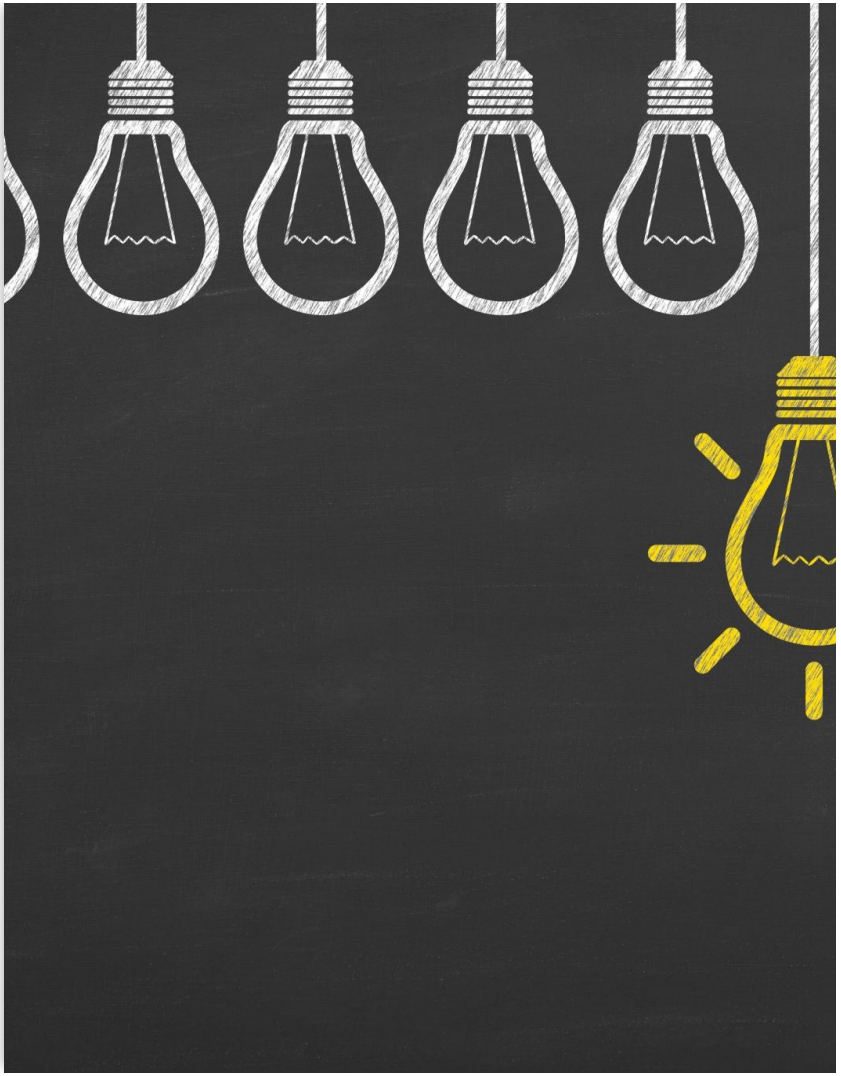


SUSTAINABLE INNOVATION IN VITICULTURE

Vision: A systemic transformation that aligns viticulture with environmental and social needs, ensuring long-term prosperity for future generations.

KEY PILLARS

1. **Environmental Sustainability** – Efficient resource use (water, soil, biodiversity), reduction of greenhouse gas emissions and pesticides, adoption of regenerative agriculture and precision viticulture.
2. **Social Responsibility** – Fair working conditions, support for local communities, supply chain transparency, and preservation of cultural and landscape heritage.
3. **Economic Resilience** – Sustainable business models, fair market access, value-added strategies, and integration of digital innovation and circular economy principles.



Main Innovation Drivers

Quality research, better varietal expression.

1980 - ...

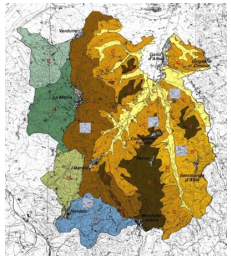
Improvement of viticulture sustainability

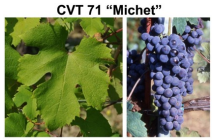
1990 - ...

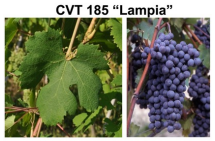
Climate change damages mitigation

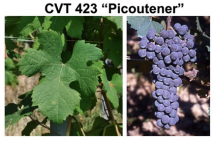
2010 - ...

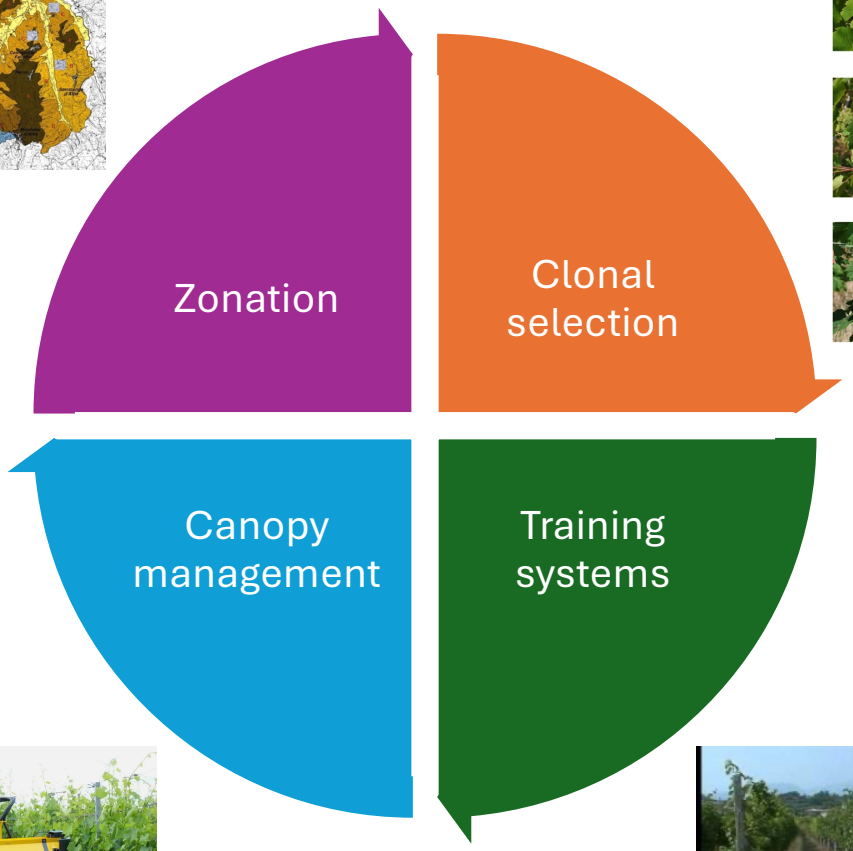
Quality research for better varietal expression



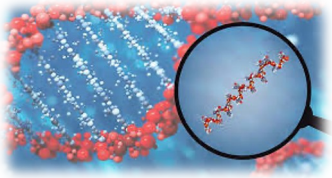


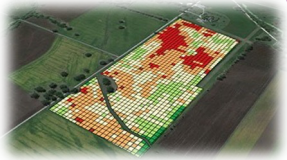


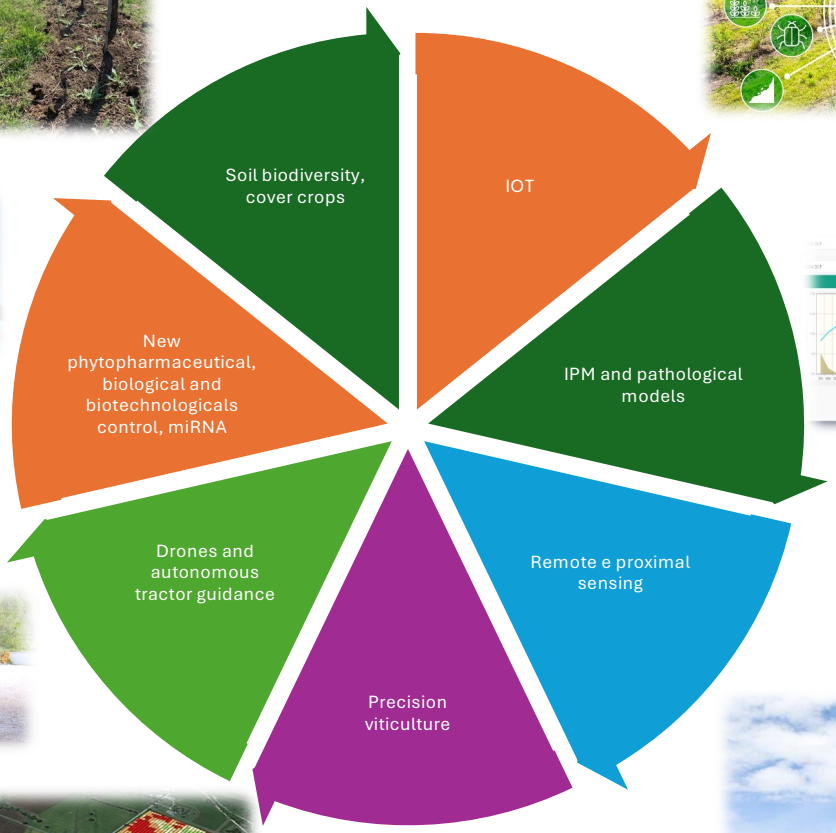




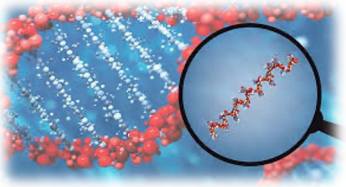
Sustainability improvement

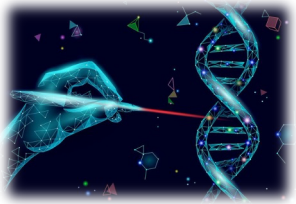




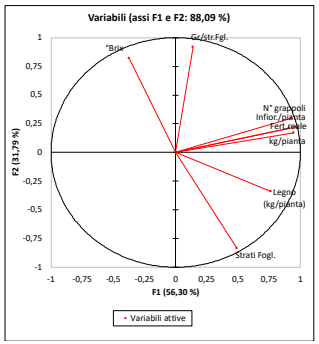


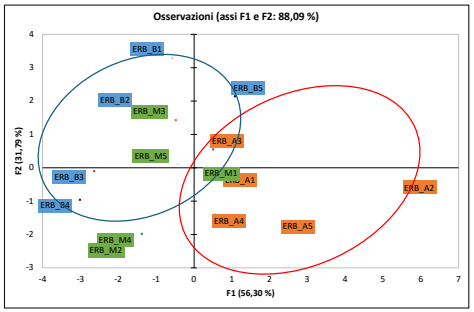
Climate change damages mitigation





Erbaluce Tenuta Roletto CLASSI NDVI 2021





Application of EOS Crop Monitoring – Sentinel-2 in Erbaluce and Nebbiolo vineyards

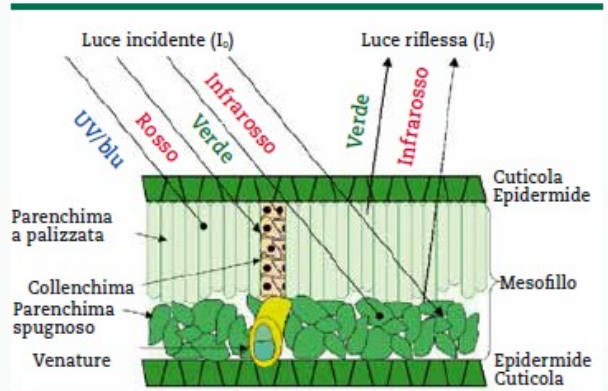
Alberto Cugnetto, Giorgio Masoero, Giuseppe Sarasso Enrico Borgogno Mondino

Theory

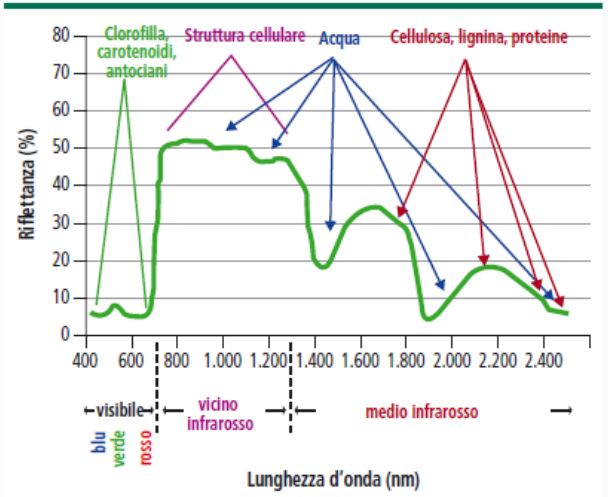
The spectral response (reflectance) of vegetation in different wavelengths is related to the health status or photosynthetic efficiency of the leaves

In the case of vegetation, synthetic indices can be defined, by aggregating spectral information residing in several bands. These indeces are able to describe plants physiological state

$$\mathrm{NDVI} = \frac{(\mathrm{NIR} - \mathrm{RED})}{(\mathrm{NIR} + \mathrm{RED})}$$



Schematizzazione della riflettanza della foglia

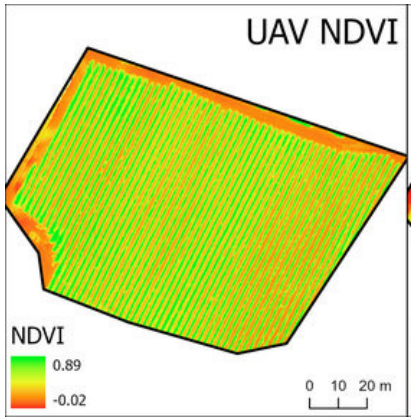


Curva di riflettanza della foglia

UAV vs Satellite Remote Sensing

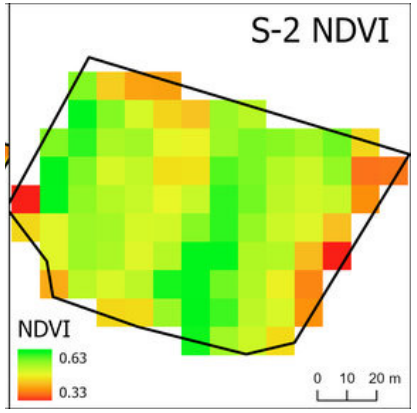
UAV

- More spatial resolution (excess informations)
- Possibility to map little size plot
- Possibility to use more spectral bands
- Operational cost + , specific flight permission (1-2 flight year)



Satellite

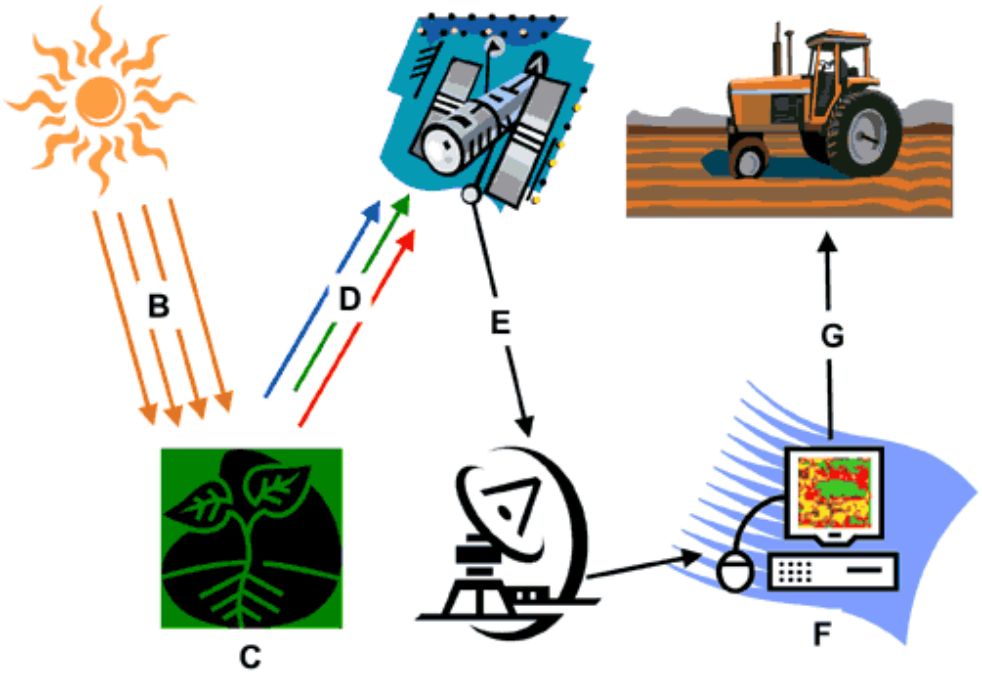
- Sensor calibration and imaging elaboration (GIS expert operator)
- Less spatial resoltution
- Difficult to map little size plots (< 0,5 ha)
- Less operational cost / no burocracy / (Opern Source)
- More efficient for monitoring during time (images every 2-5 dd)



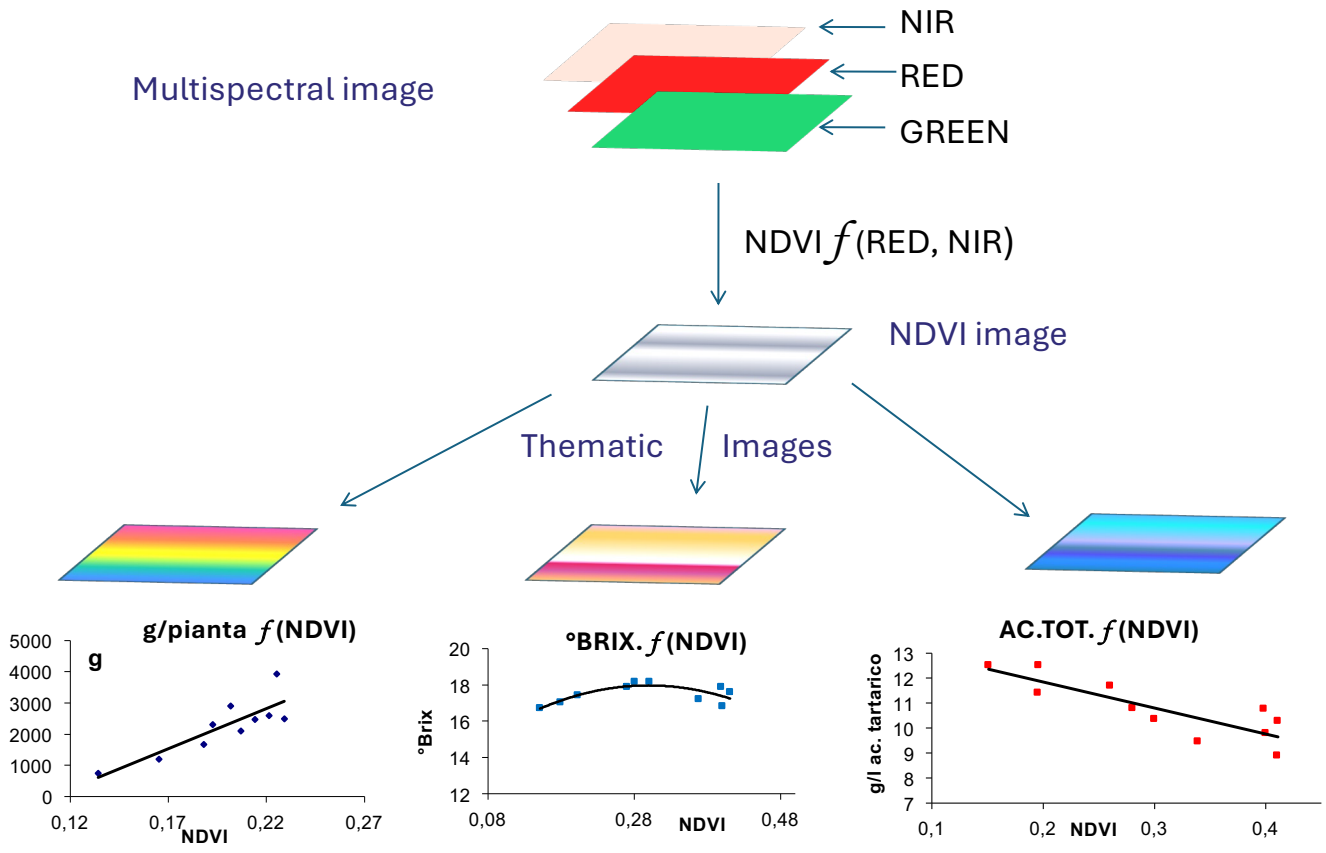
S2 specifications

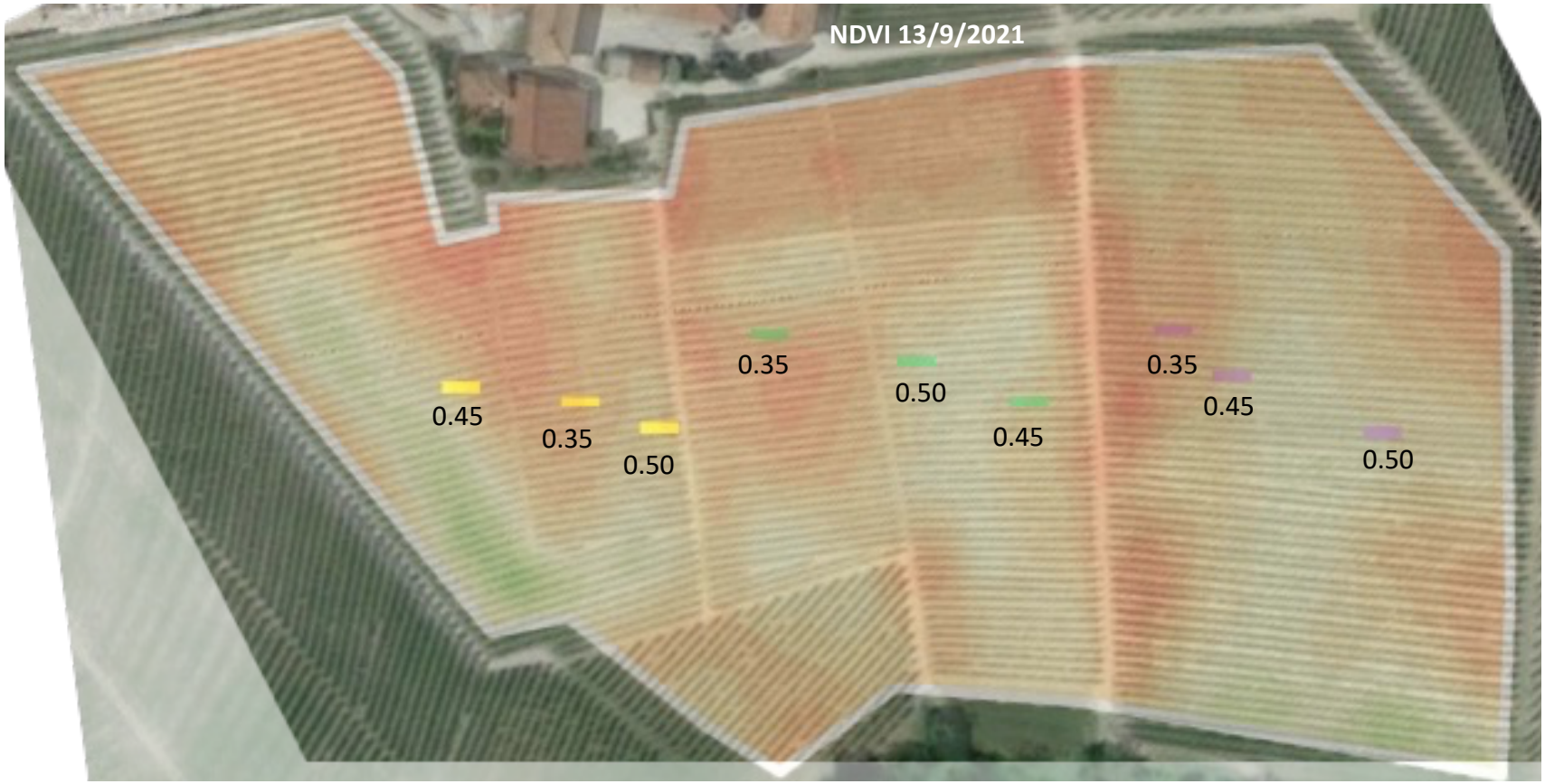
Sentinel-2 bands	Central wavelength (µm)	Resolution (m)
Band 1 – Coastal aerosol	0.443	60
Band 2 – Blue	0.490	10
Band 3 – Green	0.560	10
Band 4 – Red	0.665	10
Band 5 – Vegetation red edge	0.705	20
Band 6 – Vegetation red edge	0.740	20
Band 7 – Vegetation red edge	0.783	20
Band 8 – NIR	0.842	10
Band 8A – Vegetation red edge	0.865	20
Band 9 – Water vapour	0.945	60
Band 10 – SWIR – Cirrius	1.375	60
Band 11 – SWIR	1.610	20
Band 12 – SWIR	2.190	20

The working flux



Thematic maps generation

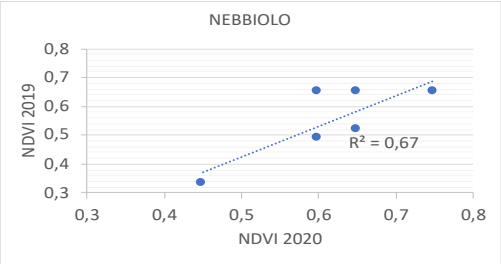


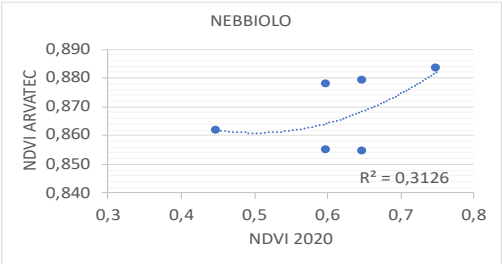

NDVI 13/9/2021
0.45
0.35
0.50
0.35
0.50
0.45
0.35
0.45
0.50

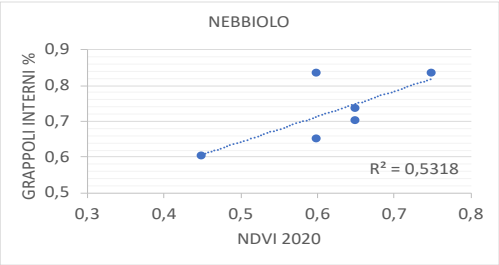
Nebbiolo

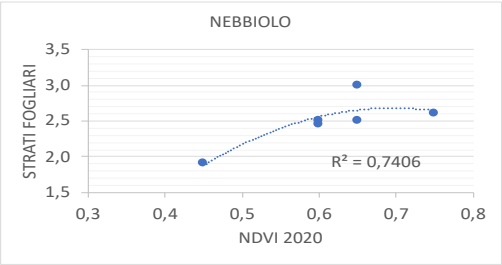
PEARSON CORRELATION.– VIGOR CLUSTER MEAN

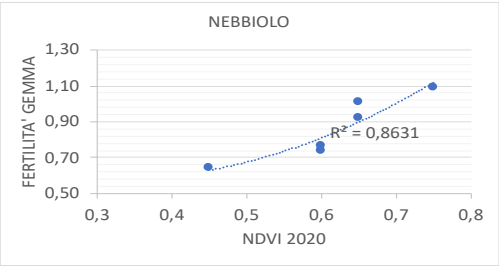
Variabili	NDVI_ARVATEC	NDVI 2019	NDVI 2020	Legno (kg/mq)
NDVI_ARVATEC	**1**	0,740	0,479	0,278
NDVI 2019	0,740	**1**	**0,816**	0,725
NDVI 2020	0,479	**0,816**	**1**	0,556
Legno (kg/mq)	0,278	**0,725**	0,556	**1**
Gemme/mq	0,179	0,097	-0,040	-0,310
Germogli/mq	0,416	0,138	0,224	-0,488
Germ/Gemma	0,481	0,095	0,346	-0,490
Grappoli int%	**0,792**	**0,901**	0,729	0,743
Grappoli Est.	**-0,788**	-0,677	-0,466	-0,411
Strati Fogl.	0,504	**0,858**	**0,755**	**0,931**
Fert. Reale	0,511	0,693	**0,911**	0,564
Infior./mq	0,652	**0,731**	**0,841**	0,288
grappoli/mq	0,638	**0,767**	**0,843**	0,341
Kg/mq	0,717	0,700	**0,803**	0,244
PMG(g)	**0,803**	0,642	0,678	0,244
PMA(g)	0,524	0,549	0,330	0,555
°Brix	-0,084	-0,242	-0,594	0,052
pH	0,192	0,060	-0,361	0,131
Indice ravaz (prod/legno)	0,475	0,141	0,368	-0,424
CLUMPING INDEX	-0,011	0,202	-0,090	0,572
LAI	0,480	**0,782**	0,509	**0,871**
CROWN POROSITY	-0,594	**-0,942**	**-0,785**	**-0,876**
CANOPY COVER	0,331	0,613	0,324	**0,773**
I valori ROSSO alfa < 0,05				

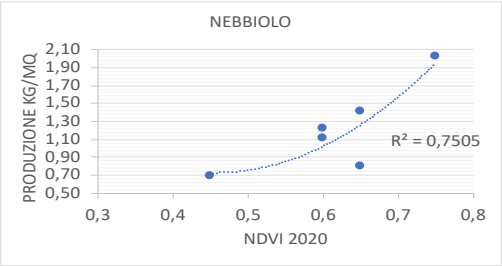


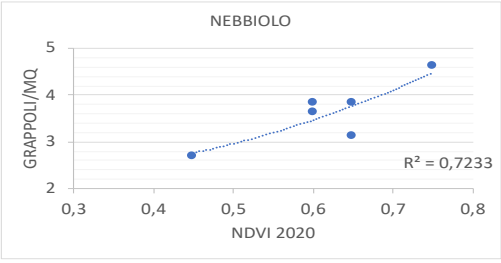


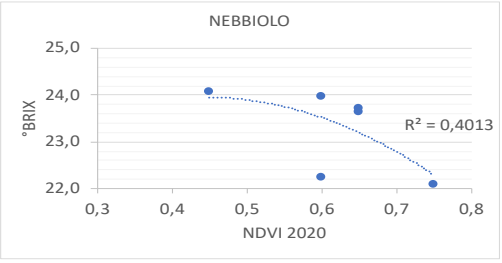












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Research Article | Freely Available Online

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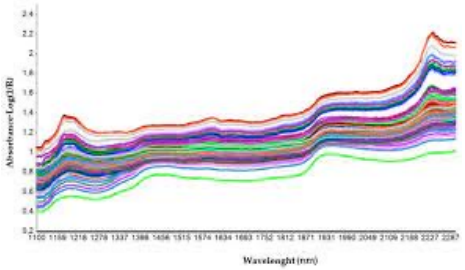
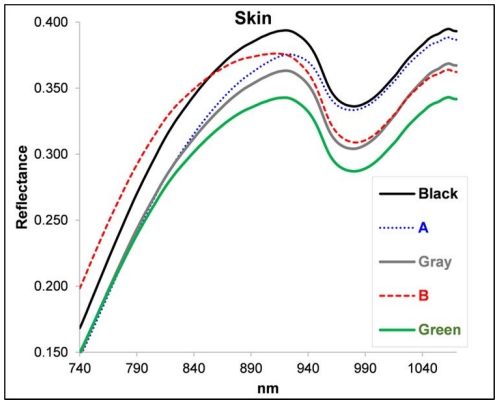
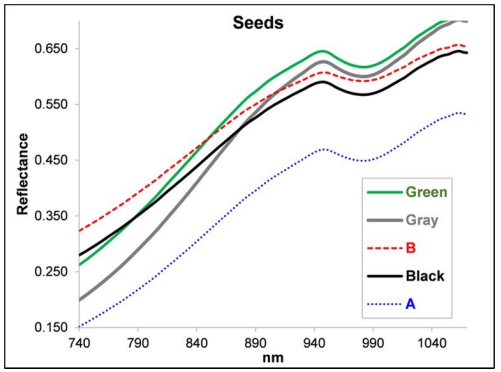
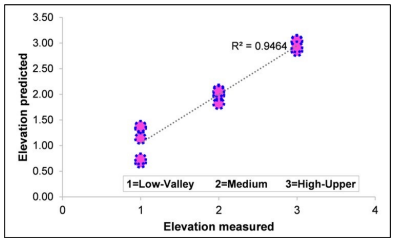
Alberto Cugnetto[1], Giorgio Masoero[1,*]

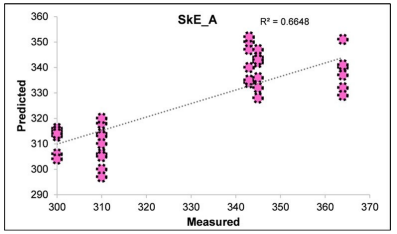


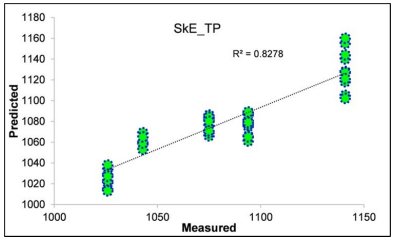


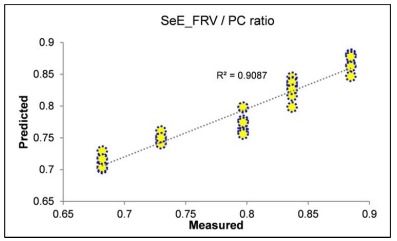
Method PLS (WinISI & SCIO)











PSM = Phenol Seed Maturity

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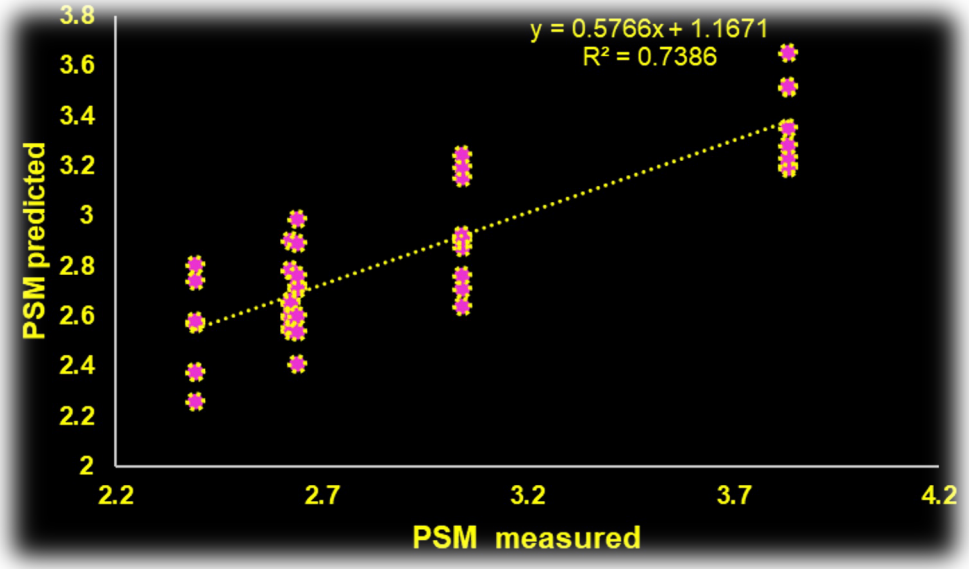

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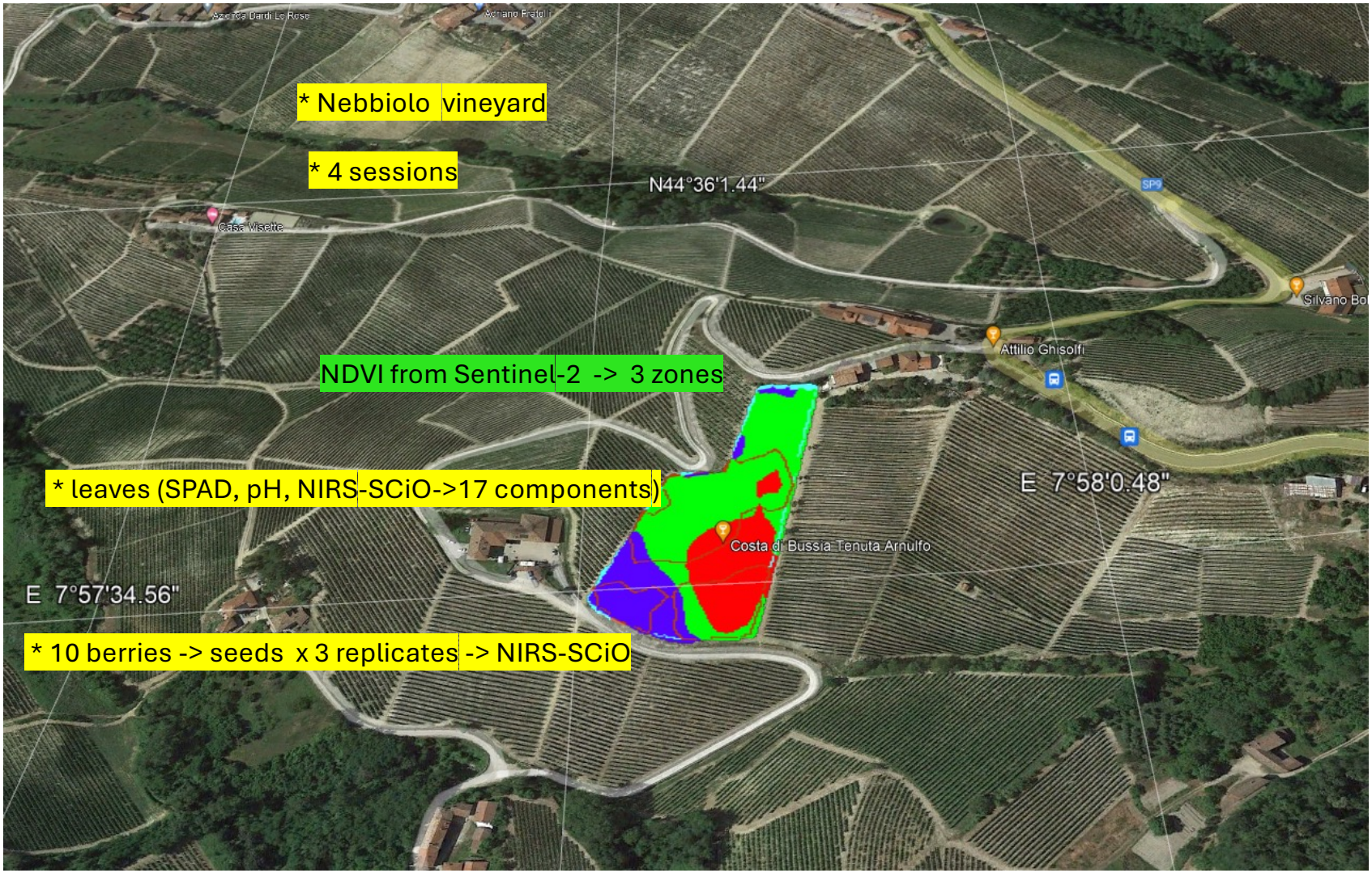

* Nebbiolo vineyard
* 4 sessions
N44°36'1.44"
Casa Wisette
Attilio Ghisolfi
NDVI from Sentinel-2 -> 3 zones
* leaves (SPAD, pH, NIRS-SCiO->17 components)
E 7°58'0.48"
Costa di Bussia Tenuta Arnulfo
E 7°57'34.56"
* 10 berries -> seeds x 3 replicates -> NIRS-SCiO

PSM = Phenol Seed Maturity

* leaves (SPAD, pH, NIRS-SCiO->17 components)

* 10 berries -> seeds x 3 replicates -> 164 spectraNIRS-SCiO

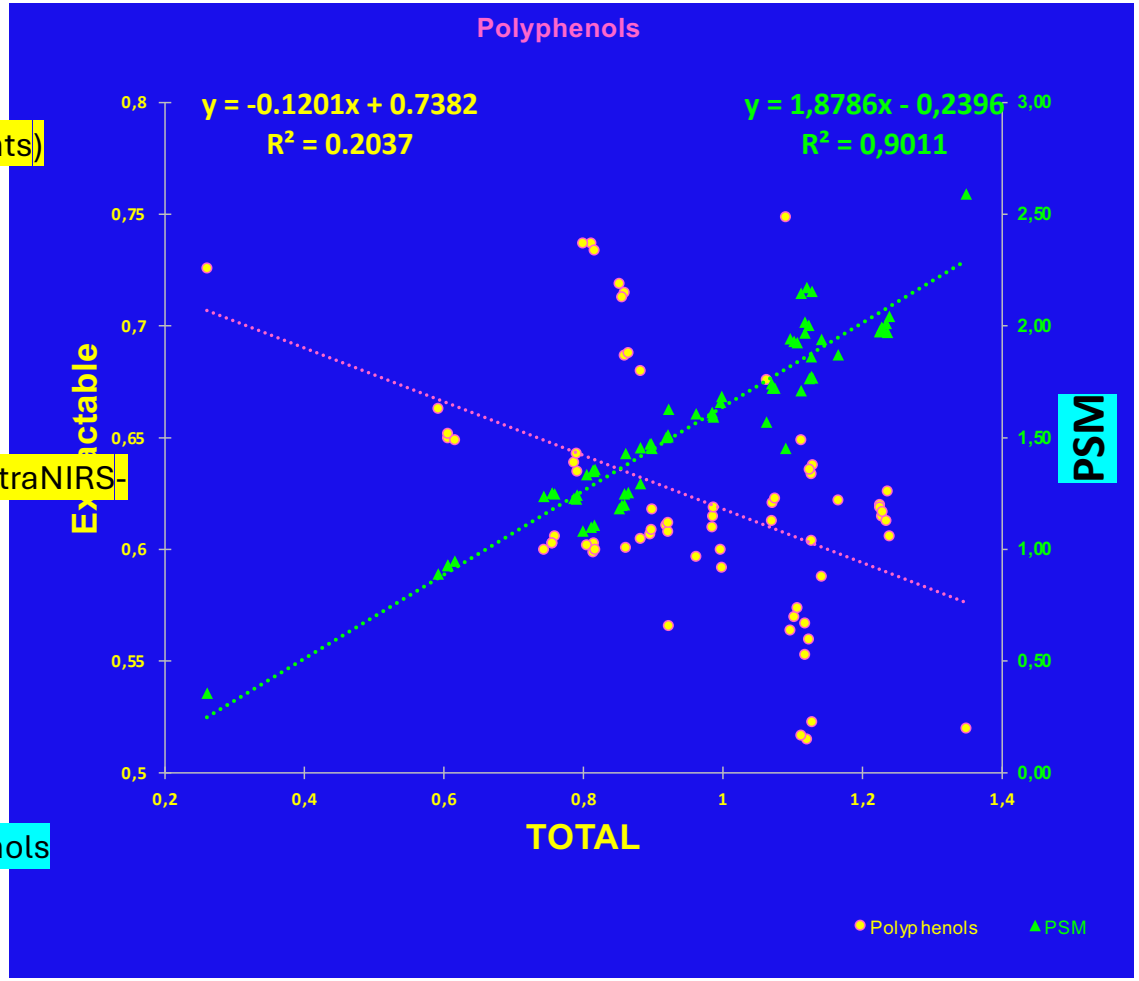
Total\Extractable -> PSM

Total Relationships

r2 0.44 (Extractable, Total)

The ratio PSM = TOTAL / Extractable Phenols

R^2 0.90

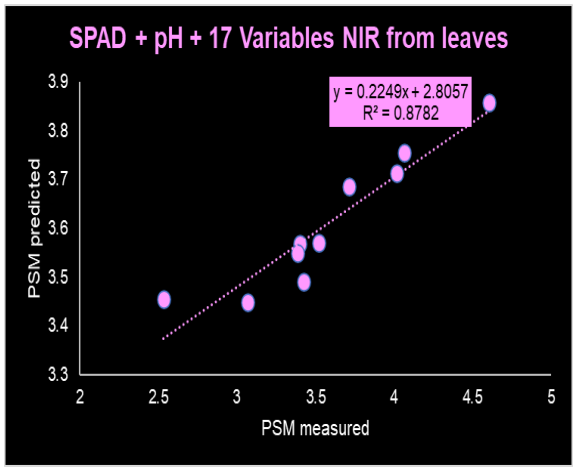


PSM = Phenol Seed Maturity

SPAD $R^2$0.54

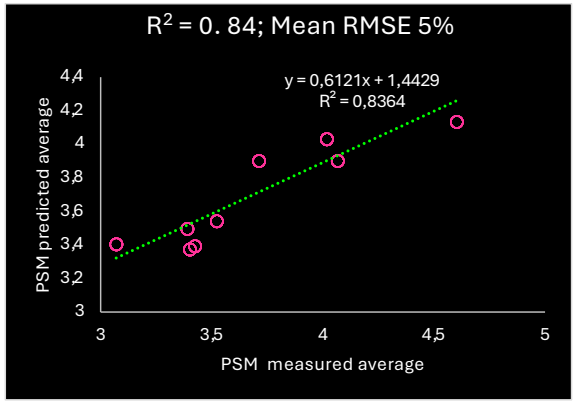
Foliar pH R^2 0.47

17 variables R^2 0.58

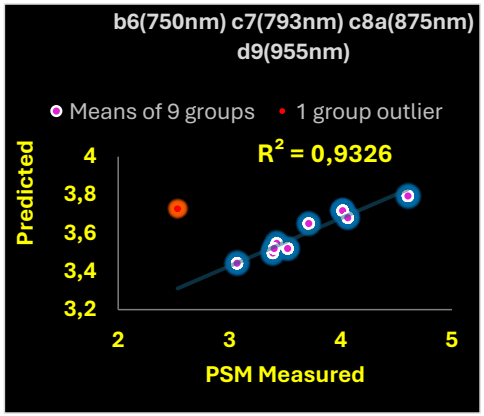


R^2 0.88

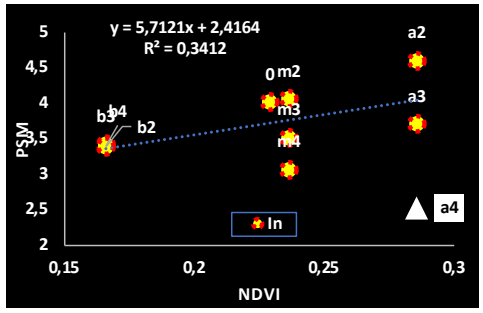
Full spectra 740-1070 nm R^2 0.84



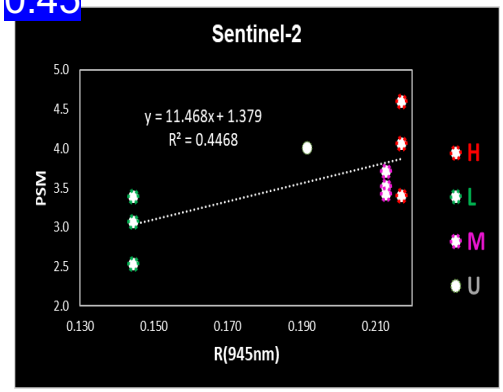
Sentinel-2 like bands R^2 0.93



Sentinel-2 NDVI R^2 0.34



Sentinel-2 R(945nm) R^2 0.45

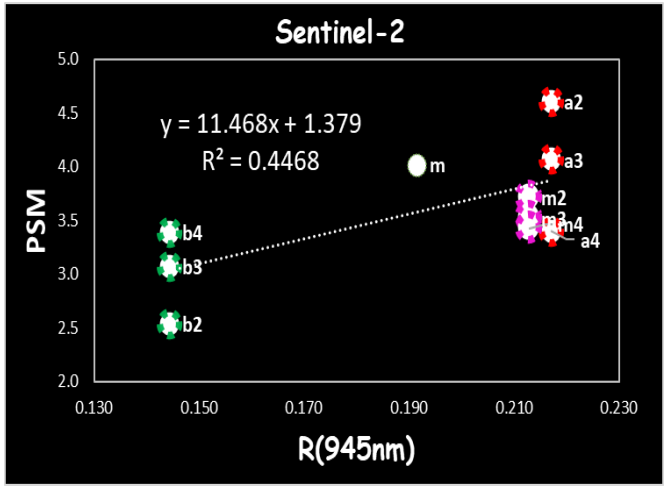


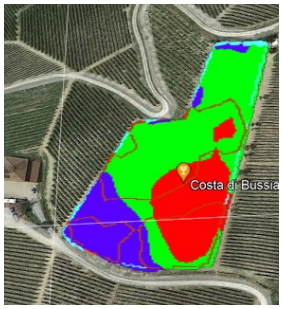
CONCLUSIONS

- **Look at the leaves to understand the PSM !**
- By NDVI (Sentinel-2, R^2 0.34)
- By SPAD (R^2 0.54)
- **By R(945nm _Sentinel-2 R* 0.45)**

LEAST COST - MAX EFF.

- By a SCiO spectrometer provided by verified model (R^2 0.93)
- By a UAV 750-850-950 nm (R2 0.80)



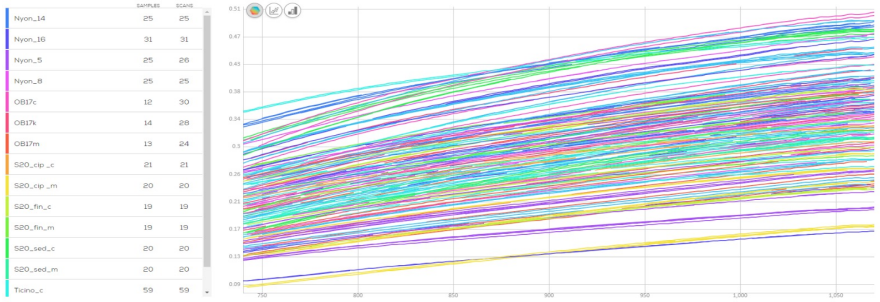


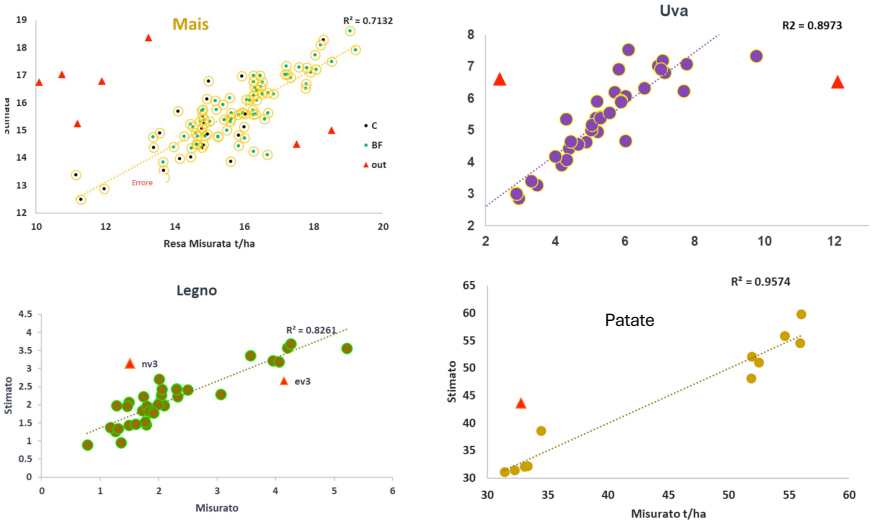
Sampling Area

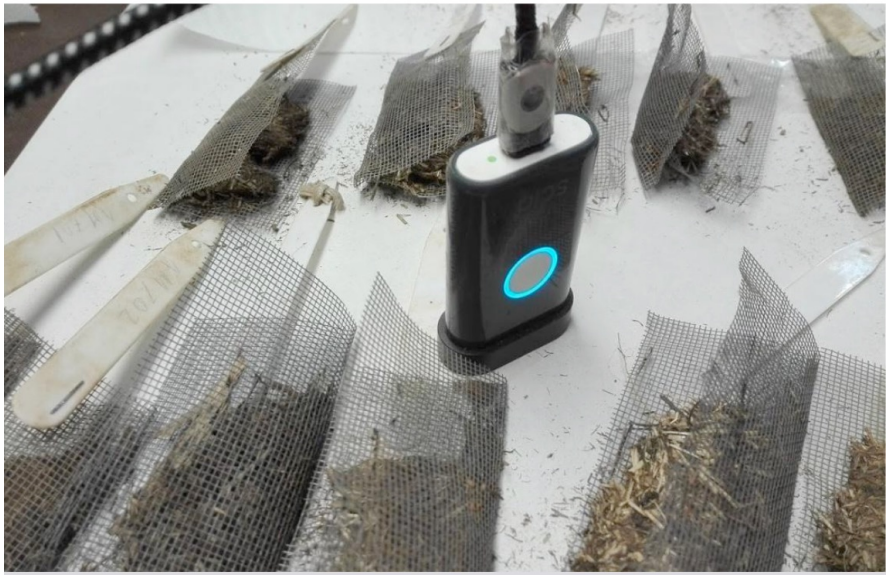
Direct field read

PSM = Phenol Seed Maturity

Studi of Biofertilizer on Soil Microbiota trought Litterbag and Teabag







LITTERBAG and TEABAGS

10 cm in the soil

30 dd

Il giorno **27 Febbraio 2025** alle ore **17:00**

Auditorium della Scuola Enologica di Alba " UMBERTO I", Corso Enotria n. 2

Accademia di Agricoltura di Torino
1785

Centro Studi sul Paesaggio Culturale di Langhe Roero Monferrato

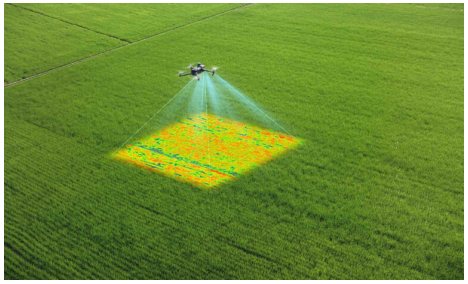
PROGETTO ERASMUS+
2023-2-IT02-KA210-SCH-000178557
SOSPOPILLIA
Cofinanziato dall'Unione europea

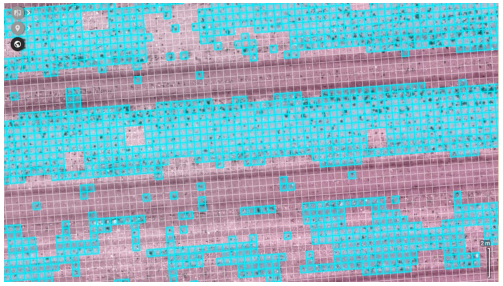
UTILIZZO DEI DRONI PER IL CONTRASTO DELLA POPILLIA JAPONICA IN VIGNETO

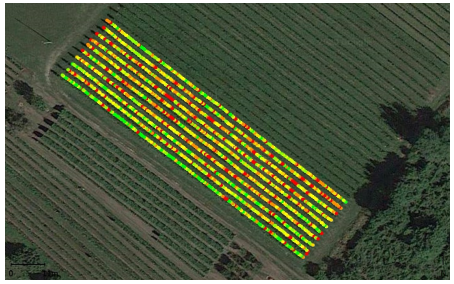
GiottoDroni

Presentazione dei principali risultati ottenuti dal

Progetto DANTE







https://www.lemonde.fr/politique/article/2025/01/27/l-assemblee-autorise-l-epandage-par-drone-de-produits-phytosanitaires-pour-certaines-cultures_6518858_823448.html

https://www.anses.fr/fr/system/files/PHYTO2022AST0026.pdf

Critical Aspects:
Orthomosaic and laborious map making

Specialized operators

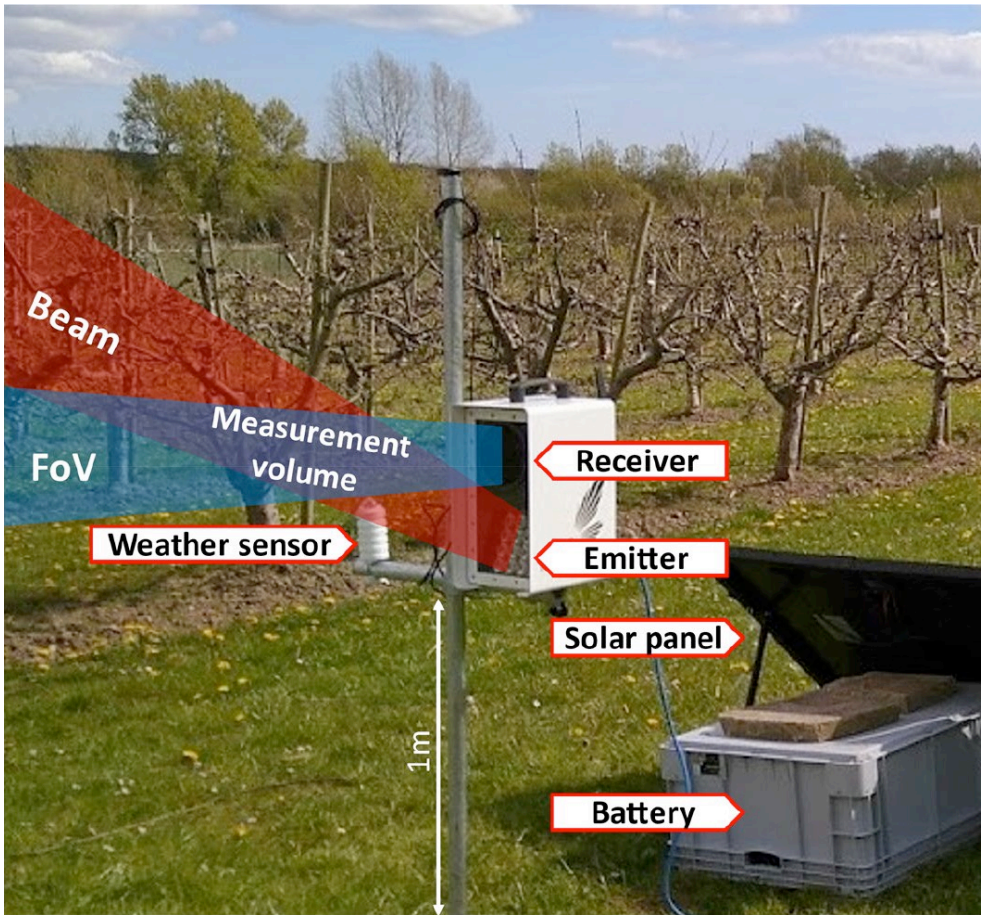
Critical aspects
European regulation prohibits the use of aerial systems for treatments with pesticides

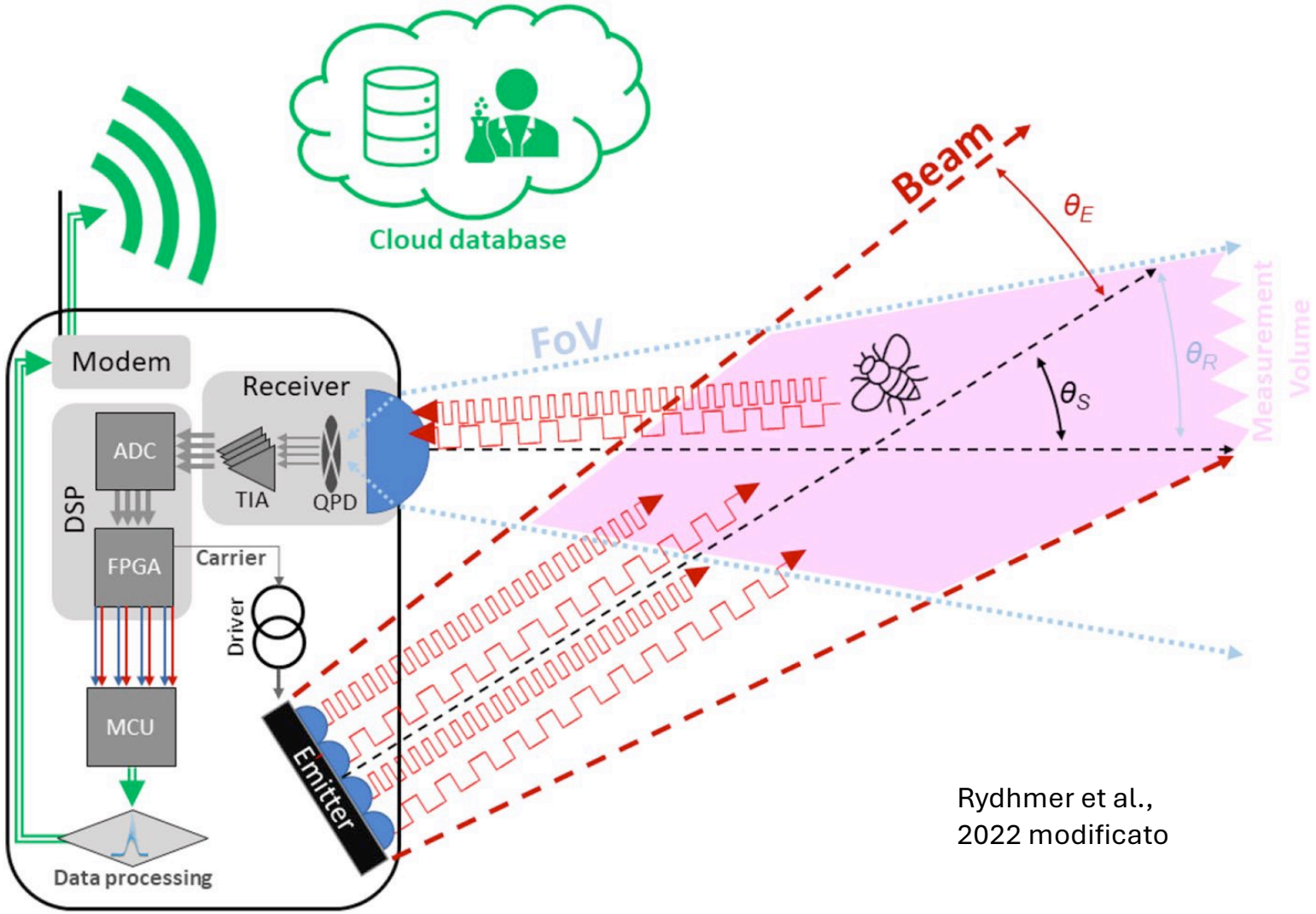
ENAC: Specific flight permits
Specialized operators

Exsiting Prototypes

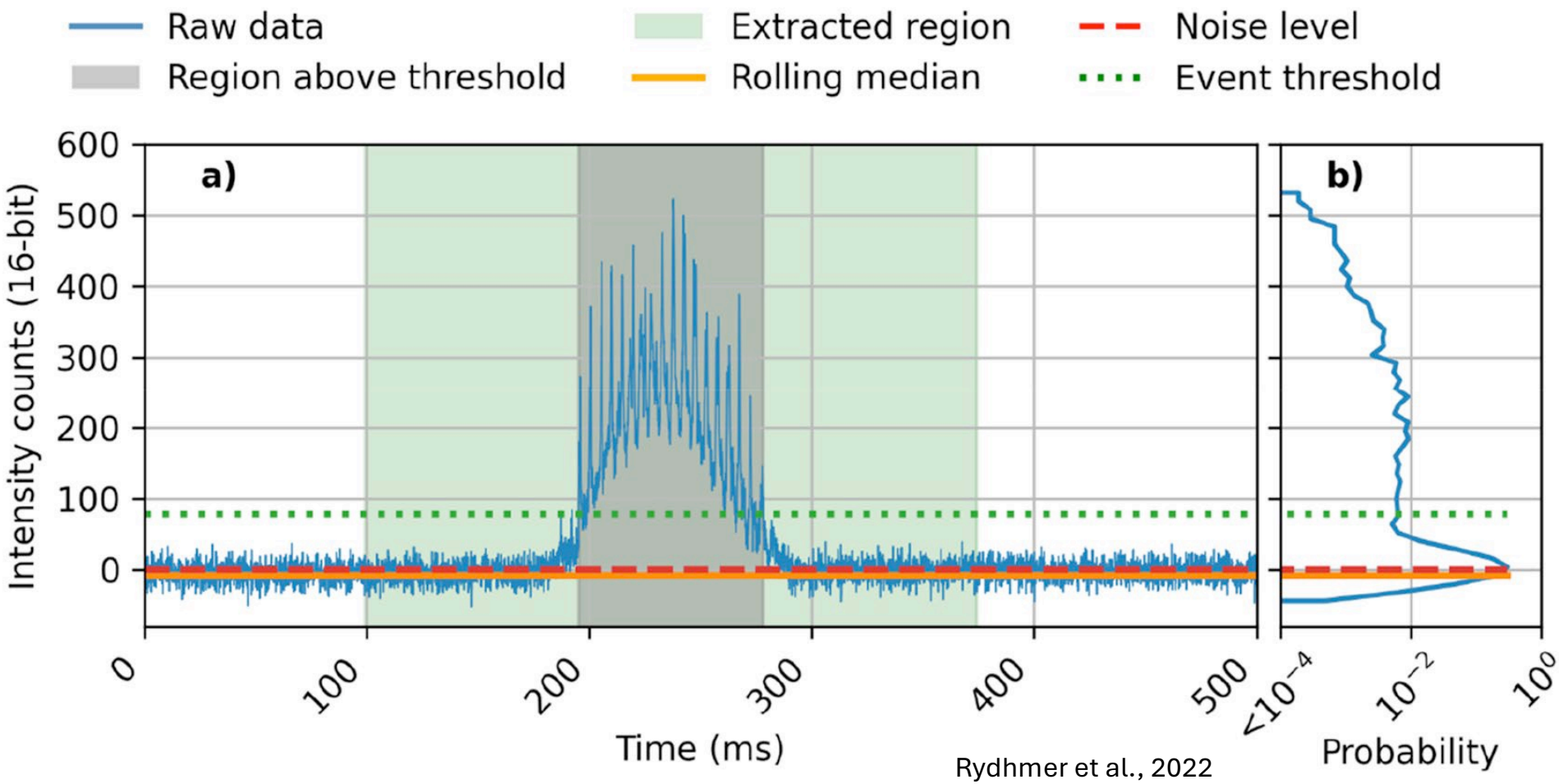
Rydhmer et al., 2022 modificato

Automating insect monitoring using unsupervised near-infrared sensors

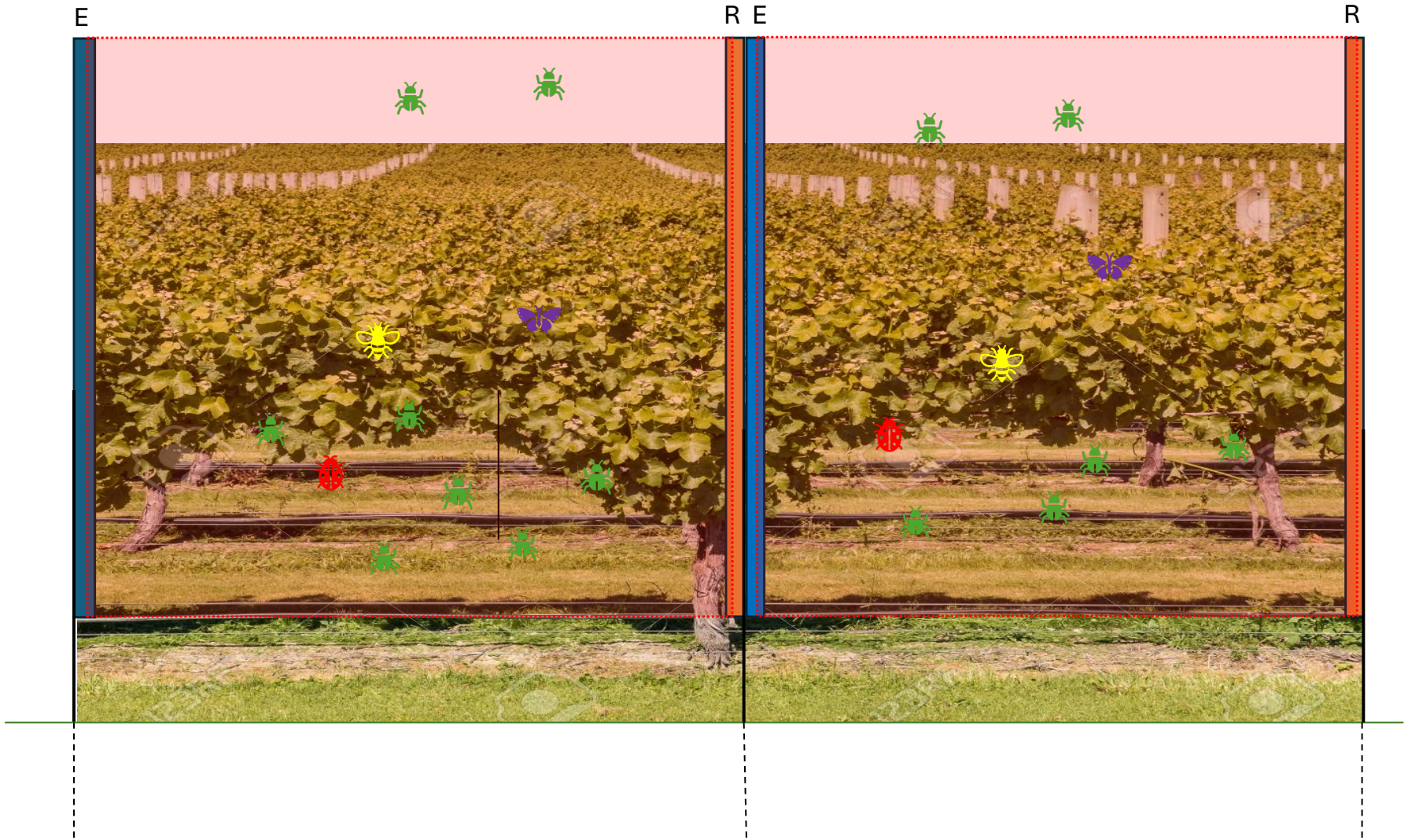




Rydhmer et al., 2022 modificato



Rydhmer et al., 2022
modificato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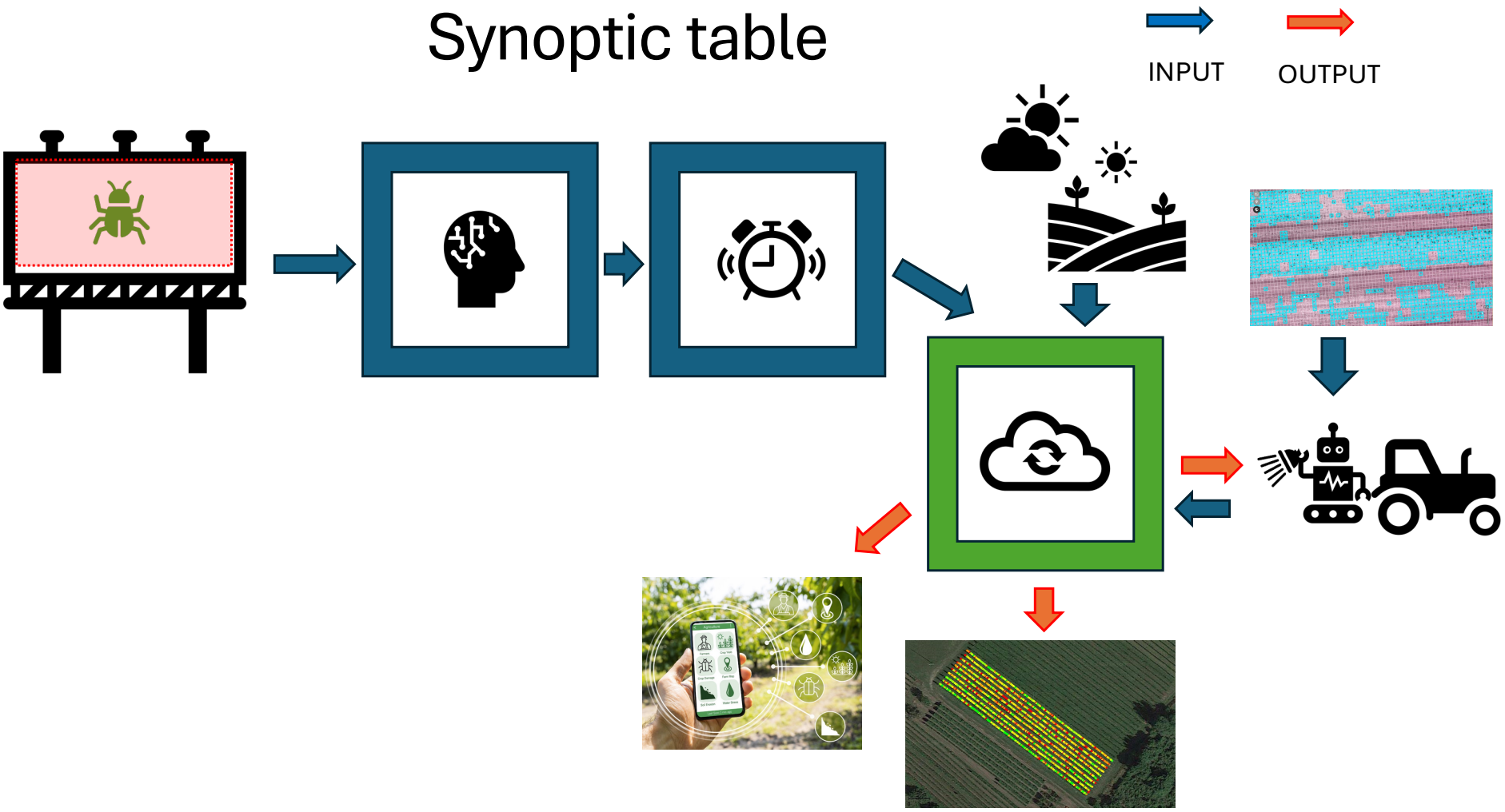
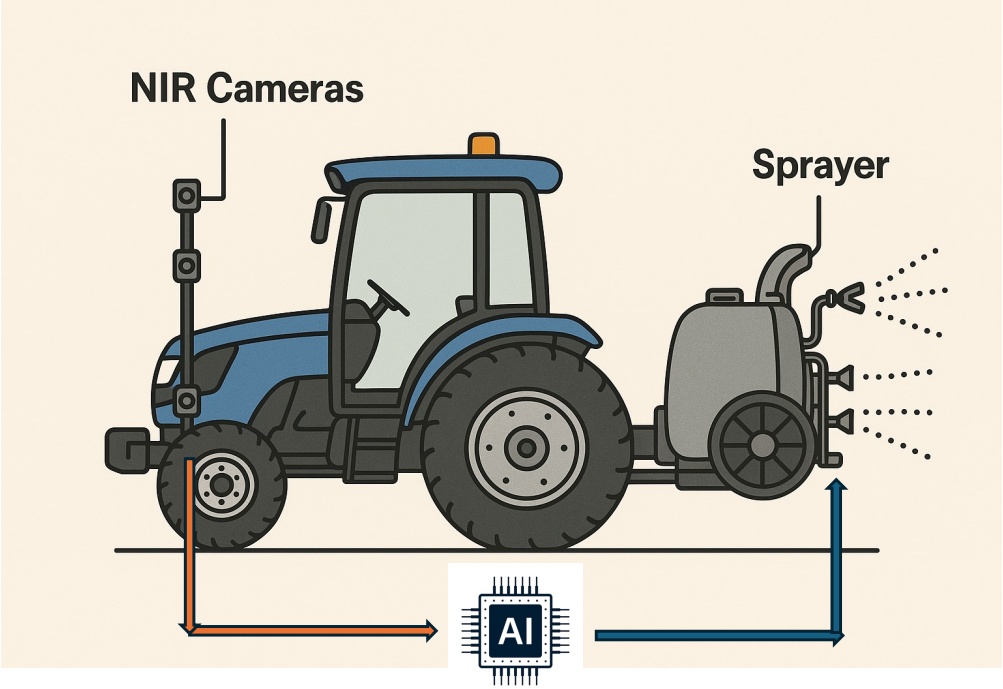
Synoptic table





Images Created with Chat GPT

Conclusions

Improvement of viticulture sustainability and climate change mitigation/adaptation are the main innovation drivers

Economical Sustainability must be ensured first.

Future Innovation: needs a strong interdisciplinary and an open mind aproach

Tadition vs Innovation: Acceptability of these innovations and their diffusion among producers

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Thanks for the attention!