Advanced research and innovations in viticulture and wine making fields

Alberto Cugnetto, PhD

Accademia di Agricoltura di Torino

30-04-2018

- Grape genetic improvement
- Agrometereology and climate change mitigation
- Terroir studies
- Precison viticolture
- Modern winemaking

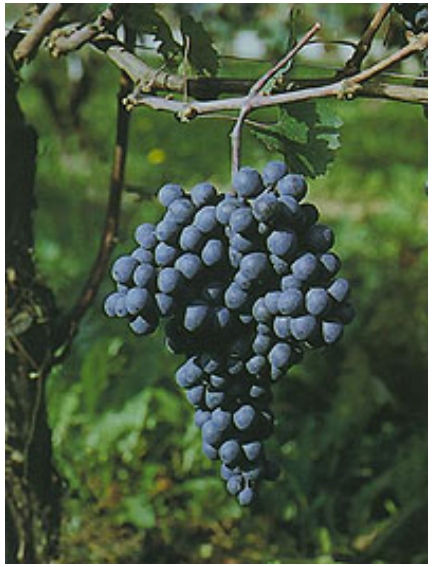
- Cooperation Grape and wine characterization

Grape genetic selection

(prof. F. Mannini)

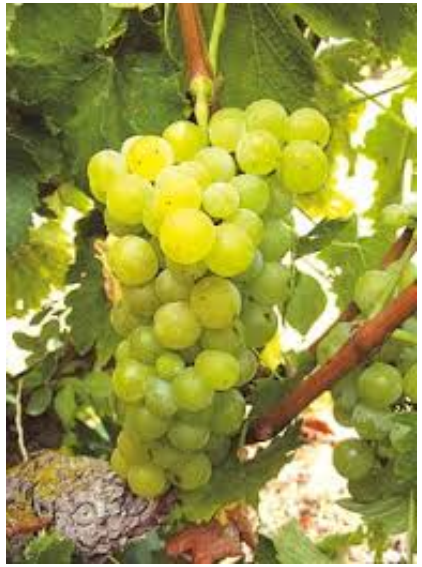
- Clonal selection
- Sanitary selection

Barbera



Nebbiolo

Erbaluce

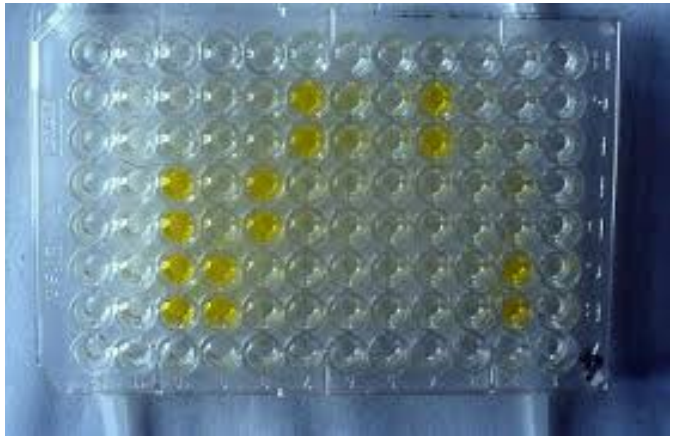


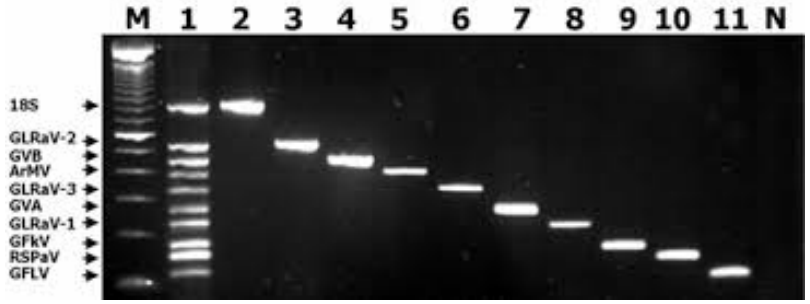
Moscato Bianco

Dolcetto/Ormeasco

GRAPE GENETIC SELECTION

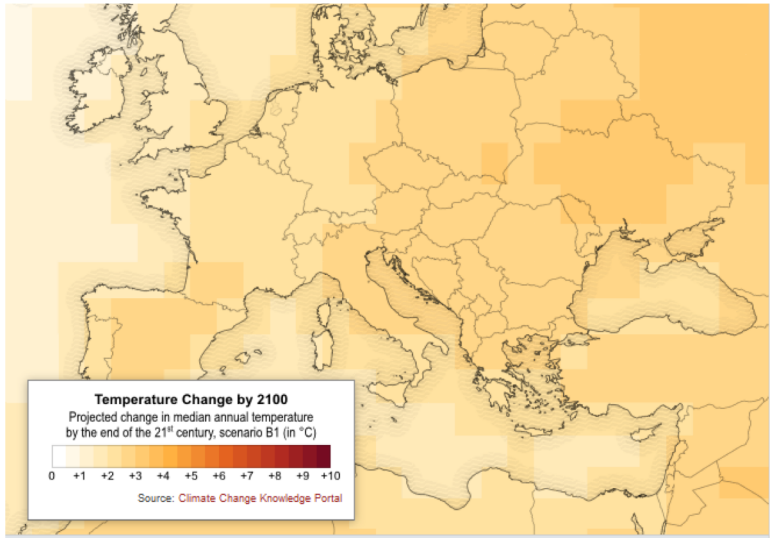
Grapevine Associate Viruses diagnosis and recovery





Multiplex PCR diagnosis (*Gambino et al.)*

Agrometereology and climate change mitigation

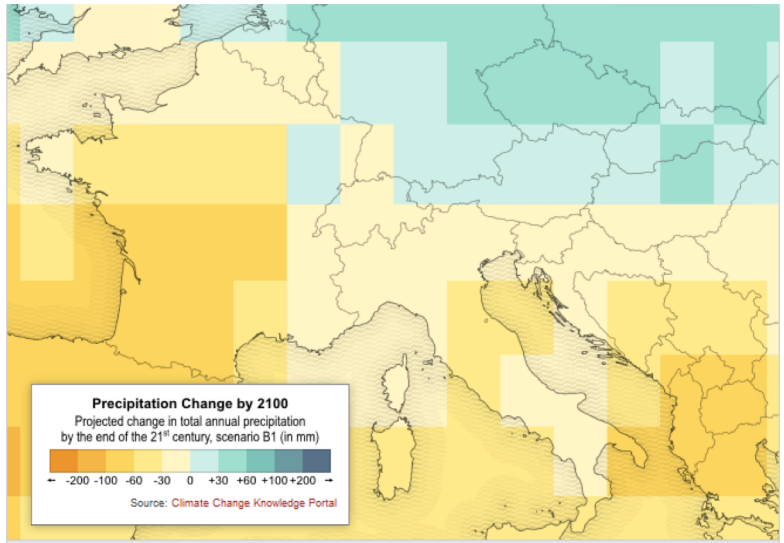


Choose a scenario:

Scenario A2

Scenario B1 ▸

Scenario B1 assumes a convergent world with a global population that peaks in mid-century and declines thereafter. It assumes rapid changes in economic structures toward a service and information economy with reductions in material intensity and the introduction of clean and resource-efficient technologies.



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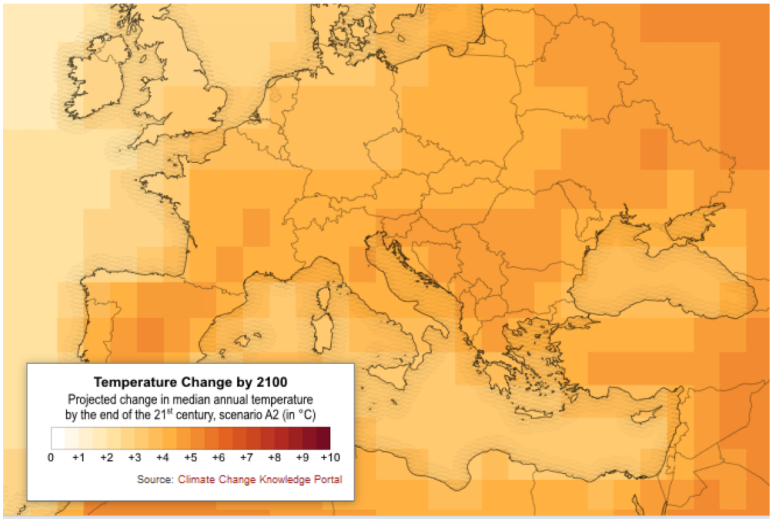
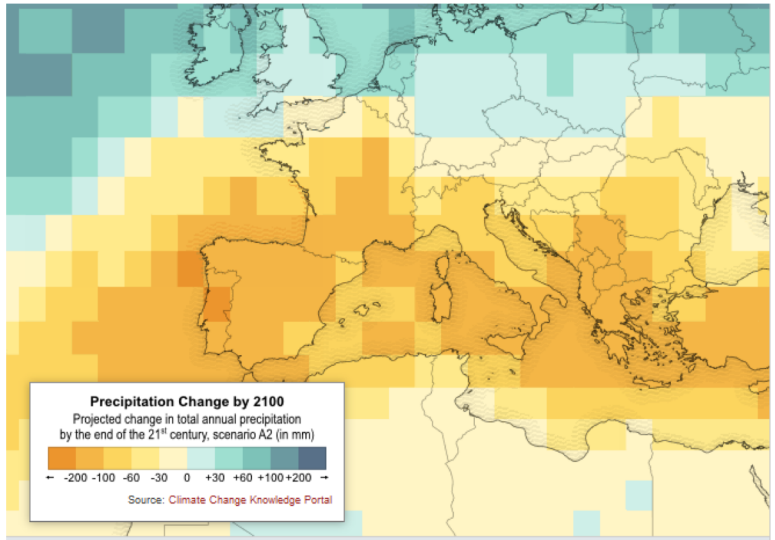


Choose a scenario:

Scenario A2 ▸

Scenario B1

Scenario A2 assumes a very heterogeneous world with a continuously increasing global population and regionally oriented economic growth that is more fragmented and slower than in scenario B1.



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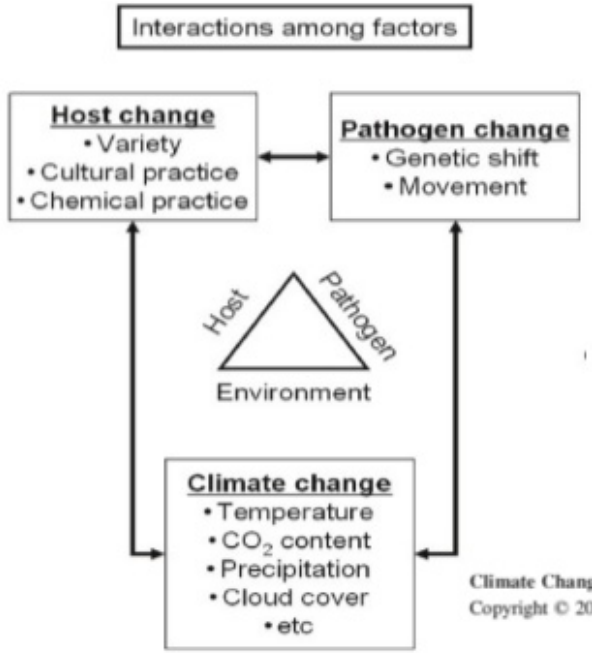
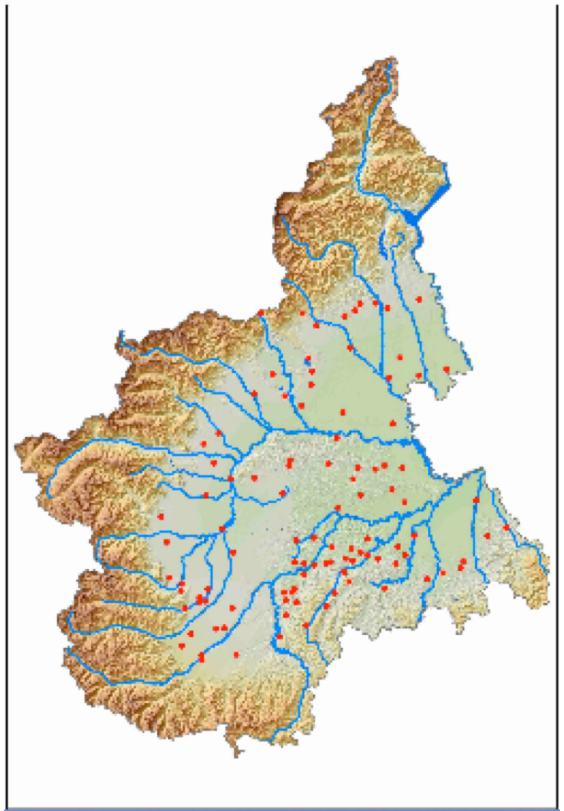
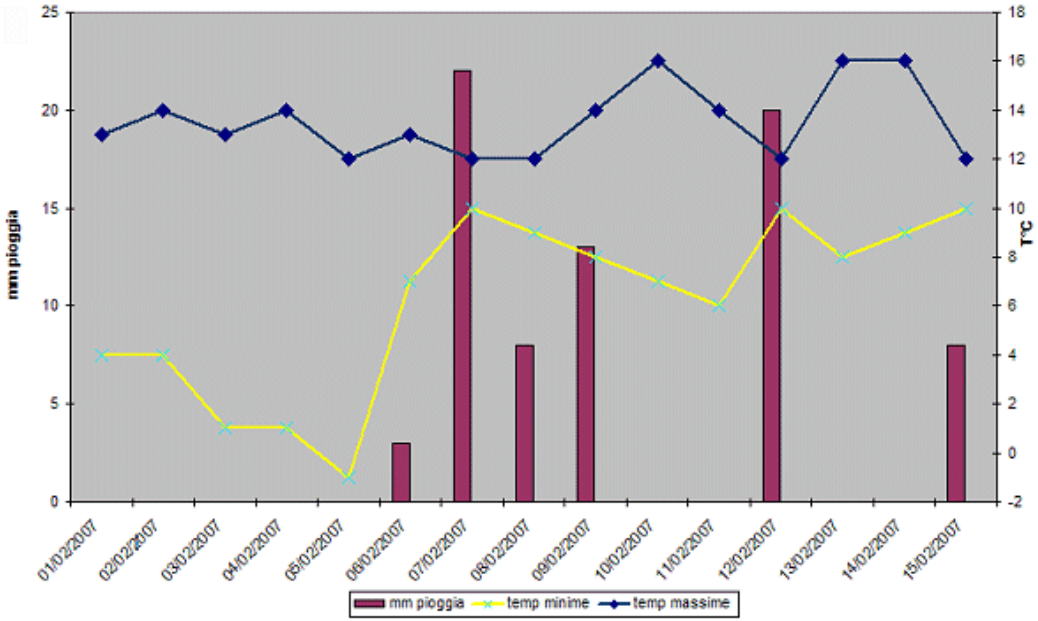


Climate Change: Observed Impacts on Planet Earth



Meteo stations network
Available open source data
- Daily
- Monthly
- Yearly

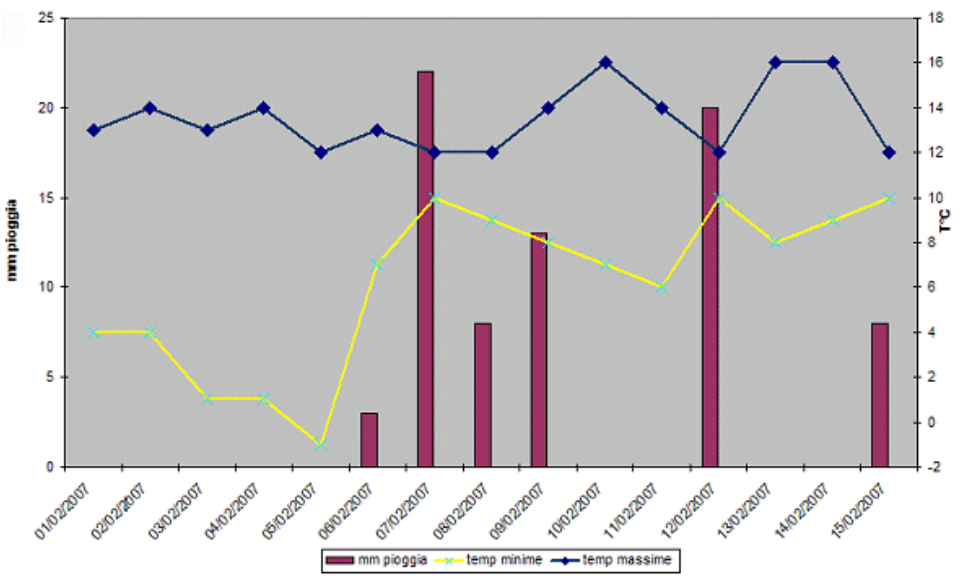
(Dr. Federico Spanna)

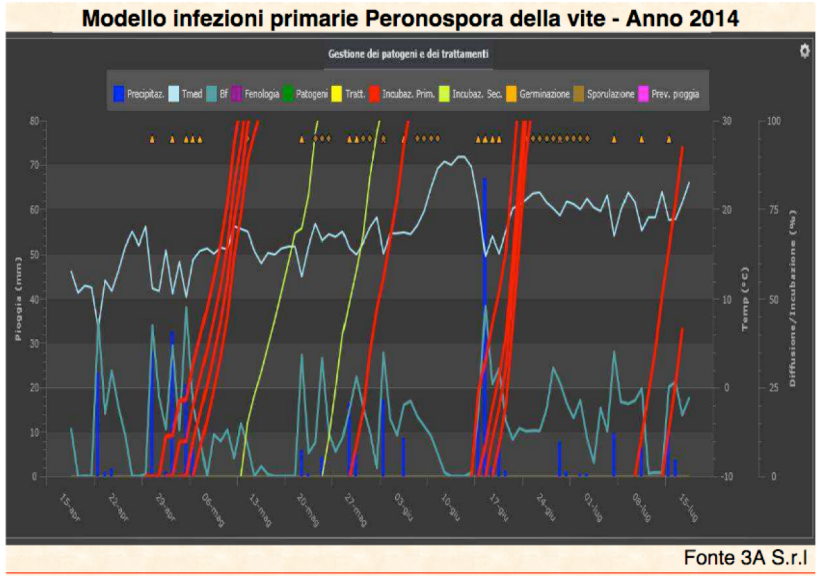


AGROMETEREOLOGY AND CLIMATE CHANGE MITIGATION:

Integrated Pest Management decisional support: Forecasting models

(Dr. Federico Spanna)

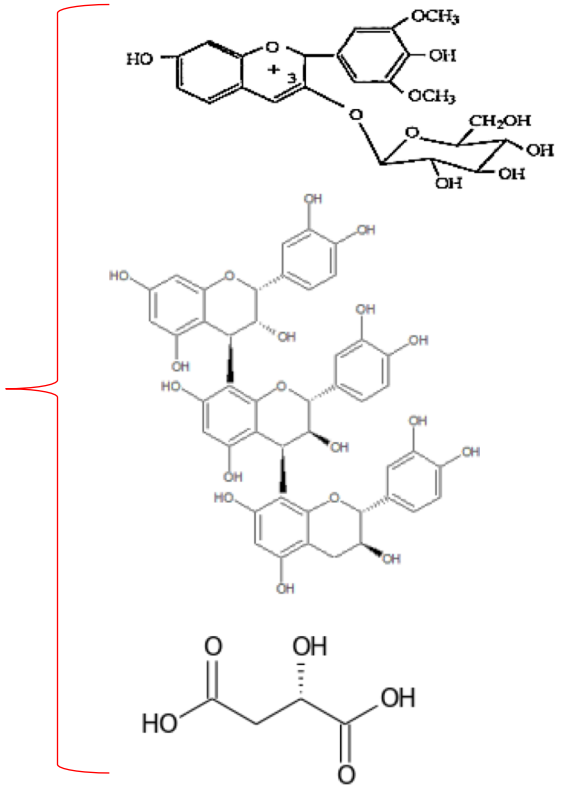




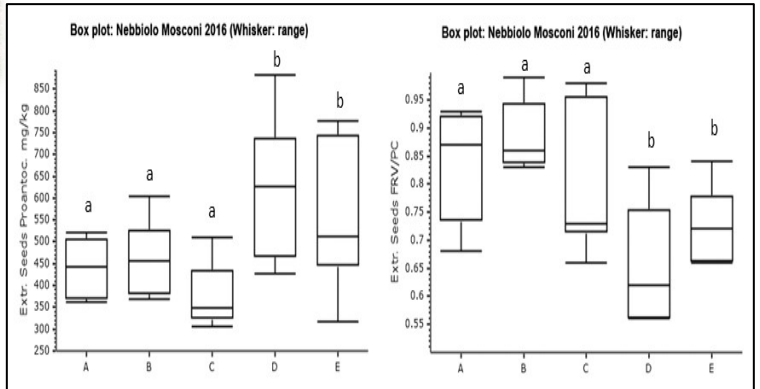
AGROMETEREOLOGY AND CLIMATE CHANGE MITIGATION:

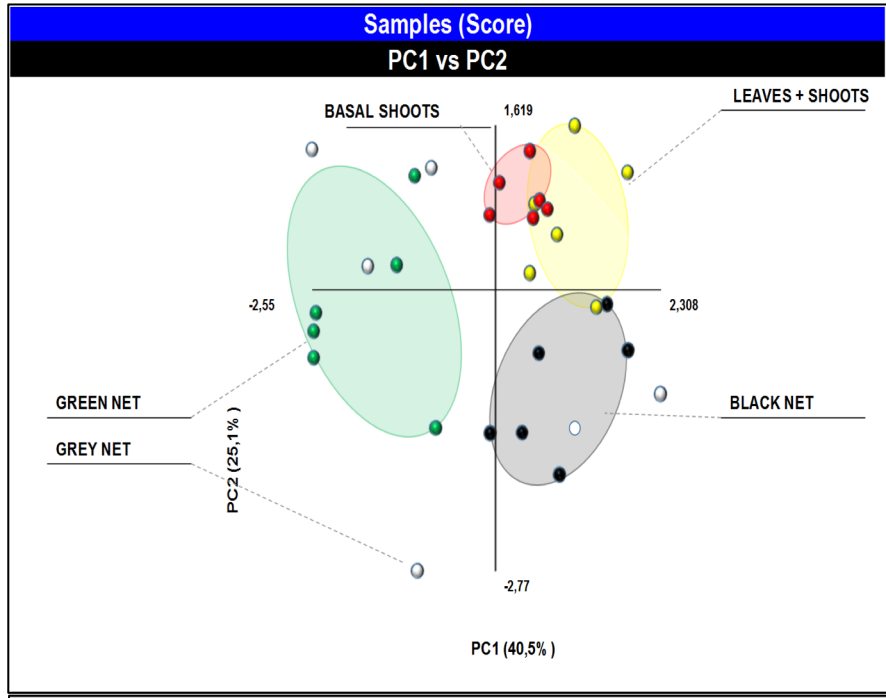
(PhD A.Cugnetto)

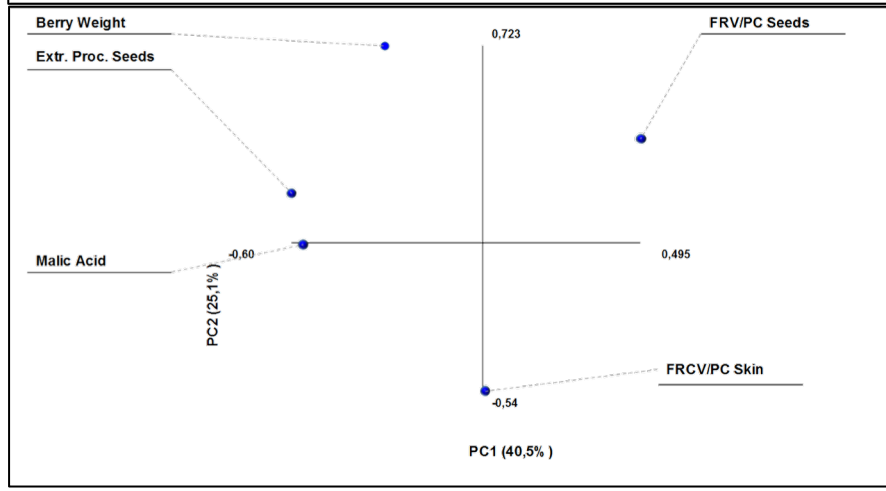
Grape Berries high temperature damages mitigation by means of plastic net canopy coverage.



- **BLACK NET (C)**
- **GREY NET(E)**
- **GREEN NET (D)**

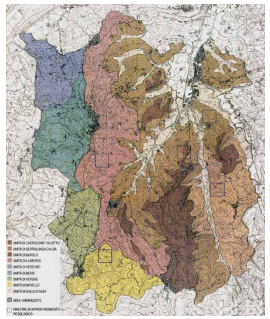






Terroir studies

Grape



Terroir

Environment

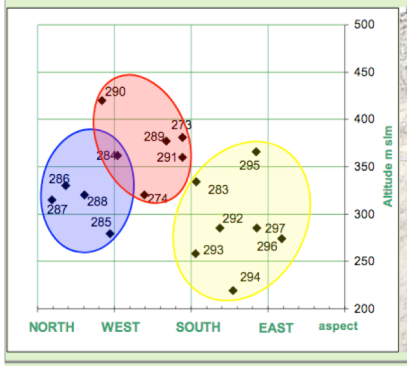
(Soil, clima, exposure)

Human interaction

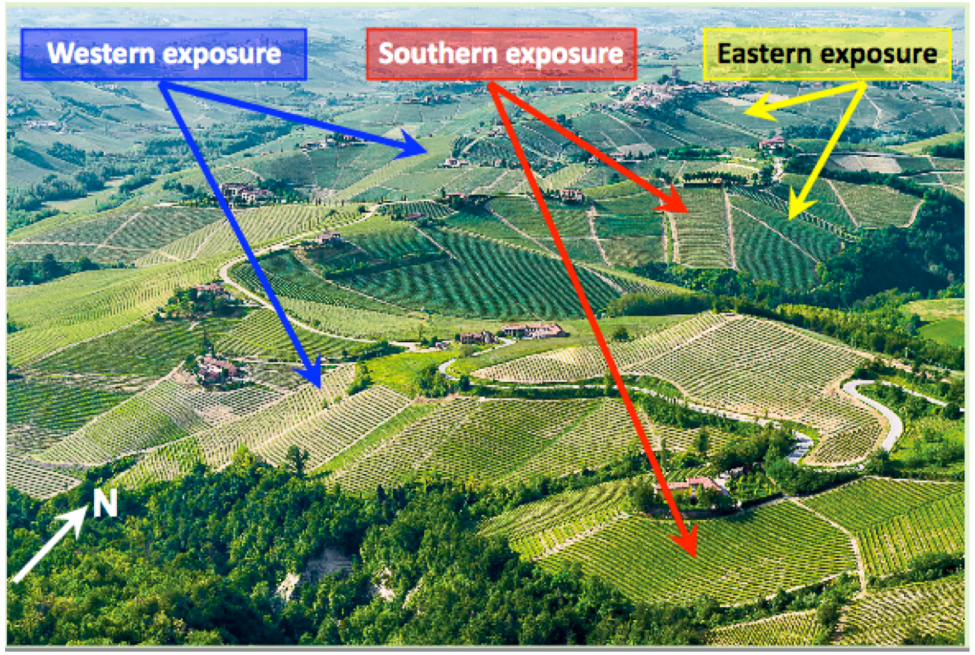
TERROIR STUDIES: GEOGRAPHICAL FEATURES SUCH AS SLOPE AND EXPOSURE ARE TERROIR ELEMENTS INFLUENCING GRAPE QUALITY

(prof. Silvia Guidoni)

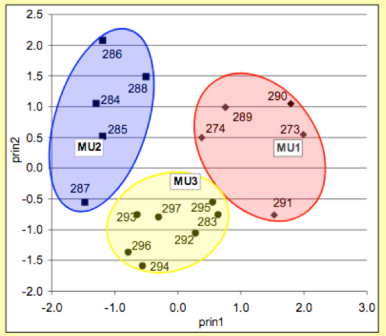
In Barolo area, vineyards cover almost all the cultivated surface and **Nebbiolo** is by far the most used variety. All the possible **exposure** and **altitude** range of the hilly system are represented in the studied vineyard set.



In similar areas, the influence of **geospatial variability** has to be analysed as a **terroir component**. Our hypothesis was that these characteristics could also influence **grape quality**.



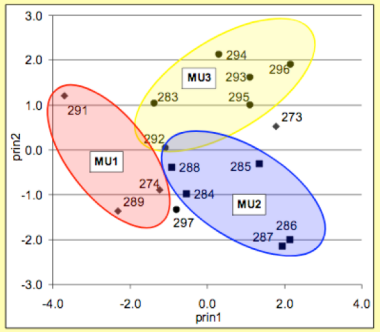
The **geographical features** of the vineyards, such as **slope, altitude, exposure** have been assessed and **intercepted surface solar radiation** has been estimate by using the tool "Area Solar Radiation" of ArcGIS Pro 2.1 software (ESRI, US). The main bioclimatic indexes related to the vine vegetative period were calculated using data from Regional Meteorological Station Network.



Distribution of the vineyards based on a PCA model considering the geographical features.

PCA classified the vineyards into 3 **geomorphological units**

The **grape ripening** has been monitored in **2012-2013** analysing: soluble solid content (Brix), titratable acidity (mg/L), pH, malic and tartaric acids (mg/L), potassium (mg/L), yeast available nitrogen (YAN) of the must and skin anthocyanin concentration (mg/L). The vine vigour and yield have been also assessed.



Distribution of the vineyards based on a PCA model considering the **2012** grape ripening variables.

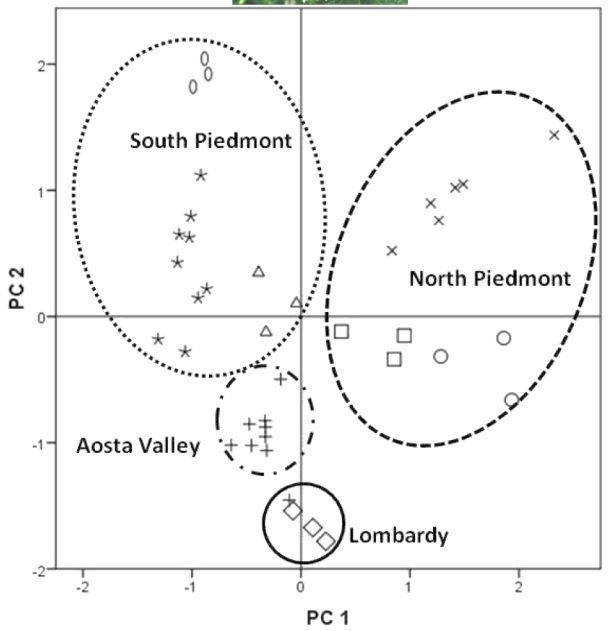
Eastern vineyards (MU3) were more **vigorous**, had higher **yield** and lower **berry sugar** and **anthocyanins** concentrations than the others.

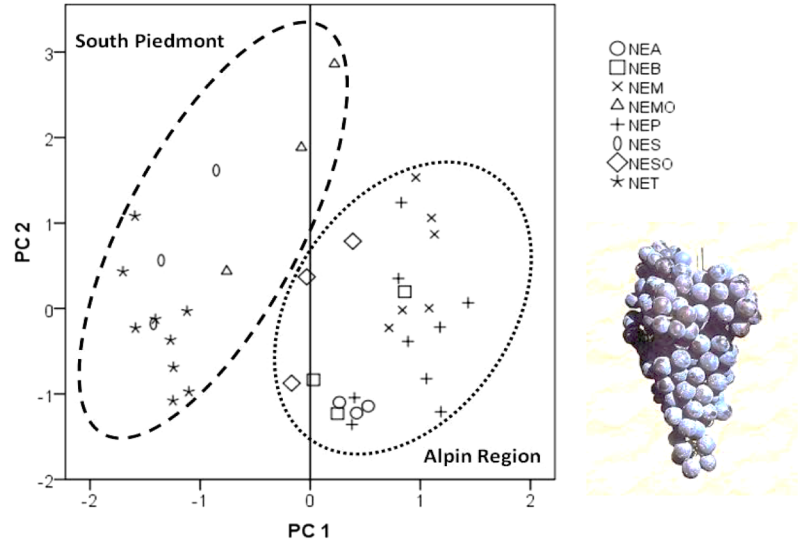
In **2012**, a warm and dry season, few differences between vineyard exposures emerged, whereas in **2013**, with wetter and cooler conditions, the eastern

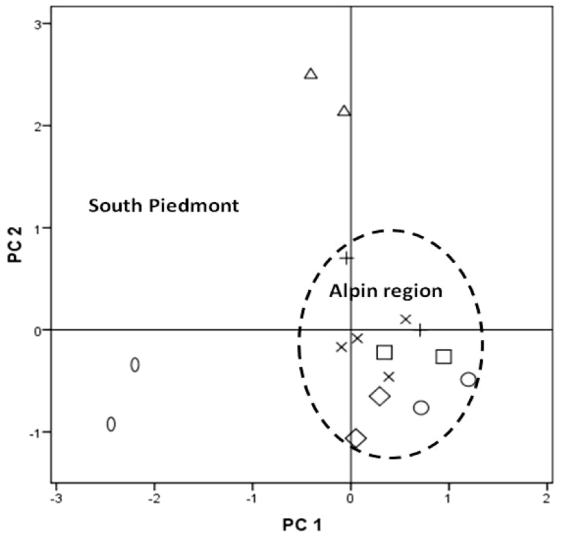
Despite the potential of the vineyard **geomorphological traits** in determining grape quality, winegrower's choices may contribute to drive grape ripening. **Winegrowers' know-how** interacts with the environment footprint and plays a decisive role in refining vineyard quality potential. These results may lead winegrowers **to adapt their traditional practices** in order to improve the **vineyard resilience** in a **climate changing** scenario that, in the study area, become visible in a huge seasonal meteorological anomaly.

TERROIR STUDIES: Tracing the "*terroirs*" by means of elemental composition of leaves, grapes and derived wines in cv Nebbiolo (*V.vinifera L.)* (PhD A. Cugnetto, prof. V. Novello, prof. Silvia Guidoni, prof V. Gerbi, prof A.Marchesini)

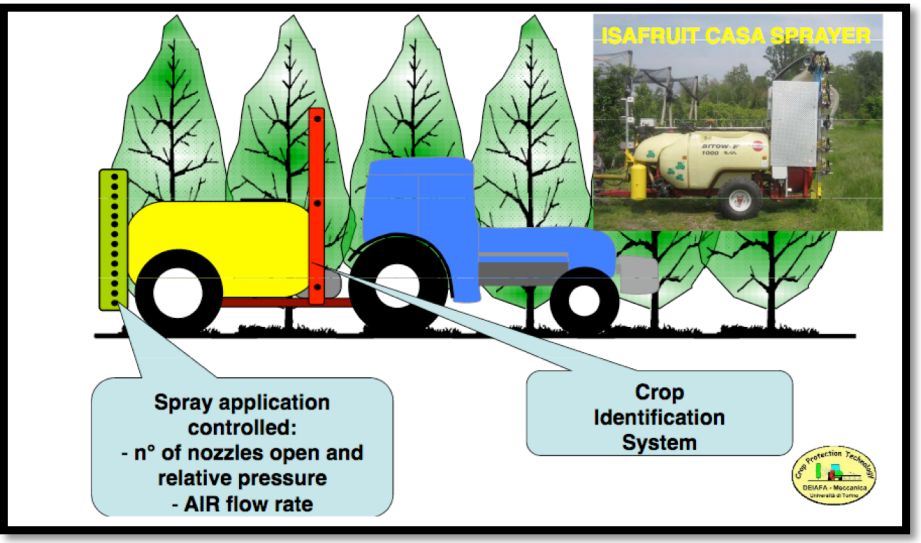
Elements	Units	concentration range leaves	berries	wines[b]
Al	mg/kg	104-176	4-28	0.5-1.8
Ba	mg/kg	0.25-54	0.65-7	0.04-0.17
Ca	g/kg	15-42	1-2	0.6-1.1
Co	mg/kg	N.D.	0.11-1.5	0.06-0.12
Cr	mg/kg	0[a] - 91	0.01 - 1	N.D.
Cu	mg/kg	89-163.7	10-113	0.08-0.22
Fe	mg/kg	N.D.	10-36	N.D.
K	g/kg	27-356	7-24	1.4-2
Li	mg/L	N.D.	N.D.	0.03-0.07
Mg	mg/kg	1.4-4	354-917	73-110
Mn	mg/kg	34-705	1.7-22	0.27-1.5
Mo	mg/kg	0[a] – 3	0.02 – 0.5	0.03-0.14
Ni	mg/kg	2.7-40	0.2-0.9	0.04-0.21
Sb	mg/kg	0.3-42	N.D.	0.01-0,05
Si	mg/kg	155-904	4-86	6.5-11.5
Sr	mg/kg	27-167	2.7-8.4	0.18-0.68
Ti	mg/kg	0.23-5	0.01-1.1	0.11-0.19
V	mg/kg	0[a] - 4	0.9 – 2.8	0.13-0.2
Zn	mg/kg	0.5-94	3.4-20	0[a]-0.66
Zr	mg/kg	0.2-13	0.03-1.37	0.02-0.07

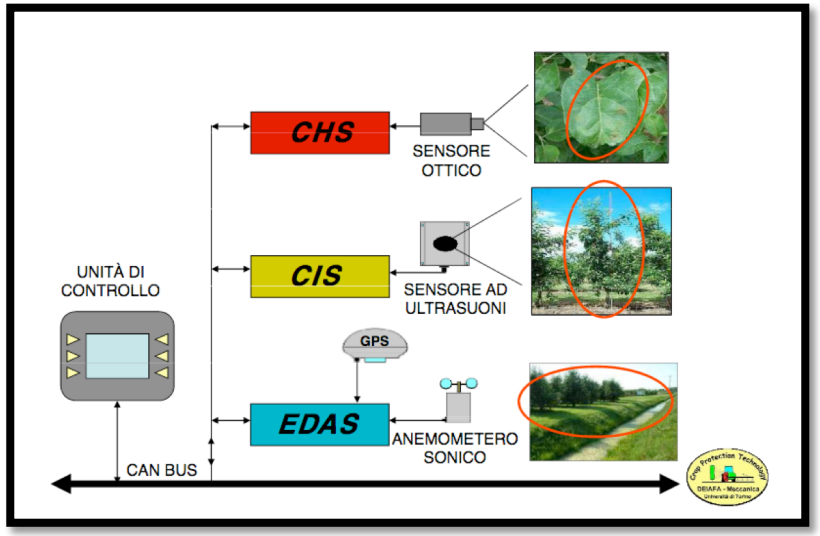




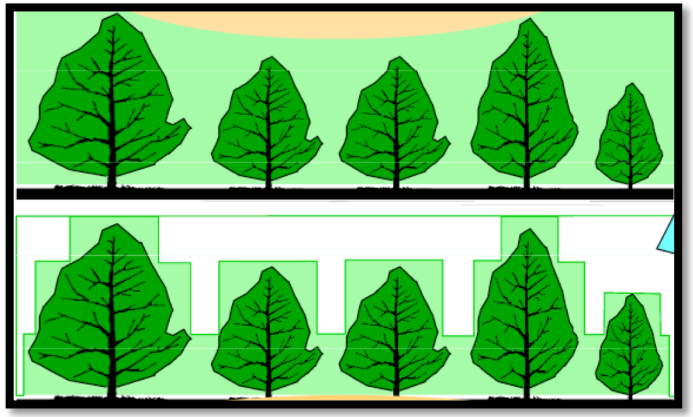


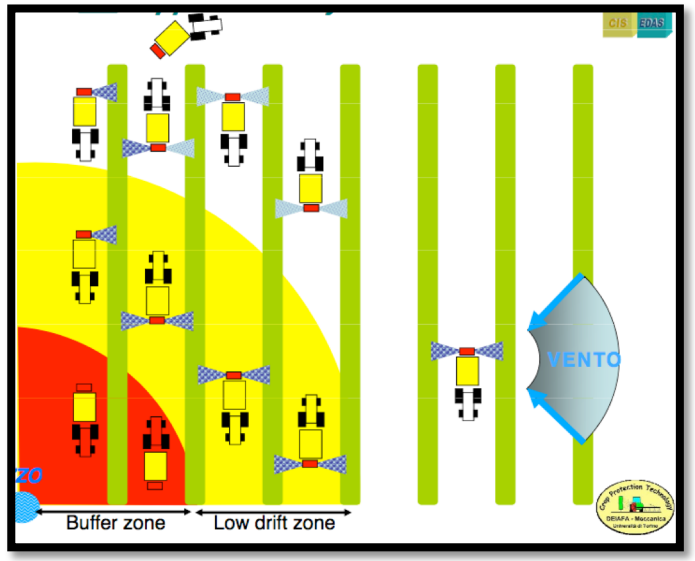
Precision viticulture: Adjusting the Spray Application to the Target Characteristics (Prof. P. Balsari)



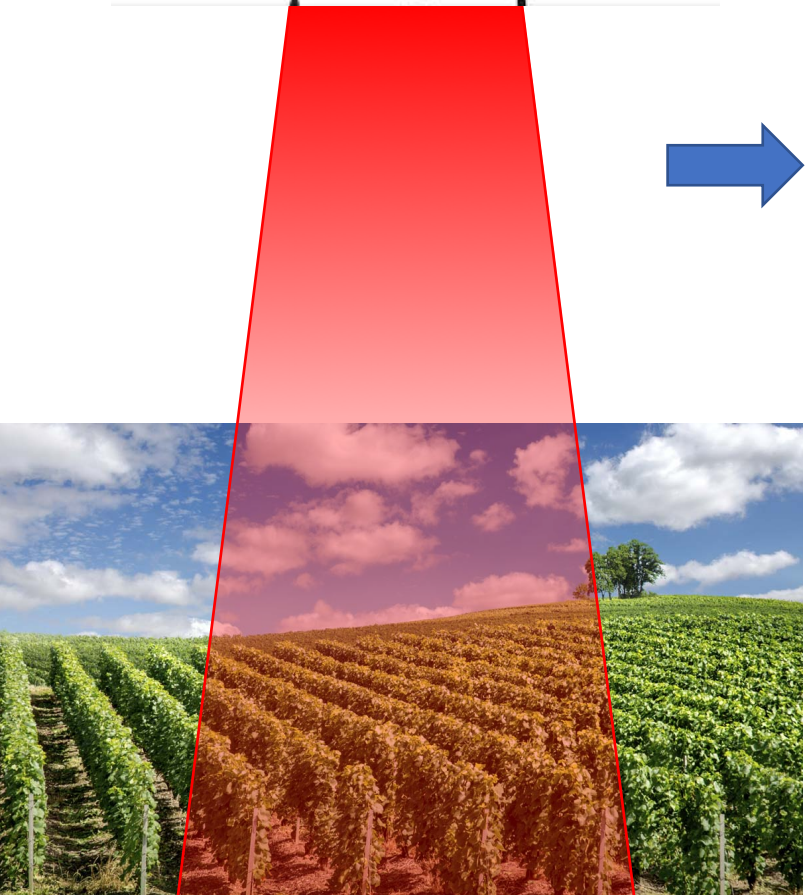


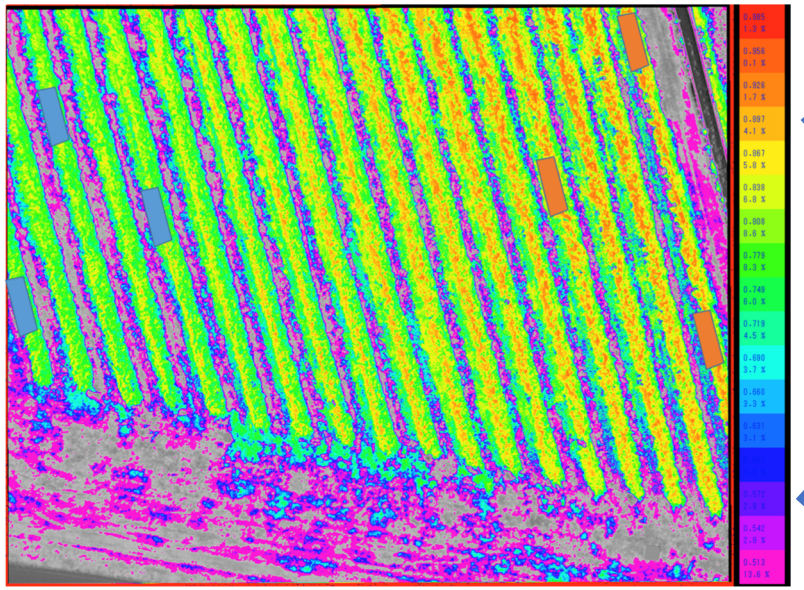
Area to treat/not to treat

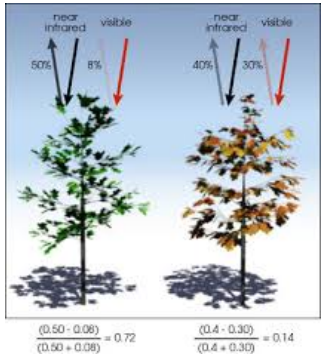


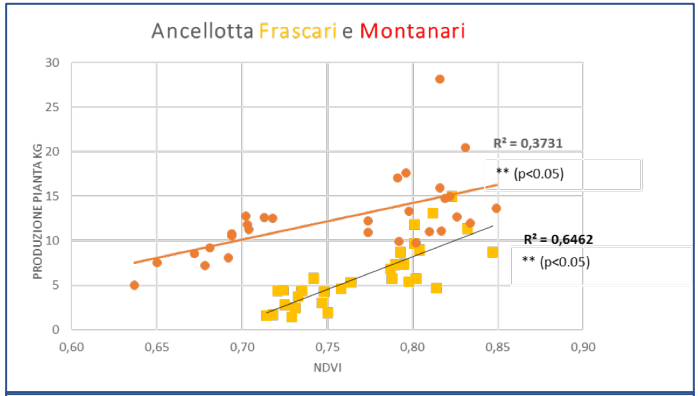


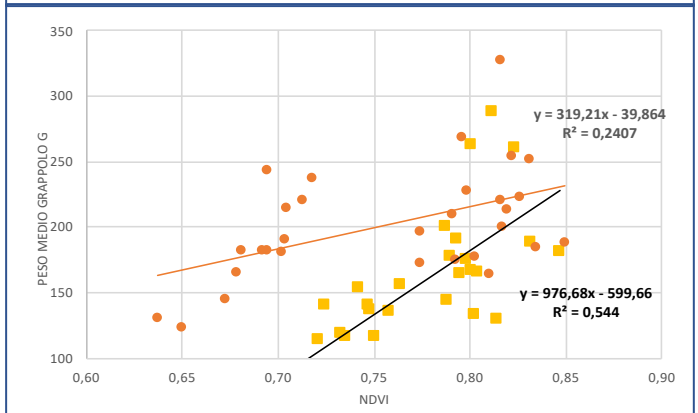
Precision viticulture: Remote multispectral sensing for precision viticulture (PhD A.Cugnetto)

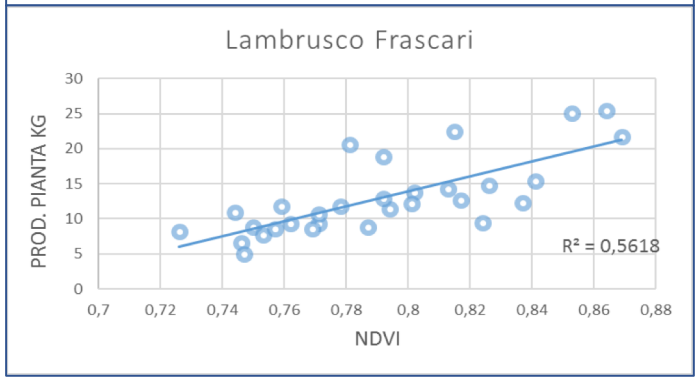






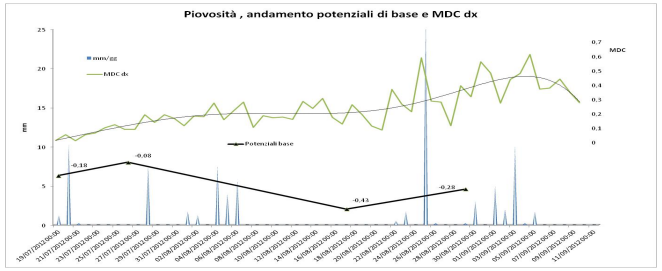


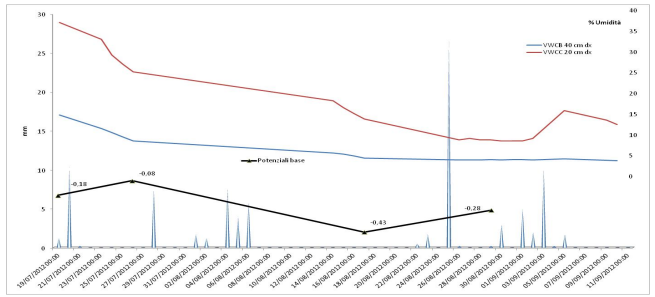


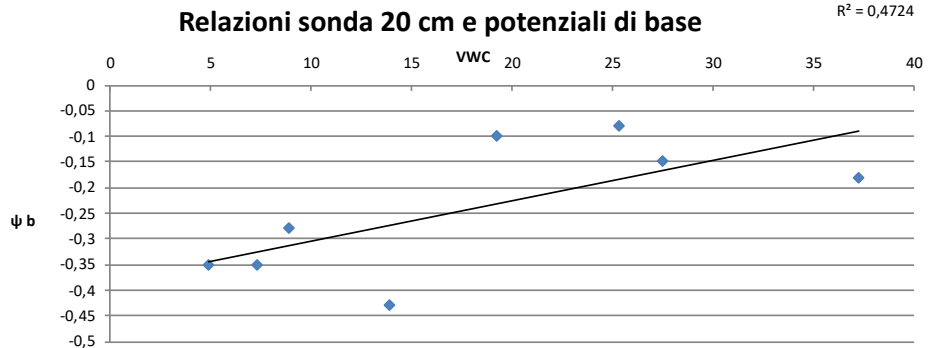


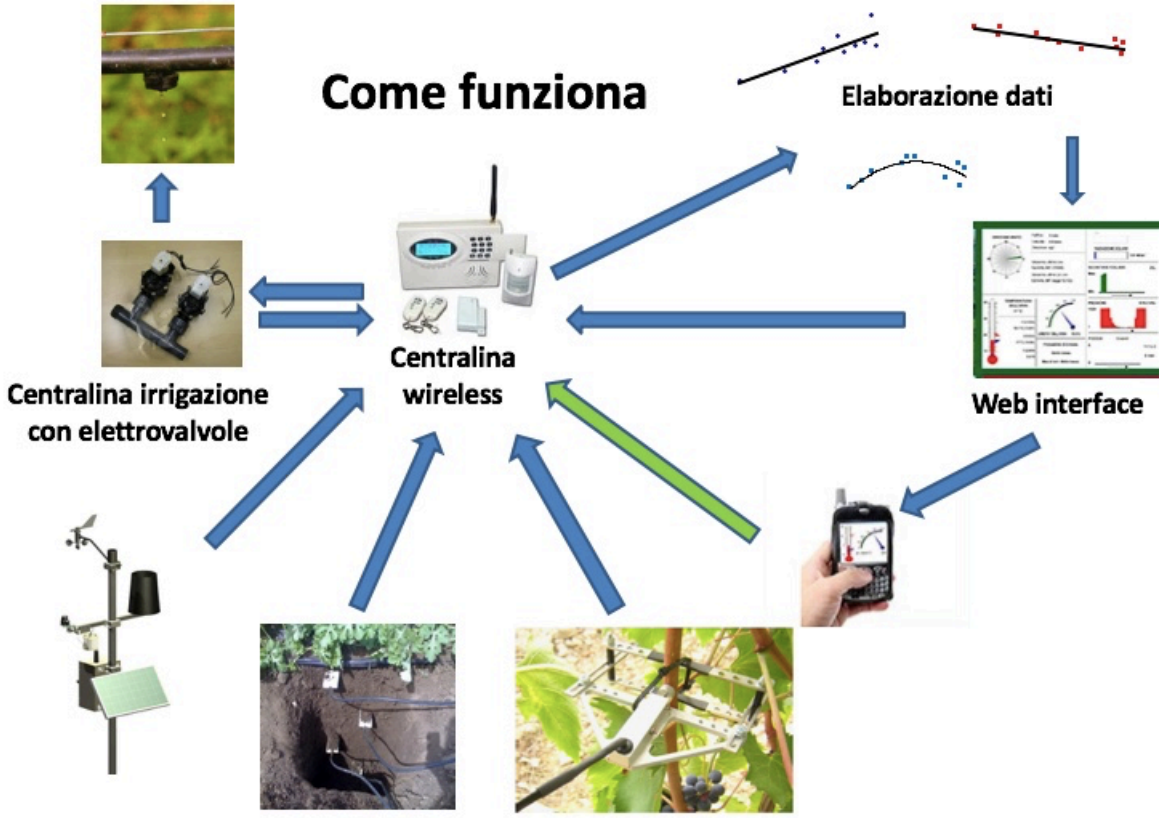
$$NDVI = \frac{RED_{IR} - RED_{VIS}}{RED_{IR} + RED_{VIS}} = \begin{cases} < 0 & water \\ \cong 0 & soil \\ > 0.4 - 0.8 & vegetation \end{cases}$$

Precision viticulture: Sensor network for the grape precision irrigation management (PhD A.Cugnetto and prof A.Marchesini)

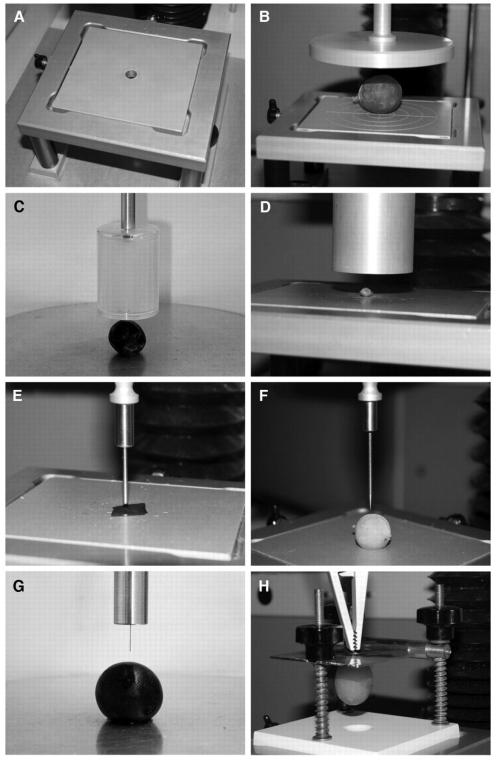




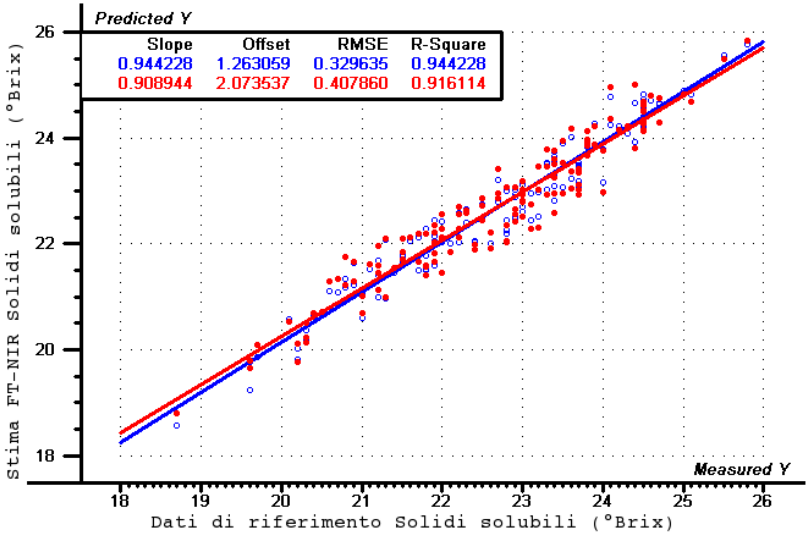


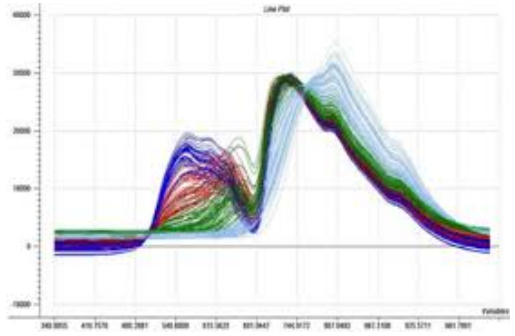


MODERN WINEMAKING: Grape ripening fast detection: Texture analysis, portable NIR (prof. V. Gerbi)



Texture analysis

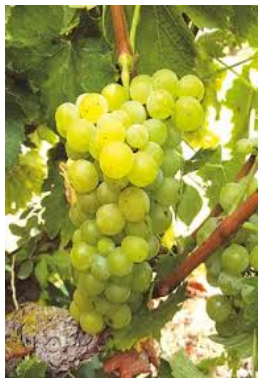


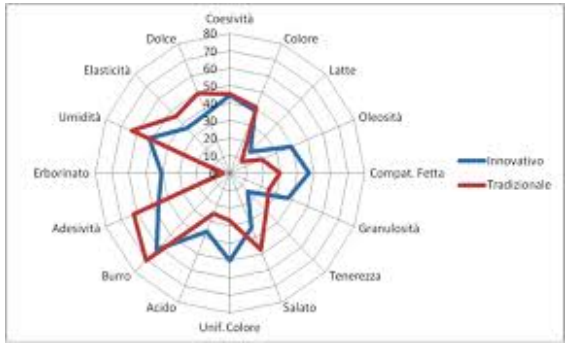


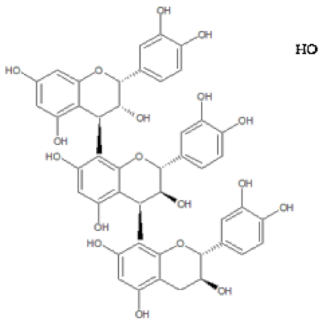
NIR sensor

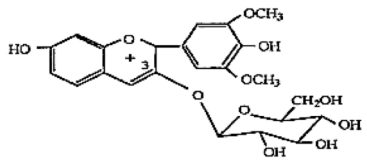
MODERN WINEMAKING Use of new techologies for winemaking: continuos criomaceration with liquid CO2

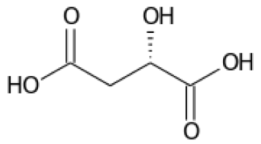
(prof V. Gerbi and Dr. P.Berta)

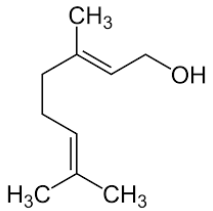


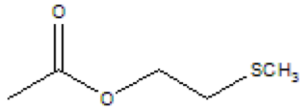




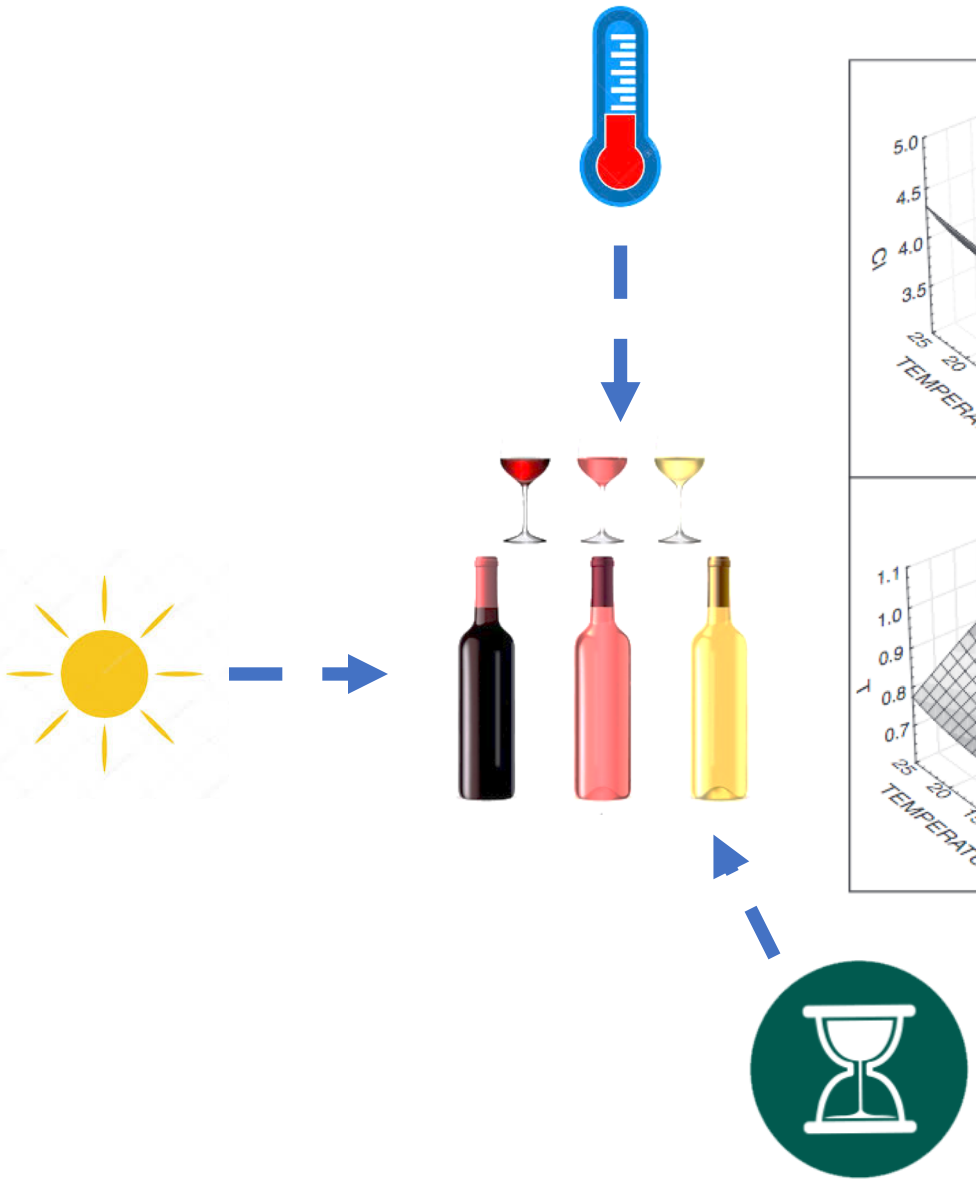


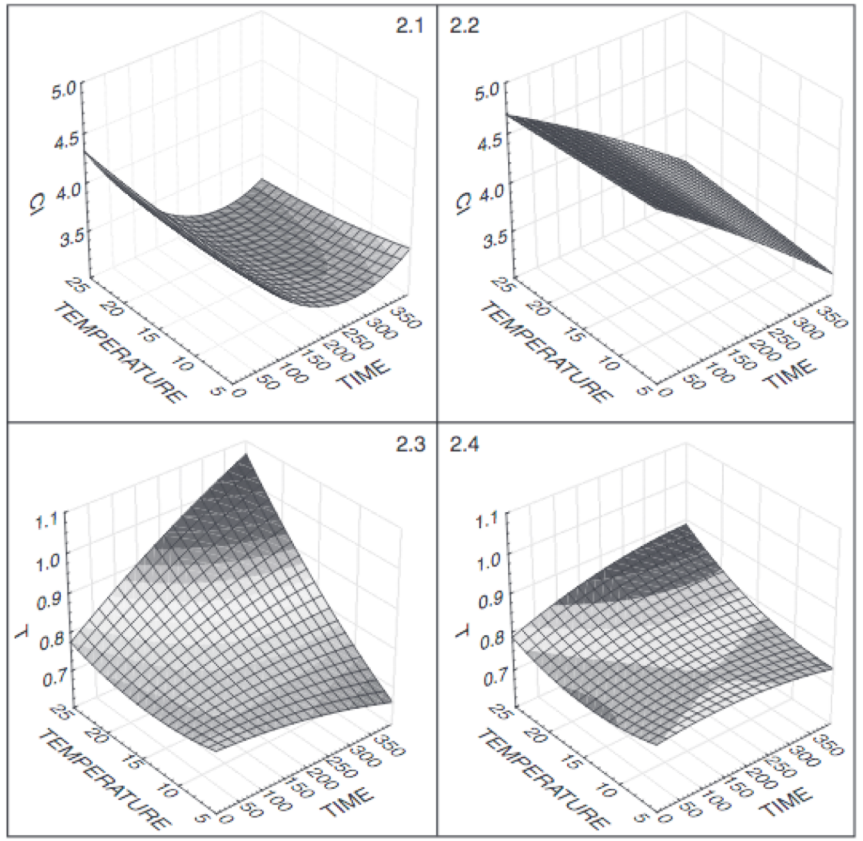






MODERN WINEMAKING : Shelf life studies and product evolution forecasting (prof. V. Gerbi).



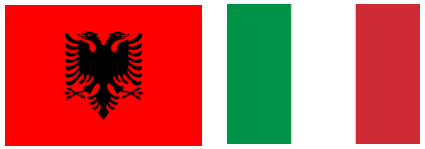


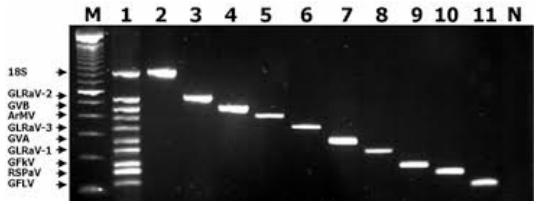
Second-order polynomial model by central composite design (CCD).

Parameter	Wine type	Equation
Total anthocyanins	L	$Y = 165.6011 - 0.3893X_1 + 1.5676X_2 + 0.0010X_1^2 - 0.0172X_1X_2 - 0.0515X_2^2$
	F	$Y = 163.6117 - 0.4540X_1 + 2.1255X_2 + 0.0012X_1^2 - 0.0157X_1X_2 - 0.0692X_2^2$
Monomeric anthocyanins	L	$Y = 75.6341 - 0.0373X_1 + 1.0373X_2 + 0.0001X_1^2 - 0.0097X_1X_2 - 0.0409X_2^2$
	F	$Y = 71.2994 + 1.7393X_2 - 0.0090X_1X_2 - 0.0607X_2^2$
Total flavonoids	L	$Y = 1220.1238 - 2.9880X_1 + 2.2766X_2 + 0.0069X_1^2 - 0.0442X_1X_2$
	F	$Y = 1194.7988 - 3.6052X_1 + 12.9461X_2 + 0.0090X_1^2 - 0.0492X_1X_2 - 0.4214X_2^2$
Color intensity	L	$Y = 4.2966 - 0.0071X_1 + 1.3548E\text{-}5X_1^2$
	F	$Y = 4.7535 - 0.0035X_1$
Tonality	L	$Y = 0.7954 - 0.0003X_1 - 0.0086X_2 + 4.9356E\text{-}5X_1X_2 + 0.0003X_2^2$
	F	$Y = 0.8162 + 7.3120E\text{-}5X_1 - 0.0103X_2 + 1.6084E\text{-}5X_1X_2 + 0.0004X_2^2$
Clarity (L*)	L	$Y = 34.2133 + 0.0809X_1 + 0.2023X_2 - 0.0002X_1^2 - 0.0077X_2^2$
	F	$Y = 30.9367 + 0.0655X_1 + 0.2624X_2 - 7.3118E\text{-}5X_1^2 - 0.0009X_1X_2 - 0.0094X_2^2$
Red/green (a*)	L	$Y = 50.2920 + 0.0643X_1 + 0.4647X_2 - 6.1386E\text{-}5X_1^2 - 0.0018X_1X_2 - 0.0156X_2^2$
	F	$Y = 52.9750 + 0.0645X_1 + 0.2539X_2 - 4.3912E\text{-}5X_1^2 - 0.0022X_1X_2 - 0.0093X_2^2$
Yellow/blue (b*)	L	$Y = 31.7410 + 0.0289X_1 - 0.1004X_2 - 8.0444E\text{-}5X_1^2$
	F	$Y = 30.4499 + 0.0743X_1 + 0.1466X_2 - 0.0002X_1^2$
Chroma (C*)	L	$Y = 58.9718 + 0.0643X_1 + 0.1711X_2 - 5.5315E\text{-}5X_1^2 - 0.0015X_1X_2$
	F	$Y = 61.5898 + 0.0836X_1 - 6.9311E\text{-}5X_1^2 - 0.0021X_1X_2$
Hue (H*)	L	$Y = 0.5588 - 0.0001X_1 - 0.0050X_2 - 5.4997E\text{-}7X_1^2 + 1.3887E\text{-}5X_1X_2 + 0.0002X_2^2$
	F	$Y = 0.5214 - 0.0004X_2 - 1.6665E\text{-}6X_1^2 + 1.0643E\text{-}5X_1X_2$
Color difference (ΔE*)	L	$Y = -0.6669 + 0.1056X_1 + 0.2775X_2 - 0.0002X_1^2 - 0.0006X_1X_2 - 0.0100X_2^2$
	F	$Y = -1.8469 + 0.1094X_1 + 0.5149X_2 - 0.0002X_1^2 - 0.0016X_1X_2 - 0.0173X_2^2$

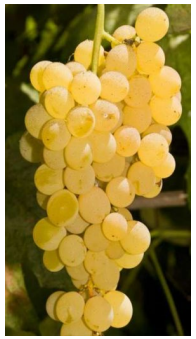
L: sweet lightly sparkling wine; F: sweet fully sparkling wine; X_1: time (days); X_2: temperature (°C).

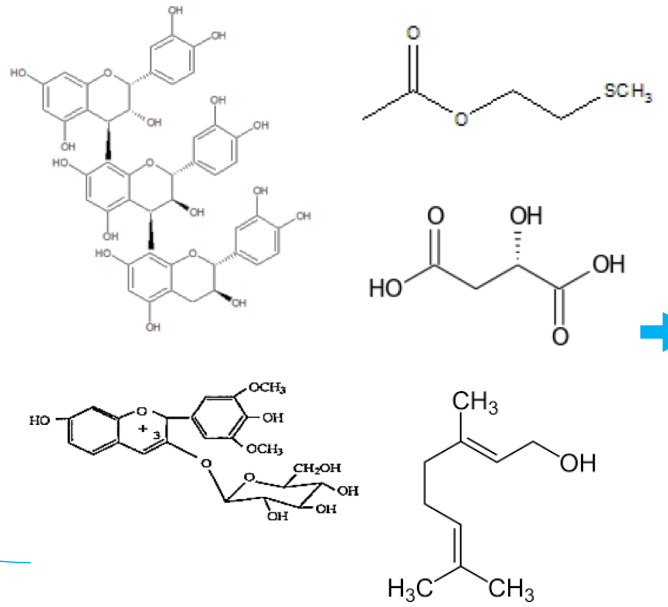
Cooperation project with North Albania: Kallmet cultivar clonal selection and others local varieties characterization (**PhD A. Cugnetto**).





IN PROGRESS….





Thanks for the attention!!