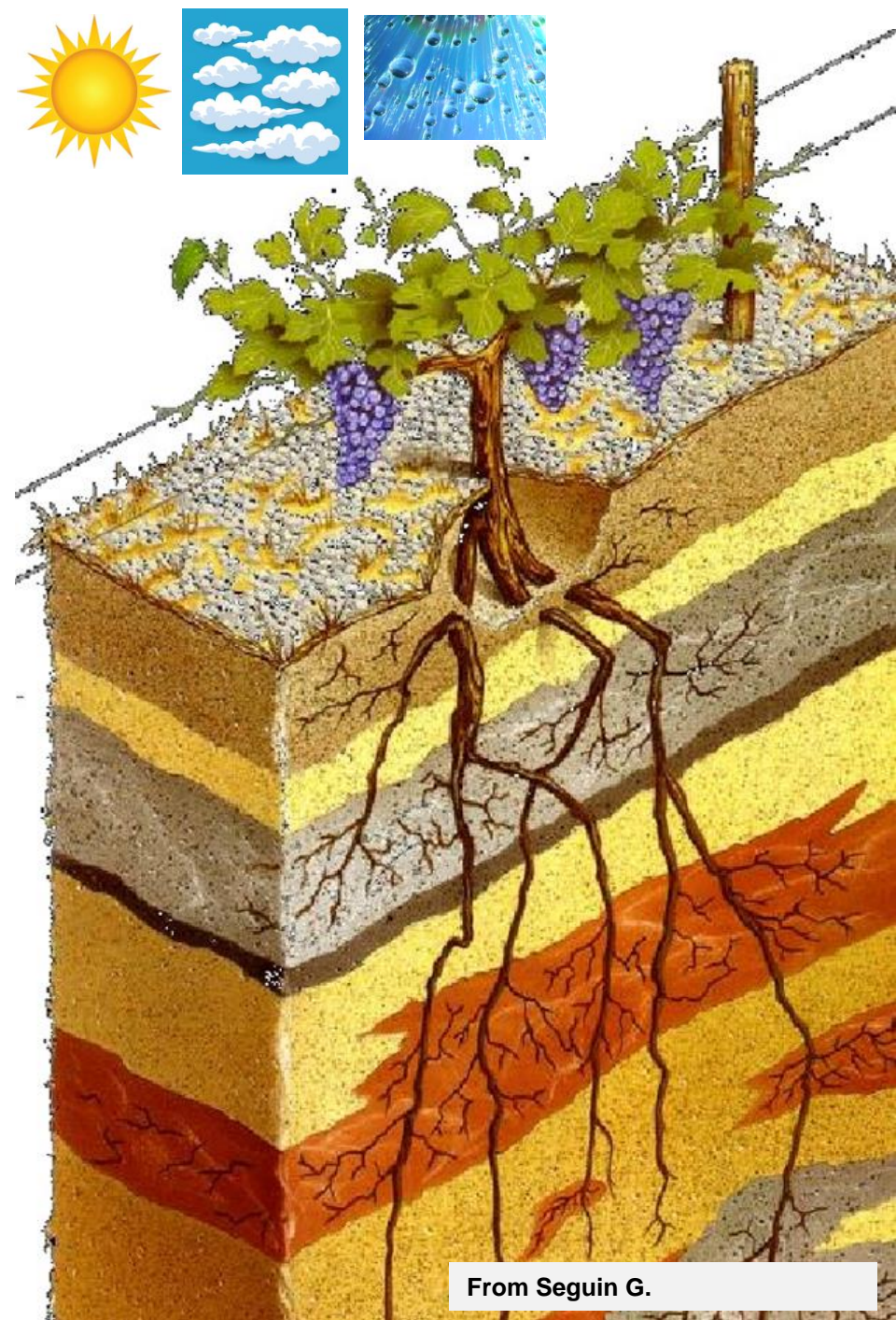


Let's briefly discuss the functioning of grapevines and berries, as well as their relationship with climate

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Lech
Austria
10/12/2024



An integrated reasoning Soil - Plant - Climate

Climatic demand
(evapotranspiration)

Vine and vineyard transpiration: leaves (total and exposed leaf surface, vegetation architecture)

Vine balance: the yield-to-fruit ratio

Pruning: Vascular conduction of perennial organs (non-mutilating pruning)

Graft (vascular connection scion/rootstock)

Reserves: Carbohydrate and nitrogen

Roots (morphology, depth, functioning)

Soil (microbiota, organic matter, texture/structure/rockiness)

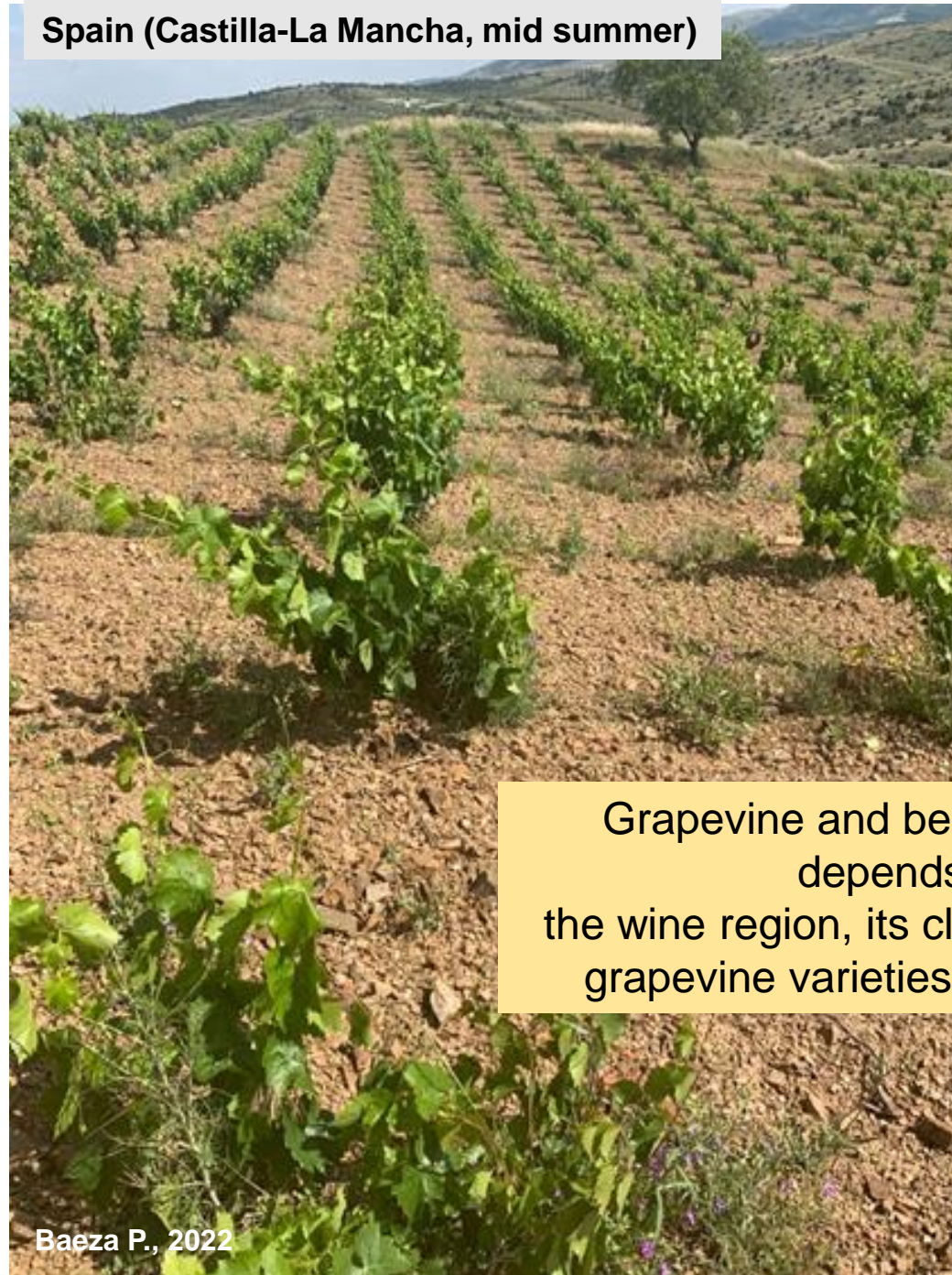


Slovenia



Deloire A., 2021

Spain (Castilla-La Mancha, mid summer)



Grapevine and berry physiology depends on the wine region, its climate, soil types, grapevine varieties, and rootstock

Baeza P., 2022



Deloire A., 2021



Deloire A., 2021



Deloire A., 2021



Deloire A., 2021

Slovenian vineyards, which are well integrated into the landscape, address the question of **regenerative viticulture** and **soil hydrology**.



Deloire A., 2021



Examples of **Gobelet vineyards** in **Spain**:

(a) **Castilla-La Mancha**
Gobelets in winter and

(b) during mid-summer;

(c) **Gobelet arms** in an old vineyard turning closer from mid height to favour tractor pass along alley – Extremadura;

d) Four-year-old Garnacha Gobelets in **Daroca (Zaragoza)**.

Deloire A., Rogiers S., Pilar Baeza Trujillo, 2022. What could be the architectural forms of future vines adapted to climate change: a new challenge! Let's discuss the Gobelet (Bush Vine), IVES Technical Reviews, <https://doi.org/10.20870/IVES-TR.2022.5384>

Gobelet is a training system which is **NOT** resistant but adapted to drought

Adaptation strategies for Mediterranean viticulture: a few thoughts/suggestions for mitigating climate change

- New varieties and rootstocks
- Agronomy and new growing techniques
- Regenerative viticulture
- Irrigation
- Moving vineyards to cooler areas
- New oenology
- Grape production legislation update





About
regenerative
hydrology...



(a) & (b): Examples of keylines and associated water channels (ditches) installed in vineyards.

(c): Example of a water channel under construction.

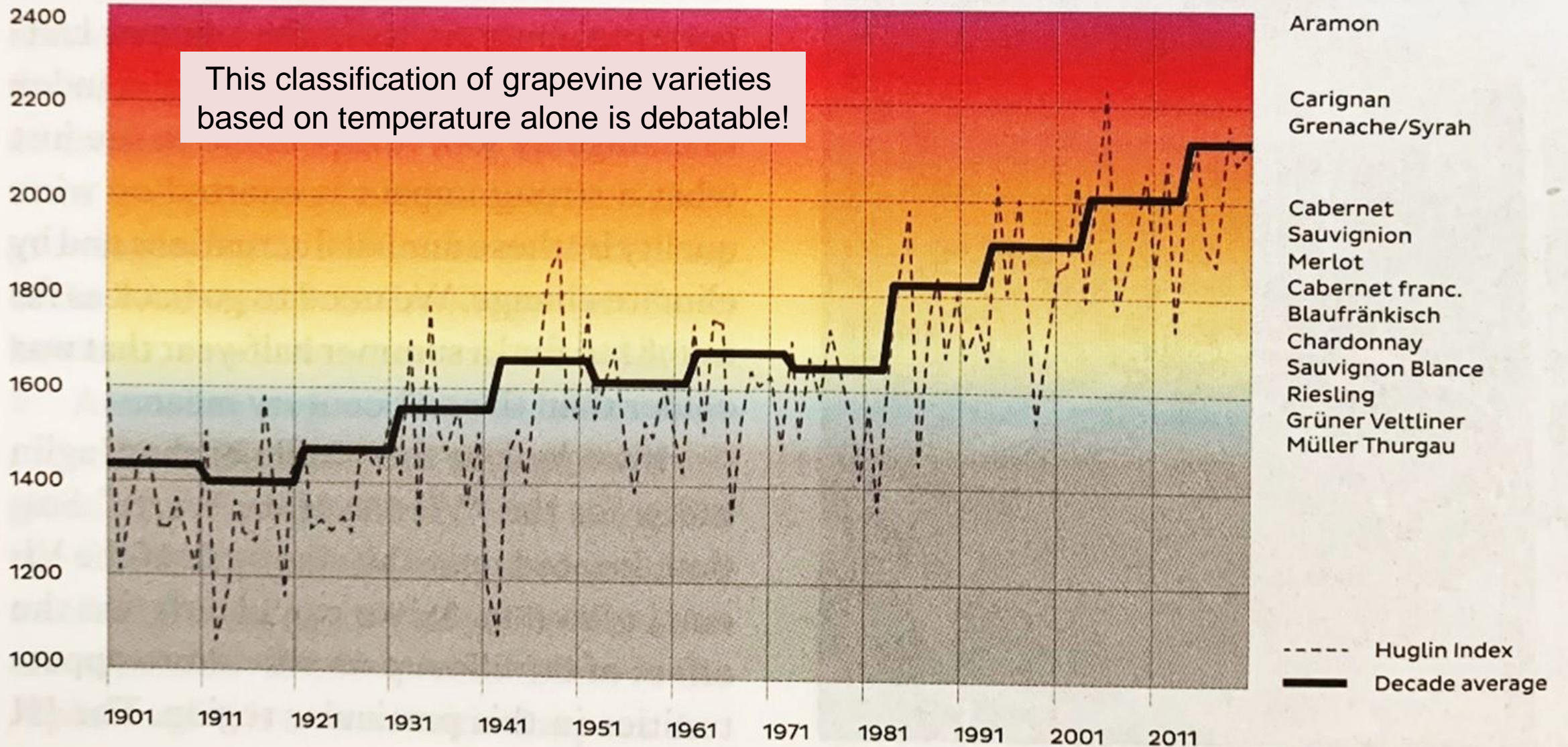
Climate: a key factor of the **terroir** concept



Temperature
Light
Wind
Air humidity
Rainfall

So, what is the most important climate factor for vine and berry physiology?

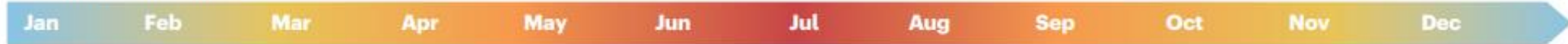




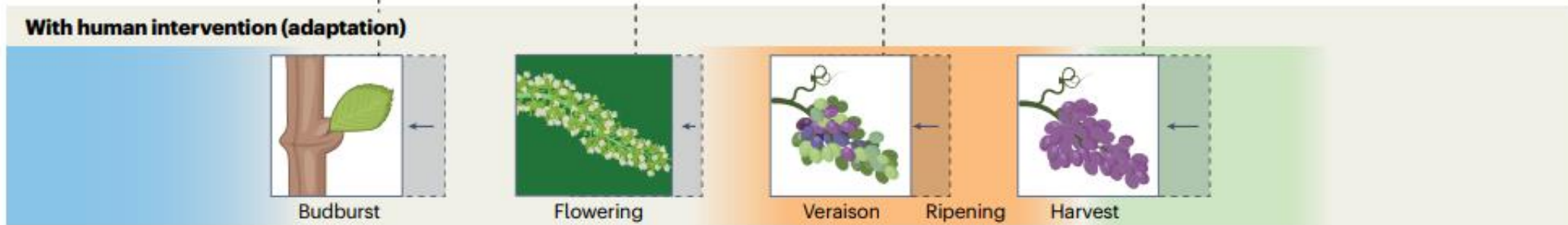
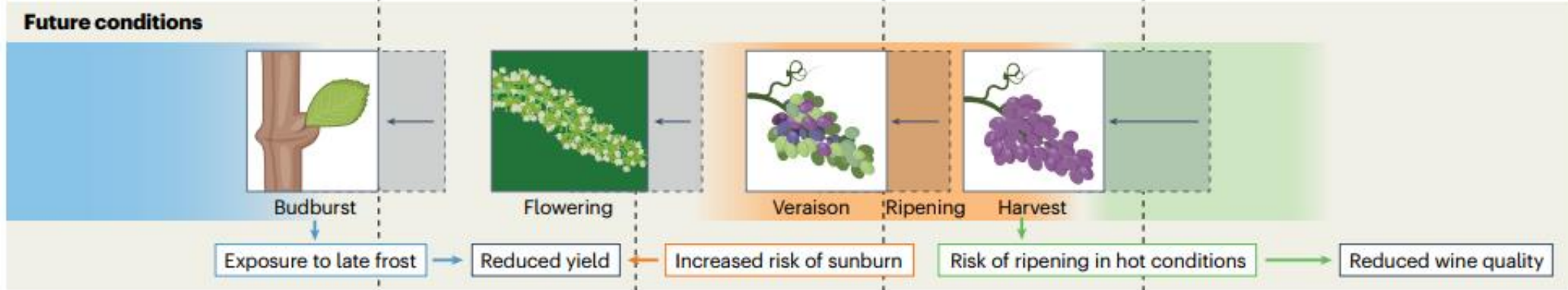
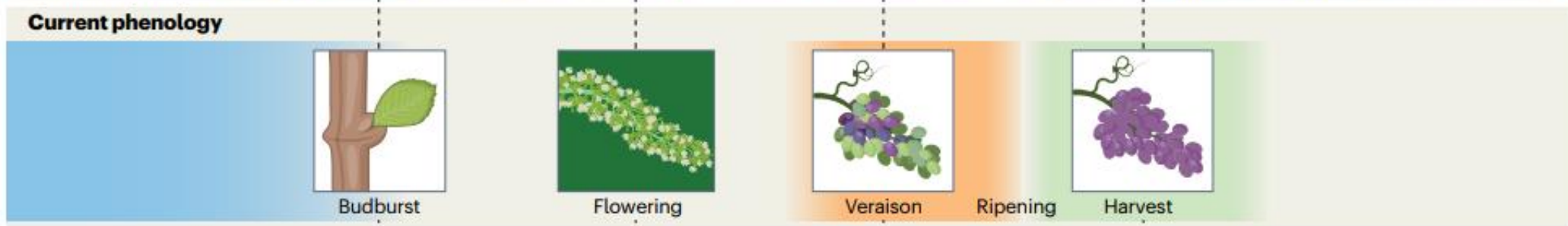
Development of Huglin Index values at the Vienna Hohe Warte Station since 1901 until 2011. The thick black line indicates mean values for the decades (data source: Central Institution for Meteorology and Geodynamics (ZAMG))

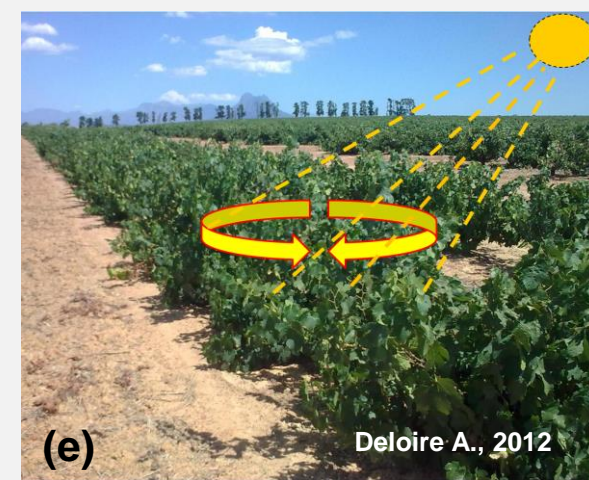
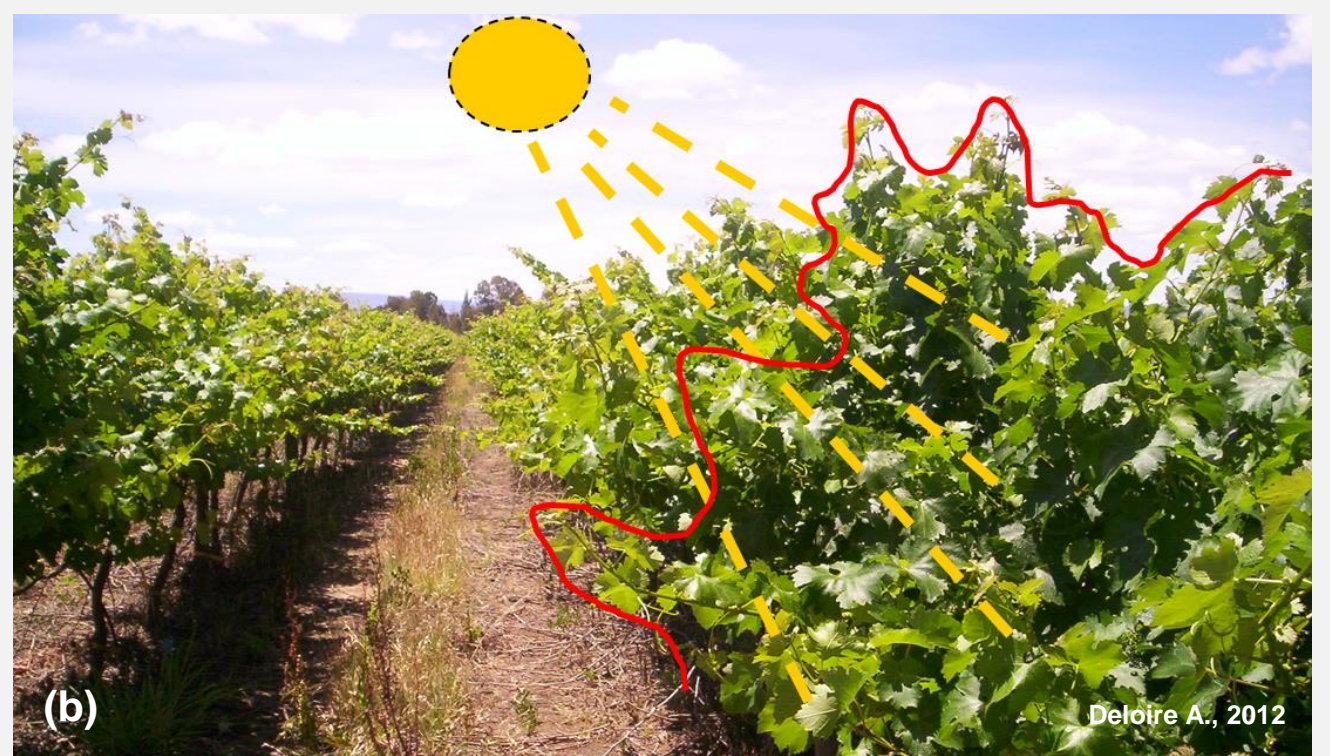
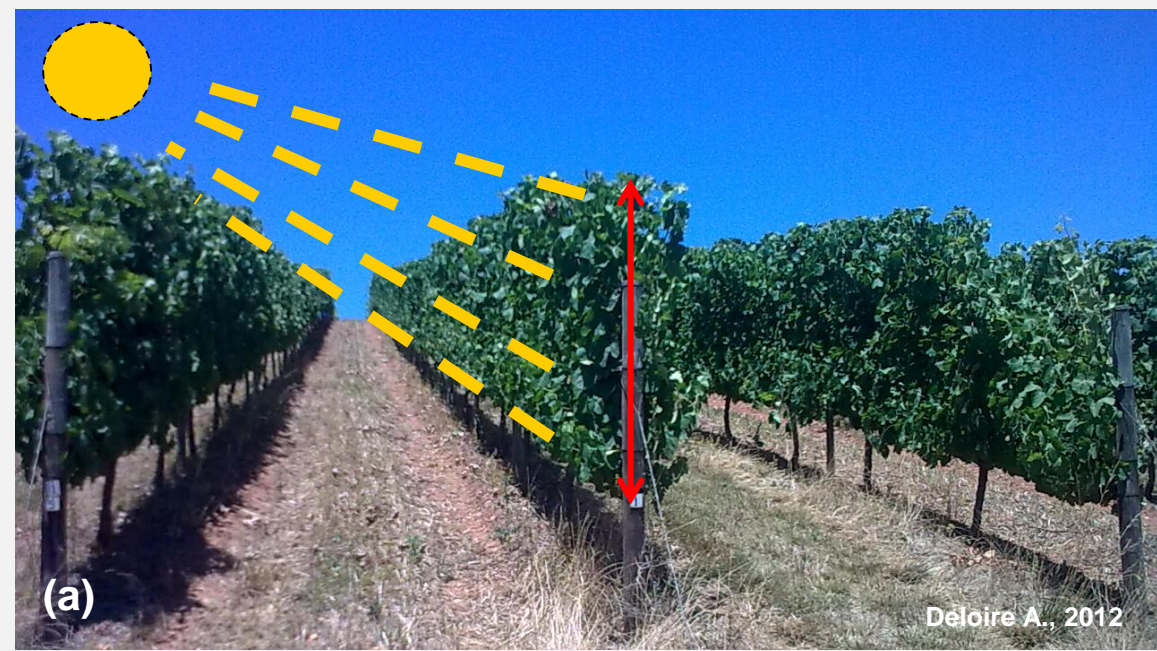
Northern Hemisphere

■ Risk of $T < 0^\circ$ ■ Risk of $T > 35^\circ$ ■ Optimal ripening window



Southern Hemisphere





The concept of grapevine exposed leaf area (ELA)

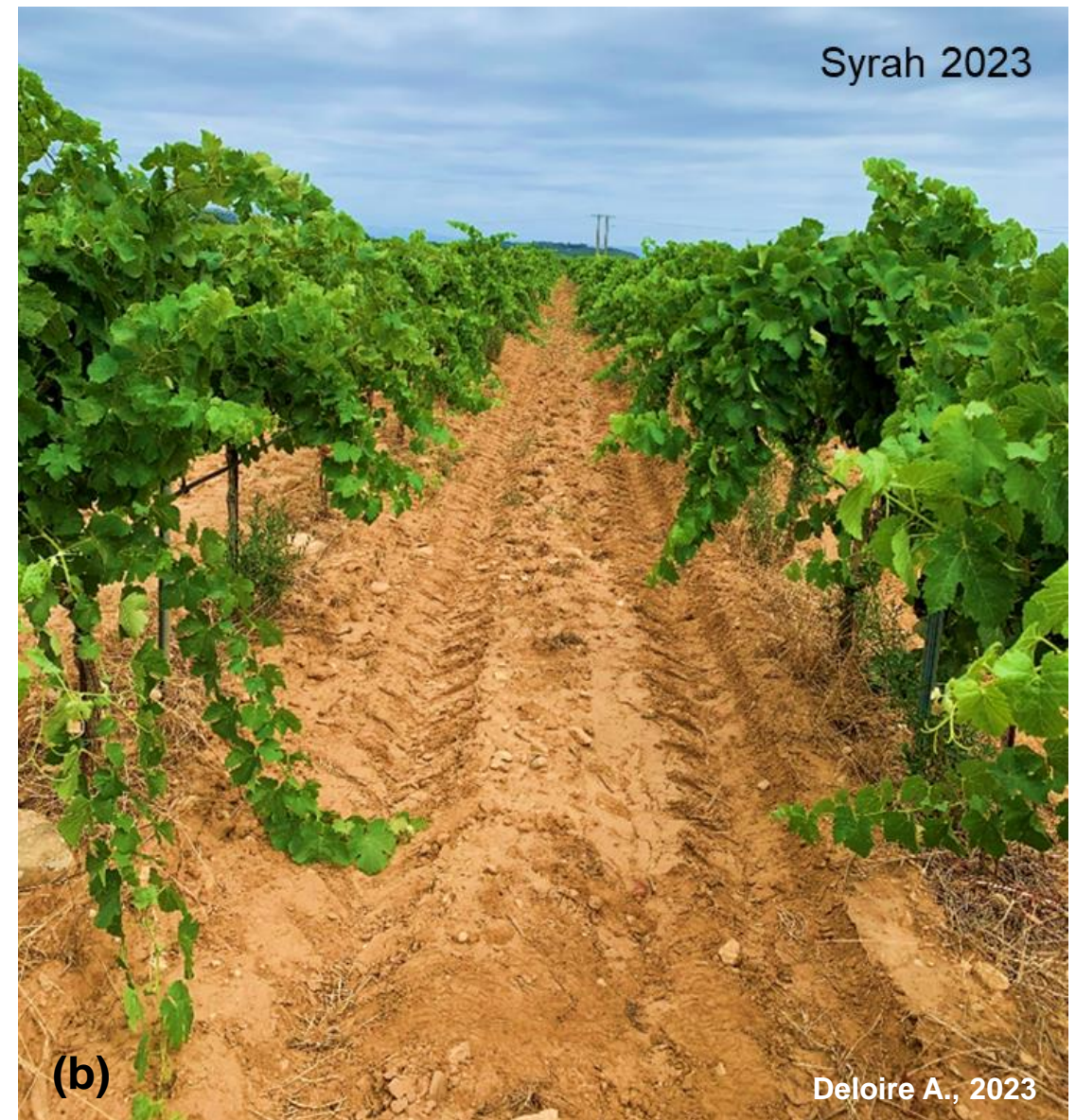
Don't Look UP

only



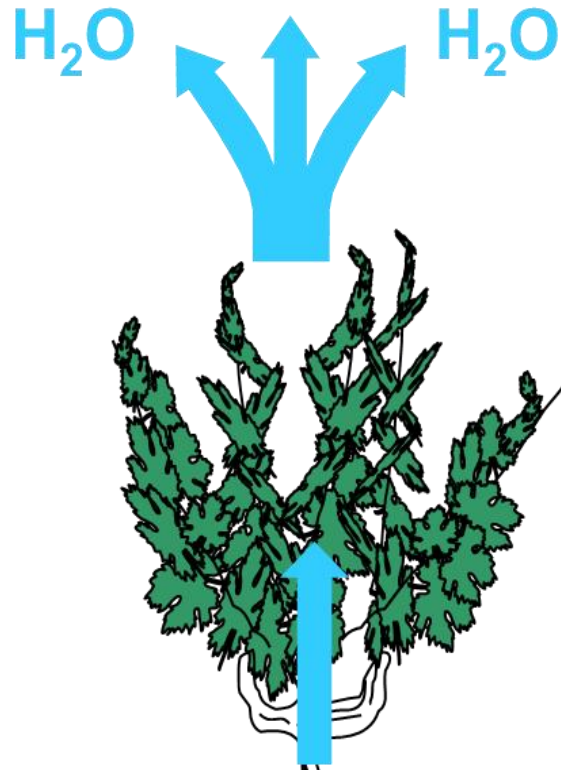


(a) : dry farming, none irrigated vineyard (2022)



(b) : the same vineyard under irrigation (2023)

Stomata are controlling leaf transpiration



“250 – 350 litres of water is needed in a vineyard to produce one litre of must... and this applies for all *Vitis Vinifera* L.”

H_2O



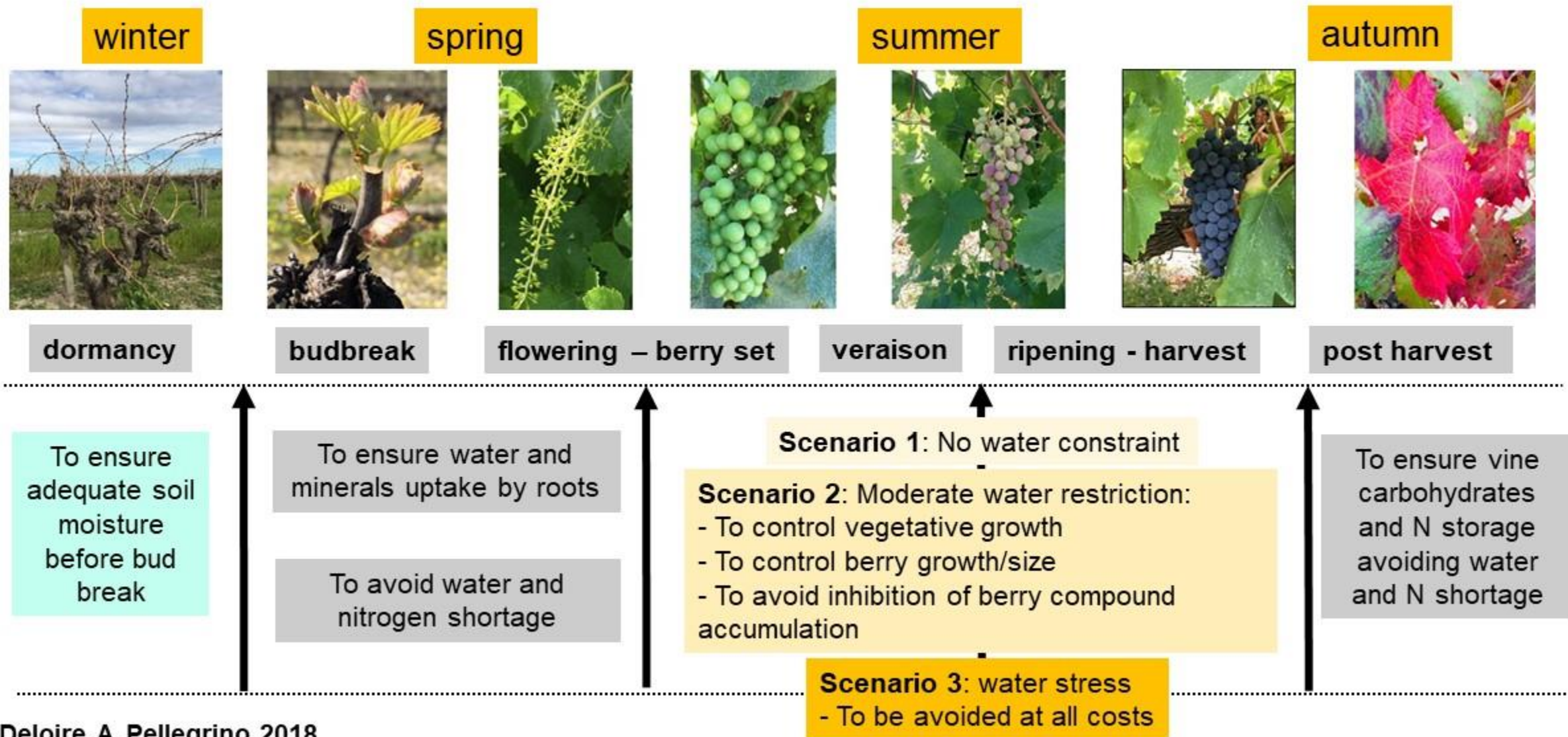
The main roots, along with the fine roots, pump water



H_2O

Water is needed at all phenological stages for vine functioning...

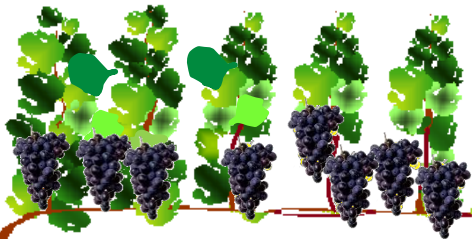
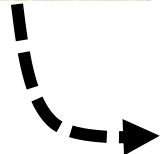
Water & nitrogen supply are major soil factors impacting yield components and wine aromatic profiles



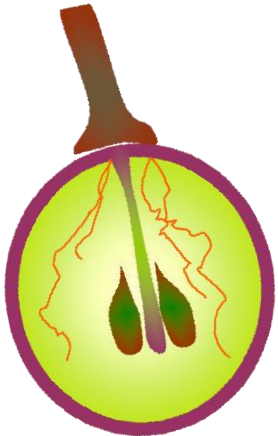
**The fruit of the vine
is the berry**



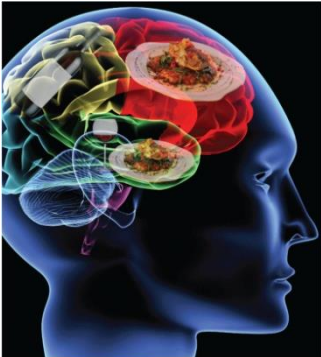
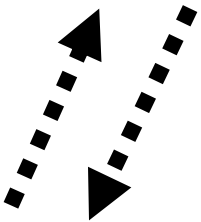
From vineyard to wine : A complicated path...



Variety
Site (climate x soil)
Cultural practices



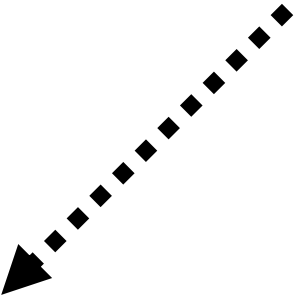
Berry growth
Berry composition
Berry ripening

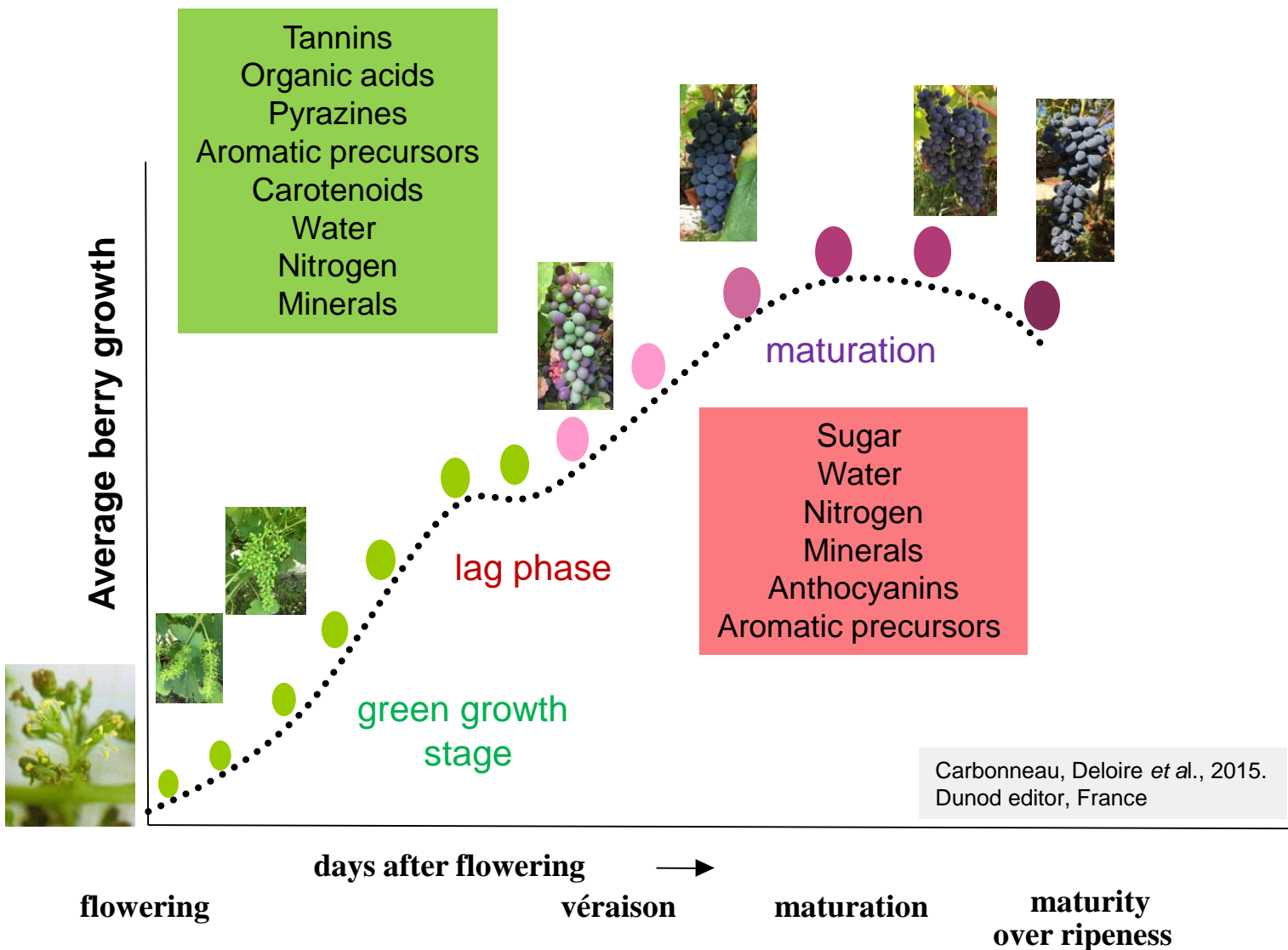


Wine tasting
Wine sensory analyses



Wine composition



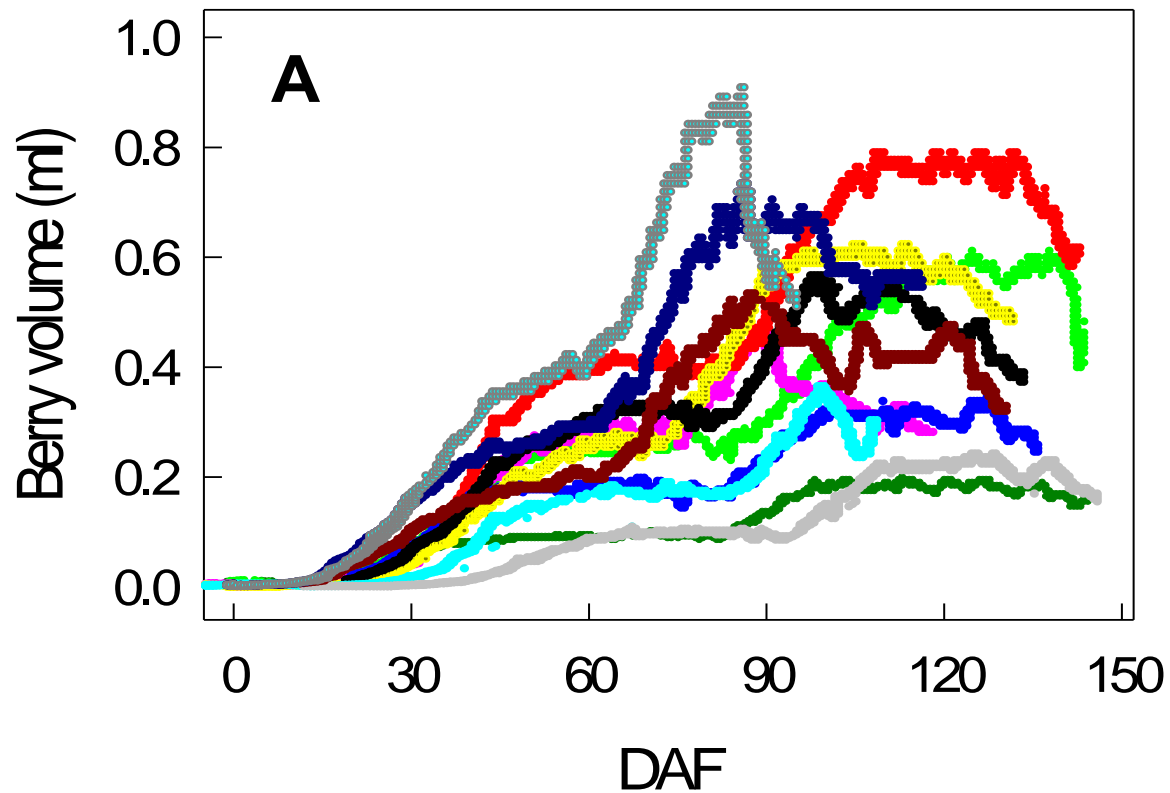


Carbonneau, Deloire *et al.*, 2015.
Dunod editor, France



Deloire A., 2024

What do grapevine berry asynchronous development and heterogeneity within clusters mean?



Recalculated from berry diameter in Fig. 1, Friend *et al.*, 2009.

Courtesy of Rezk Shahood & Charles Romieu, 2017



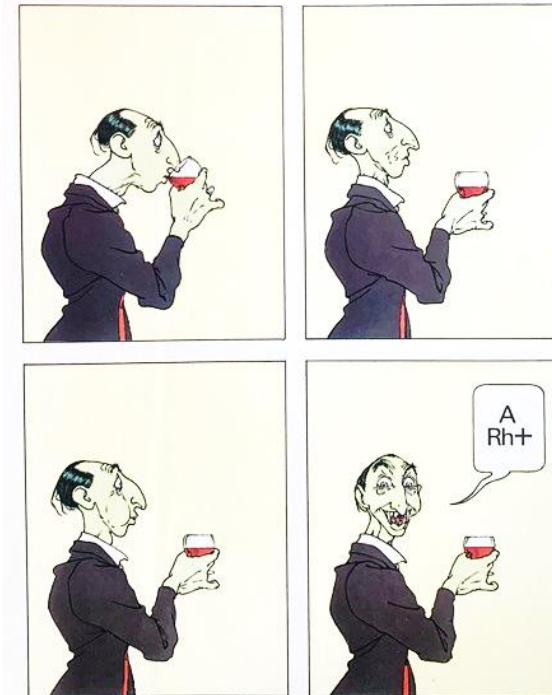
Deloire A., 2024

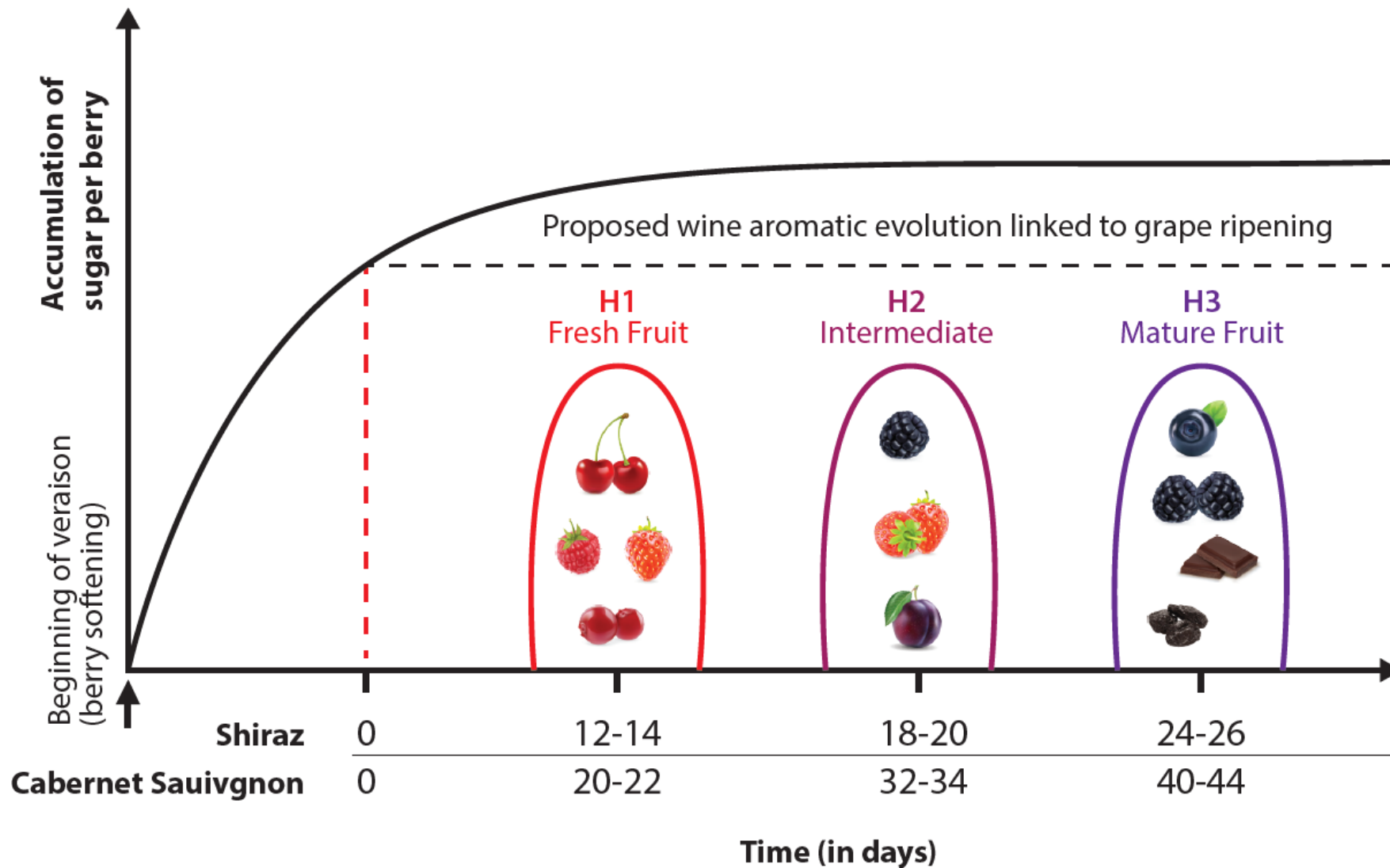


Let's talk about wine aromatic profiles (not wine typicality)

This addresses the key question of **harvest date** in relation to wine aromatic profiles, in order to meet market demand and consumer preferences.

Technological maturity (Brix and total acidity) is not always aligned with aromatic and phenolic maturity!





Day 0 = when sugar per berry reaches a plateau

The **aromatic sequence of berries** in Syrah and Cabernet Sauvignon and its impact on wine aromatic profiles: From fresh to mature fruit.

G. Antalick, K. Šuklje, J W. Blackman, L. M. Schmidtke & A Deloire, 2021. Sequential harvest and red wine sensory profile through use of grape berry sugar accumulation. Oeno-One (<https://oeno-one.eu/article/view/4527>).

Harvest date 1



pH: 3.09
TA: 10.86
20.7°B

Sauvignon blanc

pH: 3.13
TA: 9.54
22.9°B

- Same vineyard
- Same oenological process

Seven days separate each harvest date

Harvest date 2



pH: 3.16
TA: 9.17
22.8°B

It is possible to produce three different aromatic wine profiles from the same vineyard simply by implementing sequential harvesting

Harvest date 3



Word Cloud des profils aromatiques des vins clairs



Vin issu de la parcelle BV
Date de prélèvement : 28/08



Vin issu de la parcelle OL
Date de prélèvement : 28/08



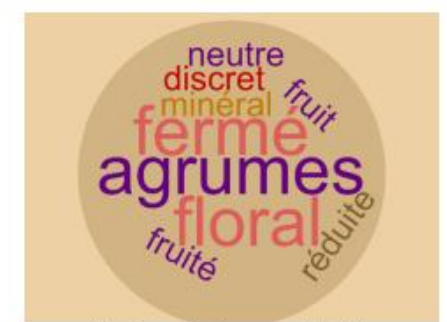
Vin issu de la parcelle BV
Date de prélèvement : 03/09



Vin issu de la parcelle OL
Date de prélèvement : 03/09



Vin issu de la parcelle BV
Date de prélèvement : 09/09



Vin issu de la parcelle OL
Date de prélèvement : 09/09

Champagne Wine Region

Examples of the evolution of the aromatic profiles of Chardonnay wine harvested using the sugar loading method.

Two vineyards were compared, and the harvests were done six days apart:

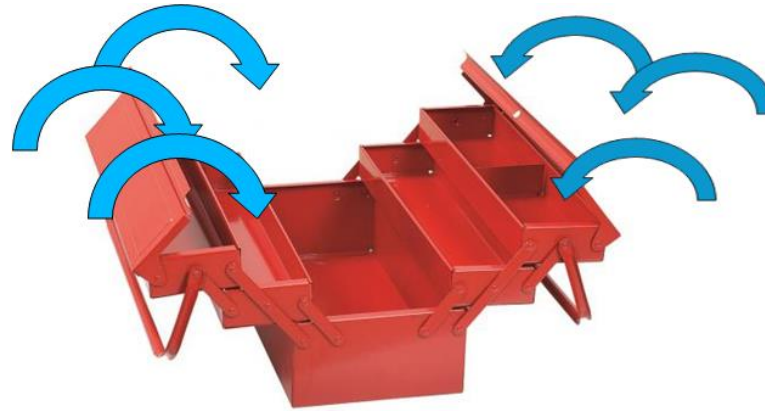
- 28/08/2019
- 03/09/2019
- 09/09/2019

Tara SMIT-SADKI, 2019. Mise en place de référentiels viticoles pour les cuvées Champagne premium et ultra-premium, Champagne Nicolas Feuillatte, mémoire de fin d'étude pour l'obtention du diplôme d'ingénieur viti-oeno, L'institut Agro, Montpellier

Levers of action to improve vineyard functioning?

Short and Medium Term

- Non-mutilating pruning
- Precision/Supplemental irrigation
- Regenerative hydrology (permaculture and keylines, etc.)
- Vineyard shading (nets, trees, photovoltaic panels)
- Yield and leaf area (ELA/Y)
- Foliar "fertilization"
- Cover cropping
- Soil fertilization (organic matter)



Short term

Medium term

Long term

Long Term

- Planting material: local grape varieties,
- new varieties adapted to climate change
- Rootstocks
- Planting density
- Row orientation
- Training systems (small versus large training systems)
- Soil health (organic matter, etc.)
- Expansion into new terroirs/sites



Thank you
for your attention

