Grapevine pruning dates
a physiological approach of delayed pruning using Syrah (*Vitis vinifera* L.) as example
Is it worth to do it?

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What are we going to talk about?

- Is it worth to delay grapevine pruning and why?
- When to prune to delay budbreak? For how long?
- What are the pros and cons of delayed pruning?

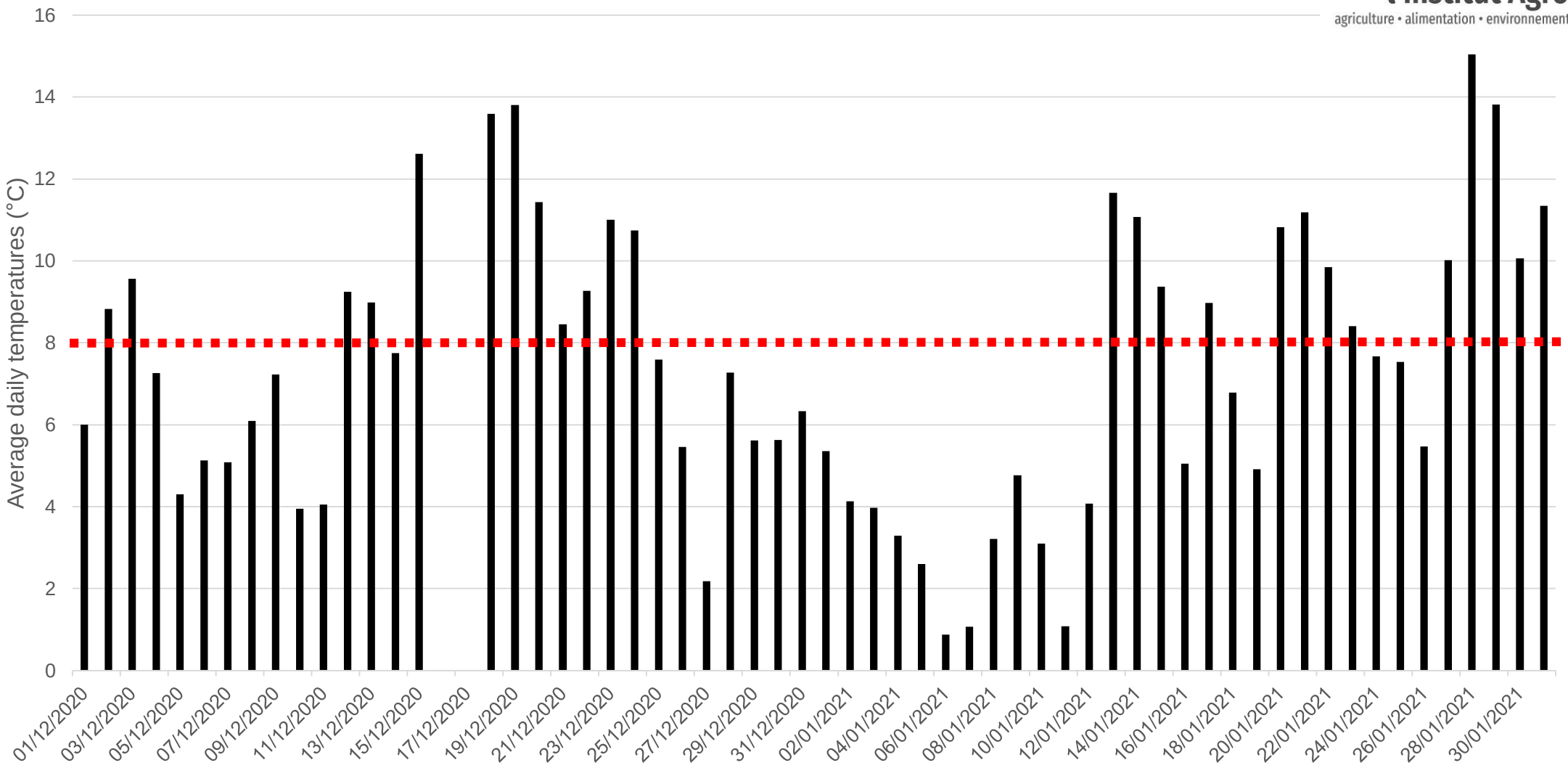
What basic knowledge is needed to reason properly delayed pruning ?

- A few words on grapevine **dormancy** to get a sens of what is going on before budbreak
- Why the understanding of the concept of **acrotony** is crucial for post budbreak delayed pruning?
- Grapevine primary shoot growth is under the control of temperature: so what is the **phyllochron** and how this concept could help while applying post budbreak pruning?
- Why **carbohydrate reserves** matter while applying post budbreak pruning?

What is grapevine dormancy?

- **Endodormancy (pre budbreak)**
- Endodormancy is the winter dormancy that is released by around 10 days with average daily temperatures ≤ +8°C

- **Ecodormancy (pre budbreak)**
  - Before grapevine tears : the average daily air temperatures ≥ +10°C (including soil temperature) to allow latent buds to develop after the release of endormancy.
  - During grapevine tears : the roots started to function and pump water to allow budbreak.



December 2020 – January 2021
SupAgro vineyard (Montpellier, France)

Deloire A. & Pellegrino A., 2021

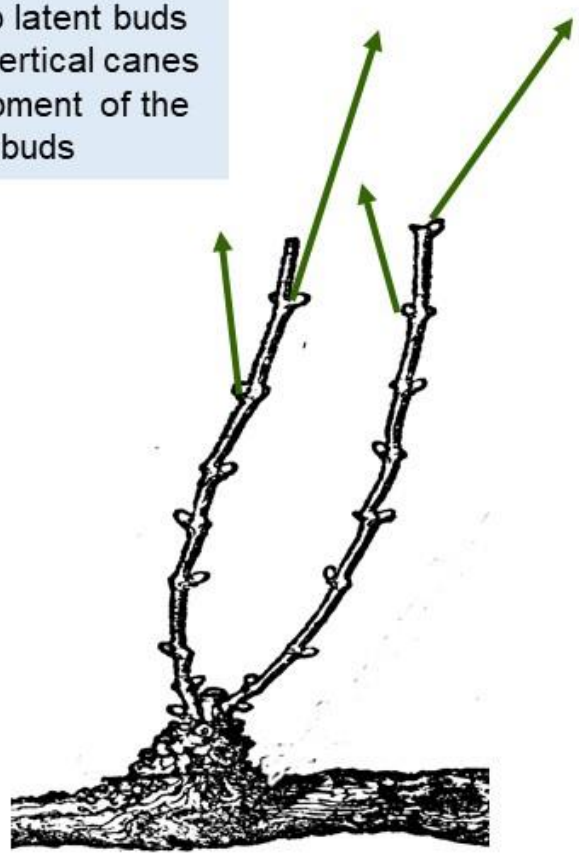
For grapevine endodormancy to be released, around 10 days of average temperatures ≤ +8°C. are needed. From 01/12/2020 to 31/01/2021, 35 days of temperatures ≤ +8°C were measured (L'institut Agro, Montpellier weather station)

Endodormancy of the already formed latent buds is happening soon in summer on lignified primary shoots (future canes), generally around mid August.
By pruning Syrah primary shoots on 08 July 2020, it was observed that the 3 to 4 bottom latent buds located in a lignified part of the primary shoots did not develop. It was concluded that these buds were aleady in **endodormancy.**

What is grapevine acrotony ?

The concept of « acrotony » on grapevine winter cane

At bud break, the top latent buds will develop first on vertical canes inhibiting the development of the bottom latent buds

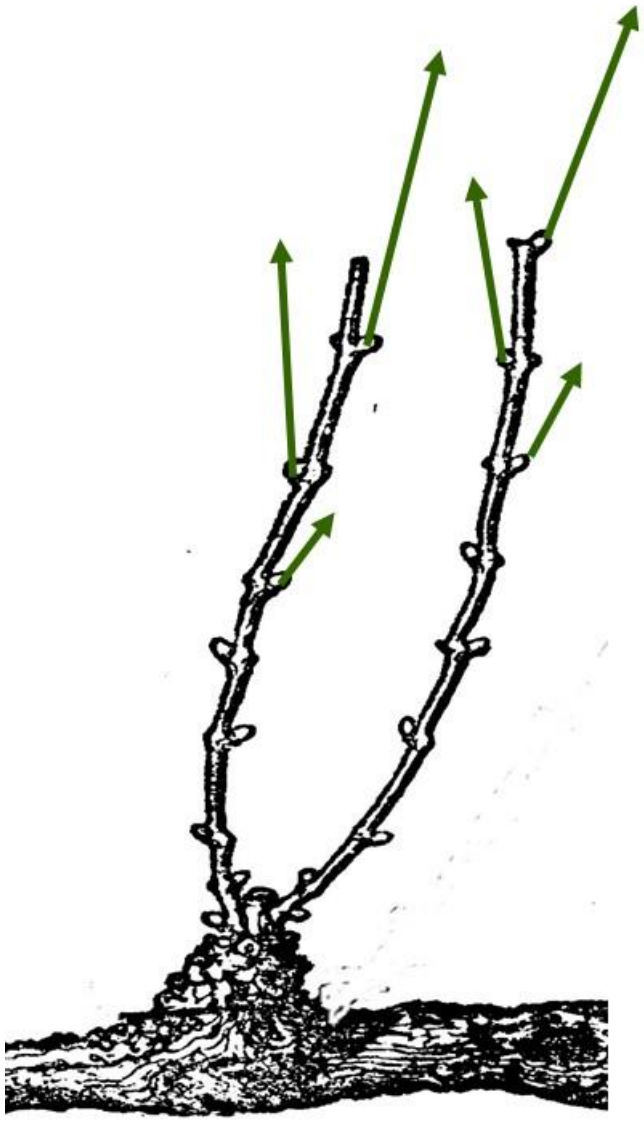


Deloire A., 2021

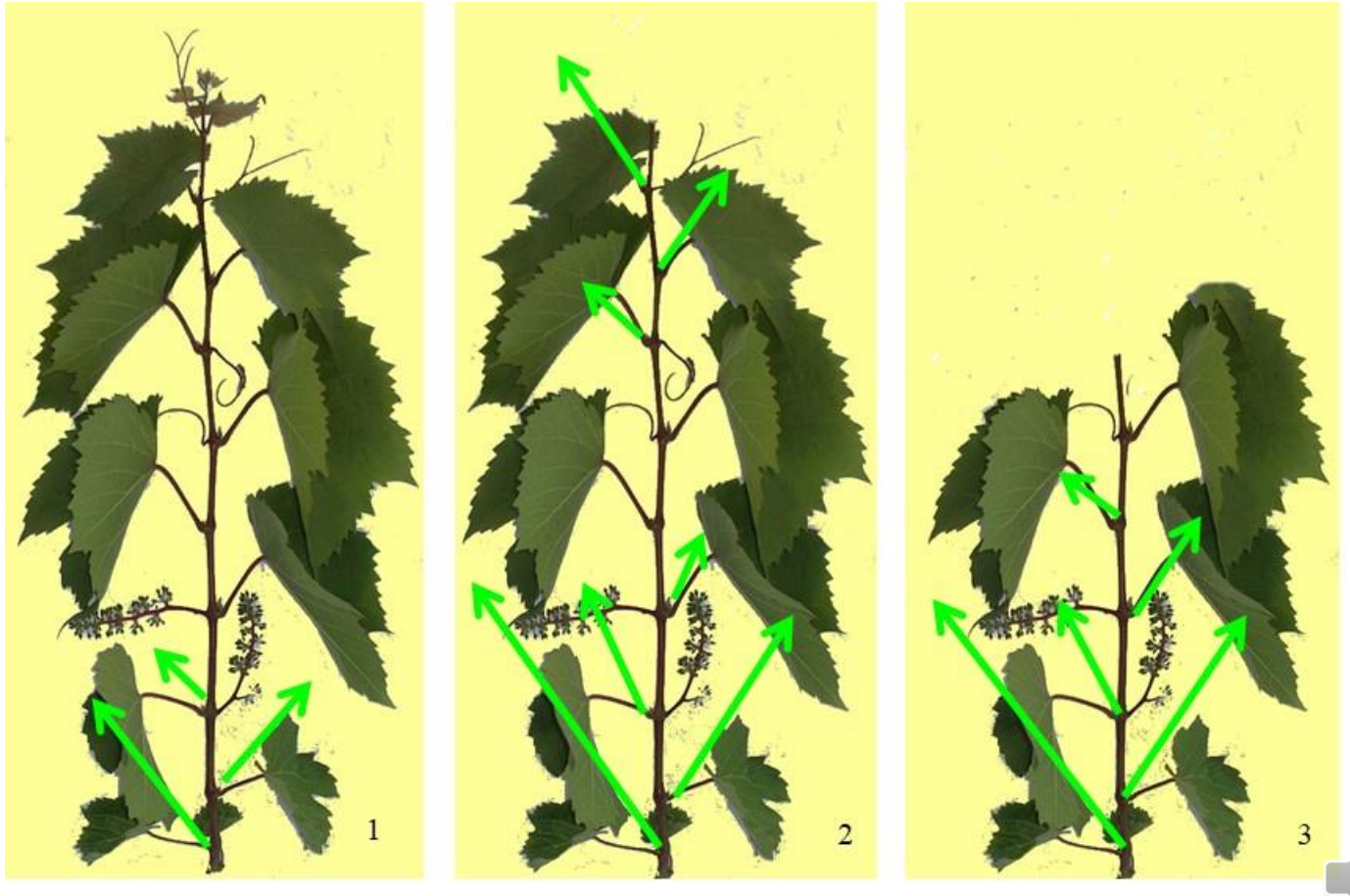
The concept of « acrotony » allows to implement post bud break delayed pruning

More in
Carbonneau A., Torregrosa L., Deloire A., Pellegrino A., Pantin F., Romieu C., Ojeda H., Jaillard B., Métay A., Abbal P., 2020. Traité de la Vigne, Physiologie-Terroir-Culture, Dunod Editeur, Paris, France, ISBN 978-2-10-079857-5, 689 p.

Acrotony
on a grapevine winter cane
the top latent buds develop first
at budbreak

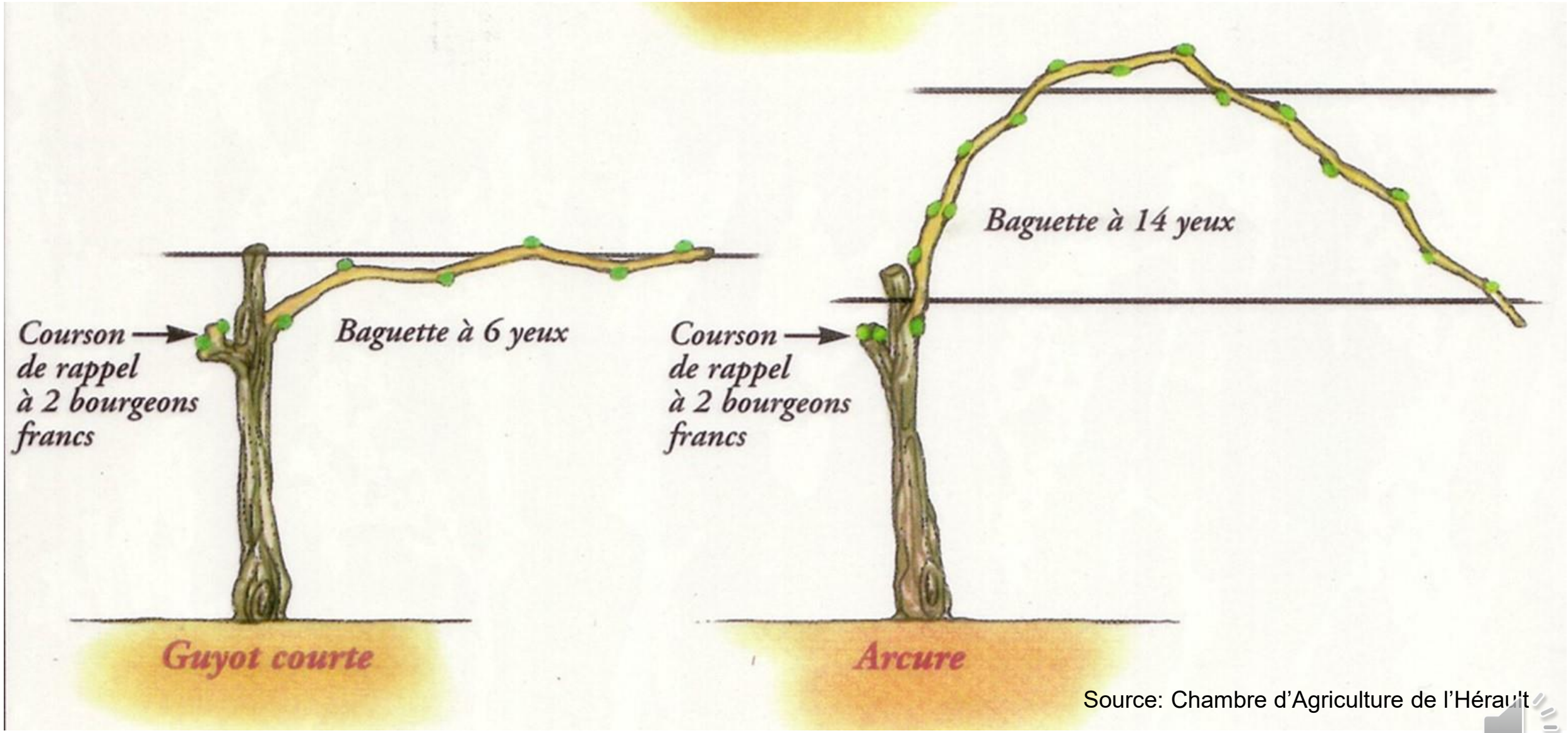


Apical dominance (paradormancy)
On a growing grapevine primary shoot
when the apex is removed by toping, it favorises the development of the top laterals (secondary shoots).
Apical dominance is decreasing for the basal latent buds as the primary shoot is growing.



Deloire A., 2020, adapted from Carbonneau *et al*., 2015, Dunod

Acrotony is released by putting canes horizontally or by bending them…



Source: Chambre d'Agriculture de l'Hérault

What is behind the concept of phyllochrone ?

Did you know that the grapevine primary shoot growth is mainly dependent upon the air temperature (T) ?

The **phyllochron** is the Thermal Time (TT) between two successive unfolded leaves.

~+21 °Cd are needed for a new leaf to be unfolded on the PS.
This is calculated from the sum of daily average temperature minus +10°C, because +10°C corresponds to the base T (i.e. the minimum required temperature for a vine to grow).

For example: 2 consecutive days with an average temperature of +20.5°C per day are enough to see a new unfolded leaf.
Vine nutritional imbalance (minerals, nitrogen, carbohydrates) and vine water deficit increase the phyllochron.

Shoot morphology : A phytomer

Inflorescence or tendril

Node

Internode

Lateral or secondary shoot in growth

The node bulge

Nascent latent bud

CARBONNEAU A., TORREGROSA L., DELOIRE A., PELLEGRINO A., PANTIN F., ROMIEU C., OJEDA H., JAILLARD B., MÉTAY A., ABBAL P., 2020. Traité de la Vigne, Physiologie-Terroir-Culture, Dunod Editeur, Paris, France, ISBN 978-2-10-079857-5, 689 p.

What about grapevine carbohydrate reserves ?

Carbohydrate reserves are refilled year “N-1” to ensure, during year “N”, the vegetative and reproduction development of the primary shoots.

Trunks, roots and canes sugar content is increasing from the plateau of berry sugar accumulation to post harvest, this is why to keep the leaves functioning during ripening and if possible post harvest is important.

Carbohydrate reserves are needed from budbreak to flowering (year “N”).

At flowering a primary shoot bears around 17 leaves.


So when to prune a vine
to delay budbreak?
And why?

Organisation du bourgeon latent de vigne

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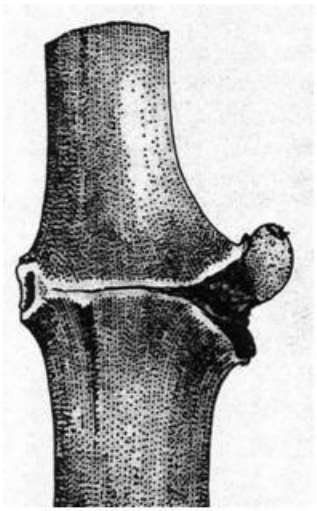
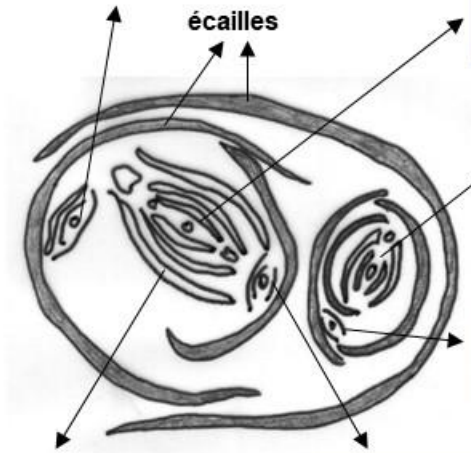
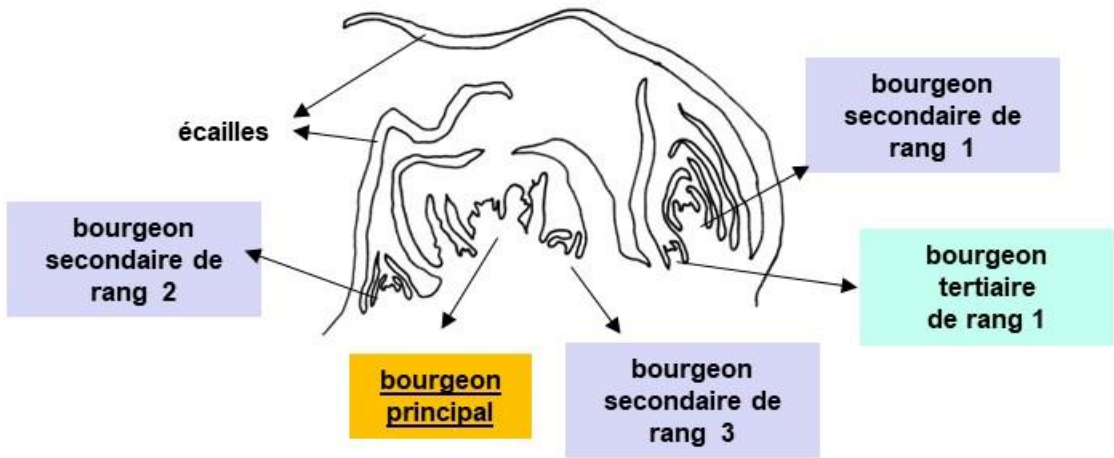
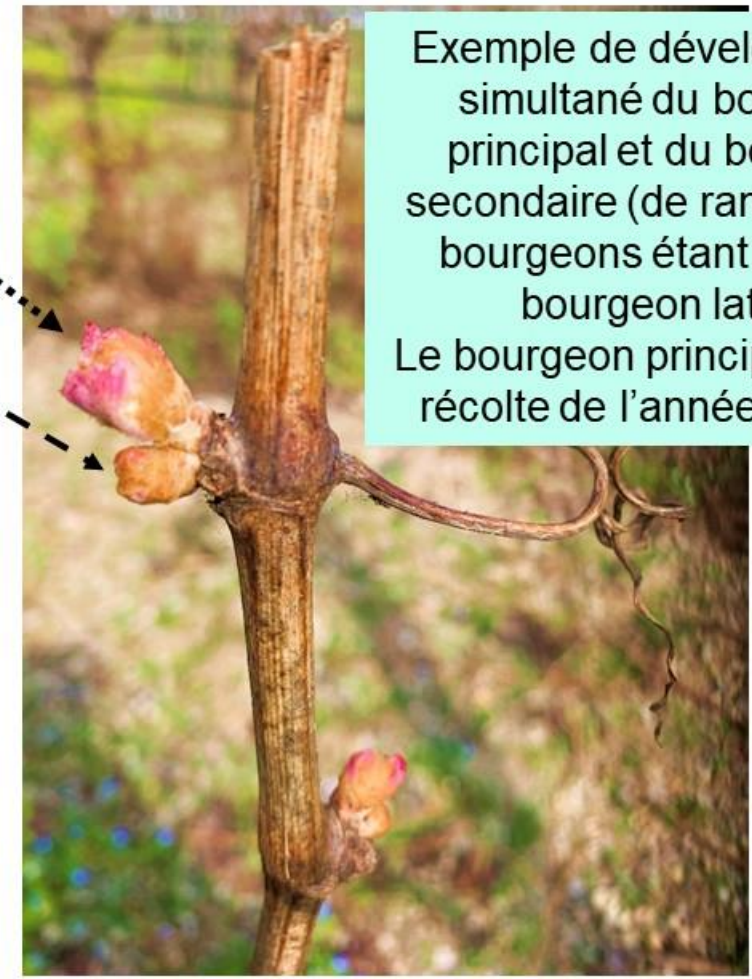








Exemple de développement simultané du bourgeon principal et du bourgeon secondaire (de rang 1), les 2 bourgeons étant issus du bourgeon latent.
Le bourgeon principal porte la récolte de l'année en cours

Adapté par A. Deloire,
de Carbonneau A. *et al.*, 2020. Traité de la Vigne, Physiologie. Terroir-Culture, Dunod Editeur, Paris, France, ISBN 978-2-10-079857-5, 689 p.

From grapevine winter buds to leaf tips visible, the start of a new crop…

E-L 1-2 (winter buds and tear drops)

E-L 3 (woolly buds)

E-L 4 (budburst-green tips)

E-L 5 (leaf tips visible)

Pre budbreak

Post budbreak

Deloire A. & Pellegrino A., 2021

Budbreak period will depend upon the cultivar….

Syrah

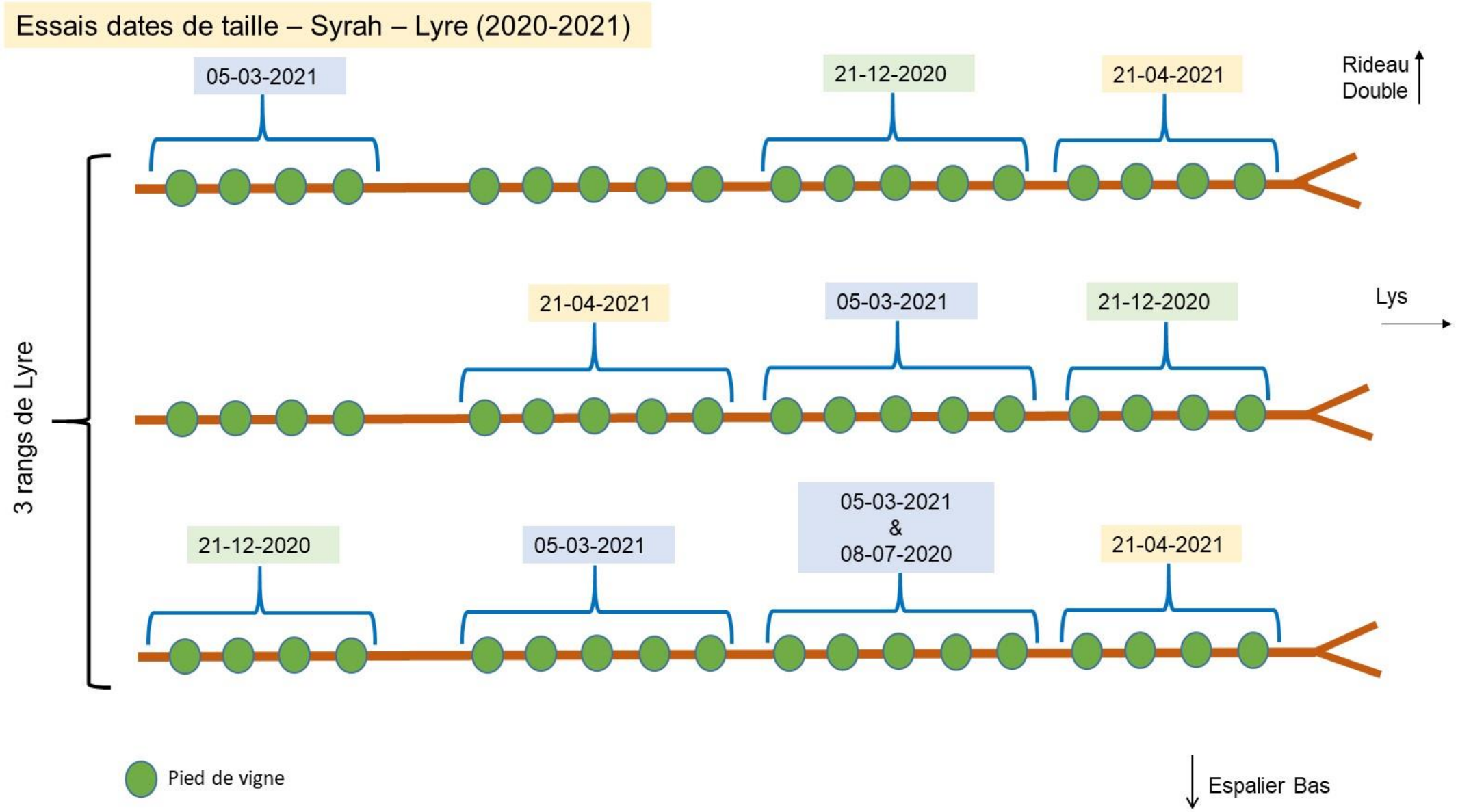
Chasselas

Chardonnay

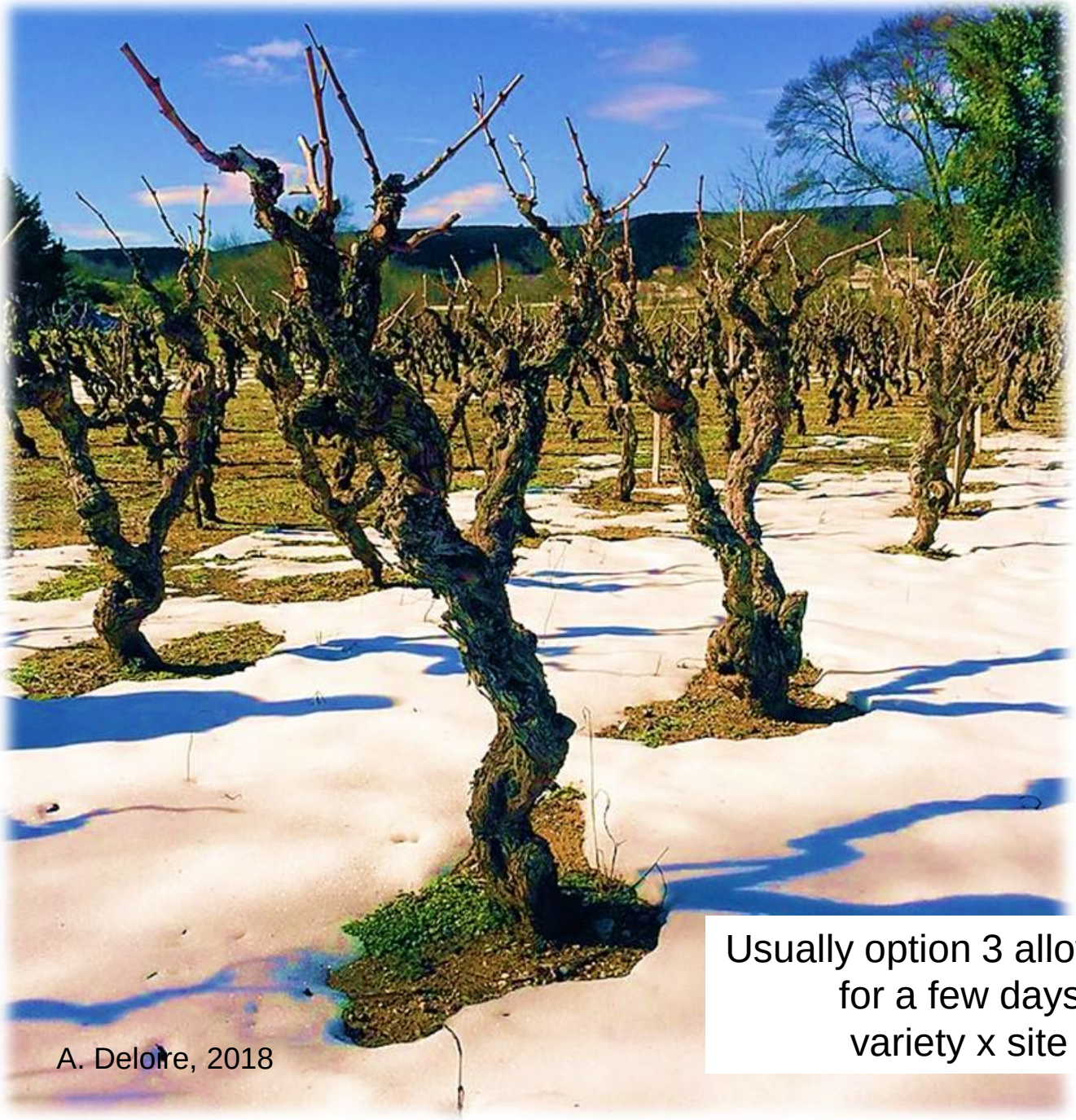
Madeleine Angevine Oberlin

The photos show the latent bud development stages of a few grapevine cultivars in comparison with the Chasselas as a reference (L'Institut Agro, Montpellier vineyard, 05 March 2021).

The lay out of our experimentation on delayed pruning (Syrah, training system Lyre, 2020-2021)



PRE BUDBREAK



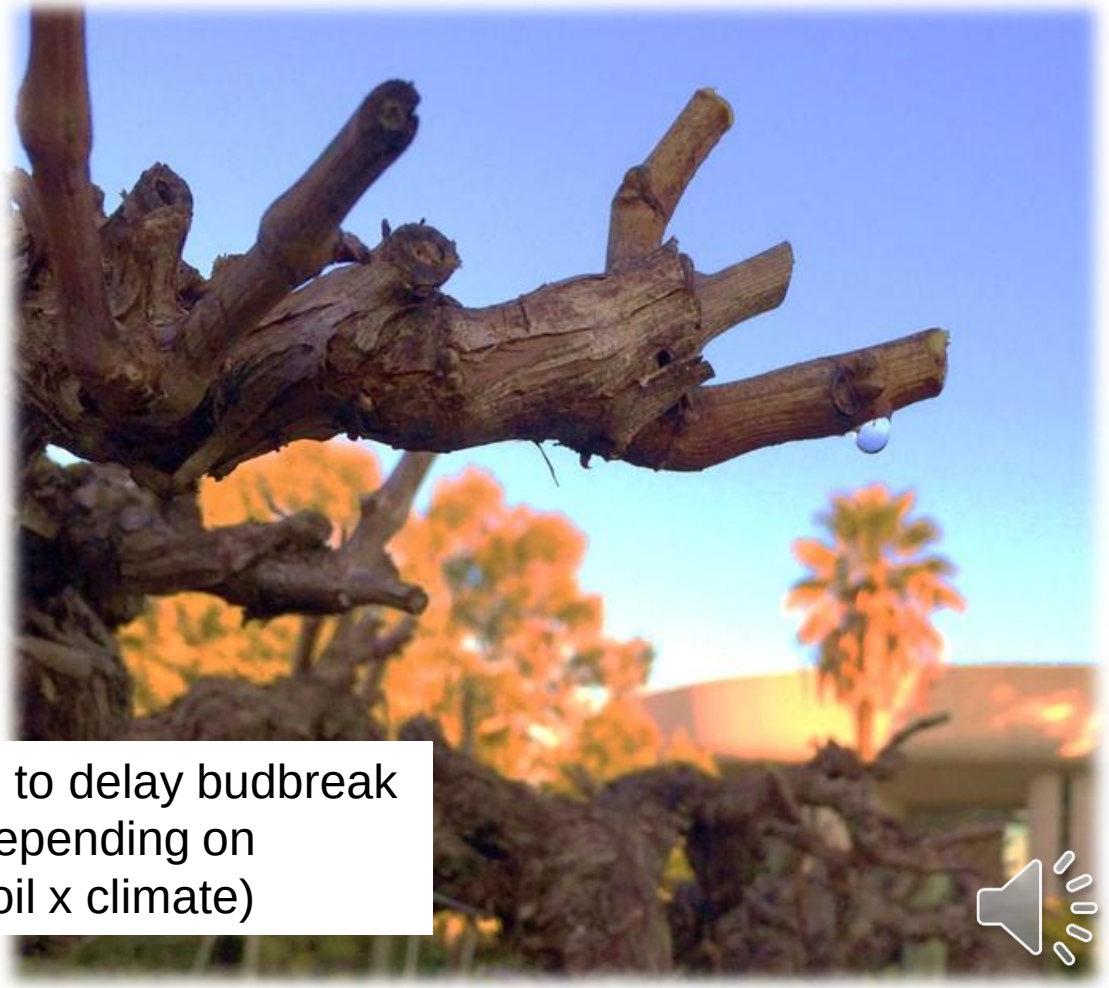
A. Deloire, 2018

Pre Budbreak: three options

1- During endodormancy

2 - During ecodormancy before tears

3 - During grapevine tears

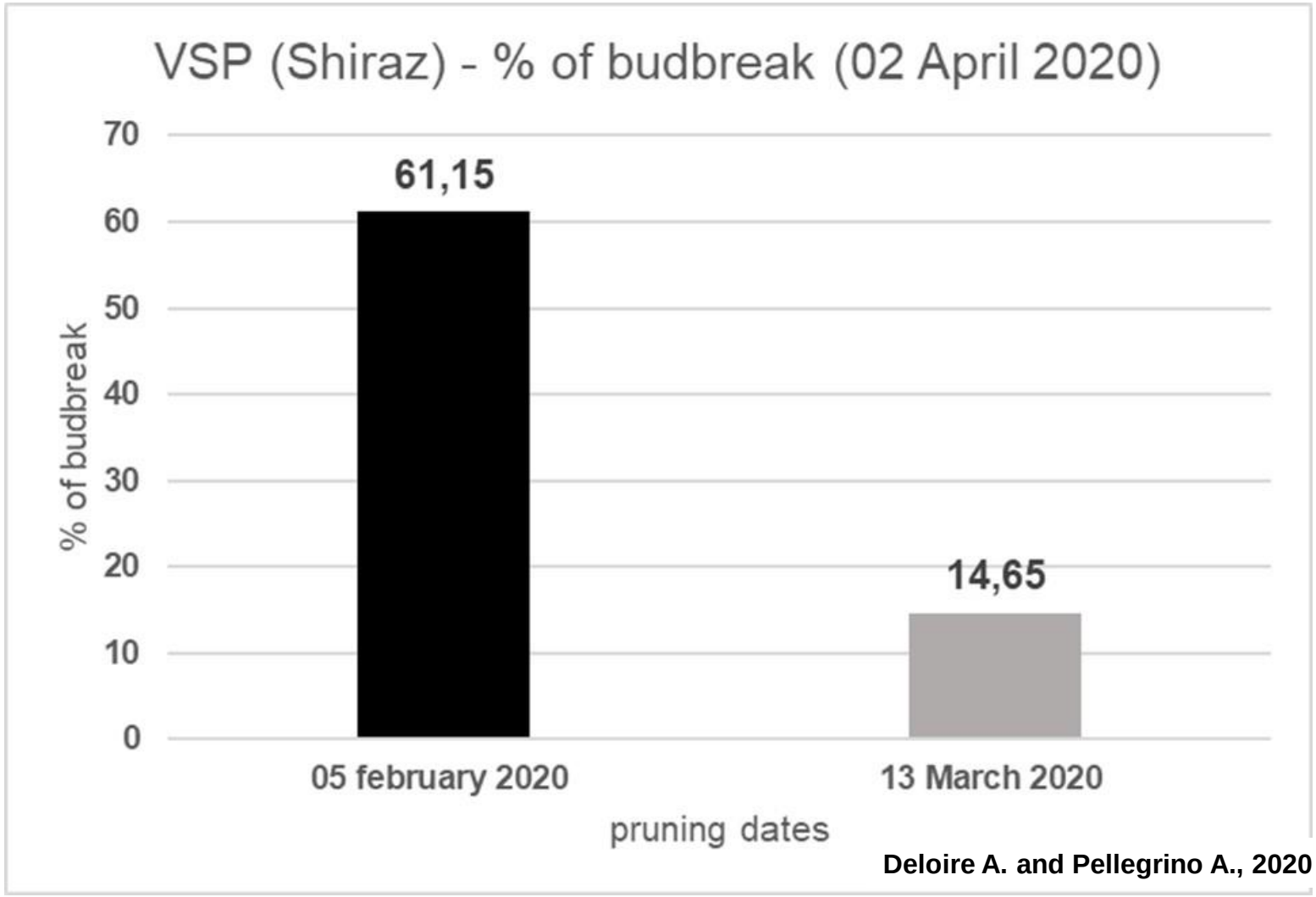


Usually option 3 allows to delay budbreak for a few days depending on variety x site (soil x climate)

Developmental stage on 02/04/2020
Pruned on 05/02/2020

Developmental stage on 02/04/2020
Pruned on 13/03/2020

Delayed winter pruning (pre budbreak)…

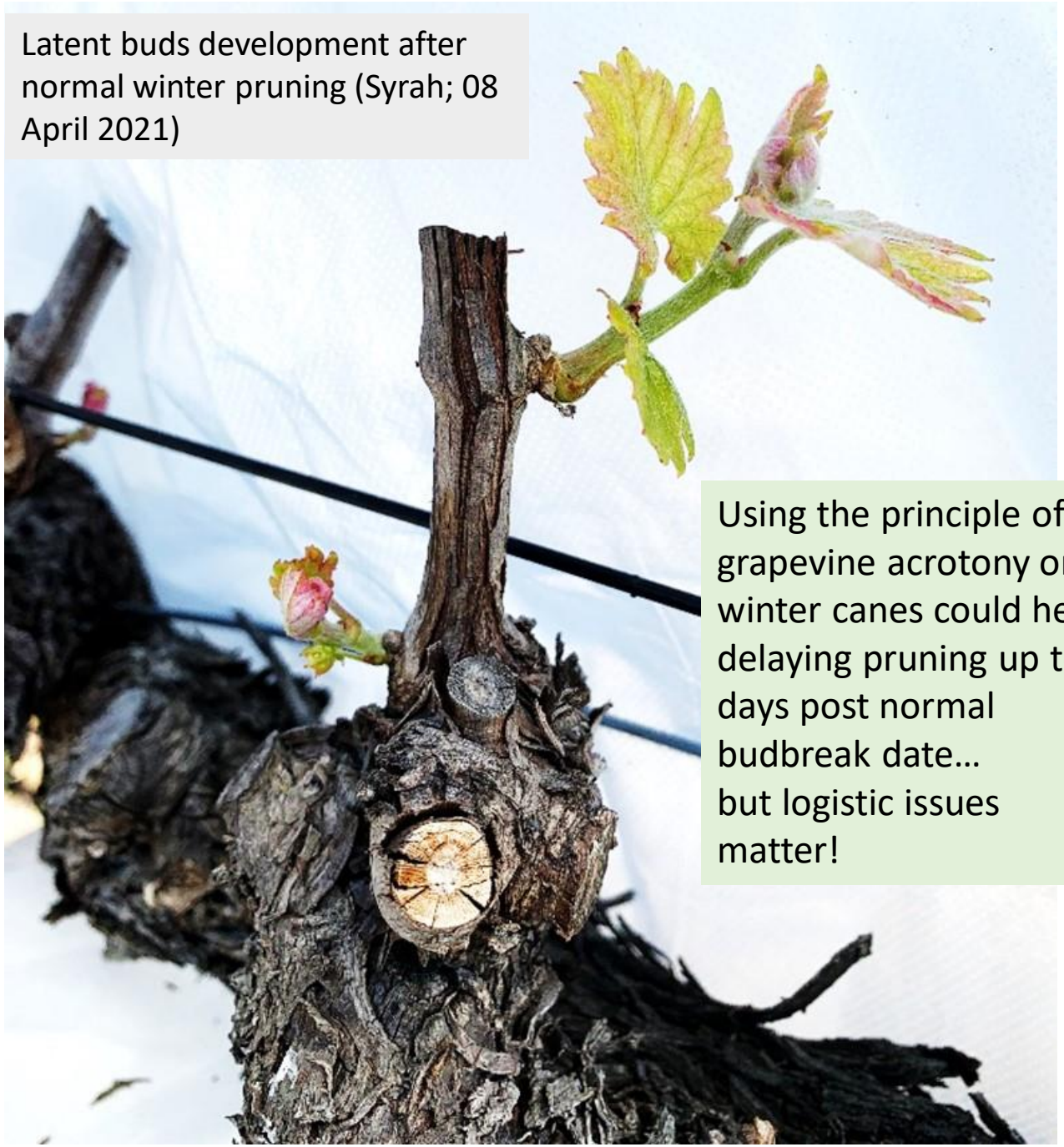


Deloire A. and Pellegrino A., 2020

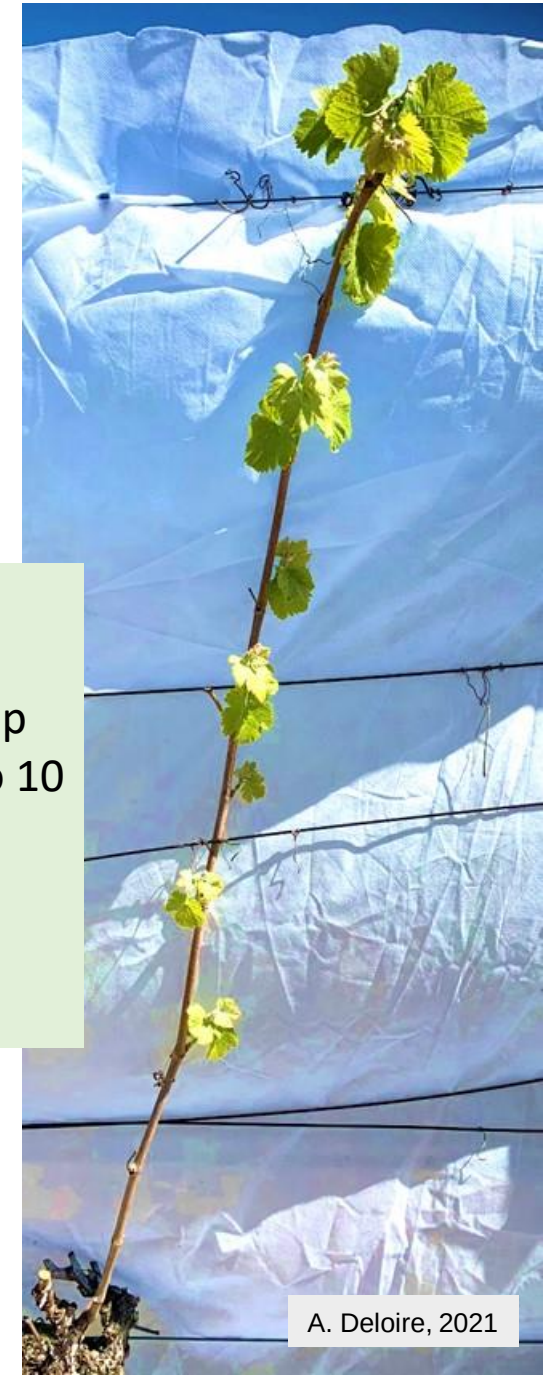
First pruning date (05/02/2020): Endodormancy is released
Second pruning date (13/03/2020): Roots started to function, vines are bleeding (no budbreak at the pruning date)

POST BUDBREAK

Latent buds development after normal winter pruning (Syrah; 08 April 2021)



Using the principle of grapevine acrotony on winter canes could help delaying pruning up to 10 days post normal budbreak date…
but logistic issues matter!



On the none pruned winter cane, the eight top latend buds developped up to 2-4 young leaves
(Syrah; 08 April 2021)

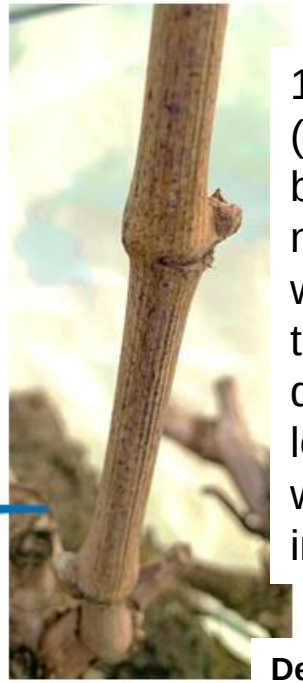
On the none pruned winter cane, the four bottom latend buds did not develop on the 08 April 2021 allowing to delay pruning and budbreak

Experimentation on delayed pruning
(Syrah; l'Institut Agro experimental vineyard)

(a) On the pruning date of 21 April 2021, it is observed that the canes' top latent buds developped into primary shoots bearing from 4 to 7 leaves (visible Inflorescences).

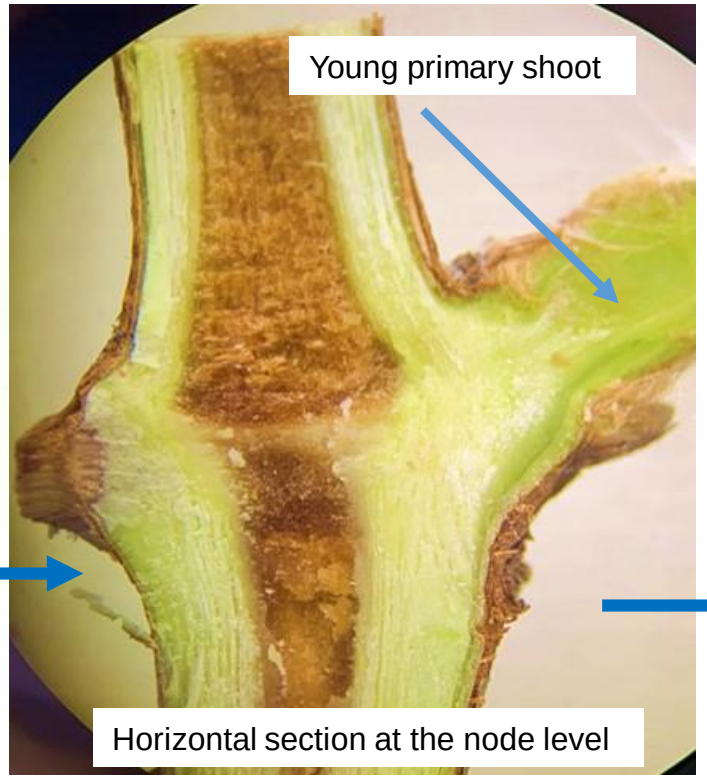
(b) After pruning on the 21st April, it is observed that most of the bottom latent buds were not develop on the pruning date which occurs almost 15 days after the normal budbreak period (DD50, = 50% of budbreak).

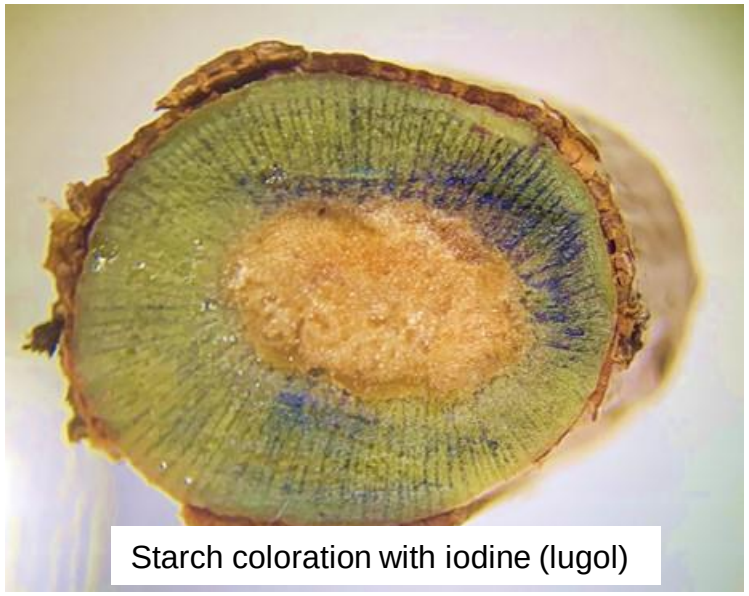
Deloire A. & Pellegrino A., 2021



15 days post bud break (DD50), most of the bottom latent buds are not developped on the winter canes while the top latent buds have developped onto 4-7 leaves' primary shoots with visible inflorescences

Deloire A. & Pellegrino A., 2021





While pruning 15 days after the normal budbreak period while most of the top latent buds developped onto primary shoots bearing 4-7 leaves (principle of acrotony), it is intersting to observe some starch in the winter canes, that will allow the bottom latent buds to develop after late pruning.

Deloire A. & Pellegrino A., 2021

What about post budbreak pruning and the delay of the phenological stages?

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And what about delayed pruning and cluster development?

Deloire A., 08 July 2020

Delayed pruning experimentation on Shiraz (training system VSP; pruning system: single cordon; SupAgro Vineyard).

Bud Break (BB) was around 01/04/20.

Visual observations of 08/07/20

Photo 1: cluster of vine pruned 05/02 (Pre-BB)
Photo 2: cluster of vine pruned 13/03 (Pre-BB)
Photo 3: cluster of vine pruned 09/04 (Post-BB)
Photo 4: cluster vine pruned 07/05 (Post-BB)

1-Average berry fresh mass: 1,04g

2-Average berry fresh mass: 1,12g

3-Average berry fresh mass: 0,82g

4-Average berry fresh mass: 0,057g

Pre budbreak

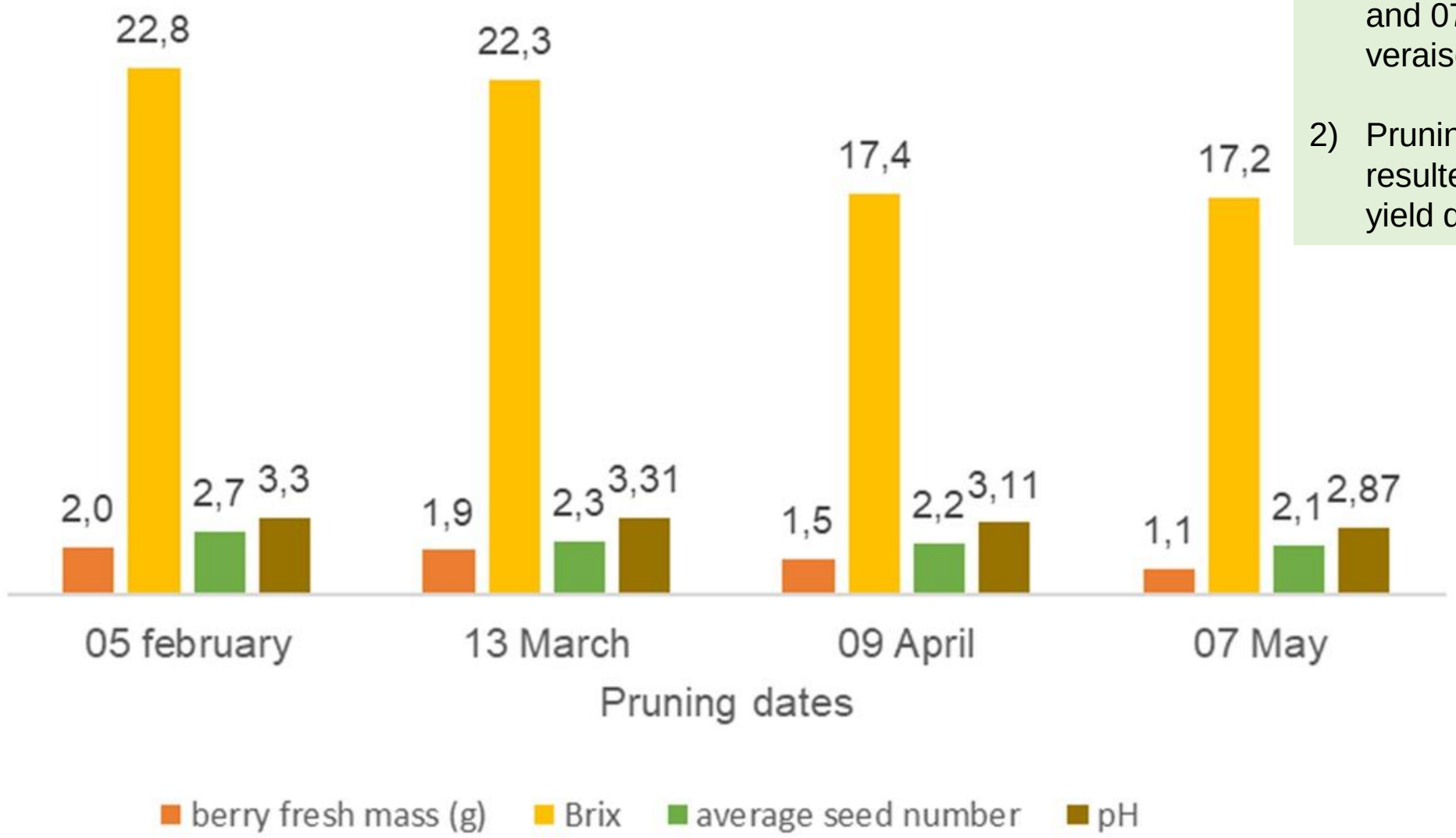
Post budbreak

Deloire & Pellegrino, 2020

Post budbreak pruning : when is it too late to prune regarding the carbohydrate reserve depletion **avoiding yield loss** ?

- The answer will depend on the following parameters to be considered :
  - Sites (climate and soil)
  - Soil water content from budbreak onwards
  - Varieties
  - Phyllochrone (daily average temperatures from budbreak onwards)
  - Carbohydrate reserves from the previous year
  - Speed of carbohydrates depletion in relation with the young primary shoot growth on none pruned winter cane

When to prune post budbreak? It is suggested to assess the average number of developped phytomers on vine primary shoots for none pruned winter canes and to link this information to carbohydrate reserve content and/or simply to calibrate the date versus « variety x site ».



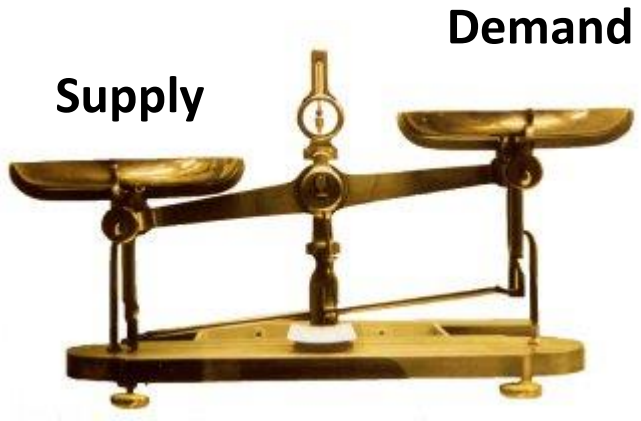
50% of bud break was observed around 01 April.

1) Pruning dates of 09 April and 07 May delayed veraison and ripening

2) Pruning date of 07 May resulted in a 50% of yield decrease

Deloire A. and Pellegrino A., 2020

How the carbon balance may be impacted by delayed pruning?



Aerial part carbon supply

Carbon allocation from **reserves** + Carbon acquisition from daily **net photosynthesis**

Storage level & rate of allocation

Maturity of the photosynthetic system

Aerial part carbon demand

Carbon use during **night respiration** + Carbon fixed in **biomass**

Respiration for growth and maintenance

Phyllochron & Growth

To follow berry sugar accumulation to assess if post budbreak pruning delayed ripening is a good idea

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OENO One
VINE AND WINE OPEN ACCESS JOURNAL

Performing sequential harvests based on berry sugar accumulation (mg/berry) to obtain specific wine sensory profiles

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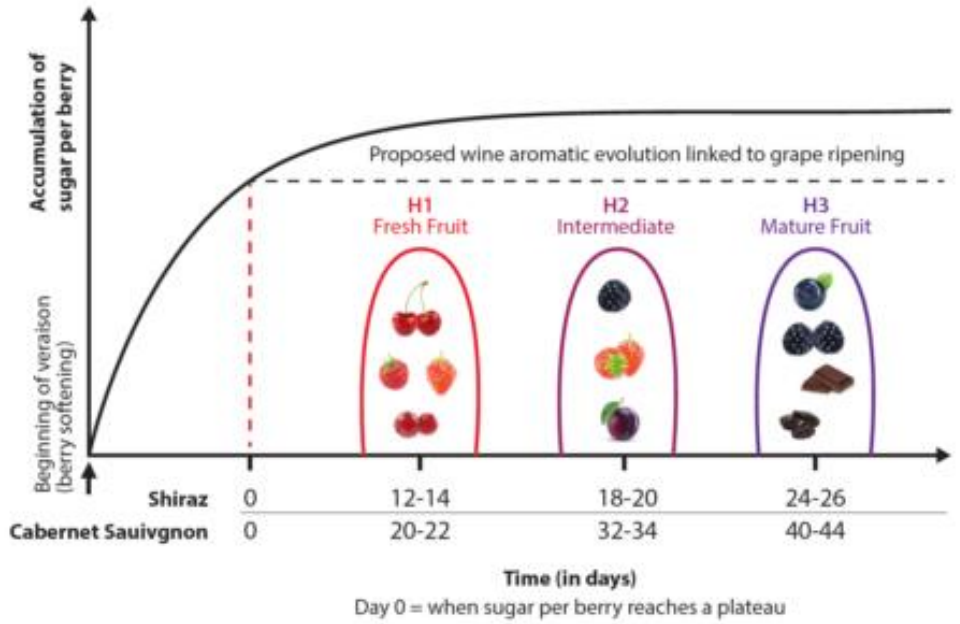

G. Antalick, K. Šuklje, J.W. Blackman, L. M. Schmidtke & A Deloire, 2021. Sequential harvest and red wine sensory profile through use of grape berry sugar accumulation. Oeno-One (in press).

Some drawbacks applying post budbreak pruning ?

- Loss of yield depending on carbohydrate reserve depletion linked to the choice of post budbreak pruning dates
- Loss of vine vigour
- Logistic issues to organise post budbreak pruning by hand (so what about mechanical pruning when possible?)
- Labour issues depending on the vineyard area
- cost associated with hand pruning

Some references…

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Thank you for your attention

www.supagro.fr

Alain’s professional website

www.grapevine-paradise.com

China, 2018