

Working document on grapevine yield components

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Some basic information regarding grapevine yield components

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Yielding in grapevines is a challenging process that begins with the differentiation of inflorescence primordia during latent bud formation in year N (figure 1) and ends with the harvest in year N+1.

Anything can happen between budbreak and harvest (as shown in Figure 1), and the harvest can be lost or reduced due to various factors such as climatic events (frost, hail), pests and diseases, water and heat stress, mineral and nitrogen deficiency, or inappropriate cultural practices. The potential yield is determined at pruning by the number of latent buds left per vine or per square meter.

However, from budbreak to harvest, the establishment of yield components is not an easy journey (figure 2).

During the development of the primary shoot primordium (pre-differentiated year N-1) and the differentiation/development of the associated primordia of inflorescences (generally two per bud) in year N, different phases take place.

These include :

- the growth of inflorescences and flower differentiation on the inflorescences, from bud break to flowering, that will determine the length of the inflorescence and the number of flowers per inflorescence
- flower fecundation : normal berry growth requires one viable seed per berry from successful flower fertilization
- ovary cell multiplication from flower fecundation to berry set which determines the number of cells per berry.
- during the berry green growth stage, which occurs from berry set to the beginning of véraison (i.e. berry softening), the berry volume increases due to berry cell enlargement
- from the onset of véraison to harvest, which is the berry maturation stage, the volume of each single berry will double from the onset of berry sugar loading to the plateau of berry sugar accumulation. The fruit is loading sugars and water during this period,
- and from the plateau of berry sugar accumulation onwards, the volume of the berry could decrease due to berry water evaporation and up to harvest (as the connection between the berries and the vine is interrupted).

In general, the potential yield decided by pruning can only decrease, and the critical period is from budbreak to fruit set.

Factors such as vine physiology, carbohydrate reserves, light, temperature, mineral and nitrogen nutrition, and vine health can influence inflorescence development, flower differentiation, fertilization, and the start of berry development (fruit set), including the multiplication of ovary cells.

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Once the number of clusters per vine and the number of berries per cluster are set, the yield will mainly depend on berry enlargement and therefore their volume. Vine water status is important from fruit set to véraison and from veraison to harvest, as well as the microclimate around the clusters (air humidity).

It should also be noted that after the plateau of sugar loading in the berries, the fruit loses water by evaporation, and that is when yields start to decrease again. Concentration effects, such as sugars increasing alcohol content in wines, should also be considered.

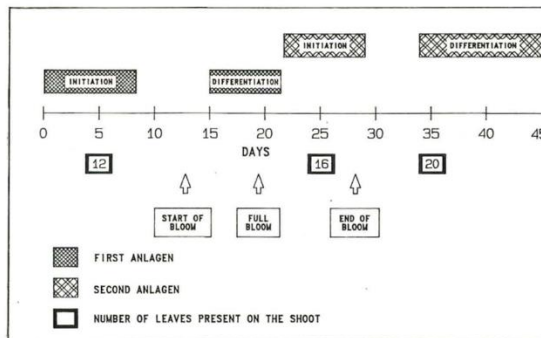
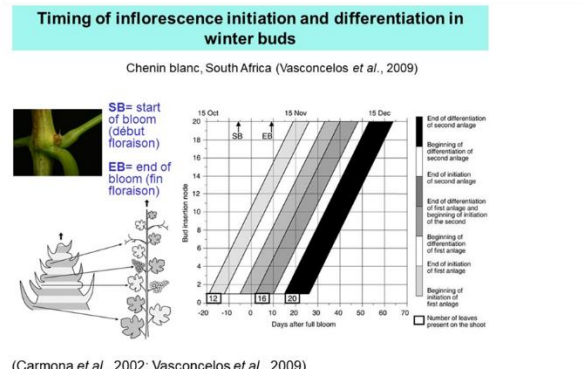


Fig. 14: A diagrammatic representation of inflorescence formation in *Vitis vinifera* L. cv. Chenin blanc.
Diagramm der Infloreszenzentwicklung von *Vitis vinifera* L. cv. Chenin blanc.



(Carmona et al., 2002; Vasconcelos et al., 2009)

Figure 1 : Timing of inflorescences initiation and differentiation during the formation of the future winter buds (year N)

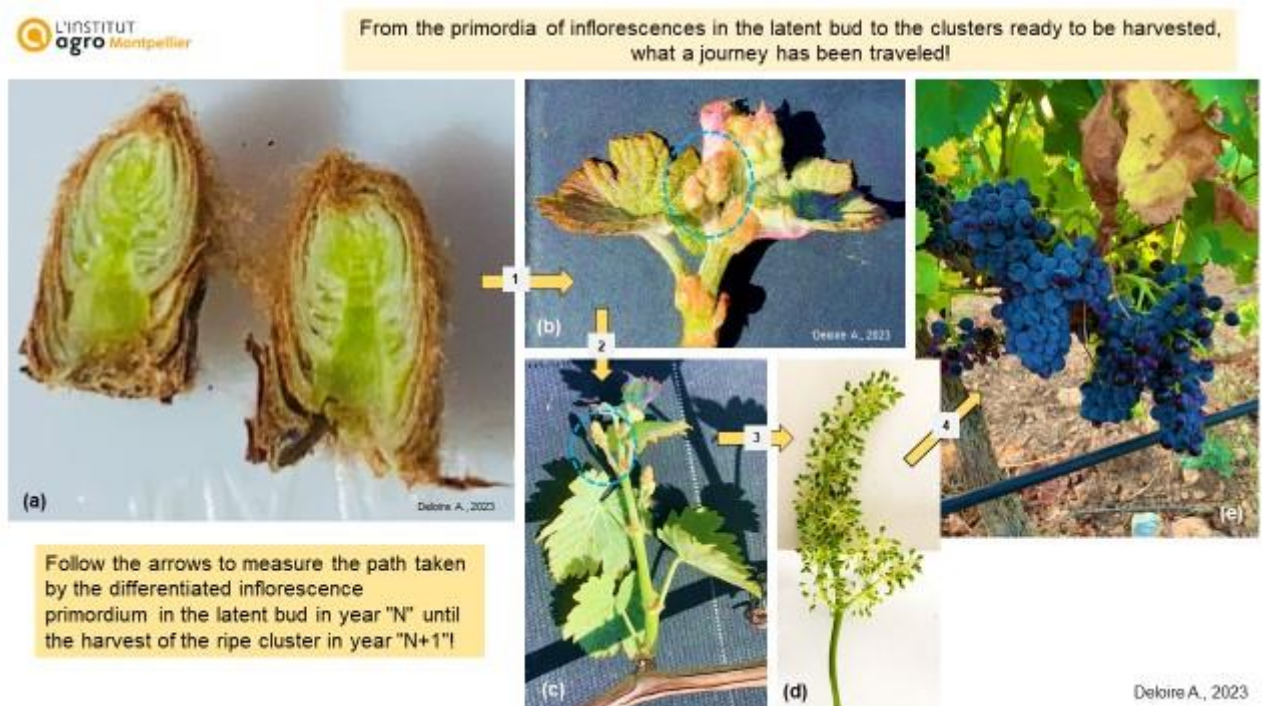


Figure 2 : Establishing yield in grapevines is a long journey from the bud's dormant state to harvest

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Literature

Alleweldt, G. & Hofacker, W., 1975. Influence of environmental factors on bud burst, inflorescences, fertility, and shoot growth of vines. *Vitis*, 14(2), 103-115.

Carbonneau, A., Torregrosa, L., Deloire, A., Pellegrino, A., Métaï, A., Ojeda, H., Lebon, E. & Abbal, P., 2019. *Traité de la vigne 3^e éd: Physiologie, terroir, culture*. Dunod, Paris, France, EAN13 : 9782100726691. 712 p.

Cheema S.S., Torregrosa L., Domergue P. and Carbonneau A., 1996. A comparative study of the differentiation of inflorescence and flower of *Vitis vinifera* L. CV Syrah *in situ* and under greenhouse conditions, *Le progrès Agricole et Viticole*, 113, N°12.

Guilpart N., Métaï A., Gary C., 2014. Grapevine bud fertility and number of berries per bunch are determined by water and nitrogen stress around flowering in the previous year, *Europ. J. Agronomy*, 54, 9-20.

Levin A.D., Deloire A. and Gambetta G.A., 2020. Does water deficit negatively impact wine grape yield over the long term? *IVES Technical Reviews*, <https://doi.org/10.20870/IVES-TR.2019.4029>

Li-Mallet A., Rabot A. Geny L., 2016. Factors controlling inflorescence primordia formation of grapevine: their role in latent bud fruitfulness? A review. *Botany* 94: 147–163 (2016) [dx.doi.org/10.1139/cjb-2015-0108](https://doi.org/10.1139/cjb-2015-0108)

Pellegrino A., Blackmore D., Clingeleffer P. and Walker R.R., 2022. Comparison of methods for determining budburst date in grapevine, *Oeno-One*, DOI:10.20870/oeno-one.2022.56.1.4751.

Swanepoel J.J. and Archer E., 1988. The ontogeny and development of *Vitis vinifera* L. Chenin blanc inflorescence in relation to phenological stages, *Vitis* 27, 133-141.

Vasconcelos M.C., Greven M., Winfield C.S., Trought M.C.T., Raw V., 2009. The Flowering Process of *Vitis vinifera*: A Review, *Am. J. Enol. Vitic.* 60:4.