

The grapevine different types of meristems and buds

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For **grapevine pruning** and canopy manipulation it is crucial to know and to understand vine functioning and morphology.

Did you know that in the grapevine, 8 types of buds or stem meristems can be identified, with 6 being present on an adult plant.

According to environmental conditions and production targets, the practices can balance the development of the different categories of meristems to optimize the shape and functioning of the shoot system.

Let's present the **6** types of **mersitemsbuds** present on an **adult vine** (figures 1, 2 & 3).

- 1) **The shoot apical meristem (R0)** - *This is the tip of the main growing stem. It develops all the organs of the stem including axillary meristems, and the tissues of the primary anatomy (Fournioux, 1995). This meristem develops lateral organ organized according to an alternate distichous plan. Also called Terminal bud, this structure died once the primary growth stops (grapevine shoots are growing according to the sympodial model).*
- 2) **The lateral shoots (R1)** - *There are the first lateral meristems formed by R0 of each node of any growing stem, axillary to the leaves (Bugnon, 1953; Bugnon and Bessis, 1968; Deloire et al., 2020). Except in the case of excessive vigor or/and early shoot tipping (trimming), this axis develops only a few centimeters without lignification. At the end of the ongoing vegetative cycle, it undergoes an abscission that leaves a scar on the R0 main stem. The phyllotaxis of R1 is also alternate distichous but with a plan orthogonal to R0.*

3 & 4) **The winter buds (R2 + R3)** (Figure 2).

R2 are the **first axillary meristems** formed by the lateral shoots. At the base of the lateral shoot, this meristem is initiated axillary to the first R1 pre-leaf (Carolus, 1970) which form the first scale of future winter bud. This structure evolves into a complex of rudimentary buds called the gemmary complex. Indeed, the meristem of R2 axis will develop up to **10 preformed phytomers** and also **secondary axillary R3 meristems**. All types of vegetative (stipules, leaves, tendrils, secondary meristems) and reproductive

(inflorescences) organs are present in winter bud (under the form of organ primordia) but their expansion only take place at budburst when a new crop cycle starts (Rivals, 1965). Indeed, during the season, R2 expansion and development is first inhibited by the apical dominance of the R0 and R1 meristems, then then by endodormancy (unfavourable hormonal balance) and ecodormancy (unfavourable thermal conditions).

Nb. The phyllotaxis of R2 is orthogonal to R1, therefore parallel to R0. Years after years the stem can maintain the same dorso-ventral organization.

5) **The basal buds** - They are rudimentary buds, deriving from the axillary meristems of the R0 scales, located at the junction between annual and perennial structures. These buds only develop if the number of R2 of the main stem is too low, e.g. due to a very severe pruning, and/or the plant has excess vegetative strength (figure 2).

6) **The old buds** - As basal buds, they are very rudimentary present beneath the bark and incapable of fruiting (figure 3). Very frequent on young vines, they give rise to shoots named suckers whose development cannot be controlled nor in number or in position. Because the formation of adventitious buds has never been observed in adult vines (Torregrosa, 1995), they are supposed to derive from previous basal buds left after pruning, which end up being embedded in the deep tissues, whose number decreases with the age of the vine. They have a natural regenerative potential in case of a major vegetative accident (winter frost, mechanical trauma or pathogenes) which is used to renew the aerial structures to limit the expansion of wood diseases.

More in

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

Torregrosa L., Carbonneau A., Kelner J.J., (2021). The shoot system architecture of *Vitis vinifera* ssp. *Sativa*, <https://doi.org/10.1016/j.scienta.2021.110404>

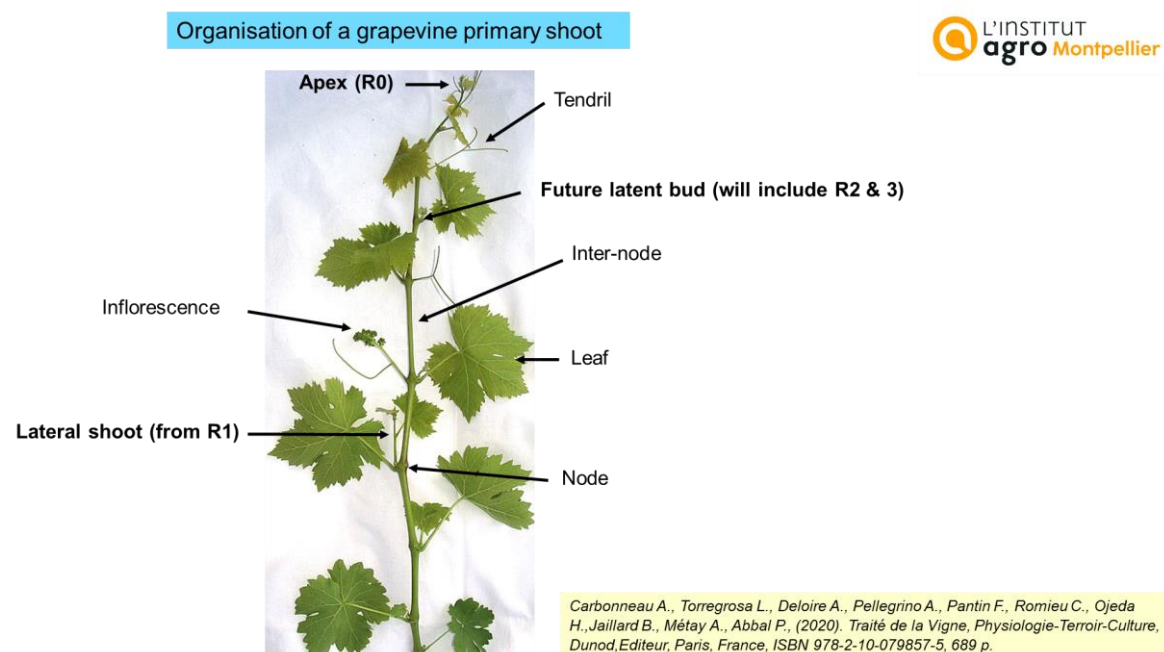


Figure 1 : Organisation of the grapevine primary shoot

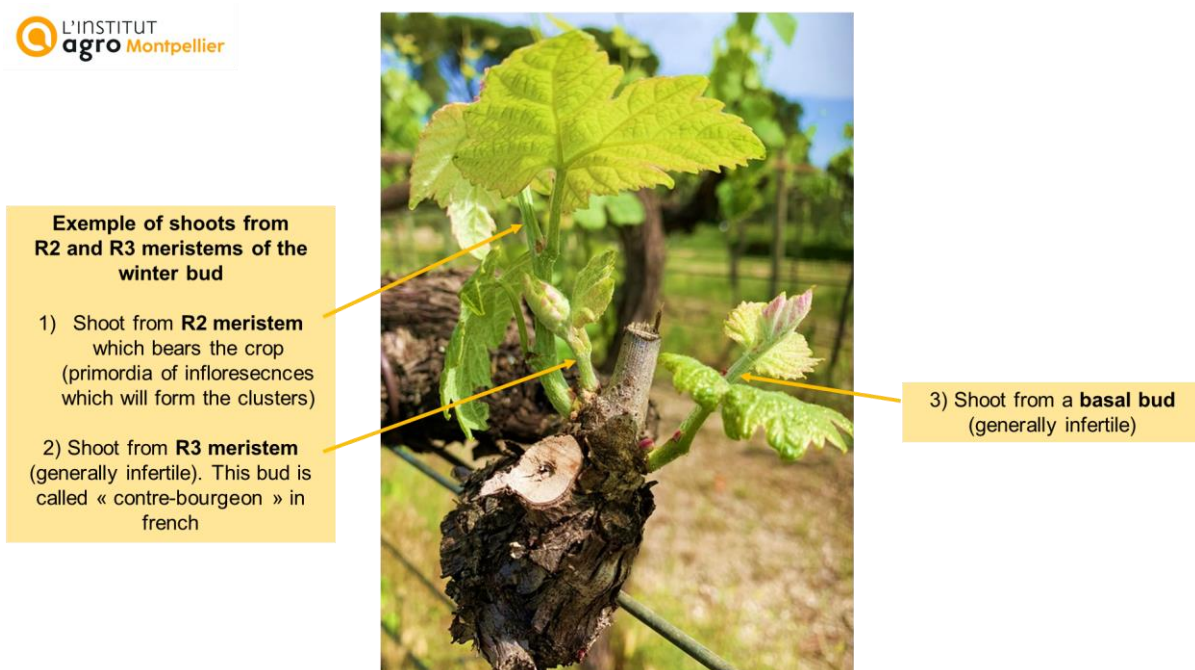


Figure 2 : 1) & 2) Example of R2 and R3 meristems that developed onto shoots ; 3) example of shoot from a basal bud.

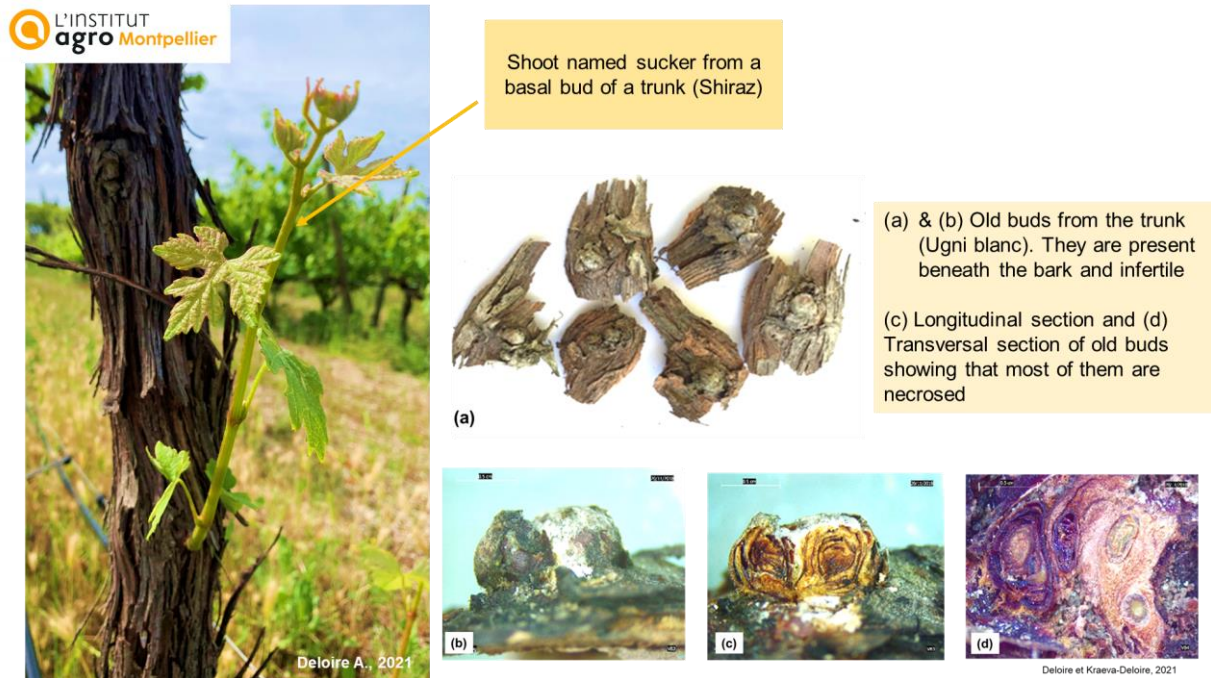


Figure 3 : Example of a shoot (named sucker) which developed on a trunk of Shiraz from an old bud ; and examples of transversal and longitudinal sections of old bud (*Vitis vinifera* L., cv Ugni blanc).