viti-notes
[understanding grapevine growth]

Research to Practice

Bud dormancy and budburst

Viti-note Summary:

- Bud dormancy
- Whole vine winter dormancy
- Budburst
- Factors affecting the time of budburst

Figure 1. Dormant bud (left), bud scales opening (middle) and budburst – leaf tips visible (right). (Photos courtesy of AWRI image collection)

In temperate climates, we generally only think of vines as being dormant during the winter. Although the vine as a whole could be said to be dormant when it is without leaves, it is the state of bud dormancy that is of most interest for vine management.

Bud dormancy

An individual grapevine bud actually goes through three phases of dormancy: these are known as conditional dormancy, organic dormancy and enforced dormancy. (Note that other names have been used for these phases).

Conditional dormancy refers to the state of newly-formed buds in the spring and summer of their formation.

During organic dormancy, buds will not burst (within a specified time period) regardless of favourable conditions and this dormancy is deepest in early autumn. The transition from conditional to organic dormancy occurs from January (in the southern hemisphere) as the days start to shorten, coincidentally with periderm development and a slowing or cessation of shoot growth.

When buds are in the third phase—enforced dormancy—they do not burst in the field because the air temperature is not sufficiently high. For a grapevine bud to progress from organic dormancy to enforced dormancy requires very little chilling (unlike most other woody perennial plants) and for this reason organic dormancy in each bud only lasts for 2 to 3 months. As a result, for much of the winter, buds are actually in a state of enforced dormancy. For enforced dormancy to be lifted to result in budburst, the air temperature needs to be greater than a particular minimum which is variety dependent.

Whole vine winter dormancy

Towards the end of the growing season in autumn, vines lose their leaves. As temperature further decreases, vines undergo a number of processes in preparation for 'shutting down' for the colder months. These include:

- Decrease in the levels of water in various tissues;
- Increase in soluble proteins in the bark;
- Adjustment of enzymes to withstand temperature changes;
- Changes to the functionality of cell membranes.

Other topics in this Viti-Notes series include:

- *Bud dormancy and budburst*
- Spring shoot growth
- Flowering and pollination
- Berry development - up to veraison
- Berry development - Ripening
- Defining berry ripeness
- Site factors influencing berry ripening processes and rates of ripening
- Restricted Spring Growth syndrome

Vines set themselves up with the biological equivalent of 'anti-freeze' to ensure live tissue remains for the renewal of growth in the following spring. If vine tissues freeze, the cells can explode or damage cell contents or membranes, and enzymes and other proteins that control metabolic functions can be destroyed. Freezing damage to buds can impact on the vine's growth and fruitfulness over the coming season (the primary latent bud is particularly susceptible to injury).

Vines are not completely inactive when dormant. They do not photosynthesize because they have no leaves, but they do respire to maintain basic metabolic functions. Their energy source at this stage is carbohydrates stored during the previous growing season, mostly as starch, in the roots, trunk and cordons. Dormant vines have to exist on their stored reserves from leaf fall. The new shoot growth in spring is completely dependent on these reserves for approximately the first month.

Budburst

Growth of dormant buds is the result of the commencement of expansion of internodes, leaves etc. pre-formed in the previous season, initially due to cell expansion. Later cell division also occurs as the apical meristem resumes activity and new nodes are formed.

Once buds are in a state of enforced dormancy, they only need sufficiently high temperatures in order to burst. Note that buds will reach this state in most temperate locations by early winter and therefore it is possible for buds to burst prematurely in the event of unseasonal warm weather. But of course, there is also the ever-present danger of low temperature injury to bursting buds and young shoots.

Factors affecting the time of budburst

Temperature. The effect of temperature is paramount and there is probably a constant temperature summation from mid-winter for each variety. Higher temperatures in the latter part of winter advance the time of budburst. The number of buds bursting per day is strongly correlated with mean air temperature on the day that the buds burst.

Variety. Irrespective of climate and seasonal conditions, the order of budburst of different varieties tends to be maintained. For example, Chardonnay always bursts relatively early, whereas Cabernet Sauvignon always burst relatively late.

Root temperature (soil temperature). Budburst date is positively correlated with soil temperature in the rootzone. A soil temperature of 25°C will lead to earlier budburst than 12°C. This relationship has implications for vineyard site selection and soil management. Because well-drained, stony or calcareous soils warm up faster in spring than wetter, clay soils, such sites are preferred in cool climates in order to increase the length of the growing season and to increase the chance of ripening.

Other factors: Rootstock genotype, cultural practices in the preceding season, timing of winter pruning and application of growth regulators such as hydrogen cyanamide can influence the timing of budburst.

Acknowledgement

The Australian Wine Research Institute would like to acknowledge:

- Cooperative Research Centre for Viticulture (CRCV) and all involved in the VitiNotes series (1996 - 2006).
- Associate Professor Peter Dry (Viticulture consultant, The Australian Wine Research Institute) in the preparation of this document.

Further information

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