

## WINTER COLD DAMAGE AND VINE FRUITFULNESS

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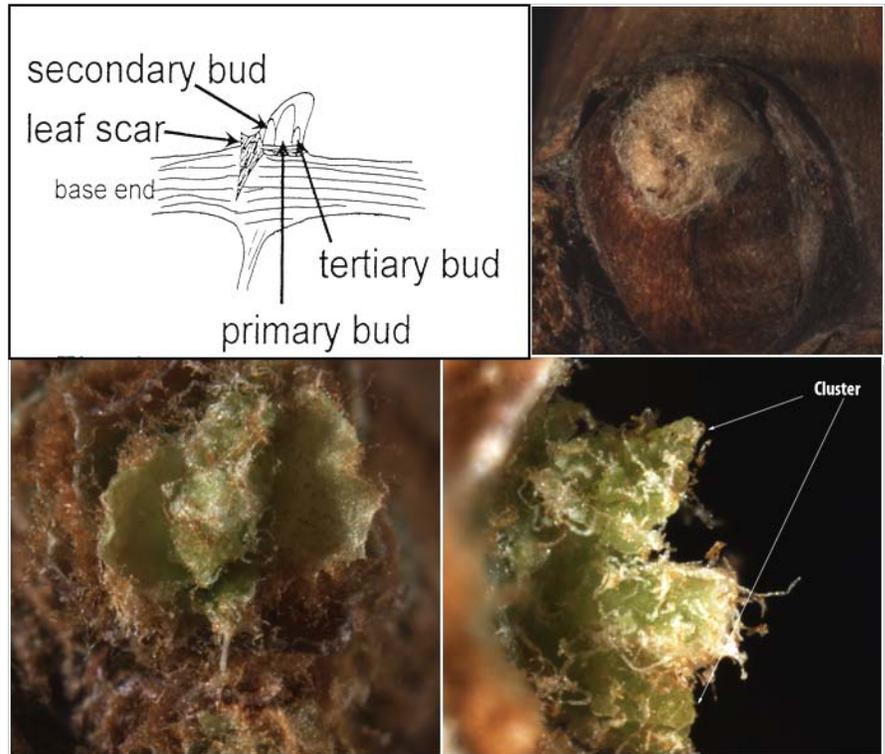
### Compound/Dormant Buds

The dormant buds in grapevine are referred to as “compound” buds, as they contain three, internal buds (Fig. 1). These are called the primary, secondary and tertiary buds. The primary bud is the main fruiting bud for the following year (Fig. 1) and generally contains 2-3 inflorescence primordia and 6-12 leaf primordia by the time of winter dormancy, depending on the variety and species. Unfortunately, it is also the least cold hardy of the three buds. The secondary bud may or may not be fruitful, the extent of which is also determined by the variety and species, and may contain 4-6 leaf primordia by the time of winter dormancy. The tertiary bud is vegetative. Their dominance in breaking the following spring is in the same order as their numbering: breaking of the primary bud will generally inhibit that of the secondary and tertiary buds.

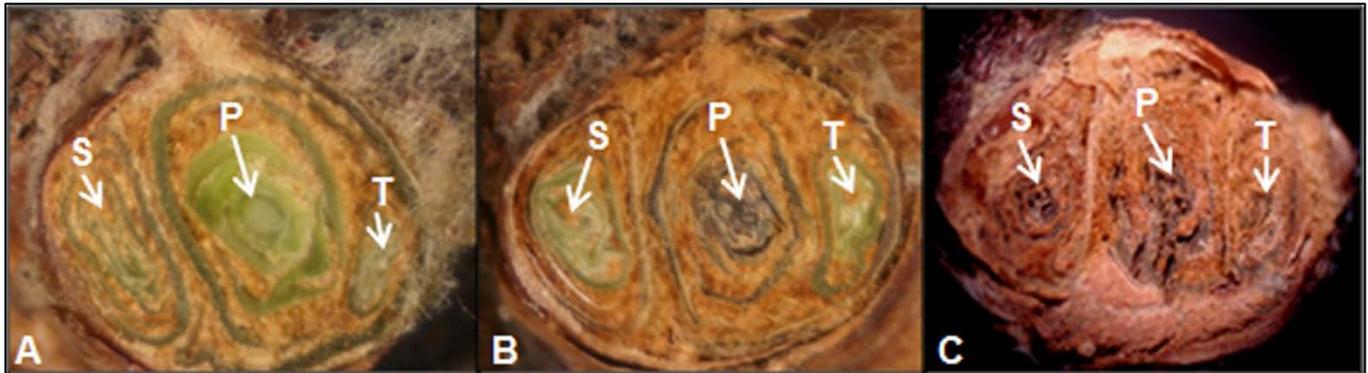
The primary bud is less cold hardy because the larger organs and more differentiated (specialized) cells reduce its ability to super-cool and heal in response to damage. The less mature, less specialized cells (and denser arrangement) in the secondary and tertiary buds afford more extensive cold hardiness. Lack of differentiation also allows for a more rapid healing response to damage.

### Winter Damage

All three buds are formed during the previous growing season. So what happens if the primary bud dies during the winter? Once the compound bud is dormant for the winter, the internal buds do not continue to develop. Therefore, if the primary bud dies due to winter damage, the secondary bud cannot “catch-up” during dormancy. At budbreak, however, without inhibition by the primary shoot, the secondary bud will break and continue with normal development. While significantly smaller than the primary bud during dormancy, there are reports that the secondary bud can develop to approximately the same size as the primary during budswell (although it still has less preformed leaf primordia). Bud fruitfulness cannot be changed at this point (this was determined in the previous growing season; Fig. 1), but vegetative development of the secondary bud (and resulting shoot) can be very similar to the primary. However, not much research has been done on whether the breaking of the secondary bud is later compared to an undamaged primary bud. Research on vine recovery from high primary bud damage has shown that shoots arising from secondary buds are comparable to shoots arising from the primary bud, and any vegetative difference is quickly lost as the season progresses.



**Figure 1-** The compound/dormant bud of a grapevine contains three internal buds at various stages of development (upper left). These buds are protected from winter cold via bud scales and wool (upper right). Removal of these bud scales reveals the primary bud that has preformed leaves (lower left) and preformed clusters (lower right) at the time of dormancy in August-October. *Drawing by Lynn Mills, photos by Michelle Moyer.*



**Figure 2-** Cross-sections of dormant buds displaying various degrees of internal bud damage. A) The primary (P), secondary (S) and tertiary (T) buds are all alive; B) Dead primary bud; C) All three internal buds are dead. *Photos by Lynn Mills.*

An assessment of buds, trunks and canes in late winter helps to determine the extent of cold damage in a vineyard. Buds are assessed using 3 cuts through the compound bud to reveal the primary, secondary, and tertiary buds (Fig. 2). Thin cuts on canes reveal damage done to the xylem and phloem (Fig. 3). Similar cuts are also made on the trunk. Vines can recover, to a certain extent, from winter damage (Fig. 4). Latent buds can push, and may be fruitful. Damaged phloem can be repaired by cambium reactivation in the spring. But not all damage is created equal. Symptoms of mild to moderate xylem damage can be exasperated by subjecting vines to water stress during the growing season, and it is recommended to avoid plant stress after a damaging winter. Focus on long-term vine recovery. However, in cases of extensive xylem damage, where the vine's ability to transport water and nutrients in the spring is severely impaired, cutting back to retrain may be the better option.



**Figure 3-** A longitudinal cut into a cane reveals healthy phloem (P) and xylem (X) tissue. *Photos by Michelle Moyer.*



**Figure 4-** Trunk assessments in early 2011 had a wide range of damage. A) A trunk with dead phloem (P) but living xylem (X); B) A trunk with dead phloem and damaged xylem; C) A trunk with both dead phloem and xylem. *Photos by Michelle Moyer.*