

What Does Deacclimation Mean to Me?

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The ability of a vine to withstand cold winter temperatures is due to its ability to acclimate or adapt to cold environmental conditions. The reverse of this acclimation process – **Deacclimation** – occurs as the vines prepare to leave cold winter temperatures and begin to resume active growth as daylight periods lengthen and temperatures rise in the spring.

As we move into February temperatures are generally rising, days are getting longer and vines are not quite as hardy as they were in late December through January. However, there are expectations each year of brief severe cold temperatures in February and March or even April. Although, these low temperatures are not quite as cold as January, they can still be capable of causing bud and trunk damage.

Below is a generic view of acclimation, to a period of maximum or optimum hardiness (Dec-Feb) followed by deacclimation during the dormant period for a grapevine. The lines are smoothed out to show the general trend from the time of the grapevine entering dormancy in the fall to the point of bud break in the spring.

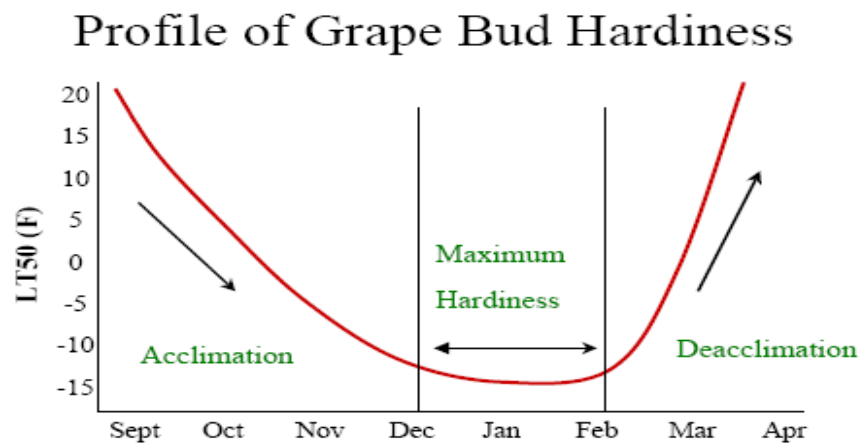


Figure 1. Acclimation and Deacclimation of Grapevine Buds (adapted from Zabadal 2007)

Based on historical weather records, most injury in Ontario occurs during the deacclimation period. Deacclimation periods are often characterized by longer day-lengths and progressively warmer temperatures (often above freezing) during the day.

In mid winter we can experience a few warm days followed by progressively colder days and the buds appear to be able to regain some of their hardiness. However, as deacclimation moves into full swing, the hardiness that may be regained does not match the magnitude of that lost. This is why we find that buds can be damaged at higher temperatures in February and March than in January (see Figure 2.).

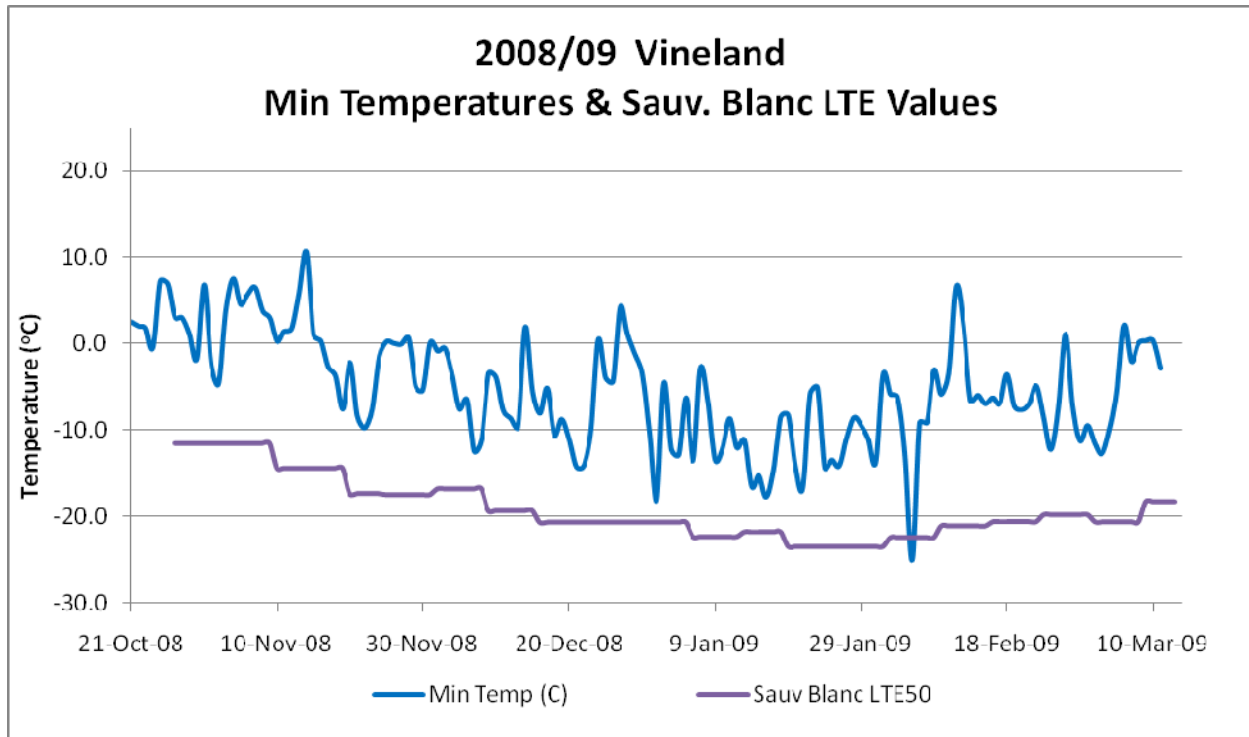


Figure 2. Acclimation and Deacclimation from Fall 2008 to Spring 2009

So what is changing? Despite what we may visually see, the vine and cells within the buds are still alive and functioning albeit at a much reduced rate to what we see during the growing season. As the vines acclimate, the water content of bud cells decrease at the same time as there is an accumulation of “cryoprotectants” (antifreeze sugars, proteins and amino acids). This reduction cell water content along with increased cryoprotectants depresses the freezing point of water inside the cell. In addition, a plug which prevents water movement into the bud develops below the bud in the cane.

The dormancy we observe from mid January onward is environmentally controlled – it is the below freezing temperatures that keep the plant from growing. During deacclimation progressively warmer temperatures enable the vine to begin to have water redistribute back to proximity of the bud cells.

Vines are not completely inactive when dormant. The energy used is stored carbohydrates from the previous season and stored in the roots, trunk, cordons and canes. As temperatures increase “plugs” in the parts of the vascular system, which were in place as part of entering dormancy, are broken down by

enzymes to allow sap to begin to flow. The sap flow observed in spring is the change in water concentration outside of the vine in the root zone relative to that inside the vine. Water moves from high concentration (in the soil around the roots) to low concentration (inside the vine) to re-establish a water balance.

As vines deacclimate, some of the changes inside the cells that allowed them to survive very cold temperatures are reversed. The vascular plugs are digested by enzymes, allowing water to move into proximity of the buds. Hormone levels that kept the cells dormant decline and some of the cryoprotectants that helped dehydrate the cells are metabolized. This allows the cells to rehydrate and freeze at higher temperatures. Water starts to move into the roots and trunk as storage starches are metabolized into sugars in the xylem.

Of concern to many growers is the movement of water into the vine as sap flow begins and the potential for freezing injury (freezing of water inside the vine and cell injury). As water content in the vine increases and cells rehydrate the temperature at which freezing can occur increases as cryoprotectants are lost and cell functions resume. This loss of hardiness is much faster than the rate in which hardiness developed in the fall and is extremely rapid as we approach bud break.

Each year is different as the spring temperatures fluctuate dramatically. As you can see in Figure 3 below, the deacclimation curves for Chardonnay differed significantly for spring 2009 and 2010. As of February 15, 2011 sampling, it appears that vines are likely to move out of dormancy in 2011 as fast as 2010.

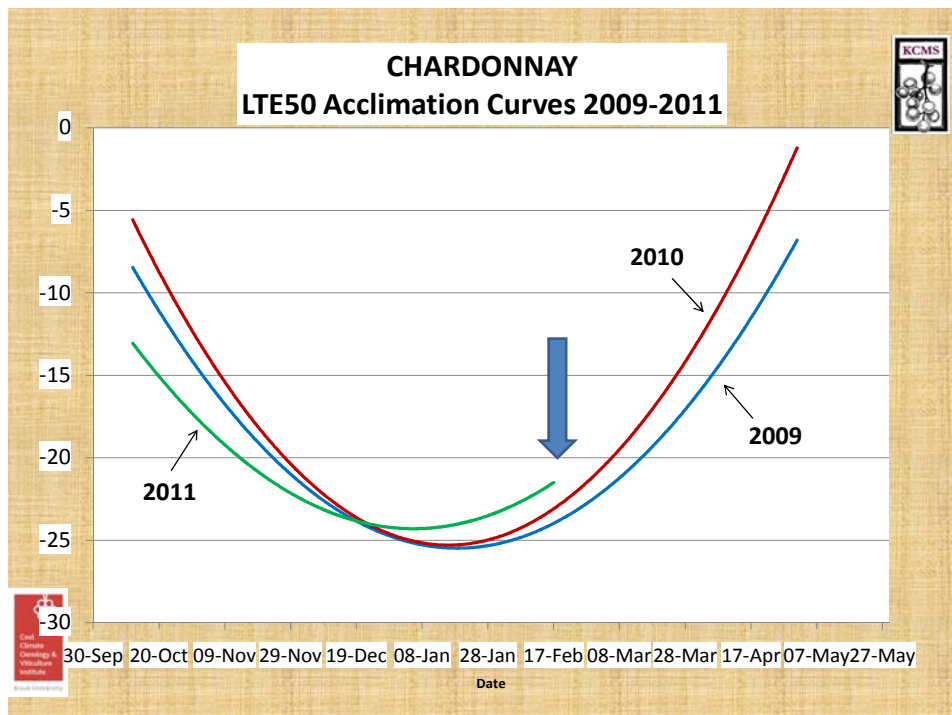


Figure 3. Acclimation and Deacclimation Curves of Chardonnay for 2008/9, 2009/10 and preliminary data to Feb 15 2011 for the dormant season 2010/11.

So what does all of this mean?

1. Growers should be aware that those vines that enter dormancy earliest are likely to lose hardiness in the spring at a faster rate than those that matured later last fall.
2. Vines are reasonably hardy until sap flow begins in the spring and then hardiness levels can be lost at a rate of up to 4 degrees C in a week.
3. If you are using wind machines, you should constantly adjust your start-up temperature as we have longer days and warmer daytime temperatures.
4. Vines that are pruned earliest will lose dormancy sooner (bud break will occur earlier) than those pruned late in winter
5. Loss of snow cover will result in the ground absorbing more sunlight and will warm the root zone earlier leading to earlier vine growth
6. Always monitor the weather forecasts and be prepared. For up-to-date hardiness levels of vines check the CCOVI VineAlert pages at www.ccovi.ca/vine-alert and PDF summaries are also available at KCMS Applied Research web pages at www.kcms.ca/research and from the Grape Growers of Ontario web pages at www.grapegrowersofontario.com under 2011 WINTER INJURY INFORMATION