ASSESSING COLD DAMAGE
guides pruning for bountiful vineyard production

Jeremiah Vardiman

Are you helping or hurting your grape production?

Pruning grapevines is necessary for getting a growing season off to a great start, preparing the plant for a bountiful year, and for vigorous growth.

But if pruned too much, yield can be significantly reduced or even cause the vine to not bear fruit. You can avoid these situations by determining the correct amount of pruning, which should be done while the vines are still dormant.

In Wyoming, vines are exposed to extremely low temperatures. When temperatures fall below the cold hardiness tolerance of the grapevine, there can be damage to buds, canes, cordons, trunks, roots, or complete vine death.

Since cold damage is such a major factor in vineyard health in Wyoming, assessment will help you plan appropriate pruning for that year.

Bud Information Shows How Much to Prune

A cold damage assessment of a vineyard determines the percentage of dead or damaged buds. A bud is the point of growth for new shoots, leaves, and flowers. Damage or death to these buds significantly influences next year's yield. A grapevine bud is a compound bud, meaning there are multiple buds within the one bud.

In grapevines, there are three small buds (primary bud, secondary bud, and tertiary bud (Figure 1). The primary bud is the largest of the three buds, located in the center of the compound bud, and produces a majority of the flowers, which equates to fruit seen through the growing season.

The secondary bud is less developed and may or may not produce flowers (depends on variety), although the bud does produce shoots and leaves.

The tertiary bud is the smallest of the three and only produces shoots and leaves.

The secondary bud usually only grows if the primary bud is damaged, and the tertiary bud usually only grows if the primary and secondary buds are damaged. Cold damage typically kills the primary bud first followed by the secondary and then tertiary bud.

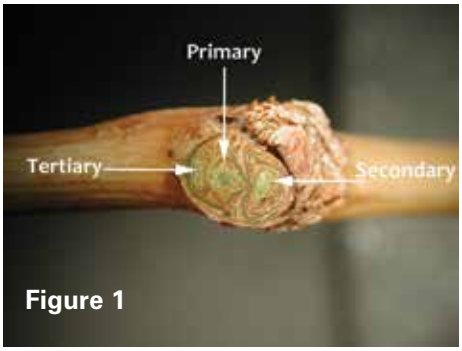

Figure 1

Selecting Zones in the Vineyard

Assessing a vineyard for cold damage can be laborious, especially in large vineyards (or backyards). Sampling every vine is usually unfeasible, so to effectively assess a vineyard, focus on the grape varieties and landscape characteristics to determine various zones within a vineyard.

To determine zones, be mindful of where the different grape varieties are in the vineyard, elevation changes throughout the vineyard, structures inhibiting airflow, soil variation, and vineyard size.

Since cold damage is

being assessed, the zones should be representative of the different temperature regions found within the vineyard. Remember, cold air sinks, meaning that cold damage usually occurs on portions of the vine closest to the ground, vines that are lower in elevation, and low spots in the topography. Uniform damage can be seen in small vineyards or relatively level topography. If there is a zone that always has cold damage, focus a good portion of the assessment there.

Assessing Buds for Cold Damage

Assess the vineyard while the buds are still dormant – after the lowest winter temperatures have occurred and prior to bud break, approximately March through April. As a general rule, sampling 100 buds per zone is a good representation and makes the math simple.

Collect entire-length canes from random vines throughout the entire zone. If the vineyard is small enough to sample each vine, then remove one entire length cane from each vine. Samples should be bundled and labeled with the zone and variety from which they were collected.

Once samples are collected, use a sharp razor blade to carefully cut open the buds to assess the interior color. Using a magnifying glass or loupe may be helpful in seeing the three different buds. Hold the cane horizontally with the bud pointing straight up, then make three cuts horizontally through the bud as described below:

1. First cut should be approximately two-thirds up the bud. If done correctly, the primary bud is exposed. (Figure 2)
2. Second cut should be slightly lower down on the bud. If done correctly, the second and primary bud is exposed. (Figure 3)


Figure 2


Figure 3


Figure 4


Figure 5

3. The third cut should be slightly lower still. If done correctly, all three buds should be exposed. (Figure 4)
4. Three small cuts are preferred to one large cut, in fear of cutting too deep and removing the bud altogether. (Figure 5)

Green color in the bud indicates live and healthy tissue, whereas a brownish/black color indicates bud damage or a dead bud. Begin with

the first bud on the cane (which is the closest to the base where the cane was cut from the cordon) and work toward the tip of the cane. Record the variety, zone, bud number, and the status of the three buds (primary, secondary, and tertiary) in sequence as you work down the cane.

After all the buds are assessed per zone, calculate the percentage of primary, secondary, and tertiary buds that are still alive with this equation.

*(# of live buds / total buds) * 100 = percent of alive buds*

*Example: (64 / 95) * 100 = 67% of primary buds are alive*

Pruning Adjustments to Deal with Cold Damage

Knowing the number of live buds, especially primary buds, determines how many buds should be left on the vine during pruning to produce the most bountiful yield. Most pruning adjustments are based off survival of the primary buds. Some calculations use both the primary and secondary bud to determine crop potential and to adjust bud number for pruning. The information of tertiary buds is only used when most or all primary buds are dead and canopy recovery is a concern.

Use the percentage of live primary and secondary buds for each zone and variety to adjust pruning practices as recommended below.

After estimating the adjustments for pruning, analyze the information you have just created on your vineyard. Are there any patterns that jump out?

For example, has one variety received more cold damage than

others? Has a certain zone received more cold damage than others? Is there a pattern of which buds on the cane received the most damage? For example, you noticed that, after the eighth bud on the cane, all other buds were dead.

This management technique will aid understanding the vineyard's dynamics and help maximize future crops. For more information, contact your local extension office.

Table 1. Pruning recommendation based on primary bud damage.

If you have…	Then…
Under 25% primary bud damage	Prune as normal
25-75% primary bud damage	Use the adjustment calculation in Table 2.
Over 75% primary bud damage	Prune after bud break or not at all

Table 2. Bud adjustment calculation

Step 1:
$\text{Crop potential} = \frac{(\%\text{ alive primary buds}) + (0.25 \times [\%\text{ alive secondary buds}])}{100}$
Step 2:
$\text{Adjusted bud number} = \frac{\text{The number of buds you normally leave}}{\text{Crop potential}}$

Example	
Step 1: After assessment, you found only 30% of your primary and 60% of your secondary buds are alive.	$\text{Crop potential} = \frac{30 + (0.25 \times 60) = 30 + 15}{100} = 0.45$
Step 2: In most years, you would leave 24 buds/vine at this particular site.	$\text{Adjusted bud number} = \frac{24}{.45} = 53$ buds for this year

Wolfe, W. 2000. Vine and Vineyard Management Following Low Temperature Injury. Proceedings of the American Society for Enology and Viticulture 50th Anniversary Annual Meeting. Seattle, WA. June 19-23.

Sounds like **Jeremiah Vardiman** *is a budding (we couldn't resist!) grape grower. He is a University of Wyoming Extension educator based in Park County and serving northwest Wyoming. He can be reached at (307) 754-8836 or at jvardima@uwyo.edu.*