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Strategies to Recover from Winter Damage

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Knowing that winter injury has occurred and where in the vineyard is just half of the process of dealing with winter injury. The second involves what mitigation strategies to use depending on severity of injury and whether the vines can be easily renewed or require re-trunking or removal and starting a new block.

There are general guidelines for how a vineyard will perform after being subjected to winter injury. Vine survival and long term health is first priority in trying to have a vineyard return to full productivity as soon as possible.

Assessing injury levels is very important as this will be used as a guide for pruning, re-trunking or replanting. If you have not taken advantage of hilling or have single trunks that are old and have not produced suckers for a few years, the chance of recovery is very poor to slim. Experiences after the freeze events in 2003 and again in 2005 demonstrated that many trunks were “blind” and did not push sucker growth from the scion wood to recover and instead pushed rootstock suckers or were just plain dead! **Blocks with vines that had multiple trunks of different ages and hilled HAD MUCH HIGHER survival rates and successful renewal than those vineyards with a single trunk. The use of double or multiple trunks for cold tender vines should be standard, especially in higher risk locations or those not capable of using wind machines or other practices.**

Additionally, vines in the 3 years and under category (no crop) and older, well balanced vines had better survival rates than those in the 4 to 7 year category producing their full heavy crops. Unbalanced vines with excess or too little crop (with excessive shading and wood growth – large canes) had more injury than properly balanced vines.

Another observation was the increased presence and development of crown gall and not just the season following injury but for multiple years afterwards. The presence of crown gall in a vine is not enough to cause galls; rather it is the infection of outer cambium cells (conductive tissue just beneath the outer bark layer of the trunk) that become infected as they attempt to heal wounds caused by freeze injury. These cells are altered such that they continue to form callus tissue that continues to enlarge and eventually block the conductive tissues and cause a physiological girdling of the vine. When this occurs, the entire vine parts above the galling area die.

Bud Mortality and Suggested Pruning Modifications	
Primary Bud Mortality (%)	Pruning Adjustments
0-15 %	None – prune as normal for balanced crop
16 to 30%	Increase buds retained by 50% Bring up renewal suckers to establish future trunks
31 to 50%	Leave double the number of buds If pruning, hedge only leaving long spurs Bring up multiple renewal suckers to establish future trunks
>60%	Don't prune Bring up multiple suckers if scion pushes any from above graft union

Pruning Strategies

The goal of pruning a vine after winter injury episodes is to get the vine back to full health, fruitful productivity and in balance. Some vines may die immediately or trunks may collapse over a period of 2 to 4 years after damage.

Removal of the parts known to be damaged or suspected as being injured should be part of the pruning process. However, do not remove old trunks if they are supporting canes to provide a better balance of bud numbers during a recovery period. There is no need to prune out a crown gall infected trunk immediately if it is supporting some buds during renewal/retraining. Once new trunks are established this crown gall infected trunk should be cut out and removed from the vineyard.

With severe winter episodes in 2003, 2005 and now 2013/14 it is apparent that we need to protect vintages and reduce risks at all times. The first recommendation is using multiple trunks and regular trunk renewal. The use of double or multiple trunks should be a STANDARD practice to provide extra protection against winter injury. This will allow for the vine to be capable of being renewed on a regular basis.

Bringing up several suckers will allow for better balance of shoot growth to establish new trunks and to support the existing large root systems and to minimize the growth of bull wood renewals. Any non-needed suckers can be removed the following year.

A **balanced vine** will have strong, but not overly vigorous cane growth (roughly pencil size in diameter) that developed all retained buds the previous season. If some canes are **weak or spindly**, this may correspond to having too many retained buds or **excessive crop levels**. This should be a guide to reduce the number of buds per vine for the next season. If some canes have a **large diameter** (thumb size diameter or greater) this is an indicator of excessively vigorous growth with likely **too small of a crop level** perhaps because too few buds were retained the previous year. Other signs of excessive vigour in the previous season are dense thick canopies requiring multiple hedging and leaf removal in season, uneven fruit maturity and quality and high percentages of non fruitful shoots (often due to excessive shading the previous growing season).

Determining Vine Balance

Assessing whether a vine is in balance or not can be undertaken in season or at pruning time. The pruning time decisions can be easily and quickly done by weighing the prunings. The following is a general table showing whether or not a vine is producing too little or too much crop and targets for balance.



For measuring pruning weights, do one vine at a time and then repeat the process on a few “average vines” in the block. This must be done before any trimming or pre-pruning.



The pruning's you collect are only the growth of the previous season (all shoot growth – primaries and laterals from previous growing season present at time of dormant pruning). Do not include trunk or permanent cordon wood removed due to injury.





Record the pruning weight for each vine. By doing this for multiple vines you will quickly develop an eye for estimating the weight of pruning's on a given vine and can adjust the bud numbers accordingly.

Formulae were developed for *labrusca* and *hybrid* grapes based on vigour and size. Some may have heard of a "30 plus 10" or "20 plus 10" formula. For a large vigorous vine this meant:

- Pruning Formula: 30 + 10 meant Leave 30 nodes ("count buds") for first pound of canes removed plus an additional 10 for each additional pound. This resulted in Pruning wt = 1 lb – leave 30 nodes, Pruning wt = 2 lb – leave 40 nodes, Pruning wt = 2.5 lb – leave 45 nodes, Pruning wt = 3 lb – leave 50 nodes, etc

For *vinifera* grapes, the general formula was "20 plus 20" as rarely did we have individual vinifera vines producing 2 pounds or more of canes in a single season.

However, over time these formulae proved less reliable and growers looked for other mechanisms. Information developed and used by many researchers has looked at the pruning weights and number of buds per meter of row as one component of measuring vine balance.

General guidelines were developed by Richard Smart (1985) and have been modified and adapted by others depending upon local conditions, site potential and cultivar. These were noted to ensure good, even spacing of nodes along the fruiting wire to get good shoot positions, adequate fruit exposure and optimum (not maximum but optimum) shoot and leaf development over the season and to provide for good fruitfulness in following years.

	Very large vine	Ideal vine	Very small vine
Pruning Wt/m row	>0.52 kg/m >0.35 lb/ft	0.22-0.52 kg/m 0.15 – 0.35 lb/ft	<0.22 kg/m < 0.15 lb/ft
# nodes/m row (VSP)	>16/m >5/ft	5 – 16/m 1.5 – 5/ft	<5/m <1.5/ft
# nodes/shoot	>20	10 – 20	<10

The goal of achieving a balance between crop level and canopy/shoot growth is often a challenge. Despite the significant impact of pruning on crop levels, it is not enough by itself to achieve the desired vine balance. For instance, Pinot noir, Riesling, Cabernet Sauvignon, Merlot, etc., grown in Ontario generally requires additional crop thinning during the season to ensure complete ripening of the fruit AND proper vine maturity going into winter to achieve optimum winter hardiness. Studies currently being done at CCOVI indicate that crop levels can impact cold hardiness dynamics and that heavier crops can lead to slower vine acclimation and mid-winter hardiness. The impacts of crop levels on cold hardiness can also be cultivar AND vintage specific.

Balanced vines produce the best fruit each year and continue to do so for many years. To hedge our bets, we must practice “spare parts” viticulture as we may not know when we are faced with adverse winter temperatures but we can be sure they will happen!

There is no single training system or bud number or crop level that fits all sites and environments just as no one suit fits all people that work in a single company. Keep this in mind that not all blocks and cultivars are the same even at one location. Modification to get high quality fruit and keep the vines productive and economical each and every year should be the target!