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Brock University

Recovering from Cold Symptoms: Grapevine Cold Hardiness and Mitigating the Effects of Freeze Injury

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Consequences of cold injury



- Loss of fruit
- Uneven or poor vegetative growth
- Inability to achieve vine balance
- Disease incidence (crown gall)
- Loss of uniformity
- Loss of consistency
- Loss of vines
- Overall management issues
- Ultimately reductions in yield, quality and income





Cultivar differences in cold tolerance

- Ontario alone grows over 32 varieties (VQA-approved)
- *V. vinifera* (*different groups of origin*)
- French hybrids
- New hybrids with extreme cold hardiness
- New cultivars to our region
- Variation within and between these categories



What has happened this winter?



- **Types of freezes**
- **Radiation freeze**
 - More ‘Typical’ Ontario freezes
 - Dry cold air mass settles in area under calm, clear conditions
 - Cold dense air settles while warm air is above
 - Wind machines useful due to temperature inversions
- **Advection freeze**
 - Huge mass of dense, thick dry cold air
 - Higher winds, no inversion and wind machines rendered useless
 - Polar Vortex 2014
- **Localized cold events influenced by ice and ‘lake effects’ (or lack of)**



- Our advanced cold hardiness database and alerting system during periods of risk

Vine Alert: Overview

Grapevine management and monitoring system for cold hardiness and injury.

[Overview](#) [Recent](#) [Bud Hardiness](#) [Bud Survival](#) [Alerts](#) [Resources](#)

Grapevine Bud Cold Hardiness Database

Overview

Welcome to the Ontario regional grapevine bud cold hardiness webpage. The information contained on this webpage is to provide grape growers with comparative levels of bud hardiness for cultivars at different locations throughout the dormant period. Monitoring bud cold hardiness throughout the dormant period is an invaluable tool to assist grape growers in managing winter injury. The data provided from this database will allow growers and researchers to see how cold-hardy grapevines are within a specific area. Cold hardiness is **not static** but varies throughout the dormant period and is determined through the grapevine's genetic potential and environmental conditions. Therefore, grapevine species and cultivars vary in terms of their cold hardiness. Bud sampling and testing will be done throughout the entire dormant season to monitor cold hardiness through the acclimation, maximum hardiness, and deacclimation periods. This ever-changing bud hardiness data can be helpful in determining when wind machine use or other freeze avoidance methods are warranted to protect the vines from winter injury.



Factors impacting bud survival

- Combination of factors - don't think just one
- Variety*
- Site location and temperatures reached*
- Vine health and age
- Management practices - training system, use of spare parts, canopy management
- Water - too little or too much
- Drainage - both water and air drainage
- Crop levels - over cropping and under cropping



What to do after cold injury



- ASSESS level of Damage
- 1st priority is maintaining and keeping vine alive
- Mitigate effects of cold injury on production
- Keep renewal parts of vine to ensure improved growth and production next year
- Change management practices during growing season
 - Pruning
 - Suckering
 - Training and Canopy Management
 - Crop levels
 - Nutrition program
 - Weed/pest management

Assessment of Freeze Injury



- Proper assessments to determine level of injury is critical
- Level of injury = what guidelines to use
- Where injury is present on vine
- Age of vines, # trunks, hilled or not all impact whether they can recover or be renewed



Pruning strategies



- Goal of pruning 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 2-4 years after damage.
- Removal of the parts known to be damaged or suspected as being injured should be part of the pruning process.



Mitigating cold injury through Pruning



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 Use of 'Kicker canes' Extra canes or longer spurs Bring up multiple renewal suckers to establish future trunks
>60%	LEAVE LONGER 6 BUD SPURS or don't prune Bring up multiple suckers if scion pushes any from above graft union

Past experiences (Ker and Brewster)



- Experiences after the freeze events in 2003 and again in 2005
- Many trunks did not push sucker growth from the scion wood to recover and instead pushed rootstock suckers or were just 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.
- Use of double or multiple trunks for cold tender vines should be standard, especially in higher risk locations



Use of ‘Spare Parts’ to reduce risks



- 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.
- Use multiple trunks and regular trunk renewal.
- Bringing up several suckers will allow for better balance of shoot growth to establish new trunks and to support the existing large root systems
- Always leave extra vine parts as a back up
 - ‘kicker canes’, extra spurs etc
 - These can always be cut off when tying or suckering depending on season and frost/winter risks

Factors impacting final crop in grapevines



- Based on environment, physiology and management decisions
 - Primary bud survival
 - # of buds RETAINED following pruning
 - Variety - fruitfulness of buds (primaries and secondaries)
 - Overall vine health - cold injury, disease, stress
 - Environmental conditions during bud development (2013 growing season - Bloom)
 - Environmental conditions during current growing season and fruit development - water, timing
 - Level and timing of crop removal
 - Timing of leaf removal
 - Timing of harvest
- Bottom line: difficult to predict especially right now

Crop control



- Always important to look at a per vine basis
- A small weak vine can support less crop
- A large strong vine can support more crop
- Therefore, low yields/vine do not correspond to better survival or hardiness
- EVIDENT this year already
- Moving forward do not try to achieve by yields/acre and crop control on a per vine basis is very important to maintain vine health, renewal and sustainability
- Overcropping vines this year WILL lead to more shoot collapse

Nutrition strategies



- If dealing with cold injury do NOT fertilize
- Do not want excessive growth
- Larger root systems will be pushing more energy into fewer growth points
- Especially important for bringing up suckers to avoid bullwood (thick wood)
 - Less cold tolerant and not what you want
 - Again you can always remove extra suckers later but now need to divert growth and avoid excessive growth due to over fertilization

Pest control



- One challenge with trunk renewals are weeds
- Be proactive early with weed control
- Hilling, pre-emergent herbicides etc.
- Keep vines protected from disease
 - Crown gall issues



Conclusions and final thoughts



- Critical to know level of damage at your sites to make correct decisions
- What you do now will impact the future of the vineyard

Conclusions and final thoughts



- Vines are resilient and can recover in most cases if proper decisions are made
- 2006 was a big crop following winters of 2003 and 05
- Use of ‘spare parts’ in our climate is important
- Use resources available through CCOVI VineAlert, OMAF, GGO etc.
- There are opportunities to learn from this winter - networking of information and “reactive” cold hardiness projects

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Constellation Brands



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Thank you for your attention.

<http://www.ccovi.ca/vine-alert>

