



Cool Climate Viticulture: The Implications of Letting Your Grapes Hang

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ABSTRACT

In cool climates, growers must balance the limited heat units available between the needs of the ripening fruit and those of the vine as it prepares for the long dormant season ahead. While this prevailing wisdom appears intuitive, there is limited empirical evidence in the literature to support it, while other studies have failed to show an impact on account of harvest timing. In a study conducted in an emerging, short season wine grape region, Vidal and Riesling, two cultivars favoured for ice wine production, were continuously harvested either early or late over the course of five years. Crop loads varied from year to year due to environmental factors. Leaf potassium levels, frost tolerance and leaf senescence were all observed to increase in the early relative to the late harvest in years with a heavy crop, but not when yields were low. Bud hardiness levels more often remained unaffected, but were observed to be impacted in Vidal in a year with a heavy crop. In the same year, vine carbohydrate and potassium levels, early spring growth, and crop load in both Riesling and Vidal were impacted by harvest timing. This study demonstrates that while harvest timing does not always impact vine physiology and hardiness, it has the capacity to do so in years with a heavy crop and limited postharvest canopy.

RÉSUMÉ

Dans les climats frais, les producteurs doivent équilibrer les unités thermiques limitées disponibles entre les besoins des fruits mûrissants et ceux des vignes en vue de la longue saison de dormance à venir. Bien que cette idée admise semble intuitive, il existe peu de preuves empiriques dans la documentation pour l'appuyer et d'autres études n'ont pas démontré qu'elle avait une incidence quant au moment de la récolte. Dans le cadre d'une étude menée dans une région vinicole émergente de courte saison, Vidal et Riesling, deux cultivars privilégiés pour la production de vin de glace, ont fait l'objet d'une récolte continue, soit tôt ou tard, sur une période de cinq ans. Les charges fruitières ont varié d'une année à l'autre en raison de facteurs environnementaux. Les concentrations de potassium dans les feuilles, la tolérance au gel et la sénescence des feuilles ont toutes augmenté lors de la récolte hâtive par rapport à la récolte tardive au cours des années de lourde charge fruitière, mais pas lorsque le rendement était faible. Dans la plupart des cas, les niveaux de rusticité des bourgeons n'étaient pas touchés, mais on a observé qu'ils l'étaient avec Vidal au cours d'une année de récolte abondante. Au cours de la même année, le moment de la récolte a eu une incidence sur les concentrations en glucides et en potassium de la vigne, la croissance au début du printemps et la charge fruitière tant avec Riesling que Vidal. Cette étude démontre que, bien que le moment de la récolte n'ait pas toujours d'incidence sur la physiologie et la rusticité des vignes, il peut avoir une incidence au cours des années où la charge fruitière est lourde et le couvert végétal après la récolte est limité.

Introduction

In the weeks leading up to harvest, grapevines use a significant amount of energy and resources to mature the crop. After the crop is removed, the vine can focus its resources on ripening the wood and building up its carbohydrate and nutrient reserves. The vines rely on these reserves not only to help endure the long dormant season, but also to supply the energy and nutrients needed for early growth the following growing season. In cool climates such as those found in Canada, shorter growing seasons often tempt growers to delay harvest in hopes of increasing berry sugar accumulation and acid metabolism. In the extreme case of ice wine production, typically performed using Vidal (hybrid) or Riesling (*vinifera*) in the region, the fruit are not harvested until the vines are dormant (Figure 1).



Figure 1. Dormant Riesling vines being harvested for ice wine production (< -7 °C). (Nova Scotia, Canada).

Best practices recommendations often underscore the importance of a healthy postharvest canopy for a period of weeks; however, there is scant evidence in the scientific literature documenting the possible negative implications of ignoring this practice. The objective of this study was to document the implications, if any, of routinely harvesting your vines either late or early over multiple years in a cool-climate, short-seasoned wine grape region (Nova Scotia, Canada).

Methods

- Early versus late harvest trials were conducted using Riesling and Vidal—two cultivars commonly used for sparkling, still or ice wines—over the course of five years.
- Two single-factor trials, one for each cultivar, were conducted within the same vineyard. Two consecutive panels (i.e., 8 vines) served as the experimental unit. For each cultivar, 16 consecutive panels of vines were divided into four blocks that were further divided into two treatments: 'early' vs 'late'. Harvest timing designations were consistent across years.
- While vines were not shoot or cluster thinned, the crop load was depressed because of cold damage in year 1 (June frost), year 3 (winter freeze) and year 5 (winter freeze).
- Bud hardiness values were approximated via differential thermal analysis (DTA).
- Various other response variables were also measured in the vines in the weeks following the early harvest treatment, though these did not occur in every year. These measurements included leaf nutrients and chlorophyll, cane nutrients and carbohydrates. Observations on frost tolerance were also made.
- In multiple years, bud break and early shoot growth assessments were performed in spring.

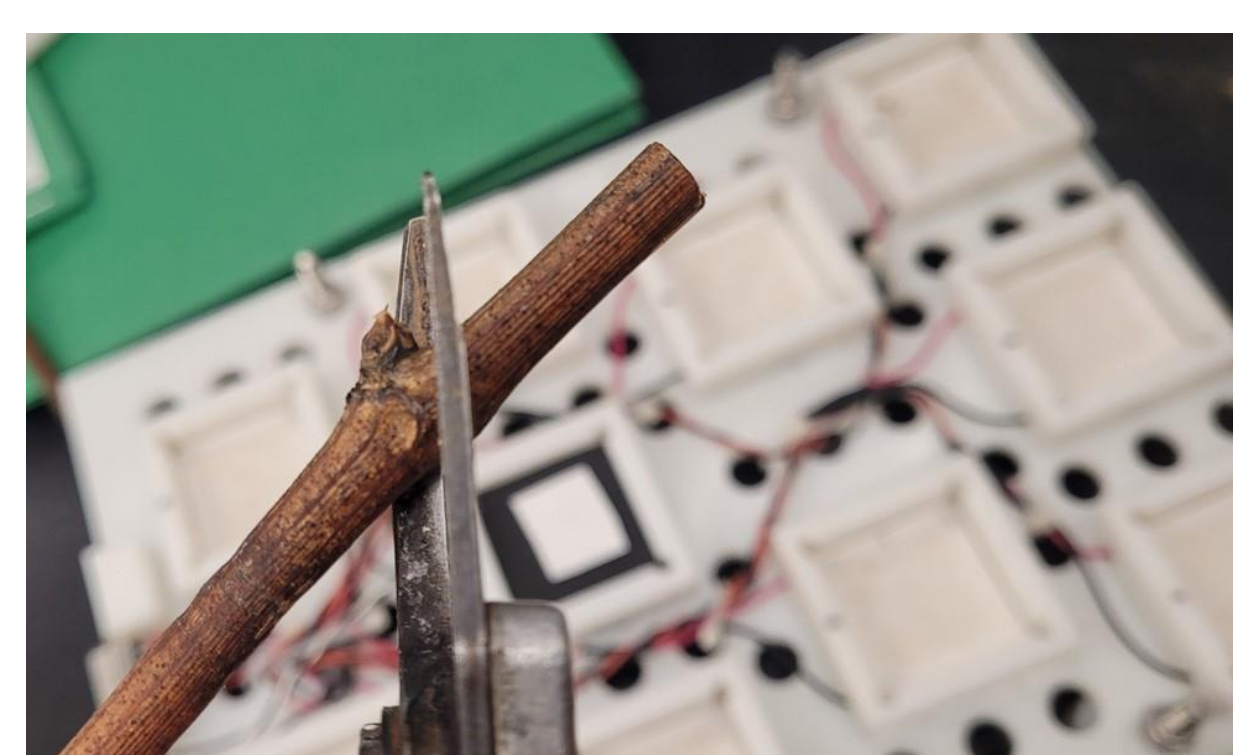


Figure 2. Removing wine grape buds for bud hardiness measurement via DTA.

Results

- Most macro and micronutrients were impacted minimally by harvest timing in the weeks after the early harvest, with the exception of potassium (K), which increased by up to **86%** in the early-harvested leaves, but only in years with a moderate to heavy crop. Leaf starch and sugar levels, measured only in Vidal after a year with a high crop load (> 7 kg / vine), were up **112%** and **43%**, respectively, in early- relative to late-harvested vines. Anecdotal observations suggest the implication of higher K and sugar levels in early-harvested vine leaves is increased frost tolerance. In addition, leaf senescence, measured with a chlorophyll meter and visually (Figure 3) was more advanced in early relative to unharvested vines in higher cropping years.
- Higher K (**24%** and **20%** in Riesling and Vidal, respectively) and carbohydrates (Table 1) in early-harvest vines was also observed when measured in the heavy-cropping year 4 dormant canes in late fall. Bud hardiness (LTE50) values were not impacted by harvest timing, except for late fall in year 4, when early-harvested Vidal buds were **1.8 °C** harder than late-harvested. This treatment difference disappeared when measured midwinter (early February).
- Implications of harvest timing were observed in year 5, in the wake of a deep freeze (< -25 °C) event. While bud break appeared unchanged, early season shoot growth was **>40%** more in early- vs late-harvested fruit for both cultivars. Furthermore, while the Riesling crop was wiped out for both treatments in year 5, the Vidal early-harvest vines crop (**2.1 kg/vine**) was significantly higher than the late-harvested crop (**1.1 kg/vine**).



Figure 3. Early-harvested (two vines left of the post) vs unharvested (two vines right of the post) Riesling in fall.

Table 1. Wine grape cane carbohydrates (mg/g) in year 4. Significance (*) is determined by $p < 0.05$.

Treatment	Sucrose	Glucose	Fructose	Total sugar	Starch (glucose equiv.)	Total sugar equiv.
Riesling						
Early	36.5*	30.9	35.0	116.3	38.3	154.5*
Late	31.9*	30.8	35.1	112.6	29.0	141.6*
Vidal						
Early	47.1*	28.9	31.7*	121.7	39.8*	161.5*
Late	37.6*	31.8	35.1*	116.7	28.8*	145.5*

Conclusions

- In years with a light crop, or when the canopy is damaged due to an early, hard fall frost, harvest timing has little impact on the vine.
- In years with a moderate to heavy crop, and when the canopy remains healthy and intact well after harvest, there are many possible implications to harvest timing. An early, as opposed to late, harvest in this context can increase leaf K, sugars and frost tolerance and hastens leaf senescence. In the corresponding cane tissue, similar changes to K and carbohydrates hold the potential to increase bud hardiness, bolster early spring growth and improve the crop load the following season, especially in the wake of winter damage.