

# **Bud Hardiness and Winter Injury Assessment 2019-2020**

## **Progress Report**

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### **Research and Extension**

**Introduction.** This project was designed to provide timely information on bud hardiness and potential winter and spring frost injury to growers throughout New York by completing the three objectives outlined:

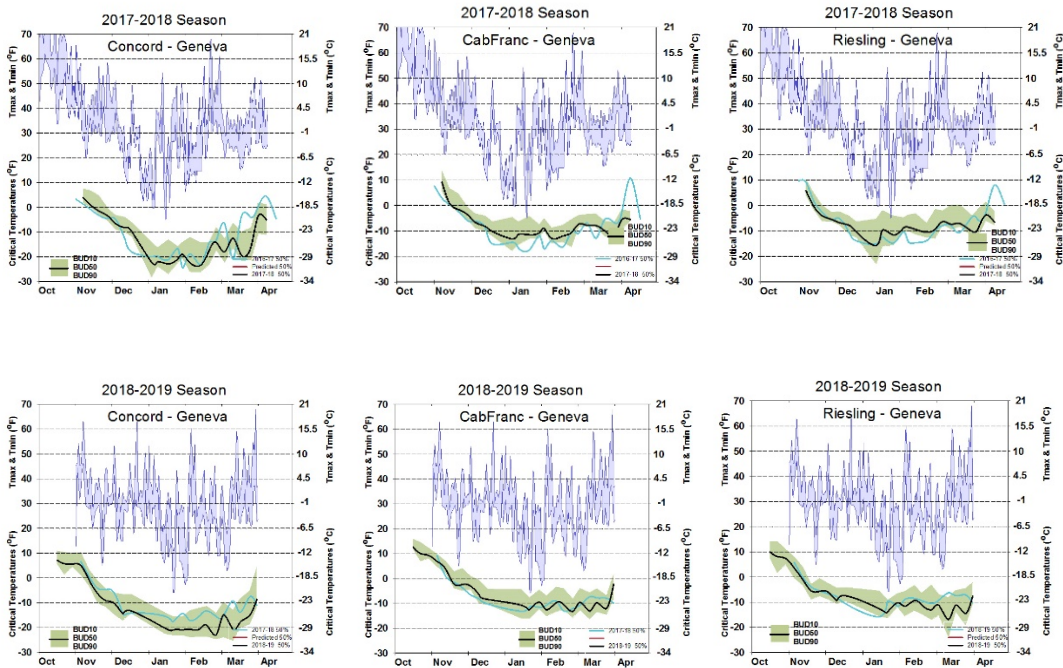
1. Continue using differential thermal analysis (DTA) to determine bud LTEs in standard varieties in three regions of NY (Finger Lakes, Hudson Valley, and Portland, NY (Lake Erie) Laboratory) from late November through April.
2. Provide timely extension information to the industry through the [Bud Hardiness web page](#).
3. With new equipment at CLEREL, monitor and report bud hardiness for regionally important varieties, and determine the relationship of bud hardiness to cropping levels in existing research projects in Lake Erie research and commercial vineyards.

One important fact to note is that this project operates during the dormant season, and this year's results won't be final until after budburst. So as this is written in January, 2020, results from this year are incomplete, because we are in the middle of the dormant season. So much of what we can report is from the previous year's work (2018-2019 season).

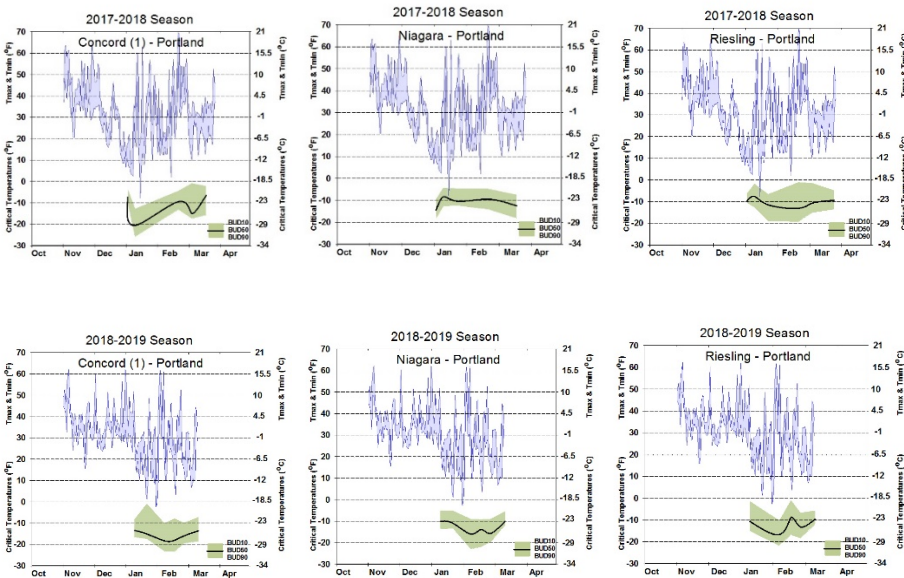
The 2018-2019 winter season had two sub-zero F cold events in Geneva, with temperatures ranging from -5° F (Mid January) to -3° F (Late January). At CLEREL in Portland, NY, winter lows were more moderate at +1° F (Mid-January) and -1° F.. Bud injury estimates from cutting and examining buds at the end of the cold season were in the 2-10% range at cooler Finger Lakes sites (except the West Keuka site with higher levels for Riesling (24%) and Cabernet Franc (43%). At Geneva, bud injury ranged from 2-6% (Concord and Noiret) to 8% (Cabernet Franc) and 10% (Riesling). No estimates were made in the Lake Erie and Hudson Valley regions. Resulting bud injury and spring frost injury was minimal, except in the Hudson Valley, where Jim Meyers reported a significant late winter (March) cold-event that we didn't capture, resulting in significant cold injury. Monitoring for the [2019-2020 season](#) is still underway.

#### **Activities by objective:**

1. **Differential thermal Analysis (Bud freezing runs).** Buds were collected from Geneva (NYSAES) weekly from Concord, Cabernet franc, Riesling, and Noiret vines from 1 November 2018 through 1 April 2019, and subjected to controlled freezing to determine the range of bud-freezing temperatures. In addition, The Finger Lakes, Lake Erie, and Hudson Valley grape extension programs collected buds from the same varieties at 6 locations in the Finger Lakes, 2 locations in Lake Erie, and from the Hudson Valley Laboratory in Highland, NY. Collections were made at two week intervals from early January to March 18, 2019.
2. **Seasonal LTEs.** Maps and tables showing current LT50s for Concord, Riesling, Cabernet Franc and various hybrids from the Lake Erie, Finger Lakes, and Hudson Valley were posted at the [Bud Hardiness web page](#). Shown below are data from, 2017-2018, and 2018-2019. Current collections for 2019-2020 are still in progress.



**Figure 1.** Daily min/max temperatures and bud freezing temperatures (Low Temperature exotherms from laboratory tests on dormant buds; black line is  $LT_{50}$ ) in Cabernet franc, Riesling, and Concord at Geneva in 2017-2018 and 2018-2019. In contrast to 2016 (not shown), the minimum temperatures never crossed the black ' $LT_{50}$ ' line. However, early January 2018 temperatures of -5 to -7 °F came close to  $LT_{10}$  values in Cabernet Franc and Riesling. Since 2015-16, we have also posted the previous year's  $LT_{50}$  (light blue) along with current bud hardiness measurements (black line).

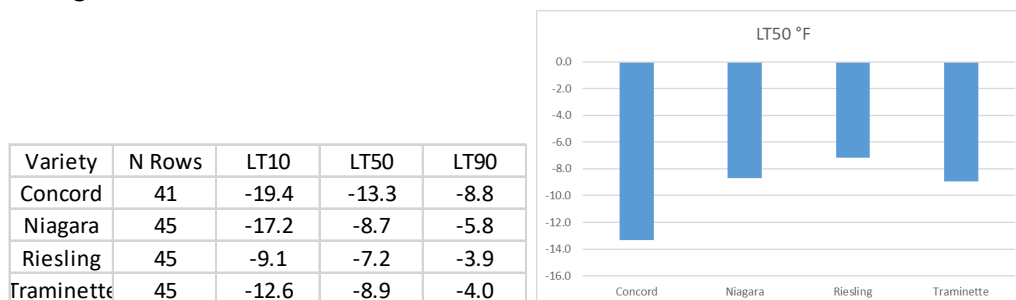


**Figure 2.** In the Lake Erie Region, temperatures dropped to -9 °F, leading to predicted bud injury in Niagara and Riesling blocks, but not Concord.

### 3. With new equipment at CLEREL, determine the relationship of bud hardiness to cropping levels in existing research projects in Lake Erie research and commercial vineyard. .

The Lake Erie Regional Grape Program purchased a Tenney T2 freezer and Brock University Bud Freezer software package to conduct research at Cornell Lake Erie Research Extension Laboratory on grapevine cold hardiness. The freezer was installed and is currently running. However there were a few technical issues that had to be resolved to start collecting data. To this end, Jennifer Russo has been working with Watlow software technical support, Tenney Environmental, Inc., and Brock University BudLTE software designers to resolve software issues of communication between the Tenney T2 freezer and other components of the system (Keithly data logger). Data collection started in January 2020, rather than early November as had been planned.

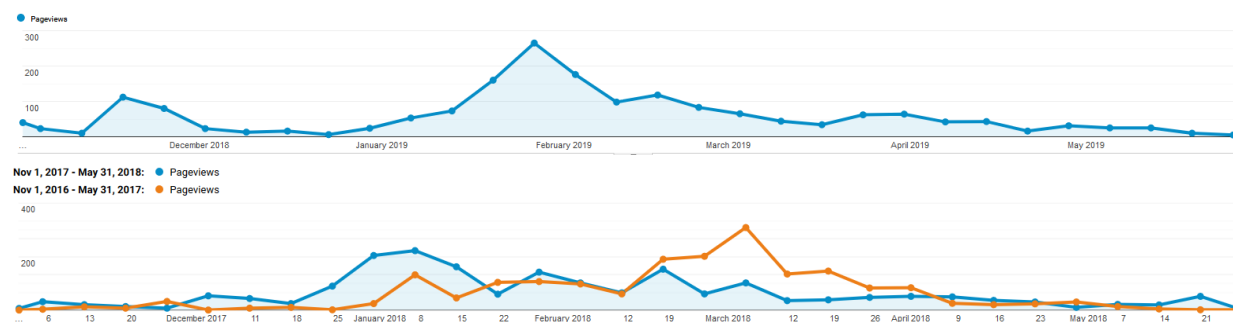
To date, we have had one successful run on January 17. We are looking forward to expanding our testing for the remainder of the dormant season.



**Figure 3.** Results of the January 17, 2020 run with the new equipment at CLEREL laboratory in Portland, NY.

**Crop Updates.** Information from bud hardiness monitoring was included several crop updates and newsletter articles by the Lake Erie Regional Grape Program, the Finger Lakes Grape Program, and the Hudson Valley-based Eastern New York Horticulture Extension Program.

**Number of web accesses:** We tracked how many times the bud hardiness pages were accessed three dormant seasons (November-May, 2016-7, 2017-8, 2018-9). Pages were accessed 1150 times in 2017-2018, 1225 times in 2016-2017 and 1,764 times in 2018-2019.

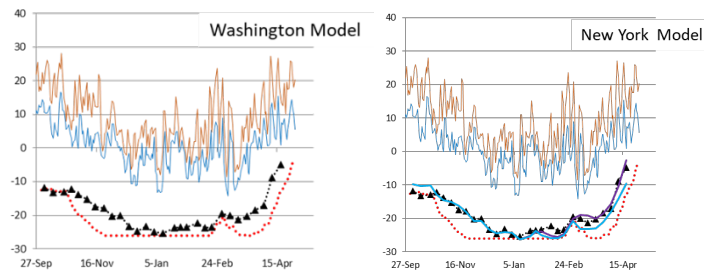


**Figure 4.** Top: Number of 'Page views' to bud hardiness site from November 2018-May 2019. Bottom: Same data from November 2016-May 2017 (orange line) and Nov 2017-May 2018 (blue line).

**Grower Outcomes:** Due to the moderately mild dormant season in 2018-2019, winter injury was less of a concern among growers than in previous years. Highest access of our bud hardiness site (Figure 4) was following the Late January cold event.

In previous seasons (2014-2015 and 2015-2016), our information had a lot of impact on growers. In part because of our extension outreach, bud hardiness monitoring, and followup bud injury surveys, growers adjusted pruning intensity, in many cases leaving 5x the normal number of buds, and were able to compensate for the winter injury. This is detailed in the Appellation Cornell article [How well did winter bud injury measurements predict the final grape crop?](#)

**Other outcomes:** In a related project, PI Martinson is working with Dr. Jason Londo, USDA ARS scientist, on developing robust predictive models of bud hardiness. His program does weekly collections from 42 varieties, including Concord and Niagara, but also a wide range of interspecific hybrids and *vinifera* cultivars. The model uses daily min/max temperatures to predict bud hardiness – and to date provides a better fit (Fig. 5, blue line at right) to observed data than a widely-used model from Washington State. Our long term goal is to include the model as an element of the NEWA site, so that growers could use local weather data to predict what the bud freezing temperatures (LT50) are at their farm.



**Figure 5.** *The Washington State model(left) predictions (red dotted line) underestimated measured bud hardiness (black line and triangles) before midwinter, and also during the springtime deacclimation phase. The New York model (right, solid blue line) developed by Al Kovaleski and Jason Londo at Geneva used precise measurements of acclimation and deacclimation rates to closely predict LT50s based on daily min/max temperatures.*

**Publications:** Information from this project was featured in 5 Finger Lakes Crop Updates and 1 Lake Erie Crop Updates (for list see appendix).

**Summary:** Information on winter injury and bud hardiness helped growers throughout New York prepare for and respond to winter injury in their vineyards. This was a coordinated effort of several grape extension programs: Lake Erie, Finger Lakes, Hudson Valley, and Statewide Viticulture Program.

## B. Appendix

### a. Impact Statement:

Winter injury associated with extreme winter-low temperatures is a major ongoing concern for grape growers in New York. Since 2009, grape extension programs from the Lake Erie, Finger Lakes, and Hudson valley regions have worked with the Statewide Viticulture Extension programs to provide seasonally current estimates of bud freezing temperatures for major varieties by using controlled freezing to determine bud low temperature exotherms. This information posted at the [Bud hardiness data](https://grapesandwine.cals.cornell.edu/extension/bud-hardiness-data) page was accessed 1150 times in 2017-2018, down slightly from 1225 times in 2016-2017 during the dormant season.

### b. Publications:

Martinson, T. and W. Wilsey. 2009-2020. [Bud hardiness data](https://grapesandwine.cals.cornell.edu/extension/bud-hardiness-data), accessed at <https://grapesandwine.cals.cornell.edu/extension/bud-hardiness-data>.

Weigle, Tim. [How Low did it go?](#) Lake Erie Regional Grape Program crop update, February 21, 2019

Walter-Peterson, Hans. [Bud hardiness Status heading into 2019](#). Finger Lakes Vineyard Update, December 20, 2018.

Walter-Peterson, Hans. [Bud hardiness ahead of the winter storm 'Harper'](#). Finger Lakes Vineyard Update, January 18, 2019

Walter-Peterson, Hans. [Update on Bud Hardiness Assessments](#). Finger Lakes Vineyard Update, February 8, 2019

Walter-Peterson, Hans. [Update on Bud Hardiness Assessments](#). Finger Lakes Vineyard Update, March 21, 2019.

Walter-Peterson, Hans. [2018-2019 Bud Cutting Results](#) Finger Lakes Vineyard Update, April 18, 2019