

# **Grapevine Cold Hardiness: Developing a Data Base for California**

## **Progress Report 2001-2002 for Research Funded by;**

American Vineyard Foundation  
California Competitive Grant Program  
California State University, Agricultural Research Initiative

Submitted by:

Dr. Robert L. Wample  
Department of Viticulture and Enology  
Viticulture and Enology Research Center  
2360 East Barstow Ave.  
Fresno, CA 93740  
559-278-7170 (Phone) 559-278-4795 (fax)  
California State University, Fresno

## **II.**

### **Co-Principal Investigator:**

Larry J. Bettiga, - Cooperative Extension Agent  
1432 Abbot Street, Salinas, CA 93901

### **Cooperator (s):**

La Panza Vineyards – P.O. Box 720 Arroyo Grande, CA 93421  
Contact Person – Rob Murray 805-550-1864  
Red Hill Vineyards - – P.O. Box 720 Arroyo Grande, CA 93421  
Contact Person – Rob Murray 805-550-1864  
French Camp Vineyards – P.O. Box 10, Shandon, CA 93461  
Contact Person – Hank Ashby 805-238-5811  
Mondavi (Santa Margarita) – 1305 Marsh Street, San Luis Obispo, CA 93401  
Contact Person – Neil Roberts 805-542-1517  
J. Lohr Vineyards – 6169 Airport Road, Paso Robles, CA 93446  
Contact Person – Steve Carter 805-239-9087  
VPS – P.O. Box 1360, Templeton, CA 93465  
Contact Person – John Crossland 805-434-2044

## **III. Executive Summary:**

The ultimate objective of this study is to develop a database of cold hardiness values for samples from the central coast region of California that can be used to develop a cold hardiness model. The model, taking into consideration the principle factors that influence grapevine cold hardiness, will be used to help growers predict the temperatures at which injury may occur. This will assist them in making decisions regarding their efforts to avert such injury through the use of wind machines, irrigation, and other vineyard management practices.

As of this date, this project has developed the necessary low temperature exotherm analysis system necessary to detect cold hardiness of grapevine buds and cane tissues. This has involved the acquisition and assembly of numerous electronic components and software to manage these components to enable the detection of the transition of the extra- and intracellular water in grapevine buds and cane tissues from a liquid to a solid state (ice). This transition is accompanied by the release of the heat of fusion. By using a computer-facilitated program to monitor the output of thermoelectric modules and the temperature in the freezing chamber, the low temperature exotherm event can be detected. The development of this system has unfortunately taken longer than anticipated and has only recently (December 18, 2001) been completed. Since this time, we have successfully identified the temperatures at which freezing of grapevine buds are occurring. We are now beginning to accumulate the database that will be necessary to develop the model.

#### **IV. Objectives and Experiments underway.**

##### **2000-2001 Objectives:**

- Conduct low temperature exotherm analysis to determine cold hardiness of grapevine bud and cane tissues from mid October through February.
- Evaluate the influence of local weather conditions on cold hardiness characteristics and cold injury of grapevine bud and cane tissues.
- Evaluate grapevine cold acclimation and deacclimation in response to weather conditions that are associated with low temperature injury.
- Continue development of a grapevine cold hardiness model to permit better and more economical management practices to eliminate or reduce low temperature injury to grapevines in California.
  - A low temperature exotherm system was designed and constructed to determine the freezing points of grapevine buds. Since there is no commercially available system to make these measurements, nor is this technology typically used by private industry, it has been necessary for us to design and build the system “from scratch”. Although some of the design was based on a previous system that the principal investigator had at Washington State University, many of the components of the older system are no longer available, requiring new components be substituted and their performance evaluated. The system is now fully functional and we are beginning construction of the second system to permit sample analysis in a timely manner.

#### **V. Research Accomplishments:**

The following tables indicate the cold hardiness of samples from the cooperating vineyards. Although the number of samples is limited at this time, there are some interesting changes and differences between vineyards. Within the Cuesta, La Panza and VPS vineyards, there is a general increase in cold hardiness from early to mid January. In the French Camp Vineyard there appears to be a loss of cold hardiness. There is too little information or there was a change in the samples that were collected to allow any interpretation. Samples taken in the next few weeks will give a good idea of how the changing weather conditions will affect bud cold hardiness. These data represent the

beginning of the data set that will eventually allow some prediction of grapevine bud cold hardiness. There may be an opportunity to examine the effects of rootstocks on cold hardiness, a subject that has been frequently discussed and often contested in the past, and differences between clones. It was never intended that we would accomplish all of the objectives listed for 2000-2001 during that time, since this is a long-term study. We have made a good start, now that we have successfully constructed the LTE system and we will now be able to move forward with these studies.

#### **Cuesta Ridge 1/17/02**

<b>Vineyard Loc.</b>	<b>High</b>	<b>Low</b>	<b>Average</b>
#901 C.S. 8 /101-14	-15.0	-18.2	-16.4
#914 C.S. 15 /1103P	-17.2	-19.2	-18.3
#915 C.S. 7 /44-53	-14.9	-19.2	-16.4
#918 C.S. 7 /101-14	-16.5	-18.7	-18.0

#### **Cuesta Ridge 1/24/02**

<b>Vineyard Loc.</b>	<b>High</b>	<b>Low</b>	<b>Average</b>
#901 C.S. 7 /101-14	-17.0	-20.0	-18.4
#914 C.S. 15 /1103P	-15.9	-19.2	-17.7
#915 C.S. 7 /44-53	-13.5	-19.5	-17.8
#918 C.S. 8 /101-14	-16	-21.2	-19.7

#### **French Camp 1/05/02**

<b>Vineyard Loc</b>	<b>High (C)</b>	<b>Low (C)</b>	<b>Average (C)</b>
Vyd #1 Samp. A	-18.1	-20.7	-19.6
Vyd. #1 Samp. B	-18.0	-21.5	-20.2
Vyd. #2 Samp. A	-19.5	-22.0	-21.1

#### **French Camp 1/23/02**

<b>Vineyard Loc.</b>	<b>High (C)</b>	<b>Low (C)</b>	<b>Average (C)</b>
Vyd #1 Samp. A	-18.5	-20.0	-19.4
Vyd. #1 Samp. B	-19.4	-20.3	-19.8
Vyd. #2 Samp. A	-17.6	-20.4	-19.2
Vyd. #3 Samp. A	-16.5	-20.5	-19.0

#### **J. Lohr Vineyards (Under VPS) 1/18/02**

<b>Vineyard Loc.</b>	<b>High</b>	<b>Low</b>	<b>Avg.</b>
PR 62 Control	-19.5	-21	-20.18
PR 62 No Irrigation	-19.0	-20.7	-20.23
PR 10 South	-19.6	-21	-20.23
PR 10 North	-19.4	-20.7	-20.03

#### **La Panza 12/10/01**

<b>Vineyard Loc.</b>	<b>High (C)</b>	<b>Low (C)</b>	<b>Average (C)</b>
Sample #5	-16.3	-19.2	-17.6

Sample #6	-14.1	-18.4	-16.4
Sample #7	-14.8	-17.5	-16.5
Sample #8	-15	-18.7	-17.5

**La Panza 1/02/02**

<b>Vineyard Loc.</b>	<b>High (C)</b>	<b>Low (C)</b>	<b>Average (C)</b>
Sample #5	-19.6	-22.3	-21.3
Sample #6	-16.0	-22.0	-18.6
Sample #7	-17.0	-22.5	-19.5
Sample #8	-17.5	-22.0	-19.2

**Reserve Vineyard Management 1/21/02**

<b>Vineyard Loc.</b>	<b>High (C)</b>	<b>Low (C)</b>	<b>Average (C)</b>
RH #1	-16.5	-19.3	-18.3
RH #2	-16.6	-20.6	-18.3
RH #3	-16.4	-18.0	-17.3
RH #4	-18.5	-20.7	-19.6
Site #5	-18.1	-18.9	-18.6
Site #6	-16.8	-18.5	-18.1
Site #7	-16.1	-18.3	-17.2
Site #8	-18.0	-18.8	-18.5

**VPS 1/05/02**

<b>Vineyard Loc.</b>	<b>High (C)</b>	<b>Low (C)</b>	<b>Average (C)</b>
#3 (LV) C.S. 08 /101-14	-18.0	-22.0	-20.6
#4 C.S. 08 /1103P	-17.9	-19.0	-18.4
#4 C.S. 337 /140RU	-17.5	-21.2	-19.3
#10 C.S. 04 /110R	-17.8	-20.8	-19.3

**VPS 1/18/02**

<b>Vineyard Loc.</b>	<b>High (C)</b>	<b>Low (C)</b>	<b>Average (C)</b>
#3 (LV) C.S. 08 /101-14	-19.21	-21.0	-20.335
#4 (LV) C.S.08 /1103P	-20.9	-20.5	-20.77
#4 (LV) C.S 337 /140RU	-17.9	-20.5	-19.05
#10 C.S. 04 /110R	-17.8	-20.6	-19.307

The organization of a group of wine grape growers in the Paso Robles area that have experienced low temperature injury to their vines is a significant contribution to this project. These growers agreed to provide support for the development of this equipment and to support this project at the American Vineyard Foundation for future funding. The growers combined to provide \$16,800 in support of the project. They have also

organized themselves to collect temperature data in their vineyards and to collect samples to be analyzed.

**VI. Presentations:**

I have also met with these growers to discuss possible management practices that would be beneficial in reducing low temperature injury in their vineyards.

Two presentations on grapevine cold hardiness have been made at grower meetings in California. The intent of these presentations is to make California growers more aware of the problem and the physiological characteristics of grapevines that are important in the decision making process.

**VII. Impact Statements:**

- Development of a low temperature exotherm system that can be used to establish a database for California grapevines. Such a system has not existed to this point.
- Beginning of an educational outreach program to make growers more aware of the problem of low temperature injury to grapevines and how their management practices may influence grapevine cold hardiness.
- Establishment of a grower group to provide input and support for the project, including the collection and shipping of samples for analysis.
- It is too early in this project to have sufficient data to develop a publication.

**VII. Funds Status:**

There is about \$8,000 in the combined AVF and CCGPVE accounts. A significant amount of this (>4,000) will be used to construct the second LTE system and there will be continued costs of running the samples through February and early March.

**Grapevine Cold Hardiness: Developing a Data Base for California**

A Proposal Submitted to

American Vineyard Foundation, Viticulture Consortium,  
California Competitive Grant Program for Research in Viticulture and Enology  
And  
Agriculture Research Initiative

Submitted on Behalf of the Co-Principal Investigators By:

---

Dr. Robert L. Wample, Chair / Director  
Department of Viticulture and Enology /  
Viticulture and Enology Research Center  
California State University, Fresno

---

Date

**Approved By:**

---

**Dr. Robert L. Wample, Chair / Director**  
Department of Viticulture and Enology /  
Viticulture and Enology Research Center  
California State University, Fresno

---

Date

---

**Joe Bezerra, Director of Operations**  
California Agricultural Technology Institute  
California State University, Fresno

---

Date

---

**Dr. Carl Pherson, Director of Farm Operations**  
College of Agricultural Sciences and Technology  
California State University, Fresno

---

Date

---

**Dr. Dan Bartell, Dean**  
College of Agricultural Sciences and Technology  
California State University, Fresno

---

Date