OSU Viticulture

Vineyard Notes

December 2009

Cold Weather Strikes Again

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The cold weather we experienced across the state and the Pacific Northwest over the past week seems like a repeat of some of last year's weather. When temperatures decrease rapidly and reach sub-lethal levels, there is potential for damage to grapevine buds or tissues. Most areas of the state surpassed last year's low temperatures. The lowest temperatures recorded in grape growing regions across the state were on December 9-11, 2009 (Table 1 and Figure 1). Some areas of eastern and central Oregon experienced near zero and sub-zero temperatures in the morning hours but were in the single digits for much of the day during this timeframe (Figure 1). Although temperatures were low, most grape production regions of western Oregon (southern Oregon and the Willamette Valley) were not in critical temperature ranges for more than several hours. Damage of grapevine buds and tissues are likely to be more evident in eastern and central Oregon. Although regional information is shown here, be sure to assess your site's weather station information to determine your potential for vine damage.

Table 1. Temperatures across Oregon December 6 – 13, 2009

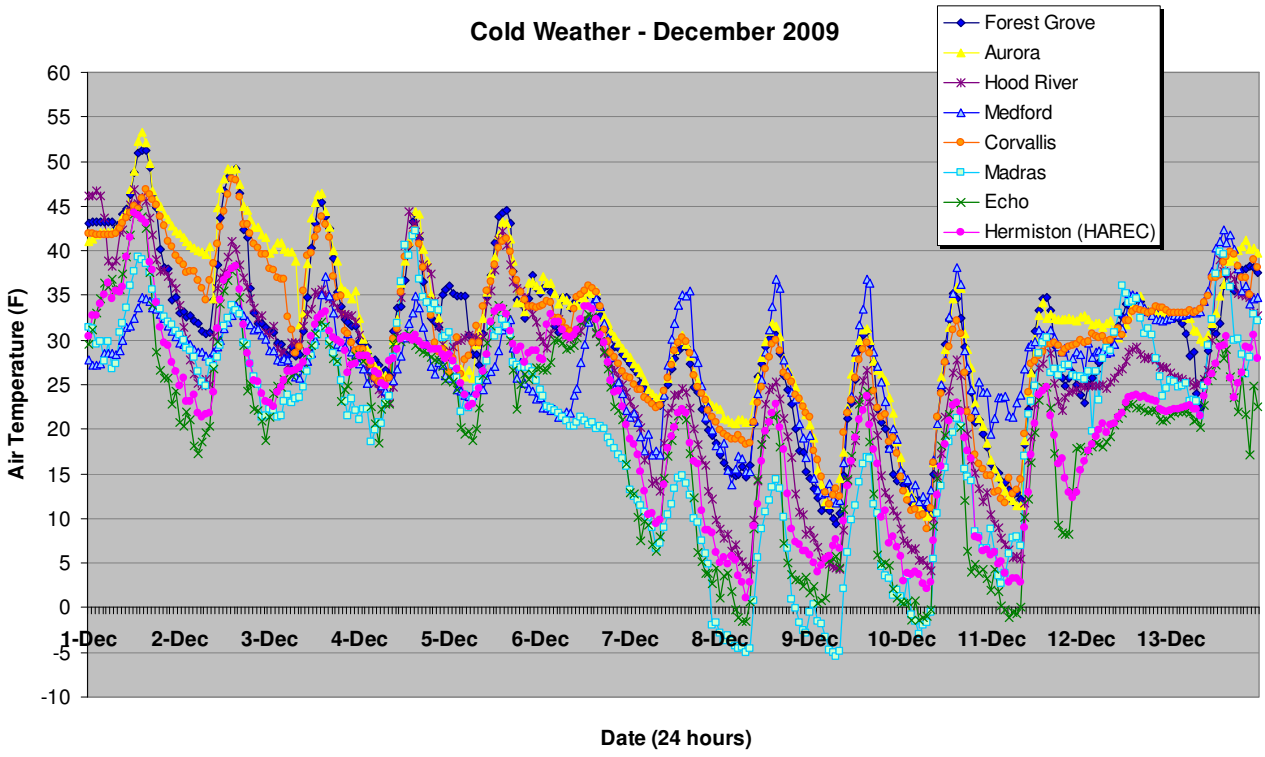
Daily Minimum Temperatures (°F)								
	Medford	Corvallis	Aurora	Forest Grove	Hood River	Hermiston	Echo	Madras
6-Dec	21	25.78	28.27	27.25	23.15	19.14	12.78	13.78
7-Dec	16.28	20.36	22.27	17.7	9.44	4.33	0.82	-2.38
8-Dec	13.73	18.07	20.2	14.5	4.28	1.15	-2.53	-6.48
9-Dec	10.26	11.15	10.18	9.44	3.73	3.51	0.25	-6.61
10-Dec	11.07	8.74	9.79	9.93	4.18	1.48	-3.13	-4.24
11-Dec	19.08	11.53	11.33	11.81	5.1	2.46	-1.29	2.75
12-Dec	26.23	29.6	29.79	22.94	24.58	15.32	16.9	19.39
13-Dec	32.38	32.93	28.45	22.26	24.83	20.49	16.96	21.08
Daily Maximum Temperatures (°F)								
	Medford	Corvallis	Aurora	Forest Grove	Hood River	Hermiston	Echo	Madras
6-Dec	35.56	36.11	37.16	36.31	32.89	34.48	33.59	24.48
7-Dec	35.54	30.3	30.58	29.44	24.58	22.24	22.14	15.07
8-Dec	37.56	30.21	31.91	30.99	25.31	23.01	22.54	14.72
9-Dec	36.87	29.68	31.36	31.66	26.79	23.68	24.23	17.09
10-Dec	38.08	32.18	36.17	35.71	27.97	23.75	23.23	21.64
11-Dec	31.25	29.79	34.16	35.09	30.5	25	24.76	30.32
12-Dec	36.2	33.73	34.92	34.8	29.6	23.93	23.09	36.51
13-Dec	43.93	40.31	41.26	38.38	39.05	32.37	29.66	40.36

Table 1 Continued…

Daily Mean Temperatures (°F)								
	Medford	Corvallis	Aurora	Forest Grove	Hood River	Hermiston	Echo	Madras
6-Dec	26.13	32.03	33.5	32.82	29.43	29.3	27.43	20.17
7-Dec	24.24	24.9	25.78	24.43	18.44	14.4	11.13	9.09
8-Dec	22.46	23.03	24.72	20.95	13.31	10.28	7.48	2.52
9-Dec	21.05	19.93	21.41	18.77	12.91	11.49	8.89	4.26
10-Dec	22.13	18.58	21.32	20.62	14	10.66	7.73	8.19
11-Dec	26.9	22.72	24.39	22.68	17.63	12.57	10.26	18.81
12-Dec	31.22	31.77	32.51	30.86	26.64	21.32	20.49	29
13-Dec	36.05	35.92	35.29	32.7	31.09	25.29	23.61	29.2

Source: Agrimet

Figure 1. Cold temperatures across Oregon from December 6 through December 13, 2009. Hourly air temperatures shown (x-axis = 1:00 hour increments).



Cold Damage of Buds and Tissues

Sub-lethal temperatures during winter can cause damage of vine tissues including buds, xylem and phloem (vascular tissues). Dormant buds have variable tolerance to cold temperatures as the dormant season progresses from fall to spring. Temperatures at which buds or tissues are damaged are higher at earlier dormancy stages than when the vine is in a full dormant stage. For example, late season frost events that occur in the harvest/post-harvest timeframe can cause damage to buds even before winter begins. Bud damage and reduced yields were observed in 2009 as a result of October frosts that occurred in some areas of southern Oregon and frost-prone sites in 2008. Timing and intensity of cold winter temperatures can lead to variable damage to grapevines, but cultivar is also a factor in vine damage. Cabernet Sauvignon and Riesling are two of the most cold-tolerant *V. vinifera* cultivars. Chardonnay and Pinot Gris are less hardy. Research indicates that Cabernet Sauvignon buds have LTE_{50} of -4°F; this is the low temperature exotherm at which 50%

of primary buds have been killed (Mills et al. 2006, Wolf and Cook 1994). Mills et al. (2006) defined cold hardiness of eight cultivars including the following reds: most hardy Cabernet Sauvignon > Malbec = Syrah > Merlot least hardy. As for white cultivars, the hardiness follows: most hardy Riesling > Chardonnay > Pinot Gris = Viognier. Pinot Noir buds were found to have an LTE_{50} of 6.8°F when quiescent (end of dormancy) in spring (Gardea 1988) and can withstand much colder temperatures when fully dormant.

In general, **dormant** buds and vascular tissues will not be damaged at temperatures above 5°F if they are acclimated properly. A lack of cold hardiness may exist in buds and wood of vines that are poorly acclimated going into winter or have had other stresses due to drought, disease, insect pest or previous frost damage. Overly vigorous vines, although apparently healthy, often acclimate later than moderate or lower vigor vines and may have a reduced cold hardiness. Monitor sensitive blocks of the vineyard for bud survival if your area experiences low or sub-zero temperatures this winter.

Bud Winter Damage Assessment

If you are concerned about the damage in your vineyard, you can easily conduct bud viability estimates before pruning this winter. For each vineyard block, select 20 shoots that grew last season. Be sure to take these randomly throughout the vineyard and from various locations within a given vine. Use at minimum 5 buds on a shoot to do bud assessments, using buds from middle to basal regions of the dormant shoot. Do not use buds from terminal ends of the shoot as they may be dead. These areas of the shoot grow later in the season, acclimate later and lack the same cold temperature tolerance. Death of terminal tissues can be quite common. To assess bud viability, use a sharp razor blade to cut through the center of the bud, half way down (Figure 2). If the bud is cut too deep, tissues will be removed and will reveal the underlying stem. A good cut will allow you to see the three bud components of the compound bud. The largest bud is the primary which is the most productive for producing fruit and also the most susceptible to damage. The secondary and tertiary buds are to either side of the primary. Live tissues of the bud will be light green (Figure 3). Dead buds will be necrotic and brown. Count the number dead primary buds of the 100 buds examined to get the percentage of bud damage. Use these estimates when pruning to determine how many buds to leave on vines to ensure an adequate crop. If there are young, newly planted vines with very little cane tissue available for sampling, alter this method by collecting more canes with fewer buds per shoot.

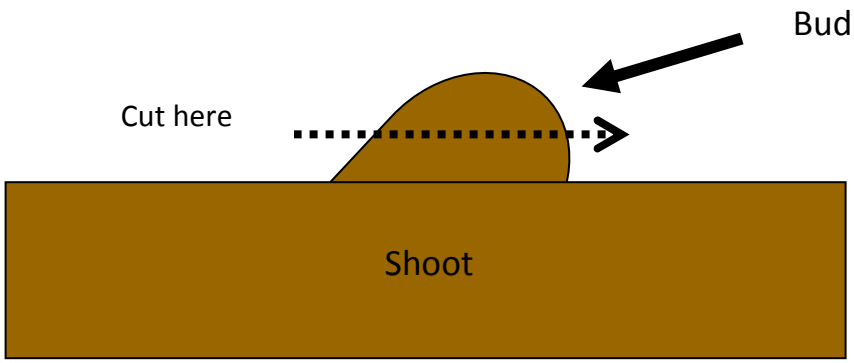


Figure 2. Cut a dormant bud with a razor blade half-way through the bud to assess bud death.

A great reference on winter damage to grapevines is *Winter Injury to Grapevines and Methods of Protection - Michigan State University Extension Publication E2930*. See the Resources section below.

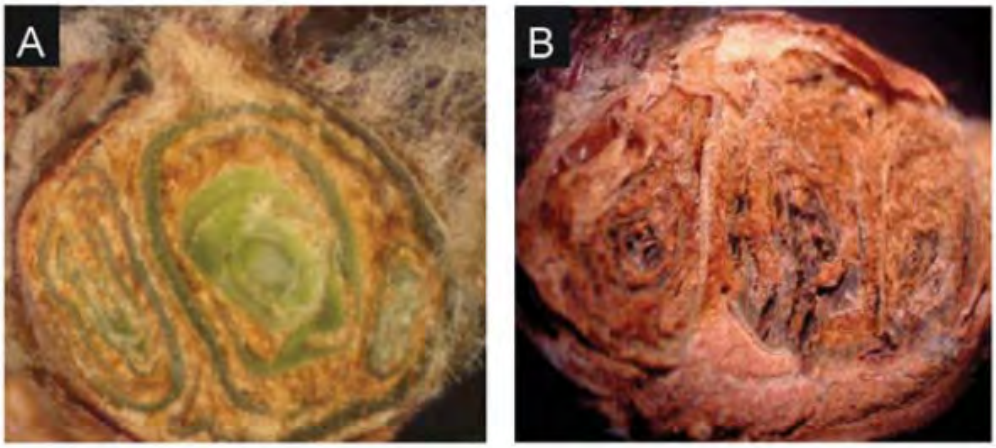


Figure 3. A live compound bud (A) shows no damage. Notice green tissues of primary, secondary and tertiary buds. Necrotic tissues are evident in a damaged bud (B) where there is significant damage and loss of the entire compound bud. *(Mills et al. 2006).*

Winter Damage and Crown Gall

Figure 4. Crown gall on a vine trunk. *(Skinkis 2008)*

Freeze damage to conducting tissues of trunks and canes can cause crown gall to form in vines. Crown gall is formed from the bacteria, *Agrobacterium vitis,* at the site of wound. This bacterium is found within grape plant material, and damage to vine tissues induces crown gall bacterium growth as the wound begins to heal. The bacterium causes uncontrolled cell growth at that site. Over time, this gall can block conducting tissues and cause death of the vine. Grafted vines have been observed to have crown gall form near the graft union when cold damage occurs, particularly on young vines.

During pruning, scout the vineyard for signs and symptoms of past crown gall infection/damage. New establishment of crown gall won't be apparent until spring or early summer. Galls will start out as green cauliflower-looking growths that follow a crack that forms on the vine. Later, the crown gall growth will turn brown as shown in the trunk in Figure 4. Vines with crown gall should be flagged and noted so they can be tracked for damage during the growing season. Damage will be more pronounced on younger vines. Older vines may have symptoms of slow growth or decline and may take longer to succumb to damage. It is important to note that callus tissue will form in the area of a wound of a vine and will not always be crown gall.

Agrobacterium vitis is found within grape plant material and can be spread through propagation. As a result, field or bench grafting can result in crown gall formation if infected material is used. Crown gall in grape was once thought to form from soil-borne *Agrobacterium spp*., but soil inoculation can only occur with *Agrobacterium vitis* that persists from grape debris that exists in a soil. There is variability in tolerance of crown gall for different cultivars and rootstocks. Some rootstocks have been shown to be resistant to crown gall formation, particularly those with *Vitis riparia* background (Riparia Gloire, 3309C and 101-14) and have the ability to confer some resistance to scion cultivars due to a reduced survival of the bacteria in the rootstock. Most *Vitis vinifera* grape cultivars are susceptible to crown gall, and only select inter-specific hybrids and American *Vitis* species show resistance.

Resources

Burr, T.J., C. Bazzi, S. Sule, L. Otten. 1998. Biology of Agrobacterium vitis and the Development of Disease Control Strategies. Plant Dis. 82: 1288-1297.

Gardea, A.A. 1988. Freeze Damage of Pinot noir (*Vitis vinifera L.*) as Affected by Bud Development, INA Bacteria, and a Bacterial Inhibitor. Oregon Wine Advisory Board Research Progress Report. <online> http://wine.oregonstate.edu/winegrape_disease.

Mills, L.J., J.C. Ferguson, M. Keller. 2006. Cold-Hardiness Evaluation of Grapevine Buds and Cane Tissues. Am. J. Enol. Vitic. 57: 194-200.

Proebsting, E.L., M. Ahmedullah, V.P. Brummund. 1980. Seasonal Changes in Low Temperature Resistance of Grape Buds. Am. J. Enol. Vitic. 31: 329-336.

Wolf, T.K. and M.K. Cook. 1994. Cold Hardiness of Dormant Buds of Grape Cultivars: Comparison of Thermal Analysis and Field Survival. HortSci. 29:1453-1455.

Zabadal, T.J., I.E. Dami, M.C. Goffinet, T.E. Martinson, M.L. Chien. 2007. Winter Injury to Grapevines and Methods of Protection. Michigan State University Extension Publication E2930. http://www.emdc.msue.msu.edu/viewitem.cfm?INVKEY=E2930

Upcoming Events

Online Viticulture Extension Course – Winter 2010 – Register Now!

Register by December 20 for the best rate!

This is an online offering to Oregon's winegrape industry to participate in one of OSU's viticulture courses taken by upper-division students at Oregon State University. This course can provide continuing education of current industry members or for those new to vineyard/wine production. Course content will focus on the production and physiology behind vineyard management practices. Students are encouraged to think critically about practices and make informed decisions based on vine physiology and management research. The course is offered online through an interactive format. For more information and registration, visit http://wine.oregonstate.edu/http%3A/%252Fwine.oregonstate.edu/VineyardProductionPrinciples.

OSU Viticulture & Enology Colloquium – March 11, 2010

This one-day event features research presentations of studies that impact Oregon's winegrape industry. This is a portal for members of the Oregon winegrape industry to learn about the most recent outcomes of viticulture and enology-related research conducted by Oregon State University, the USDA-ARS Hort Crops Research Unit and other collaborating units in the program. For more information and registration online, visit http://hort.oregonstate.edu/3-11-2010Event.

New Viticulture Extension Publications Available

Field Monitoring for Grapevine Leafroll Virus and Mealybug in Pacific Northwest Vineyards by P.A. Skinkis, A.J. Dreves, V.M. Walton, R.R Martin. July 2009.
http://wine.oregonstate.edu/files/files/em8985%20proof5.pdf
Spanish version available! http://wine.oregonstate.edu/files/files/em8985-Srev.pdf

Grapevine Leafroll Virus and Mealybug Prevention and Management in Oregon Vineyards by V. Walton, A. Dreves, P. Skinkis, C. Kaiser, M. Buchanan, R. Hilton, R.R. Martin, S. Castagnoli, S. Renquist. October 2009. http://wine.oregonstate.edu/files/files/em8990.pdf. Spanish version will be available soon.

A New Pest Attacking Healthy Ripening Fruit in Oregon by A. J. Dreves, V. Walton and G. Fisher. October 2009. http://wine.oregonstate.edu/files/files/drosophila%20zudikii.pdf.