Oregon State University OSU
Viticulture Extension
Vineyard Notes
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Cold Weather Strikes Worries of Vine Damage

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The cold weather that occurred last week caused some concern about potential damage to grapevine buds or tissues. Most areas of the state reached the lowest temperatures on December 16 and 17 (Table 1 and Figure 1). Some areas of eastern and central Oregon experienced sub-zero temperatures in the early morning hours but were in the single digits for much of the day on December 16. These are the locations that could potentially have bud kill. However, the areas of southern Oregon and the Willamette Valley likely have not experienced damage with these temperatures and short duration of the cold period. Areas of eastern and central Oregon may have experienced bud or tissue damage with the cold temperatures. Isolated incidences of colder weather and longer durations may have occurred in all of these areas shown in Table 1, so assess this information based on your site conditions.

Table 1. Temperatures across Oregon

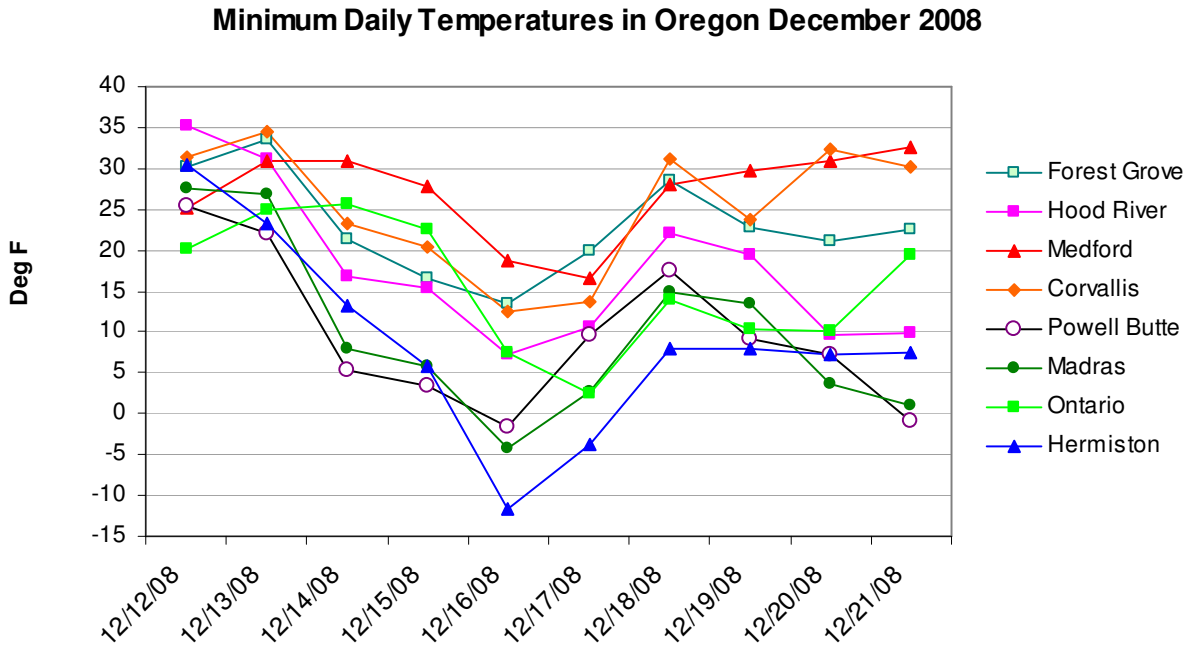
Daily Minimum Temperatures (°F)								
	Medford	Corvallis	Forest Grove	Hood River	Hermiston	Ontario	Powell Butte	Madras
12-Dec	25.19	31.43	30.24	35.31	30.50	20.12	25.33	27.58
13-Dec	30.86	34.45	33.55	31.26	23.38	24.85	22.06	26.92
14-Dec	30.92	23.20	21.31	16.86	13.11	25.77	5.31	7.88
15-Dec	27.75	20.29	16.68	15.27	5.77	22.57	3.36	5.71
16-Dec	18.74	12.47	13.48	7.24	-11.73	7.49	-1.54	-4.25
17-Dec	16.50	13.72	20.03	10.56	-3.71	2.52	9.58	2.58
18-Dec	28.16	31.14	28.43	21.98	7.95	14.05	17.61	14.85
19-Dec	29.74	23.66	22.70	19.35	7.86	10.43	9.10	13.43
20-Dec	30.84	32.46	21.03	9.63	7.29	10.07	7.14	3.65
21-Dec	32.51	30.19	22.54	9.89	7.58	19.47	-0.84	0.94
Daily Maximum Temperatures (°F)								
	Medford	Corvallis	Forest Grove	Hood River	Hermiston	Ontario	Powell Butte	Madras
12-Dec	39.56	47.57	46.84	43.35	47.96	34.94	46.90	47.99
13-Dec	39.99	40.66	40.62	39.55	41.70	34.40	36.72	37.10
14-Dec	34.34	40.78	35.05	31.21	22.97	32.40	28.90	30.37
15-Dec	35.99	26.14	25.96	19.84	18.22	26.65	7.06	10.53
16-Dec	35.34	27.57	34.15	22.97	9.26	24.13	14.66	17.35
17-Dec	35.16	36.46	35.37	32.73	25.68	17.10	33.92	37.26
18-Dec	38.31	38.06	39.73	33.86	23.95	35.17	34.71	37.01
19-Dec	37.58	36.11	33.98	29.53	20.05	31.07	25.09	30.46
20-Dec	36.20	41.04	30.94	20.21	15.24	24.81	28.78	25.09
21-Dec	43.71	44.77	23.28	16.03	15.39	29.06	10.75	9.64

Table 1 Continued…

Daily Mean Temperatures (°F)								
	Medford	Corvallis	Forest Grove	Hood River	Hermiston	Ontario	Powell Butte	Madras
12-Dec	32.28	38.96	37.43	38.31	37.70	28.8	34.58	37.21
13-Dec	35.19	37.39	37.01	37.33	36.87	30.92	29.85	32.16
14-Dec	32.63	33.28	27.78	20.83	17.08	28.42	18.06	16.71
15-Dec	31.79	22.92	22.59	17.67	14.56	24.68	5.09	8.38
16-Dec	25.76	20.87	20.89	14.67	-2.00	17.82	8.13	7.27
17-Dec	24.68	28.97	28.85	24.87	13.54	10.16	22.01	25.10
18-Dec	31.23	35.00	33.51	29.37	18.36	22.47	29.09	28.74
19-Dec	33.49	32.36	29.89	23.08	14.95	21.49	20.59	21.55
20-Dec	33.11	36.22	26.10	14.57	9.96	17.58	17.37	13.61
21-Dec	36.30	36.12	23.25	12.33	11.45	23.99	6.00	5.82

Source: Agrimet

Figure 1.



Cold temperatures during winter can cause death to vine tissues such as buds, xylem and phloem (conducting tissues). Grapevine buds in dormancy have a sliding scale of cold temperature tolerance and survival as the dormant season progresses. If we had experienced these temperatures in November when vines were not nearly as cold hardy, there could have been a larger percentage of damage to buds. However, in December and January, most grapevine buds should reach their maximum cold hardiness and be able to tolerate the coldest temperatures. Different cultivars of grapevines have varying levels of cold tolerance of their bud, xylem and phloem tissues. 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) found the following cold hardiness of eight cultivars including the following reds: most hardy Cabernet sauvignon > Malbec = Syrah > Merlot least hardy and whites: 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).

In general, **dormant** buds and conducting tissues will not be damaged at temperatures above 5°F if they are acclimated properly. There can be a lower level of cold hardiness in buds and wood of young vines or those that are poorly acclimated. Vines that are overly vigorous may acclimate later than moderate or lower vigor vines and may have a reduced cold hardiness as a result. Monitor these blocks of the vineyard for bud survival if temperatures 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 or while 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 the buds mid to basal shoot. Buds at the terminal ends of the shoots may be dead as these areas of the shoot grow latest in the season, acclimate later and thus have a lower tolerance to winter temperatures and desiccation. Death in these buds is normal, so they are eliminated from the bud viability assessment. 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, the tissues will be removed and will reveal the underlying stem instead. 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 kill. Use these estimates when pruning to determine how many buds to leave when using balanced pruning to allow an adequate crop. If there are young, newly planted vines with very little cane tissue available for sampling, this method will need to be altered.

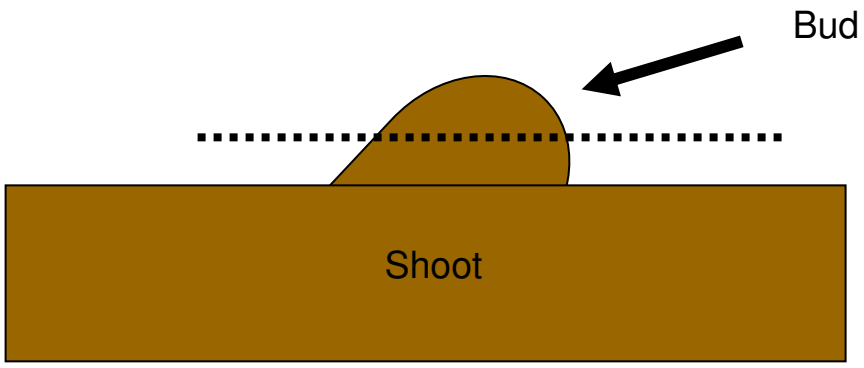


Figure 2. Cut a dormant bud with a razor blade half-way through the bud to assess bud death.

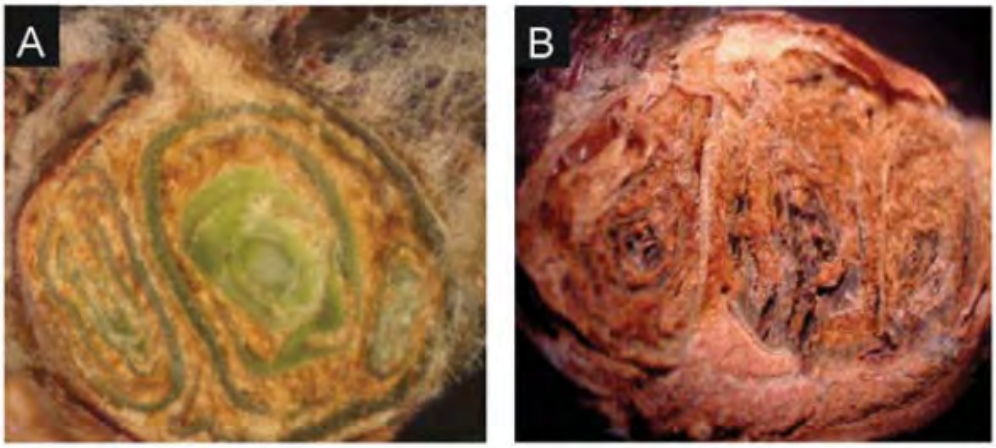


Figure 3. A live compound bud (A) shows no damage. Notice green tissues of primary, secondary and tertiary buds. Necrotic tissues are evident in a damaged bud (B) where there is significant damage and loss of the entire compound bud. *(Mills et al. 2006).*

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.

Upcoming Events

Online Viticulture Lecture Series – Winter 2009 – Register Now!

This winter term, January 6 – March 12, the OSU Vine Physiology course will be open to industry and the public for participation live online on Tuesdays and Thursdays from 8 -9:30 AM. For more information and registration, please see http://wine.oregonstate.edu. Space is limited. Register online by January 3, 2009.

Vineyard Sanitation Workshop – March 10, 2009

This one day workshop will cover the topics of clean plant materials, certified virus-free grapevines, viruses, such as grapevine leafroll virus and insect vectors, mealybugs. These are major topics in the industry right now to keep Oregon free of virus and insect vectors. This session will also have ODA available for discussions on grape quarantine and potential changes to grape plant materials and fruit importation from outside of Oregon. For more information on dates and times, see http://wine.oregonstate.edu/node/186.

New Viticulture Extension Publications Available

Vineyard Economics: Establishing and Producing Pinot Noir Wine Grapes in Western Oregon. J.W. Julian, C.F. Seavert, P.A. Skinkis, P. VanBuskirk, S. Castagnoli. August 2008. OSU Extension Service EM8969-E. View and download online at http://wine.oregonstate.edu/publications.

How to Reduce the Risk of Pesticide Resistance in Winegrape Pests in Oregon. Kaiser, J.W. Pscheidt, V.Walton and P. Skinkis. September 2008. OSU Extension Service EM8968. This is an excellent resource that can be used when formulating spray programs. Preview and purchase online at http://wine.oregonstate.edu/publications.

Review of Cold Climate Grape Cultivars, a publication by Iowa State Viticulture Extension is available for purchase at https://www.extension.iastate.edu/store/ListItems.aspx?CategoryID=52.