

Viticulture and Enology Extension News

Washington State University



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SPRING 2011

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WSU Extension programs and employment are available to all without discrimination. Evidence of noncompliance may be reported through your local WSU Extension office.

Spring Greetings from WSU- Viticulture and Enology Extension

Washington State University's Viticulture and Enology Extension News (VEEN) is back! With a slightly new look and different publication frequency (twice a year, Spring and Fall), we hope this will be a useful resource and guide to the information available to you through WSU.

This issue focuses on viticulture, with articles ranging from cold damage as-

essment, new and emerging vineyard pests, graduate student research in clonal identification, irrigation sensors for vineyards, and more. There is also an article on dealing with high acid wines.

Don't forget: more information is just a click away at: www.wine.wsu.edu, including event information, Extension Publications, and Articles regarding current issues in V&E. Of course, we always welcome suggestions, comments and questions as we work to help build on the extension and outreach resources available from the V&E Program at WSU. Happy reading!



As we eagerly await spring, this issue of VEEN will review 2010 and provide some insight to potential issues in 2011.

Dr. Michelle Moyer
Viticulture Specialist

Dr. Jim Harbertson
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FIND US ON THE WEB: www.wine.wsu.edu/research-extension

Information, when you need it. That is the power of the internet! Visit the WSU Viticulture and Enology Research and Extension website for valuable information regarding research programs at WSU, timely news releases on topics that are important to your business, as well as information regarding upcoming workshops and meetings.

It is also a valuable site for downloading our most recent Extension publications, as well as finding archived articles and newsletters you can print on demand. Find quick links to AgWeatherNet, the Viticulture and Enology Certificate and Degree programs, as well as to other Viticulture and Enology related resources.

And don't forget, you can also find us on Facebook!

Go to: www.facebook.com/WSU.Vit.Enol.Ext and "Like" the page!

WSU Grape Cold Hardiness Program

By Markus Keller, WSU-Prosser

The 'Thanksgiving freeze' on November 24, 2010, caused damage to buds and vines that varied widely among varieties and vineyard locations. Despite a general warming trend in winters seen in the last 30 years, this freeze event demonstrated once again that cold injury remains a major concern for Washington's wine and juice grape industries.

The viticulture team at WSU continues to provide critical temperatures for cold hardiness on the viticulture and enology website at: <http://wine.wsu.edu/research-extension/weather/cold-hardiness>. This service began over 20 years ago and is conducted primarily as a service to Washington's grape growers in collaboration with Ste. Michelle Wine Estates, Thurston Wolfe Winery, and Hogue Ranches. Our work is sponsored by WSU, the Washington Association of Wine Grape Growers, and the Washington State Concord Grape Research Council.

The program regularly tests the cold tolerance of buds and canes [1] and

posts these results weekly on the WSU Viticulture and Enology website. By clicking on a variety name located in the center cold-hardiness table (about 20 varieties are available), you can access a seasonal cold hardiness graph specific to that variety, along with the seasonal temperature pattern. Growers may use these graphs (Fig. 1) to follow seasonal trends and forecast approximate hardiness levels based on current temperatures.

This information is important, since the temperatures at which the buds, bark (phloem), and wood (xylem) are killed fluctuate throughout the winter. Using this information is crucial for growers to make informed decisions concerning freeze protection, as well as post-freeze sampling and pruning strategies [2-5].

Due to equipment and labor limitations, the WSU team cannot test every variety, every week, at every location. Fortunately, thanks to a grant from the USDA Viticulture Consortium-West, we are currently

Follow the cold hardiness levels of selected grape varieties at:

www.wine.wsu.edu

developing a mathematical model [6] that will eventually be able to fill in the gaps.

This model will run on AgWeatherNet (AWN) at: <http://weather.wsu.edu>. AWN is a large network of more than 130 weather monitoring stations distributed throughout the state, and is hosted and supported by WSU for the benefit of Washington State's various agricultural industries.

For further reading on cold hardiness, see the following:

[1] Mills L.J., Ferguson, J.C., and Keller, M. 2006. Cold hardiness evaluation of grapevine buds and cane tissues. *AJEV* 57:194-200.

[2] Davenport, J.R., Keller, M. and Mills, L.J. 2008. How cold can you go? Frost and winter protection for grape. *HortScience* 43:1966-1969.

[3] Keller, M. 2010: *The Science of Grapevines – Anatomy and Physiology*. Elsevier: Academic Press, Burlington, MA.

[4] Keller, M. and Mills, L.J. 2007. Effect of pruning on recovery and productivity of cold-injured Merlot grapevines. *AJEV* 58:351-357.

[5] Wolfe, W. 2000. Vine and vineyard management following low temperature injury. *Proceedings of the ASEV 50th Anniversary Annual Meeting, Seattle, Washington, June 19-23, 2000*. pp. 101-110.

[6] Ferguson, J.C., Tarara, J.M., Mills, L.J., Grove, G.G., and Keller, M. 2011. Dynamic thermal time model of cold hardiness for dormant grapevine buds. *Annals of Botany* 107:389-396.

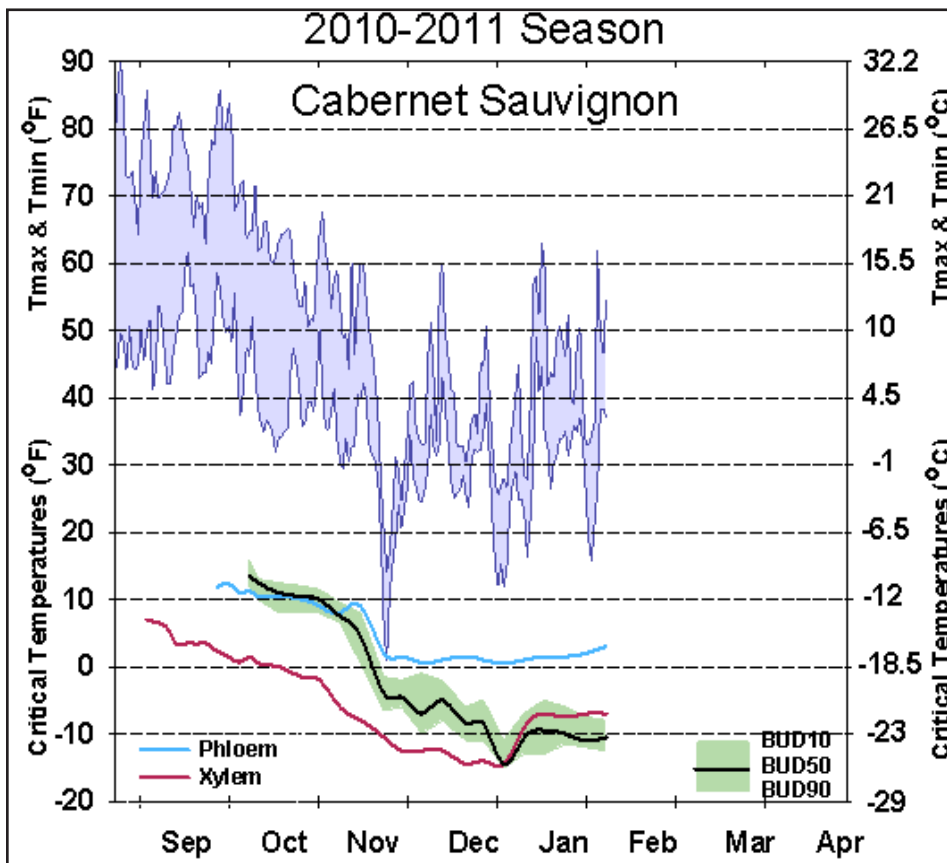


Fig. 1: As a part of the Cold Hardiness Program at WSU, graphs showing winter temperature trends and bud, xylem and phloem cold hardiness levels are readily available for viewing.

Cold Damage in Vineyards

By Michelle Moyer, WSU-Prosser

Spring is quickly approaching, making it easy to forget the long, cold winter. For many grape growers across the state, however, the evidence of just how cold it really was has become painfully obvious. The 'Thanksgiving Freeze' of 2010 not only announced the early arrival of winter, it led to damage in grapevine buds, canes, and trunks; damage which we may have not yet fully realized.

On October 31, 2002, a similar cold snap led to substantial vine inner bark (phloem) damage. As a result, WSU was frequently asked the question of "what to do next?" The resulting work demonstrated that if there was substantial phloem damage, but relatively little bud damage (67% versus 25%, respectively), vines could fully recover [1]. This occurred regardless of pruning severity (ranging from minimal pruning to complete bud removal). However, minimal pruning may help in yield compensation. It is also important to consider overall vine health and development in the years following damage, i.e. recovery years are not the best time to implement severe stress practices.

What do you do if you have substantial bud damage in addition to phloem damage? The first thing to consider is where that bud damage is seen. If injury is closer to the cordon (i.e. nodes 1-5), but bud further out are alive, then it is advisable to hedge. If the damage is only seen on distal buds, then normal spur or cane pruning is acceptable [2]. The challenge, however, is determining



Fig. 1: Damage to the wood (xylem) in the trunk isn't always brown: sometimes damaged wood will appear milky-white. Photo by Michelle Moyer

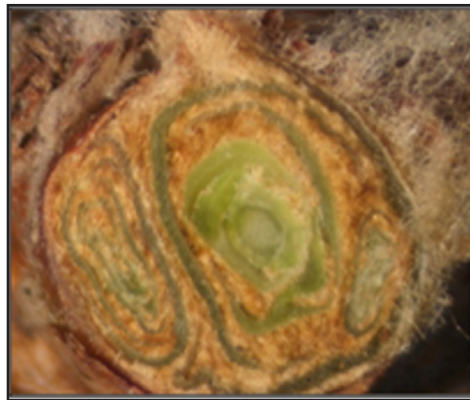


Fig. 2: Compound buds of grapevines contain 3 smaller buds, the primary (center), secondary (left), and tertiary bud (right). Live buds are green (Left image), dead buds are brown (right image). Photos by Lynn Mills

what to do in those situations where you are faced with 75-100% damage, at all nodes. Generally, a "wait and see" approach is suggested: hedge, then wait until budbreak to assess damage. Shoot numbers can then be adjusted or the decision to retrain can be made.

So how do you know the extent of cold damage in your vineyard? Sample! More information on sampling techniques can be found at: www.wine.wsu.edu/research-extension. When sampling, select individual vines randomly, but cover areas that are representative of sectional differences in your block, including those in areas that are prone to cold/frost damage. This will provide information on whether particular sections of your vineyard sustained more damage than others.

After collecting canes from these selected vines, the assessment process can begin. Specifics on assessment can be downloaded from our website. We determine the viability of tissues by their color [3]: green is good, healthy tissue; brown is dead tissue. There can also be an array of damage (and therefore, colors), so it is good to have reference tissue. In trunk wood (xylem), milky-white to light brown is also an indication of damage (Fig. 1).

For buds (Fig. 2), record the location on the cane where you see damage, as mentioned above. The same is true for cane sampling (Fig 3). To assess trunks look at both slightly above the soil line, and near the head. Pay particular attention to the south side of the vine, as it can be prone to cold damage due to daytime deacclimation as a result of reflected heat from the snow. Trunk sample with caution: DO NOT GIRDLING. Sampling for cold damage should be done shortly before pruning,

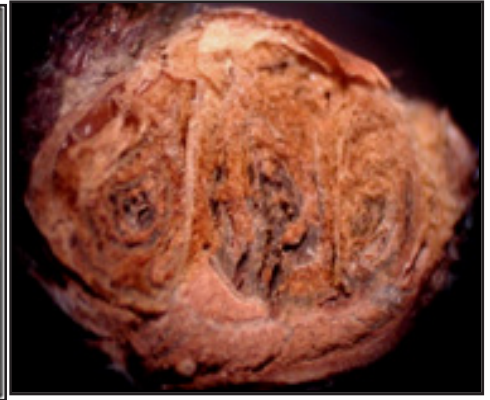


Fig. 3: In many cases, you can see dead bark (phloem), but still have live, healthy green wood (xylem). Photo by Michelle Moyer

to reduce the likelihood that additional damage will not go unnoticed.

What can we learn from all of this? In order to deal and adjust for cold damage, you need to know the extent of it. Assessing damage by looking at buds, canes and trunks before pruning is critical. While we are seeing damage as a result of the 'Thanksgiving Freeze' of 2010, there are some pruning tricks that can be done to either ensure plant survival, a crop, or both.

For detailed information on the topics discussed, see the following:

<http://wine.wsu.edu/research-extension/files/2011/03/Cold-Damage-Assessment21.pdf>

[1] Keller, M, and Mills, L.J. 2007. Effect of Pruning on Recovery and productivity of Cold-Injured Merlot Grapevines. *AJEV* 58:351-357.

[2] Wolfe, W. 2000. Vine and Vineyard Management Following Low Temperature Injury. Proc. Of the ASEV 50th Anniversary Annual Meeting. Seattle, WA. June 19-23, 2000.

[3] Mills, L., J. Ferguson, and M. Keller. 2006. Cold-hardiness evaluation of grapevine buds and cane tissues. *Am. J. Enol. Vitic.* 57:194-200.

Pest Alerts for 2011

Spotted Wing Drosophila (SWD)

Spotted Wing Drosophila (SWD) is a new pest in Washington orchards and vineyards. First introduced to the continental USA in 2008, it has slowly made its way north from California to most growing regions in WA. Related to other vinegar flies, SWD is a cause for concern due to the female's ability to pierce the skin of, and lay eggs in, ripening fruit as opposed to over-ripened and decaying fruit.

While preliminary studies at WSU indicate that grapes may not be a preferred fruit source for SWD, it is a suitable food choice, and the fly is still capable of causing damage to grapes. In addition to the direct physical damage caused by egg-laying, the piercing activity of the fly can also lead to the introduction of bacteria, yeasts and other fungi which can lead to rot or a reduction in wine quality.

Monitoring your vineyard for the presence of SWD before starting a spray program is advised. This can be done using apple-cider vinegar traps. Information on how to build traps is avail-



Fig. 1: The male SWD has the characteristic black spots near the tips of its wings. It will also have 2 sex combs (black), on its front legs. Photo by A. Arakelian

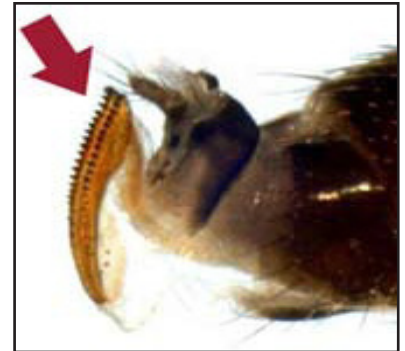


Fig. 2: The female SWD is distinguished by its large, saw-like ovipositor that has characteristic darker "teeth". Photo by M. Hauser

able at: <http://extension.wsu.edu/swd>.

Properly identifying SWD is critical to control, as there are many types of native fruit flies that can resemble SWD. Flies will be less than 1/8" in size, and will have red eyes. Male fruit flies are identified by the presence of a black spot near the tips of their wings (Fig.1), and they have 2 sex combs. Female flies are harder to ID, as they do not

have the characteristic wing spots. However, they do have a prominent ovipositor that is saw-like and used to pierce fruit skin (Fig. 2) in order to lay eggs in ripening fruit.

An extensive handout on SWD is available for download at: <http://ipm.wsu.edu> click on "Small Fruits" then find the paragraph on SWD. Click on the "bulletin..." link within the paragraph text.

Brown Marmorated Stink Bug (BMSB)

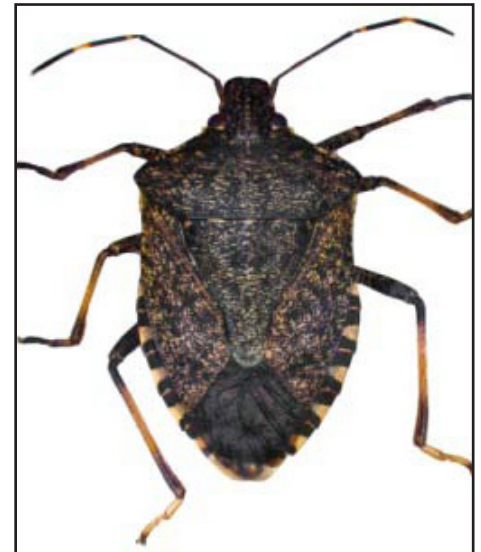


The Brown Marmorated Stink Bug likes to congregate in mass, especially in its overwintering locations. These overwintering locations often include agriculture building structures and potentially wineries. Photo by P. Shearer

The Brown Marmorated Stink Bug (BMSB) was first found in the Allentown, PA area in the 1990s. Since then, it has established itself as both a residential and agricultural pest. In addition to congregating in houses, it feeds on a number of crops, causing a range of damage and disfigurement of fruit and vegetables, including but not limited to, tree fruit, grapes, berries, vegetables, corn, soybeans, and ornamental plants.

It is distinguished from other Stink Bugs by its striped antennae, black and white banding on the abdomen, and smooth shoulders. More information on BMSB can be downloaded at: <http://pmpm.wsu.edu/downloads/bmsb1Dsheets.pdf>

The challenge with BMSB is that it travels quickly, usually as a result of hitchhiking on vehicles and storage units. It has been collected in Vancouver, WA, but has not been found in eastern WA. If you suspect you have BMSB, notify your local WSU Extension agent. Capture a bug for identification, and keep it in your freezer until you can take it in for examination.



The Brown Marmorated Stink Bug adult is distinguished from other stink bugs by its banded antennae and legs, banded coloring on the abdomen edge, and smooth shoulders. Photo by E. LaGasa

Botrytis Bunch Rot and Powdery Mildew: 2010 Review

By Michelle Moyer and Gary Grove, WSU-Prosser

“Climate is what we expect, weather is what we get.” Mark Twain

Uncharacteristic cool and wet weather in 2010 resulted in many challenges, from delayed ripening to high juice acidity. A very noticeable challenge was the widespread occurrence of Botrytis Bunch Rot (BBR), and the economic consequences of this epidemic are not entirely clear. Preliminary information from WA indicates that the disease affected about 8,000 and 3,000 acres of white and red grape varieties, respectively. While most affected vineyards had some healthy clusters, this would equate to losses of \$25,056,000 and \$15,132,000, respectively. (Assumptions based on 4 ton/acre crop loads for ‘Chardonnay’ and ‘Cabernet Sauvignon’, using prices listed in the January 2007 USDA-NASS Grape Release). To prevent the harvest of diseased bunches, hand-harvest was used in some vineyards that are normally machine-harvested, at an estimated additional cost of \$375 per ton (‘Chardonnay’).

Climates such as those in western WA are prone to annual outbreaks of BBR due to the favorable moist, cool conditions, particularly near bloom. Due to eastern WA’s normally arid summer climate, BBR occurrence tends to be sporadic. However, the unseasonably moist weather between the months of May and June, then again in September of 2010, set the year up for the wide-spread outbreak.

BBR can infect fruit at two different stages: from bloom to bunch closure, and again during véraison to harvest. During the first stage, BBR infects clusters through the cap scars and dying stamens, and can also survive on floral and other debris that gets stuck inside the cluster during closure. These infections remain latent (inactive) until véraison, where they can then express the classic BBR symptoms.

At the end of the season, BBR can infect ripening fruit through wounds, often caused by insect feeding, powdery mildew damage, or berry splitting as a result of compact cluster architecture. BBR infects fruit in this manner because it is a relatively weak fungal pathogen. It prefers readily accessible or weakened food sources. A major issue in 2010 was the need for increased hang time to bring fruit to desired sugar and acid levels. Longer hang-time means more chances for infection and BBR development.

If we have our normal summer weather

Table 1: Timing and type of fungicides for the control of Botrytis Bunch Rot (BBR), or for dual control of BBR and Powdery Mildew on clusters.

Timing	Compound	Powdery Mildew	Botrytis Bunch Rot	Notes
Bloom to Fruit Set	Trifloxystrobin (Flint)	Yes	Yes	Apply at highest labeled rates for dual control.
	Pyracostrobin + boscalid (Pristine)	Yes	Yes	
	Difenconazole + cyprodinil (Inspire Super)	Yes	Yes	
Bunch Closure	Trifloxystrobin (Flint)	Yes	Yes	Apply at highest labeled rates for dual control.
	Pyracostrobin + boscalid (Pristine)	Yes	Yes	
	Difenconazole + cyprodinil (Inspire Super)	Yes	Yes	
Véraison to Harvest	Fenhexamid (Elevate)	No	Yes	Late season sprays may only be necessary if conditions are right for BBR development.
	Pyramethanil (Scala)	No	Yes	
	Iprodione (Rovral)	No	Yes	
	Cyprodinil (Vanguard)	No	Yes	

pattern in 2011, there is the possibility of over-spraying for BBR as a compensation for last year. To avoid this, WSU in collaboration with WAWGG, held a workshop in January to help develop a rational strategy for managing BBR in 2011. Drs. Doug Gubler (UC-Davis) and Wayne Wilcox (Cornell University) shared their extensive experiences with BBR management in California and New York, respectively. Washington growers recognize the bloom to pea-sized berry period as the keystone for managing powdery mildew (PM) on fruit, and typically make 2-3 PM fungicide applications during this period to control it. Like PM, the bloom period is critical for BBR control. The use of fungicides that offer control of both is recommended at the highest labeled rates during bloom to control PM and to prevent BBR infection of flower parts.

Gubler and Wilcox also recommended taking notes on prevailing and predicted weather conditions when devising BBR management strategies. If the 2011 season has above-average precipitation, additional dual-purpose fungicide applications should be considered at pre-bunch closure, while BBR specific compounds should be applied

at véraison and preharvest (Table 1). In eastern WA, years with “normal” precipitation (e.g. DRY between fruit set and harvest), late season BBR fungicide sprays may be unnecessary.

The role of leaf removal in managing PM and BBR cannot be overemphasized. Both Gubler and Wilcox stressed the incorporation of this cultural practice into the overall vineyard disease management system. Gubler presented data indicating that leaf removal is equally or more important than fungicide applications for managing BBR. Leaf removal also improved management of PM. Much of this is through better spray penetration into the fruit-zone, and increased air circulation and sunlight penetration, which reduces the environmental favorability for BBR and PM fruit infection.

Last year also presented challenges in controlling PM, though not to the same extent as BBR. As mentioned, targeting PM fungicides from bloom to pea-size is the key to controlling disease development on fruit. What many people don’t realize is that control of PM is also a key component of control-

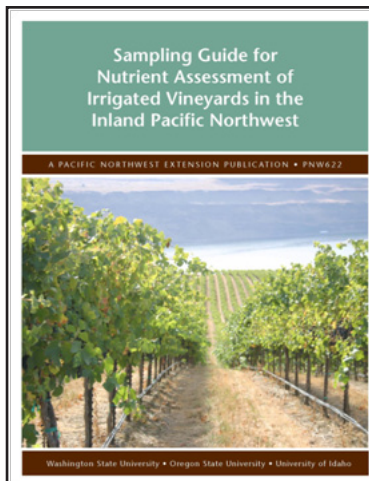
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PNW 622: Nutrient Sampling in Irrigated Vineyards

By Joan Davenport, WSU-Prosser

We all know that the inland Pacific Northwest is not California. We grow wine and juice grapes in a climate with hot summers and cold winters where irrigation is a must. But for years, the only standards for tissue nutrient testing came from other areas – in particular California for wine grapes and New York for juice grapes. Here's the good news – we have our own standards now!

Over the past 12 years the soils program at WSU-Prosser has lead a number of projects in plant mineral nutrition in wine and juice grapes – often collaboratively with former WSU-Viticulturist Dr. Bob Wample, and more recently with current WSU-Viticulturist Dr. Markus Keller, and emeritus WSU-Soil Scientist Dr. Bob Stevens. The work has been funded by an array of agencies and particular thanks need to go to the Washington State Concord Grape Research Council, the Washington Wine Advisory Board, and the NW Center for Small Fruits Research. From all of these efforts, research and survey projects have given us the data we needed on grapevine nutritional status. Dr. Don Horneck of Oregon State University (Hermiston) helped co-author the bulletin.



What's different with the new bulletin? First and foremost, we are recommending using whole blades for evaluating tissue nutrient status. Our results showed that leaf petioles overestimated the need for plant nitrogen fertilizer over 85% of the time. Why? If we think about a petiole, it really is a straw that plant sap flows through. In an arid environment, that flow varies greatly. However, the leaf blade integrates what the vine experiences throughout the season and reflects what is stored for this year's crop as well as what will

be recycled for next year.

Another difference is that we recommend sampling at veraison rather than bloom. The bulletin provides values for both, but plant nutrient transport is more stable at veraison and this data can be used for planning next year's fertilizer strategies as well as any late season fine tuning.

The bulletin provides the optimal nutrient level numbers in whole grape leaf tissues samples when the samples are collected at bloom and veraison. In addition, there is guidance for how many leaves to collect and what leaf position to use.

We developed this bulletin for you and hope it will be truly useful. But as the old Italian proverb reminds us "The best fertilizer for the vineyard is the footsteps of the vineyardist" – and no numbers can substitute for knowing your vineyard block and keeping a watchful eye.

Here is the web address and the bulletin is free – just download or print: <http://cru.cahe.wsu.edu/CEPublications/PNW622/PNW622.pdf>

The Value of Clonal Variation in Washington Grapes

By Kathie Nicholson, Graduate Student, WSU-Pullman

Compared to other fruit crops, there is very little focus on developing new wine grape varieties, outside of breeding for disease resistance, shorter ripening time, drought resistance, or other similar characteristics. The existence of grapevine clones, i.e. the specific selection of grape varieties with desirable characteristics compared to the standard, such as looser clusters or increased cold hardiness (Fig. 1), provides viticulturists with plant material

choices which may be better suited to a particular region or may exhibit fruit qualities that better fit the winemaking styles of the area.

Clones result from genetic mutations that can occur during vine development, and this variation is then maintained with vegetative propagation. In addition to looser clusters or cold hardiness, changes in chemical components of the fruit may occur that can influence

Is there a need for a resource that could genetically confirm clonal identity within wine grape varieties? Additionally, how important are clonal variations to the Washington wine industry, and to what extent are consumers interested in this facet of the wine they purchase?

These questions arose as a research project that began here at WSU looking at various methods to identify genetic differences among wine grape clones. We felt it was important to know the viewpoints of the population that could benefit from this research, thus, two surveys were conducted. The first was directed to the wine industry to determine their perceived value of clones, and the extent they believe consumers would be influenced by identifying clones on a wine label.

The second survey was directed to consumers regarding their general knowledge and interest in wine grape clones, and the extent their purchases would be influenced if labels included clonal information. Both surveys asked

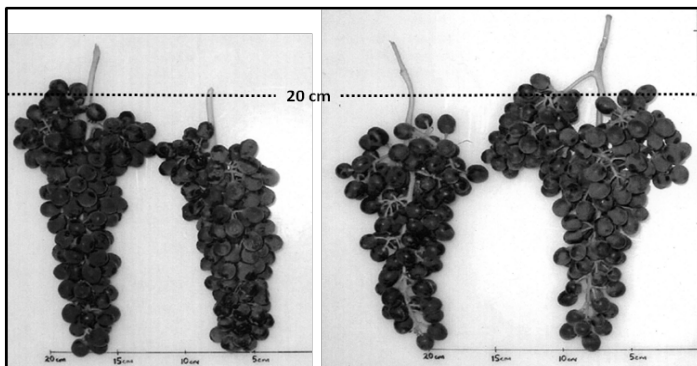


Fig. 1: Comparison of cluster density of two Syrah clones. (W. Farquhar 2006. <http://ucanr.org/sites/intvit/files/24458.pdf>)

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Beneficial Insect Conservation in Washington Vineyards

By David James, WSU-Prosser

The concept of 'Farmscaping' Washington vineyards by restoring native shrub-steppe plants and habitats has been mooted for a few years now. Research on the feasibility and potential of 'beauty with benefits', a program that envisioned developing habitat for predators and parasitoids of grape pests, has commenced at WSU-Prosser with funding from the Western Sustainable Agriculture Research and Education (WSARE), the Northwest Center for Small Fruits Research (NCSFR) and the WA Wine Advisory Committee.

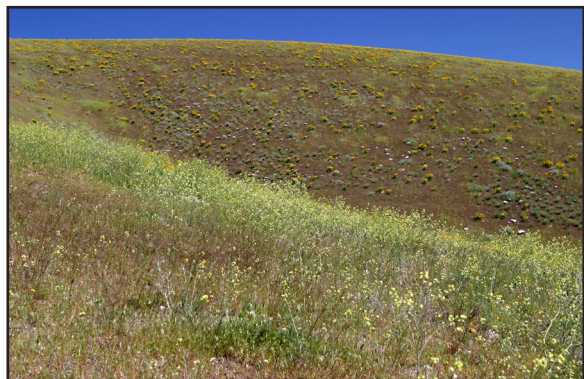
Initial studies looked at the potential of xeric, flowering native perennial plants for attracting natural enemies of grape pests. In 2010, 43 species of flowering perennials in Yakima Valley were evaluated for beneficial insect attraction. Attraction of 9 groups (families, genera) of beneficial insects was assessed using yellow sticky cards placed on, or adjacent to, plants. The top 10 species for attraction of beneficial insects were Showy Milkweed, Yellow Sweetclover, Wood's Rose, Western Clematis, Gray Rabbitbrush, Yarrow, Green Rabbitbrush, Ocean Spray, Hoary Aster, and Lewis' Mock Orange.

Different plants attracted different bene-

ficials. For example, mite-eating ladybeetles were strongly attracted to Rock Buckwheat and Columbia Basin Prickly Pear, while minute pirate bugs were most attracted to Yellow Sweetclover, Gray Rabbitbrush, Tall Buckwheat and Showy Milkweed. Predatory thrips were most common on Oregon Sunshine and Yellow Sweetclover while ladybeetles and parasitic wasps were favored by Lewis' Mock Orange and Clematis.

Fineleaf Hymenopappus, Golden Currant, Showy Milkweed, Coyote Mint and Wood's Rose attracted ichneumonid and braconid wasps while Munro's Globemallow attracted Anagrus wasps. Gray Rabbitbrush attracted almost twice as many parasitic wasps from other families than any other plant. At least 23 plants emerged as having potential for attracting beneficial insects; all are native except one (Yellow Sweetclover).

These data are preliminary and will be expanded in 2011. Plants like the buckwheats, Yarrow and Yellow Sweetclo-



Re-introducing native habitats within and around vineyards will provide refugia for beneficial insects needed in biological control for pest management of grape. Photo by David James.

ver appear to be well-suited as sustainable, IPM-enhancing ground covers because of their hardiness, drought tolerance and likely mowing tolerance.

We will shortly establish a website dedicated to our vineyard habitat restoration project. This site will provide practical information on how to optimally restore native habitats in your vineyard to provide the greatest benefits to pest management and conservation of native plants, bees and butterflies.

Clonal Variation

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if the wine industry in Washington State would benefit from a resource that could genetically confirm clonal identity.

From the wine industry, 72 responses were received (21%). When buying vineyard stock, 88% of wine industry respondents believed clonal varieties were an important consideration; 47% responded that it is an important consideration when purchasing grapes for the winery. When it came to what they felt would be important to consumers, only 26% of the wine industry respondents felt that having confirmed identity of grape variety clones would be important to the consumer and consequently enhance sales, and 33.3% responded that it would not be important to the consumer.

The consumer survey was a random sampling from consumers at a Pullman, WA, wine shop, and requests for participation were posted on two WSU websites related to viticulture and enology, resulting in 52 responses. Although 56% of consumers polled

were not previously aware of clonal variation, after a brief description, 81% indicated that their purchase would likely be influenced by identification of the clone on the label (assuming they knew the characteristics of that clone), and 71.2% indicated that they would possibly pay more for a bottle if they knew the clone used exhibited desired characteristics. Both the wine industry and consumers indicated that there is a need for a resource that could genetically confirm clonal identity, with positive responses of 79% in both cases.

In summary, the survey results indicated that clonal variation is important to the wine industry, is potentially important to consumers, and that there is a need for a resource in Washington that could genetically confirm clonal identity. Additionally, results indicated that consumers are possibly more interested in clonal variation than the industry believes they are. Realization of this consumer interest could provide motivation for novel marketing strategies in the Washington wine industry.

BBR and PM Management

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ling BBR. Severe PM infections can result in fruit cracking, a clear entryway for BBR. However, light PM infections ("diffuse infections"), on fruit can enhance BBR. Diffuse infections cause microscopic damage to the berry skin. These are also direct avenues for BBR infection.

Last year highlighted the role of weather in disease development. Knowing this influence is important in determining the timing and type of fungicide application. In 2011, keep that in mind, and be prepared to adjust if conditions change. More information on spray programs is available in the 2011 WA State Grape Pest Management Guide, downloadable at www.wine.wsu.edu/research-extension.

Use pesticides with care. Apply them only to plants, animals, or sites listed on the labels. When mixing and applying pesticides, follow all label precautions to protect yourself and others around you. It is a violation of the law to disregard label directions. If pesticides are spilled on skin or clothing, remove clothing and wash skin thoroughly. Store pesticides in their original containers and keep them out of the reach of children, pets, and livestock.

Irrigation Sensors for Washington Vineyards

By Troy Peters, WSU-Prosser

Good irrigation water management will increase yields, improve crop quality, conserve water, save energy, decrease fertilizer requirements, and reduce non-point source pollution. Using soil moisture measurements is one of the best and simplest ways to get feedback to help make water management decisions. However, the installation, calibration, and interpretation of the data from these instruments is often overwhelming. Here's an attempt to provide practical recommendations for using these sensors to improve your operation.

Soil Water Content-based soil moisture sensors: (Capacitance, Neutron Probe, Gravimetric)

Soil water content measurements are more meaningful for irrigation scheduling when they are compared to the maximum amount of water that the soil can hold long term (field capacity). The simplest way to determine your soil's field capacity is to use the sensor to take a soil water content measurement at a time when you are confident that the soil is full of water, yet free water has had time to drain. Good times to make these measurements are in the spring as soon as soil thaws (assuming adequate soil moisture recharge over the winter), or 12 to 24 hours after a heavy irrigation. The water content measurement must be multiplied by the depth of soil in the root zone that it represents, to give the total water content in that soil depth.

It also helps to have an estimate of the soil water content at which the plants begin to experience water stress. This can be estimated from the previously measured field capacity and the soil's available water capacity (AWC). See <http://websoilsurvey.nrcs.usda.gov> for soil survey information on your soil's AWC. This AWC number is then multiplied by 42 inches (3.5 ft) root depth for most vines, to get the inches of water that is held between field capacity and wilting point. It may be necessary to use a different root depth if the soil is shallow.

To manage vines for no stress, it is a good idea to limit the soil water depletion to only 50% of the AWC in the root zone. For example the soil AWC from websoilsurvey is 0.20 cm/cm (same as in/in). Multiply this by 42 inches to get a total AWC in the root zone of 8.4 inches. To manage for no stress the maximum depletion should be half of that, or 4.2 inches. If the field capacity, measured early in the spring (Mar. 1), is 10.5 inches in the root zone, then



Fig. 1: Measuring soil moisture is a good practice to help improve crop quality and water-use efficiency.

irrigate before the soil water content reaches 6.3 inches (10.5 – 4.2) if managing for no stress. To impose water stress, then irrigate to keep soil water content above 2.1 (10-8.4), but below 6.3 inches. Wilting point is at 2.1 inches.

Use plant and soil observations over time to refine these estimates. For example if the first observable signs of plant water stress is at 7.0 inches instead of 6.3, then the 6.3 inch estimate of the water stress line should be re-set to 7.0. With this method, the absolute accuracy of the sensor is less important, because it is just being compared to itself.

Tension-based sensors: (watermark sensors, tensiometers)

When using tension-based soil moisture sensors, the soil's field capacity, wilting point, and the maximum depletion point are mostly irrelevant. A soil that is full of water will have a measured soil water tension near zero. For maximum growth, vines should be irrigated before the soil tension reaches 40-50 centibars (Note: centibar is a unit for tension. The higher the number, the greater the water stress). For regulated deficit irrigation (RDI), this could be increased to 80 centibars. Again, since these measurements can be inaccurate and soil specific, refine your limits using crop observations over time. For example, note the measured soil water tension at the earliest indications of water stress (this will appear first in sandy,

or shallow soil areas), and irrigate before this point in the future. Also, take readings right after an irrigation; if the bottom sensor goes to zero, then it's possible you over-irrigated. If it shows no movement, apply more water next time. A word of caution when using tension-based soil moisture sensors when the soil is dry: Many growers find their use frustrating as the sensors tend to lose suction, or contact, with the soil under this condition.

Additional Recommendations:

- Avoid preferential flow of water from the surface to the sensor due to installation process.
- Flag the sensor so it can be easily found.
- Graphical representation of the data greatly helps with data interpretation.
- Use soil water measurements with irrigation scheduling tools such as Kansch and daily water use data from AgWeatherNet or AgriMet for better water management.
- Keep records. Correlate readings with observations.
- Stay away from both the field capacity, and water stress points if possible.
- Realize that soil and sensors have variability.
- Be patient and stick with it. It may take a year or two before you are good at interpreting your sensor readings.

Dealing with High Acidity in Must and Wine

By Thomas Henick-Kling, WSU-TriCities, and Jim Harbertson, WSU-Prosser

The following is a compilation of mini-articles released by Enology Extension during the 2010 harvest season. The scope of the articles revolved around management of must and wine in challenging production years, such as that seen in 2010.

Monitor pH and Titratable Acidity

Mistakes with acidity can be made in cool years. High titratable acidity is more acceptable in white wines but it is disrupting in red wines. Excessive acidity can cause wine imbalance, and accentuate astringency in red wines. There are several factors, including acidity, that affect astringency (tannin concentration, alcohol concentration). To make a balanced wine, you must keep these in mind. As a guideline, try to have must titratable acidity (TA) for red wines near 6 g/L. In some cases, such as Pinot Noir, a TA of 7 g/L might be acceptable. Finished wine pH can be between 3.3 and 3.8, depending on the tannin content. Low tannin wines typically have lower pH. If the must TA is higher than the goal of 7 g/L then you should consider deacidification.

Acid adjustments in wine can be made up until bottling. In addition, you can warm wine before bottling to improve mouthfeel and reduce vegetative flavors. This can be done by heating wine to 104°F for ~2 days.

Bench trials are generally a best-practice for wine adjustments. Bench-trials allow you to see if the adjustments have the desired effects before these adjustments are made on a larger scale.

Deacidification

Potassium or calcium carbonate (K_2CO_3 , $CaCO_3$) can be used to remove wine acids. Pre-fermentation addition is done for two reasons. First, with pre-fermentation addition, there is less danger of losing aroma compounds that are primarily in non-volatile precursor forms. These precursors are less susceptible to loss due to this type of addition. Second, wine yeast and lactic acid bacteria are sensitive to high acidity and low pH. Wine yeast can tolerate pH values below 3, but are stressed. Fermentation of very low pH musts should be done at moderate temperatures around 68°F.

Biological Deacidification – Malolactic Fermentation

Malolactic fermentation (MLF) is an excellent tool to lower wine acidity, improve mouthfeel, and remove some unripe, green flavor characteristics. It is used in (almost) all red wines and it

works well in most white wines, especially Chardonnay, Sauvignon Blanc, and Pinot Gris. It also can be used in Riesling. Blending of MLF and non-MLF wine should also be considered (note: sterile filter the blended wine to avoid unwanted MLF in the bottle!). In order to avoid buttery ML odors, it is best to use a co-inoculation of yeast and ML bacteria. Alternatively, inoculate wine at the end of alcoholic fermentation and keep the wine on yeast lees. The yeast will remove excess diacetyl and other ML flavors and help enhance fruity flavors in the wine. Alternatively, a yeast fining can be done after completion of MLF, to remove excess buttery flavors.

A large number of ML starter cultures are available for direct inoculation. However, all lactic acid bacteria are strongly inhibited at pH values below 3.2. The ideal starting pH for MLF is between 3.2 and 3.4, in the presence of some alcohol (5% and more). In this condition, *Oenococcus oeni* will dominate all other lactic acid bacteria. Special adaptation procedures will have to be used to induce MLF in wines below a pH of 3.1.

For low pH wine, deacidify a small amount to raise the pH to about 3.4, inoculate it with a starter culture, and after ~2/3 of the malic acid has been metabolized, use it to inoculate another part of wine which can be of lower pH. When inoculating wine with a wine ML starter culture, the starter culture must be 10% by volume. Another possibility is to start with a wine/water/juice ML starter culture. If you use a liquid starter culture, check it under the microscope to be sure it is *Oenococcus* and does not contain spoilage yeast or unwanted bacteria.

Yeast and bacteria compete for many of the same nutrients. Special nutrient mixes for ML bacteria also can be helpful when inducing MLF soon after completion of alcoholic fermentation. Many of these nutrients are depleted during alcoholic fermentation. The autolyzing yeast release some nutrients back into the wine.

Deacidification with K_2CO_3 , $CaCO_3$

Potassium (K) and calcium (Ca) will react with the grape acids (malic and tartaric) to form insoluble salts, and carbon dioxide will be given off as a result. As a natural occurrence in wine-making, K will form several types of salts with tartaric acid and malic acid (K_2TA , KHTA, K_2MA , KHMA). Calcium, as a contrast, will only form a couple of salts ($CaTA$, $CaMA$). However, Ca can form a salt with malic and tartaric acid simultaneously (MAHCaHTA) and the treatment has been dubbed the “double-salt” technique as a result. The formation of the double-salt is actually rare, but the name persists.

Which Carbonate Salt Should I Use?

If the TA needs to be lowered by only 2-3 g/L, simply use potassium bicarbonate or potassium carbonate ($KHCO_3$ or K_2CO_3). If more acid needs to be removed, it is better to use the double-salt deacidification with calcium carbonate ($CaCO_3$). It is important to note that the double-salt technique favors the removal of tartaric acid rather than malic acid, unless the initial concentrations of malic acid are double the concentration of tartaric acid. This technique should only be carried out on a portion of the juice (~25%) because it would otherwise destabilize the wine by leaving primarily malic acid behind,

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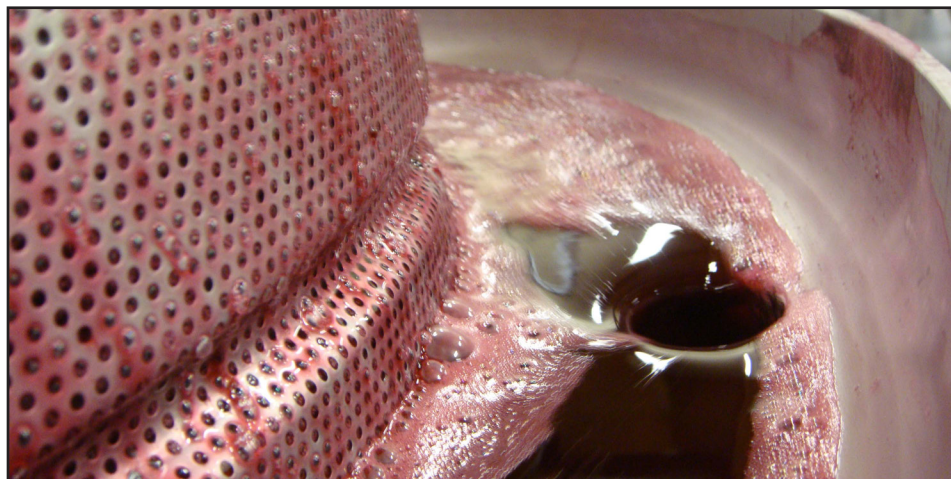


Fig. 1: High acidity can be dealt with in the winery, when longer hang-time isn't an option. Photo by Jim Harbertson

New Faculty and Visiting Scientists in V&E

Gerrit Hoogenboom
Director
AgWeatherNet



Dr. Hoogenboom joined WSU in August 2010 as the Director of AgWeatherNet and Prof. of Agrometeorology. He is originally from the Netherlands, where his parents owned two acres of greenhouses for fresh vegetable production, including table grapes. He graduated from Wageningen University with a dual MS in Horticulture and Theoretical Production Ecology. His PhD is from Auburn University in Agronomy and Soils. Prior to WSU, Hoogenboom managed the Georgia Automated Environmental Monitoring Network for the University of Georgia. His goal is to make AWN one of the best automated weather station networks in the USA, providing high quality weather data and practical decision aids in support of the grape, enology and other local industries.

Michelle Moyer
Assistant Professor
Viticulture Extension



In February, Dr. Moyer joined the faculty at WSU-Prosser. She is a graduate of Cornell University (New York) with a PhD in plant pathology, focused on grape powdery mildew and decision aids for disease management. She also spent time in the Riverland region of South Australia. Moyer is originally from Wisconsin, where her family owns a wholesale and retail horticultural nursery and landscape company. She joined the V&E team with a 70% extension and 30% research appointment, and will be focusing on canopy management, vineyard site selection, and vineyard mechanization. She will also be working closely with the Certificate Program and mentoring graduate students.

Pascual Ramero
Visiting Scientist



The V&E Program welcomed a visiting scientist this January. Hosted by Dr. Markus Keller, Dr. Romero will be working on grapevine water stress and deficit irrigation; specifically, he will be investigating thresholds and indicators for stress levels. Romero is a scientist at Instituto Murciano de Investigación y Desarrollo Agrario y Alimentario in southeastern Spain, where he also works on irrigation and grapevine water stress. Romero recently won the 2010 "Best Viticulture Paper" from the American Journal for Enology and Viticulture, for his work on regulated deficit irrigation and impacts it has on vine and fruit quality parameters. It is available for free at: http://www.ajevonline.org/misc/best_papers.dtl

Dealing with High Acid

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which is easily metabolized by yeast and bacteria. Only add the amount of calcium carbonate for the entire lot to a small portion of the juice. Because such a large concentration of CaCO_3 is used, the treated juice can reach a pH between 4.5-6.5. You will need to add the treated juice back to the original lot, and then re-adjust the juice using tartaric acid to your targeted pH.

During CaCO_3 addition, juice is agitated to help the precipitation process. The reaction time is short: only 30 min in a large tank. Settling takes ~60 minutes.

When doing the CaCO_3 addition, it is counter productive to chill the juice. Calcium-tartrate solubility is unaffected by cold temperatures and carbon dioxide is actually more soluble. Also, a simple indicator that the reaction is finished is that bubbles have stopped evolving. Because the reaction generates carbon dioxide there is a danger of asphyxiation, and it is better to do the treatment either in an outdoor tank or in a very well ventilated room.

Small acid corrections (around 1 g/L) can be done in the wine after alcoholic

or after malolactic fermentation, and even just before bottling. When deacidifying the wine before malolactic fermentation is important to be careful that the pH does not increase too much. To avoid growth of spoilage bacteria, the pH before MLF should be below 3.4. Use KHCO_3 to remove excess acidity before bottling.

White wine TAs are typically higher than in red wines. At target value for white grape must is TA 8 to 11 g/L. Late harvest, botrytized, and ice wines have higher TAs to be balanced with the high residual sugar.

How much should I add?

The limit to CaCO_3 and KHCO_3 addition is the available tartaric acid, so determine this in the must. Plan your CaCO_3 or KHCO_3 addition to remove excess tartaric acid. However, it is important to leave 0.5 g/L of tartaric acid, otherwise the treated wine will oxidize rapidly at an alkaline pH.

With the double salt method, you take 20 to 40% of the must to be treated and add all the calculated necessary CaCO_3 . The high pH produced in this fraction of must will also facilitate precipitation of malic acid. After CaCO_3 agitate well, let settle and rack. Recombine the treated and non-treated

fractions. Mix well. Wait several hours and check the TA and pH.

Calculations:

CaCO_3 : 0.67 g/L reduces TA by 1 g/L
(i) (vol.) L x present TA (g/L) – a = desired TA
(ii) CaCO_3 needed = a x 0.67

KHCO_3 : 0.673 g/L removes 1 g/L tartrate
 K_2CO_3 : 0.62 g/L removes 1 g/L

LEAVE 0.5 g/L of tartrate

(i) 230 g KHCO_3 /500 mL %TA x vol (mL) = mL of solution added

Excess Ca in the wine can cause Tartrate instabilities and there is no way to test for this instability. With 0.67 g of CaCO_3 you are really only adding 0.268 g of Ca. Wine typically contains 40 to 140 mg/L of Ca; the majority of Ca added to wine will be removed with the precipitate as tartrate and malate salts.

Calculating Wine Additions

Calculating wine additions under duress can be stressful and tricky. We recommend using computers with spreadsheet applications to streamline the mathematics and archive the information. There are several wine-addition websites available that can help calculate particular additions. Example URLs: <http://wineadds.com/>, <http://vinoenology.com/>, <http://www.iwinemaker.com/>.

WSU Winery and Vineyard Tour: Chile and Argentina 2012

Are you interested in tasting Malbec while sitting in a vineyard in Mendoza, Argentina? Or how about discussing winemaking preferences with other industry professionals while sipping a Chilean Cabernet Sauvignon Gran Reserva?

If your answer was yes to either of these questions, then you may be interested in the 2nd International WSU Winery and Vineyard tour. This tour, will be visiting key viticulture regions in Chile and Argentina, drinking wine with the winemakers, and kicking the dirt with resident viticulturists.

The tour will be from January 15-28, 2012 and is designed especially for Washington State winemakers and grape growers. While in Chile, the tour will visit the most renowned wine regions surrounding Santiago; Maipo Valley, Colchagua Valley, Aconcagua Valley and Casablanca Valley. Then, after a quick flight over the Andes Mountains, the tour will continue in the famous Argentinian Mendoza Valley wine region.

Of course, all work and no play is not the way to spend a winter vacation. Built into the program is free time to allow you to explore the cities of Santiago and Mendoza, the beach at Valparaiso, and a resort in the Andes Mountains.

Space is limited, and the cost of the trip is determined by the number of participants. The 2nd International WSU Winery and Vineyard tour costs are estimated below:

Cost per participant, based on single occupancy rooms:

- 30 participants: \$3,584 each;
- 34 participants: \$3,506 each;
- Cost reduction for second person within a couple is \$824.

Items included in price quote:

- Organization of all educational activities with vineyard specialists;



Enjoy the beautiful scenery while touring vineyards in Chile. Photo courtesy of www.down2earth-prowein.com.

- Daily breakfast at hotel;
- Assistance of a bilingual local guide (who happens to be a Sommelier);
- Transportation via deluxe bus to all group activities;
- Lunches and dinners as listed in the itinerary;
- Tours of Santiago and Valparaiso;
- 12 wine tastings at vineyards;
- Two-day excursion on the Pacific Coastline.

Not included in price quote:

- Airfare from US to Santiago;
- Entry reciprocity fee for entry into Chile for US citizens (\$140);
- Entry reciprocity fee for entry into Argentina for US citizens (\$140);
- Internal Airfare from Santiago to Mendoza: \$250 per participant. (Air taxes are subject to change prior to complete purchase of airfare. This reservation is released every 10 days and needs to be quoted).

There will be a website for you to sign up for the trip with a 25% deposit due by May 15, 2011.

Payments via credit card will incur a 5% surcharge and all payments via US dollar check will incur a \$25 surcharge per check.

Sound like something you may be interested in? If so, contact Theresa Beaver (tbeaver@wsu.edu) for a more detailed daily itinerary and information on registration.

Ever thought about going back to school?

Consider the WSU Viticulture and Enology Certificate programs! These 23 month-long programs (one for Viticulture, one for Enology) are offered online, and include 3 weekend, hands-on camps for participants. Space is limited, so reserve your spot today:

<http://wine.wsu.edu/education/certificate>

Viticulture and Enology Extension News

Washington State University

Calendar of Events



Date	Description
7 April	Grape Fieldmen's Mtg: Barn Inn, Prosser, WA
15 April	LIVE Annual Meeting, NW Vit. Center, Salem, OR
19 April	2010 Vintage Review Workshop, WSU-Prosser
27 April	Tasting Room Staff Training, Woodinville, WA
5 May	Grape Fieldmen's Mtg: Barn Inn, Prosser, WA
2 June	Grape Fieldmen's Mtg: Barn Inn, Prosser, WA
20-24 June	American Society for Enology and Viticulture Meeting: Monterrey, CA
7 July	Grape Fieldmen's Mtg: Barn Inn, Prosser, WA
4 August	Grape Fieldmen's Mtg: Barn Inn, Prosser, WA
10 August	Introduction to Wine Chemistry Workshop: WSU-TC
12 August	Viticulture and Enology Field Day: WSU-Prosser
17 August	Advanced Wine Chemistry Workshop: WSU-TC
24 August	Wine Sensory Workshop: WSU-TC
25 August	Advanced Wine Sensory Workshop: WSU-TC

Check the website for changes and updates to the Calendar of Events.

Have events you want publicized? The next VEEN will be in late August/September and is accepting events between September 2011-March 2012. Let Jim (jfarbertson@wsu.edu) or Michelle (michelle.moyer@wsu.edu) know by 1 August 2011.

www.wine.wsu.edu