Viticulture & Enology
Technical Newsletter

July 2011

Welcome to the July 2011 Viticulture & Enology Technical Newsletter!

This newsletter comes at the advent of bloom and fruit set in this 2011 season. To provide information on timely topics, Patty Skinkis provides an article on early season leaf removal and how it may help reduce disease infection. Inga Zasada provides information on plant parasitic nematodes to help you prepare for vineyard nematode sampling if this is a concern. On the enology side, James Osborne provides a summary on protein fining of white wine. Be sure to check out the new publications and online resources section, as we have some fantastic new resources for you to consider using in the vineyard. Finally, we have some upcoming events through OSU and OWRI that will help keep you informed, so be sure to mark your calendars!

Cheers,
The OSU/OWRI Winegrape Team

Early Season Leaf Pulling can Impact Disease and Quality

Dr. Patty Skinkis, Viticulture Extension Specialist, OSU

During the past few weeks, I received numerous inquiries in regards to early season leaf pulling. When should it be done? How early is too early? How much can be removed without damaging flowering and fruit set? Won't I sunburn the fruit? Memories of the Botrytis battle last season have many people questioning their cultural and chemical practices in efforts to prevent a repeat of 2010.

Manipulating the canopy to reduce disease is not a new phenomenon. Gubler showed marked decreases in grape Botrytis bunch rot by cultural management alone (Gubler et. al. 1987). In studies conducted in Monterey and Napa vineyards, leaf pulling at the late bloom stage was found to be the most effective canopy management method to reduce incidence and severity of Botrytis. In their studies, they did not find shoot thinning to have as much of an impact as leaf pulling. In fact, leaf pulling was found to be effective with our without fungicide application. The timing of leaf pulling is critical as it allows modification of the cluster zone microclimate to prevent initial infections of Botrytis. Although infection is often not visible until late season, the initial infections can take place during bloom and early fruit set when there are dead tissues such as shed caps or dying stamen and anthers which can be prime infection sites. Timing canopy management practices and/or fungicide applications during this bloom time window can lead to marked reduction in Botrytis.

Given the benefit of leaf pulling for disease management, it is no surprise that the majority of vineyard managers throughout Oregon utilize some level of cluster zone leaf pulling. Often, the morning sun side of the canopy is stripped of leaves in the cluster zone, leaving a protective layer of leaves on the afternoon sun side of the canopy. Some choose to remove individual leaves to create "tunnels" to the fruit. Timing of leaf pulling has been variable across the state. Some start early (post fruit set) while others wait until late season in hopes of drying out clusters as rains set in during the late ripening phase. However, much of the disease prevention effects of leaf pulling are found with earlier leaf pulling.

IN THIS ISSUE

Contact Information
Patty Skinkis, Ph.D.
Viticulture Extension Specialist
Oregon State University
Dept. of Horticulture
Oregon Wine Research Institute
541-737-1411
skinkisp@hort.oregonstate.edu

Oregon State University

We questioned how early we could begin leaf pulling here in Oregon, and have been conducting studies with early season cluster zone leaf pulling since 2008. The studies evaluate whether complete cluster zone leaf pulling could be conducted pre-bloom or during bloom to reduce disease infestation without compromising flowering, fruit set and fruit quality. The study was conducted in commercial Pinot Noir vineyards in the Willamette Valley at the following developmental stages: pre-bloom, 50-80% bloom, fruit set, BB to pea-sized, and bunch close. These were compared to a no leaf pull control. Leaves were removed from all nodes from the base of the shoot up to the node above the top-most cluster. Our earliest leaf pulling occurred at stage EL 57, flowers beginning to separate (Figure 1). At this pre-bloom stage, we removed approximately 60% of leaves per shoot (Figure 2), and we hypothesized that this loss of carbon source to the developing flower may affect development of floral gametes for a

Figure 1. A Pinot Noir inflorescence at phenology stage 57 where flowers begin to separate from the remaining flowers in the cluster.

successful pollination and fertilization of the flower. We hoped fruit set would be reduced, thereby reducing cluster compactness, disease infection, and potentially a reduction in crop thinning. During the first two years of the study (2008 and 2009) we did not have a decrease in fruit set when comparing pre-bloom or bloom leaf-pulled vines to the control. However, we found a 17-28% reduction in set in the pre-bloom treatments when compared to the control between the trial sites in 2010. Leaf pulling at bloom did not reduce set during any year of the trial. We believe that the cooler season of 2010 and the somewhat delayed shoot development compared to previous years may have contributed to the reduced fruit set in pre-bloom leaf pulling.

Figure 2. During the pre-bloom stage of leaf removal, the main expanded leaves are removed and only the shoot tip and few leaves remain.

Disease effects. Fruit was analyzed at harvest for Botrytis and powdery mildew infection by the Mahaffee USDA-ARS Foliar Pathology Lab, a collaborator on this project. In years 2008 and 2009, the earlier leaf removal resulted in reduced disease. However, some years there was limited disease infestation, and results indicated very low incidence and severity of either fungal pathogen. The 2010 season had the most optimum conditions for Botrytis in all the years of the study, and leaf pulling resulted in reduced Botrytis incidence and severity when conducted at all stages at or prior to bunch closure (Figure 3). The reduction in disease infestation is likely attributed to better spray coverage and change in microclimate of the cluster zone and not the cluster architecture. During 2008-2009, there was a positive effect of leaf pulling on reducing disease, but there were no differences in cluster mass or berries per cluster. In 2010, both research sites had 30-40% fewer berries/cluster at harvest with the pre-bloom and bloom leaf pulling. However, leaf pulling treatments post-bloom did not have differences in berries per cluster compared to the control, but they still had reduced botrytis severity (Figure 3).

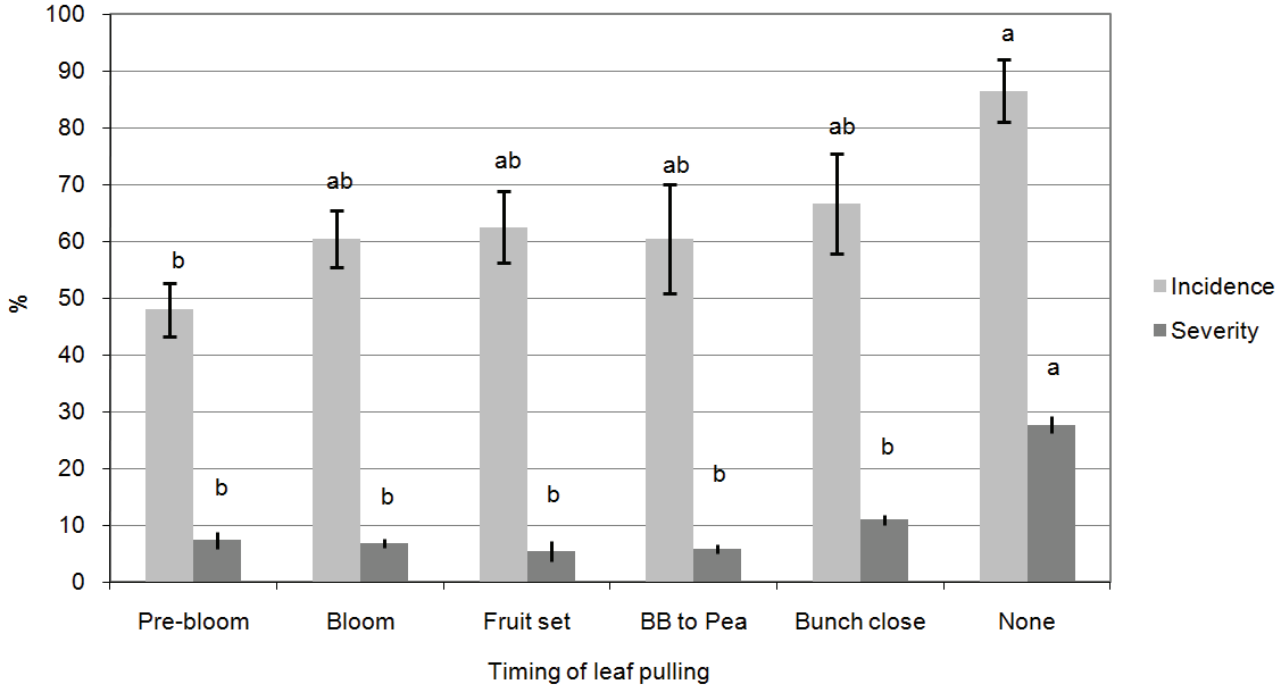

Figure 3. Botrytis bunch rot incidence and severity in berries at harvest. Different letters indicate differences in means (Tukeys, P<0.05).

Fruit ripening and quality. Fruit ripening was not affected by leaf pulling treatments. By harvest, all fruit had similar soluble solids, pH and titratable acidity. Anthocyanin and phenolic data that was analyzed in 2008-2009 indicate little to no differences with timing of leaf pulling. Samples are being analyzed for 2010 anthocyanin, phenolics and tannins during summer 2011. We hypothesized that early season leaf pulling could lead to increases in polyphenolic content of the berries as precursors to these compounds are produced at the beginning of berry development; however, data thus far have not shown differences. Much more needs to be investigated to better understand berry chemistry during early ripening, and this can be of interest for future work. At this point, we believe early season leaf pulling can allow for disease prevention in Pinot Noir without reducing fruit quality. We will have more information coming on fruit quality with the 2010 and 2011 vintages.

Return fruitfulness and growth. With early season leaf pulling, some may be afraid of reducing the total carbohydrate development of the plant for the current or future season. However, based on our research from 2008-2010, the amount of leaves that were removed from the cluster zone during the season was not enough to result in a decrease in vine growth. Total vine leaf areas at véraison did not differ between different leaf pull timings at both research sites. The non-pull control had more leaves and more leaf area, but despite cluster zone leaf removal in the other treatments, adequate canopy was available to support normal vine growth. The same leaf pull treatments were applied to the same vines all years of the study, and no reduction in growth was observed as a result of early season leaf pulling.

Sunburning. During our study, there was no sunburning of berries with the full cluster zone exposure or at any of the leaf pull timings. We believe that if leaves are pulled early enough, there should be no concern of sunburning. Waiting to leaf pull near véraison or later can put you in danger of significant sunburn if there is high heat, sunlight and low relative humidity. In giving presentations about this work to different groups throughout the region, I have learned that more aggressive leaf pulling may be OK even in warm arid regions. An eastern Washington producer reported that he used leaf pulling shortly after fruit set without experiencing sunburned berries. This is something to consider for those of you in the southern, eastern and Mid-Columbia reaches of the state. It is worth a trial to see if you notice decreases in disease and/or increases in fruit quality.

Early season leaf removal can be a very useful cultural control method to increase disease management while also impacting fruit quality. While our work was conducted in the cool climate of the Willamette Valley with Pinot Noir, there are many other benefits of doing this early season leaf removal work both mechanically and/or on different cultivars. Also, while the myriad of leaf pulling research has been done on red grape cultivars, it can also work well on white cultivars to increase aromatic compounds (Skinkis et al. 2010) and decrease disease (Gubler et al. 1987; Austin and Wilcox 2011). Simultaneous to the work being conducted by our programs here at

OSU/USDA-ARS, other researchers around the world have been using leaf pulling to reduce fruit set , increase fruit quality and reduce diseases (Diago et al. 2010, Tardaguila et al. 2010, Austin and Wilcox 2011). We encourage you to try different leaf pulling tactics in your vineyards during this and coming years to determine the best fit for your vineyards.

The funding for this project was provided by Viticulture Consortium-West and the Oregon Wine Board. The Skinkis and Mahafee Labs thank the industry for their funding in support of this work.

Literature Cited

Austin, C.N. and W.F. Wilcox. 2011. Effects of fruit-zone leaf removal, training systems, and irrigation on the development of grapevine powdery mildew. Am. J. Enol. Vitic. 62: 193-198.

Diago, M.P., M. Vilanova, and J. Tardaguila. 2010. Effects of timing of manual and mechanical early defoliation on the aroma of *Vitis vinifera* L. Tempranillo wine. Am. J. Enol. Vitic. 61: 382-391.

Gubler, W.D., J.J. Marois, A.M. Bledsoe, and L.J. Bettiga. 1987. Control of Botrytis Bunch Rot of Grape with Canopy Management. Plant Disease. 71: 599-601.

Skinkis, P.A., B.P. Bordelon, and E.M. Butz. 2010. Effects of sunlight exposure on berry and wine monoterpenes and sensory characteristics of traminette. Am. J. Enol. Vitic. 61: 147-156.

Tardaguila, J., F.M. de Toda, S. Poni, M.P. Diago. 2010. Impact of early leaf removal on yield and fruit and wine composition of *Vitis vinifera* L. Graciano and Carignan. Am. J. Enol. Vitic. 61: 372-381.

Know Your Target: Sampling for Plant-Parasitic Nematodes in Vineyards

Dr. Inga Zasada, Research Nematologist, USDA-ARS

Plant-parasitic nematodes are commonly found in Oregon vineyards. While plant-parasitic nematodes are a major economic problem in most grape producing regions in the world, the impact of these pests on vineyard productivity in Oregon is less clear. Vineyard managers who are interested in sampling for nematodes should have a basic understanding of the types of plant-parasitic nematodes found in vineyards and a working knowledge of their biology to collect a meaningful sample for analysis by a commercial laboratory. The basics of plant-parasitic nematodes commonly found in Oregon vineyards are covered herein.

The types of plant-parasitic nematodes will vary greatly between vineyard and region. However, we have a good idea of which plant-parasitic nematodes are commonly found in Oregon vineyards based on geography. Vineyard managers in western Oregon are likely to encounter the ring nematode (*Mesocriconema xenoplax*), dagger nematode (*Xiphinema americanum*), root lesion nematode (*Pratylenchus* spp.), and pin nematode (*Paratylenchus* spp.). These plant-parasitic nematodes were recovered from 85% of sampled vineyards in a survey conducted during 1994/1995. To a lesser extent, root-knot nematode (*Meloidogyne hapla*) will be found in western Oregon vineyards. In eastern Oregon the cast of nematode characters is much different. Surveys conducted in eastern Washington during 2000 and 2003 demonstrated that root-knot and dagger nematodes were present in 50% of the vineyards sampled compared to ring nematode only being present in 20% of sampled vineyards.

Knowing a little about the biology and lifestyles of these nematodes will help guide sampling strategies (Table 1, Figure 1).

The **ring nematode** is a *MIGRATORY ECTOPARASITE* (Figure 2), meaning that this nematode spends its entire life in the soil. The impact of ring nematode on vine productivity has been researched in Oregon. Controlled studies demonstrated that ring nematode population densities of 6 to 8 nematodes/gram soil reduced vine vigor by year 3 after planting. During the survey of Oregon vineyards in 1994/1995, there was no observable effect on vines with ring nematode population densities of 2 nematodes/gram soil.

The **dagger nematode** is also a *MIGRATORY ECTOPARASITE*. Unlike the ring nematode, this nematode does not cause damage to vines by direct feeding. Rather, it is the ability of this nematode to transmit tomato ringspot virus to vines that can result in reduced vine vigor and death. It is important to understand that while the

Table 1. Summary of plant-parasitic nematodes encountered in Oregon vineyards and guidelines for sampling.

Nematode common name	**Nematode scientific name**	**What to sample**	**When to sample**
Ring nematode	*Mesocriconema xenoplax*	Soil	Fall
Dagger nematode	*Xiphinema americanum*	Soil	Winter and spring
Root-knot nematode	*Meloidogyne hapla*	Soil and roots	Fall
Root lesion nematode	*Pratylenchus* spp.	Soil and roots	Fall
Pin nematode	*Paratylenchus* spp.	Soil	Fall

dagger nematode is commonly found in Oregon vineyards, tomato ringspot virus is not.

The **root-knot nematode** is a *SEDENTARY ENDOPARASITE*. This nematode will enter at the root tip and migrate inside the root before establishing a permanent feeding site. A symptom caused by this nematode is the formation of galls on the roots. These galls can be quite small in grape. Very little research has been conducted on the impact of the root-knot nematode on grapevine establishment and productivity in the Pacific Northwest.

The **root lesion nematode** is a MIGRATORY ENDOPARASITE, meaning that this nematode spends its life migrating between the root and soil. While this nematode is commonly found in Oregon vineyards, the impact of this nematode on vine productivity has not been researched.

The **pin nematode** is a MIGRATORY ECTOPARASITE. In general, feeding by this plant-parasitic nematode on any crop does not cause a reduction in plant productivity.

When sampling a vineyard for plant-parasitic nematodes, it is important to have a clear goal in mind. Are you trying to diagnosis a problem? Are you interested in knowing what plant-parasitic nematodes are present before establishing a vineyard? These types of questions will dictate where in the vineyard you will want to take samples, what type of material (roots and/or soil) to collect, and when to collect samples. There are two times during the life of a vineyard when soil samples can be collected: pre-planting and post-planting. General guidelines for how to sample in each situation are provided.

Preplant: Since nematodes are not uniformly distributed in a vineyard, the precision of estimating nematode population levels increases with the number of subsamples collected. A general rule is to collect a composite soil sample from at least 20 cores along a "W" walking pattern in 2 to 5 acre areas of a field and combine the cores into one sample. Large vineyards should be partitioned by differences in soil type and crop history. If vines are still present, soil samples should be collected in the region of most root growth at depths of 8" to 18".

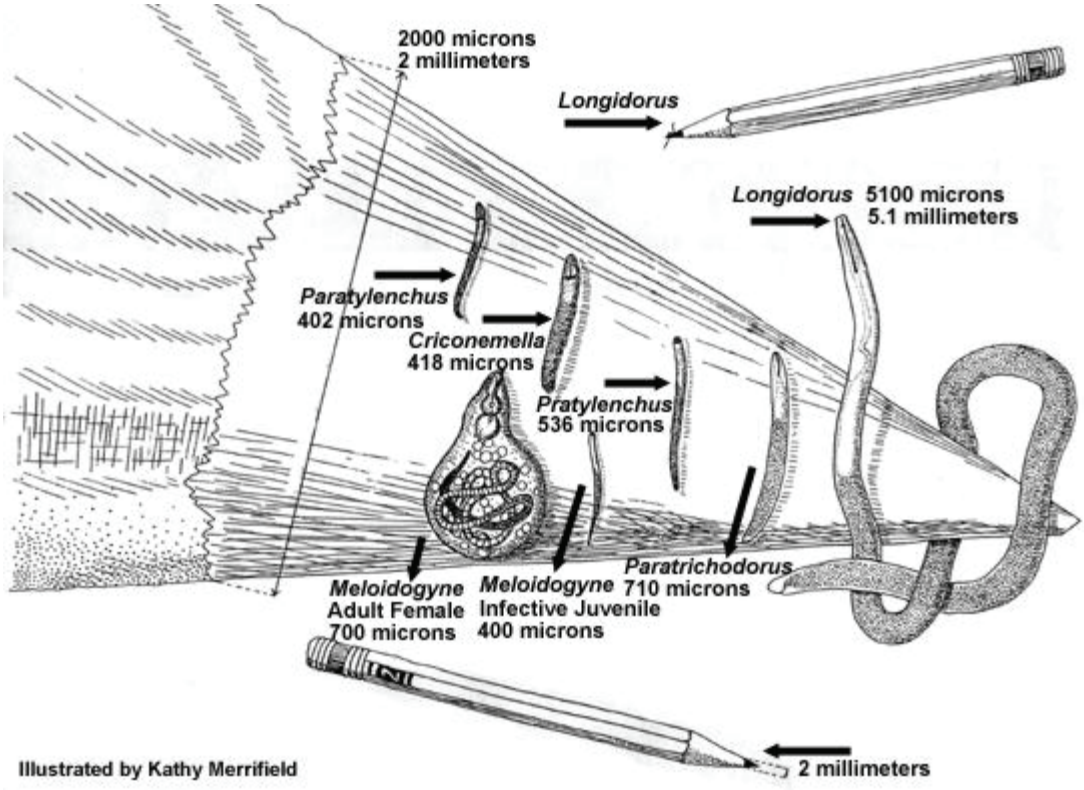

Figure 1. This illustration by Kathy Merrifield (Oregon State University) illustrates the diversity of sizes and shapes of plant-parasitic nematodes in relation to a pencil. Plant-parasitic nematodes encountered in Oregon vineyards shown in this illustration include: *Paratylenchus* (pin nematodes), *Criconemella* (aka *Mesocriconema*; ring nematode), *Pratylenchus* (root lesion nematode), and *Meloidogyne* (root-knot nematode). The dagger nematode (*Xiphinema americanum*) is most similar in size to *Longidorus* in this illustration.

Postplant: To diagnose a problem potentially caused by plant-parasitic nematode feeding, soil samples should be taken from the root zone of affected and unaffected plants. Multiple samples should be collected at depths of 8" to 18" and samples from each area combined. If root-knot or root lesion nematodes are of interest, then root samples should also be collected. A root sample should include fine feeder roots which are the preferred site for nematode feeding.

In general, it is best to sample for plant-parasitic nematodes in the fall when densities of many nematode species are at their highest. The exception to this rule is the dagger nematodes whose densities are higher in the cool, wet time of the year compared to the warm, dry summer. Soil and root samples can be collected using a shovel, soil probe, trowel, etc (Figure 3). In general, you will want to collect about 1 lb of soil or root material and place it in a heavy plastic bag. Label the bag with information such as name, date, phone number, vineyard, block, etc. Seal the bag to prevent drying and keep the sample in a cool, dark place until the sample is sent to a nematode diagnostics laboratory (Table 2). Plant-parasitic nematodes are living organisms and will not survive extreme temperatures!

REMEMBER!! You will pay anywhere from $30 to $50 to have a soil or root sample analyzed for plant-parasitic nematodes. Knowing a little bit about the target organism and when and how to sample makes economic sense and will ensure you have good information upon which to base nematode management decisions.

Figure 2. The ring nematode is commonly found in Oregon vineyards (Courtesy S.W. Westcott III).

Figure 3. Sampling tools and equipment needed to sample a vineyard for plant-parasitic nematodes. Nematodes are living organisms; place soil samples in a cooler for transportation back to the vineyard office. An Oregon State University plant-parasitic nematode sample submission form is shown. Check with your nematode testing laboratory of choice to determine sample information required and further recommendations for sampling.

Table 2. Nematode diagnostic laboratories.

A & L Western Laboratories, Inc. 10220 SW Nimbus Ave. Bldg. K-9 Portland, OR 97223 Phone: 503-968-9225 Fax: 503-598-7702 Web page: http://www.al-labs-west.com/sections/anservices
Ever Green Nematode Testing 36631 North 19th Ave. Phoenix, AZ 85086-9143 Phone: 623-465-5046
Oregon State University Nematode Testing Service 2082 Cordley Hall Corvallis, OR 97331-2902 Phone: 541-737-5540 Fax: 541-737-2412 Email: inghamr@science.oregonstate.edu Web page: http://www.science.oregonstate.edu/bpp/Nematodes/index.htm
Western Laboratories P.O. Box 1020 Parma, ID 83660 Phone: 208-722-6564 or 1-800-658-3858 Fax: 208-722-6550 Email: harry@westernlaboratories.com Web page: westernlaboratories.com

Protein Fining of White Wine

Dr. James Osborne, Extension Enologist, OSU

Fining agents are tools that can be utilized during winemaking to achieve a number of goals. They can be added to wine or juice for the purposes of achieving clarity, color, flavor and/or stability modifications. Often the use of fining agents can be minimized through changes to certain vineyard or winemaking practices. For example, protecting white wine from oxygen during the winemaking process to prevent oxidative browning will minimize the need for the use of a fining agent such as PVPP to remove oxidized color. However, the use of some fining agents, such as bentonite to protein stabilize white wine, is difficult to avoid.

Fining agents are grouped according to their chemical nature and mode of action:

(a) Earths: bentonite, kaolin, montmorillonite
(b) Animal proteins: gelatin, isinglass, casein, albumen
(c) Carbons
(d) Synthetic polymers: PVPP
(e) Silicon dioxide (kieselsol)

These fining agents interact with certain components in a wine or juice due to either electrostatic or hydrophobic interactions with

many fining agents containing an electrical charge. If the charge is the opposite of the particle in suspension then neutralization and absorption may occur. Smaller particles form larger particles as they interact and because of their increased density they will settle from solution. The most commonly used fining agent in the wine industry is bentonite. The use of this fining agent is required to prevent the formation of protein hazes in white wines. It is also commonly used as a settling aid for juice. Proteins in wine are a mixture of grape derived proteins and proteins from autolysed yeast. While yeast proteins have not been shown to play a role in causing protein hazes, grape proteins (primarily pathogenesis-related (PR) proteins) are primarily responsible for protein haze formation. Variety, vintage, maturity, condition of the fruit, pH, and processing methods, can all affect must and wine protein content with variety being one of the most important factors. For example, varieties such as Sauvignon blanc and Gewurztraminer are known to have high protein content and require much higher rates of bentonite to stabilize than other varieties such as Chardonnay.

Aside from variety, pH and alcohol have the largest impact on protein haze formation and protein removal by bentonite. As the alcohol content increases, proteins may become less soluble and tend to aggregate together. Therefore, a higher alcohol wine will be more protein unstable than a lower alcohol wine even if the wines contain the same amount of protein. The pH of the wine effects the electrostatic interaction between the protein and the fining agent bentonite. Bentonite, when dissolved, is negatively charged and interacts with positively charged compounds in wine. Proteins at wine pH are often positively charged due to the presence of amine groups (NH_3^+). A shift in pH may change the overall charge of the protein and weaken its interaction with bentonite. This is why it is recommended that, where possible, activities that may change pH such as cold-stabilization, blending, MLF, and acid adjustments, be performed prior to protein stabilization. Protein stability can also be affected by the presence of phenolic compounds and polysaccharides. In these cases, the protein:tannin or protein:polysaccharide interactions help prevent protein aggregation and haze formation.

Bentonite is used as a protein fining agent because of its negative charge and its large surface area (when hydrated). Bentonite is clay that was formed through the weathering of volcanic material and is primarily composed of silica, aluminum, and magnesium. Bentonites exist in many different geographical locations around the world and not all are the same as they may differ in levels of purity, particle size, adsorption capacity and swelling ability. In the US, bentonite is principally mined in Wyoming and sodium bentonite is widely used due to its enhanced protein binding properties compared to calcium bentonite. Bentonite exists as small plates, that when hydrated, separate to form a colloidal structure with an enormous surface area that is negatively charged. The correct preparation of bentonite is extremely important. Bentonite should be hydrated with clean, chlorine-free hot (60˚C, 140˚F) water. The bentonite should be added slowly to the water under vigorous mixing and allowed to swell for at least four hours. The bentonite slurry should not sit for too long (such as overnight) as this may encourage microbial growth. The bentonite to water ratio in the slurry is usually 5-10% wt/vol keeping in mind that the total quantity of water added should not exceed 1% of the wine volume treated. Bentonite may be directly resuspended in wine rather than water just before introduction in the tank. However, rehydrating with wine doesn't allow the bentonite to fully swell and will reduce its fining capacity. The reaction between bentonite and protein is relatively quick with mixing and temperature affecting the reaction. Warmer temperatures will encourage the reaction while vigorous mixing for at least 10-15 minutes is recommended. Bentonite works poorly at cold temperatures, so if you intend to simultaneously bentonite fine and cold-stabilize, allow some time for bentonite to react with proteins at a warmer temperature before chilling the wine for cold-stabilization. Remember, the loss of potassium bitartrate during cold-stabilization will impact the pH and should be accounted for when performing bench-top trials by chilling the wine prior to the bentonite trials.

Despite the large amount of literature regarding protein instability, the actual protein levels at which wines will remain protein stable are unknown. Therefore, carefully controlled bench-top trials must be performed to determine the correct concentration of bentonite to add to achieve protein stability. This is particularly important when you consider that bentonite can remove compounds other than proteins from wine and excessive addition of bentonite may result in loss or aroma, mouthfeel, or color. Slurries prepared for the bench-top trials should be prepared in the same manner as the slurry prepared in the cellar. Furthermore, when performing bench-top trials the mixing speed and wine temperature should be as close as possible to those that will occur in the cellar. Typically bench-top trials are more effective than cellar fining and so may result in an underestimation of the bentonite required for protein stability. Sensory evaluation of wines from the bench-top trials should be performed and different types and brands of bentonite trialed to determine the most effective one for your wine. A detailed procedure for conducting bench-top bentonite trials and protein stability tests can be found online at https://www.gusmerenterprises.com/images/document/Bentonite.pdf

References:

Boulton, R., V. Singleton, L. Bisson, and R. Kunkee. 1996. Principles and Practices of Winemaking. Chapman & Hall, New York.

Butzke, C.E. 2010. Winemaking Problems Solved. Woodhead Publishing, Oxford.

Iland, P., A. Ewart, and J. Sitters. 1993. Techniques for Chemical Analysis and Stability Tests of Grape Juice and Wine. P. Iland Wine Promotions, South Australia.

Marchal, R., and E.J. Waters. 2010. New directions in stabilization, clarification, and fining of white wines. In: Reynolds, A.G. (Ed). Managing Wine Quality. Vol 2: Oenology and wine quality. Woodhead Publishing, Oxford.

Zoecklein, B.W., K.C. Fugelsang, B.H. Gump, and F.S. Nury. 1999. Wine Analysis and Production. Chapman and Hall, New York.

New Viticulture and Enology Resources

Pacific Northwest Plant Disease Management now on Facebook!

PNW Plant Disease Management, the primary disease management guide that has been available since 1954, is now on Facebook! Through the world of Facebook, the experts behind the disease management guide, such as Dr. Jay Pscheidt, Extension Plant Pathologist, provide updates on plant disease around Oregon and the Pacific Northwest. Keep up-to-date on the plant disease scene!

Grapevine Nutrition Module provides comprehensive information

Want to learn more about grapevine nutrition? Do you have to keep remembering which mineral nutrient does what? Do you have troubles finding guidance on how to take a nutrient sample and later interpret the results? Help is just a click away with the new comprehensive, easy-to-use online module developed by Dr. Patty Skinkis, OSU and co-authored by Dr. Paul Schreiner, USDA-ARS. Bookmark this useful online module for future use! http://extension.oregonstate.edu/catalog/html/em/em9024/

eViticulture.org: A new source of viticulture information from land-grant universities

A new online consortium of articles pertaining to vineyard production can be found at eViticulture.org. This website was developed through collaboration of viticulturists from land grant institutions across the US and launched in January 2011. Articles were written by university viticulturists and peer-reviewed, ensuring sound, unbiased content which land grant universities and Extension programs are known for providing. New articles are continuing to be added throughout the coming year. Find information on vineyard production issues, and use the website for general information and training of new staff. Articles are also available in Spanish. If you have used the site and wish to provide feedback on the content, please fill out the industry survey. This information will be used to help further develop the site to meet industry needs.

Upcoming Events

LIVE Field Workshop: Exploring the soil-root-vine interface – July 28, 2011

Olsen Family Vineyards, Independence, OR

Join us for a half day hands-on workshop to explore the soil, root and vine interface in the vineyard. Patty Skinkis, OSU Viticulture Extension Specialist, and Paul Schreiner, USDA-ARS Research Plant Physiologist team up to provide you with an opportunity to learn more about above- **and** below-ground vine growth and development within a context of a research study examining cover crops and residue management in the Willamette Valley. This will allow you a more up-close look at components that make up the vineyard system: vines, roots, mycorrhizae and soil! To find out more about this program and to register, visit http://liveinc.org/lectures/10318.

3rd Annual OWRI Viticulture & Enology Research Colloquium – August 25, 2011

LaSells Alumni Center, Oregon State University Campus, Corvallis, OR

Join us for this one-day event featuring research that impacts Oregon's winegrape industry! This is an opportunity to learn about the most recent outcomes of viticulture and enology related research projects conducted by researchers at Oregon State University, the USDA-ARS Horticulture Crops Research Unit, and other collaborating units in the program. For more information, visit http://owri.org/.