OSU Wine and Grape Research and Extension Newsletter

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Welcome to the January 2008 Newsletter!

Welcome 2008!

Winter provides many opportunities for viticulture and enology programming across Oregon, the Pacific Northwest and beyond. The vines, although dormant, need pruning and the winery operations continue. This month, we've decided to focus on important considerations in both the vineyard and winery. An article on pruning operations by Dr. Patty Skinkis will give you insight into pruning methods and the importance of vine size measurements. An article regarding malolactic fermentation by Dr. James Osborne discusses the factors in achieving this method of secondary fermentation. Finally, a research update on recent publications by the enology faculty at OSU is included to keep you up to date with current progress of research in the wine world!

Be sure to check out the "Upcoming Events" section of the newsletter as a number of OSU Viticulture & Enology workshops will be offered throughout winter and spring. An updated listing is always available online at http://wine.oregonstate.edu. So, mark your calendars and register for events in advance as space may be limited!

Here's wishing for a great 2008!

-The OSU Winegrape Team

What's New in Vineyard Pruning?

Dr. Patty Skinkis, Viticulture Extension Specialist

When it comes to pruning vines, the major advances over the years has been in pruning technology to increase efficiency in the vineyard. Of all the automation that has occurred in the vineyard to increase efficiency, one of the last to be fine tuned is pruning. Over ten years ago, agricultural engineers were determining how to develop an identification "eye" and mapping system for mechanized precision pruning through image analysis (McFarlane et al. 1997). Since then, the technology has advanced significantly, and a visit to the Unified Symposium at the end of this month will quickly get you up to speed on the new technologies available.

Although technology continues to advance, there are always new research insights on the vine physiology realm for dealing with the dormant grape vine structure. Some considerations can be made in dormant pruning including time, methods, vine size estimates and factors influencing vine growth and development.

Timing and Selection during Pruning

It is well known that winter pruning of the grapevine is done during the dormant season before the vine begins to grow. However, the dormant period runs anywhere from November through March or later, depending upon the region and climate. Many may wonder if there is a best time to prune during the dormant period. Pruning timing should be based on vineyard macro- and mesoclimeate and the temperatures that are inherent during the dormant season.

Dormant pruning is considered a de-vigorating process for the grapevine as a large portion of the vegetative growth is removed from the vine each winter, taking with it stored carbohydrates and many buds. This is also a renewing process for the vine, helping to decrease vigor and maintain a productive vine. Timing of dormant pruning has a potential influence on flower bud development and spring vegetative growth. Studies done in France, South Africa and Australia resulted in decreased spring growth in the distal buds/shoots when vines were pruned later in the dormant period. By postponing pruning 1-2 months in the dormant season, Antcliff et al. (1957) and Martin and Dunn (2000) were able to delay bud break by 3 and 5 days, respectively. In addition to the delayed bud break, there was a decrease in distal shoot growth in many varieties from Merlot to Grenache (May 2004). Why is it important that distal shoot growth is reduced? Well, the apical dominance that is often expressed in the more terminal (distal) buds/shoots is modified by the later pruning, resulting in both a slight bud break delay and a more even shoot growth along the cane or cordon. This is linked to a more even distribution of auxin, a phytohormone that induces cell division and growth, within buds that are more mature with later pruning. Buds that are lain down as the terminal buds are able to produce the auxin for initiating growth, thus inhibiting the apical dominance normally observed in more distal buds or spurs.

Another advantage observed in these later pruning studies was a decrease in millerandage or "hen and chicks" without influencing total number of berries. Once again, it is thought that the buds are more mature by the time later pruning is conducted, resulting in a well developed flower primordial in the grape bud and more carbohydrate reserves available for the development of the flower (May 2000).

Determining timing of pruning operations can be made with some these potential vine physiological impacts in mind. Some locations may not have observed benefit in regards to timing of pruning, which is the case in California (Winkler et al. 1992). However, such timing decisions are often made on worker availability and keeping crews working during the season. Trying some of these practices in the vineyard or looking at the impact of development of shoots and fruit set in blocks pruned at different times in the vineyard may provide insight into potential impacts for a specific area. Keep in mind that the definition of "late" pruning can vary for different climates, and delaying pruning late in the winter/dormant season may lead to bleeding from cut ends due to sap flow that is taking place.

Using Pruning as an Indicator of Vine Size and Balance

The measure of pruning weights obtained from the dormant vine has become a standard in American viticulture by which vine balance can be determined. The Ravaz index was created in the early 1900's to measure vine growth and production using pruning weights and yield. This utilized the current season's yield and the pruning weights obtained from the vine during the dormant season following harvest. While it gave a good estimate of crop load, it was later refined by Partridge and defined the Growth Yield Relationship by using the dormant season pruning weights and the yield of the **following** season. Later, Nelson Shaulis, a well renowned researcher from Cornell University, pursued the concept of balanced pruning and studied its relevancy of determining vine size, particularly on Concord grape vines. Balanced pruning prescribed a formula for determining the number of buds to leave on the vine based on the pruning weights obtained from the vine. All of these methods were utilized to determine vine size and productivity for consistent production and management of the vineyard.

It is easy to question whether pruning weights are truly effective in determining vine size, particularly in high vigor vineyards where the vines are hedged three or more times per season. Additionally, vine yield does not include the total crop that was set and thinned. These two figures (pruning weight and yield) are not completely representative of the vine's total capacity of vegetative and reproductive growth. However, both are easy to record and the Ravaz index can be easily calculated to give an idea of the status of a given vineyard block.

Pruning weights alone can be indicative of vine size even when hedging is practiced. When taken ***precisely*** and ***accurately*** in the vineyard over a period of years, pruning weights can give insight into changes in the plant growth and response to vineyard management practices. Many abiotic and biotic factors in the grape's temporal and spacial environment can impact its growth and production. Vine size can provide an indication of impacts that these factors may have on the vine.

As a vineyard manager in the Willamette Valley recently stated, "I wonder why I need to be taking these measurements in the cold and rain each winter when others [vineyard managers] do not bother… but we've done it for 15 years or so."

When observing the same blocks across years, vine size can fluctuate significantly throughout the vineyard.

"Diameter and mass of the vine is just not there in some blocks and I look back to see what the cause may be," he adds.

An examination of potential causes of this change in pruning weights leads to action to help manipulate vine size within good production. Only good records of pruning weights and seasonal observations consistently over the years will help you determine vine size for a given vineyard or specific block. A great example of vineyard impact on vine size is a solid grass cover crop. This can lead to a progressive decrease in pruning weights over the years, thus reflecting a decrease in vine size. Conversely, over-vigorous vines can be identified for vigor management through reduced inputs and implementation or modification of a cover crop.

How to Take Pruning Weights

The method for taking pruning weights is rather easy but can be tedious with large vineyard acreage. The best method for large operations is to identify blocks of the vineyard that will be continuously monitored through the years. If the vineyard locations have multiple cultivars and/or blocks, be sure to measure representative vineyard blocks for each of these. Using the same block for pruning weight measurements each year will help determine and analyze differences over the years. When pruning the vine, collect all wood that is pruned off the vine and bundle together with a rope or string. Use a pocket hanging scale to take the vine measurement. These scales are efficient for use because, unlike flat scales, you do not need to move the cuttings outside of the vine row to a scale located on a truck tailgate or elsewhere. Furthermore, you can take measurements in inclement weather which is all too common in most parts of Oregon during pruning season. A small hanging fish scale can be used ***if*** it is in the correct range. It is best to use one that can be read in pounds and ounces with a capacity and precision within the weight that you'll be measuring. For individual vine measurements, you will want to use a scale that measures in ounces. Record all of the weights and keep in your files to compare vineyard locations and the same blocks between years.

Pruning weights can be used in several capacities. Use in conjunction with yield data to determine your Ravaz index (yield/pruning weight). Balanced vines of *V. vinifera* cultivars fall within the 5-10 range. If vines fall below or above this range, the vine needs to be managed to increase or decrease vigor. The balanced pruning method can be followed where high vigor vines are pruned using the 30+10 method where 30 buds are kept for the first pound of pruning weight, and an additional 10 buds for each additional pound. For lower vigor cultivars, a 20+10, 20+20 or 10+10 rule can be used, depending on cultivar growth and vigor for your site. The premise behind the bud count is to leave more buds on a vigorous vine and fewer buds on a weaker vine. The more buds present on the vine, the more competition they will impart. While using bud counts and addressing vine size by doing pruning weight measurements may not be the most appealing thing to do while pruning, it may be worth a trial in the vineyard, even if on a small scale.

Obtaining vine balance is important for determining consistent production in the vineyard. The intertwined relationship of vegetative and reproductive growth can determine the long term impacts of vineyard practices on productivity and quality of the vineyard. Fine tuning growth-yield relationships is necessary to truly identify the ratio of real vegetative and reproductive production. Therefore, documentation of the amount of hedging, shoot thinning and cluster thinning along with pruning weights and ripened yield will give the best estimate of the vine's growth and reproductive capacity for a given location, block, cultivar and clone.

Interesting Vineyard Trivia…

Researchers investigated the use of vine brush as a substitute for particleboard as the amount available in Greece was greater than the wood yield of forests in the area (~2.02 t/ac).

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Grape Plant Materials

As spring nears, many have already placed their orders for grape cuttings or plants from nurseries in Oregon, WA or CA. However, some individuals have had problems getting access to plant materials that they desire for planting. A quick review of the rules outlined by the Oregon Department of Agriculture regarding grape plant materials will help clarify any questions regarding shipment of plant materials from outside of Oregon. Please see the ODA's explanation of the state's grape quarantine by clicking the following link:
http://egov.oregon.gov/ODA/PLANT/docs/pdf/quar_grape.pdf

Recent Publications from OSU Enology Researchers

Michael Qian

Yu Fang and **Michael Qian**. 2006. Quantification of Selected Aroma-Active Compounds in Pinot Noir Wines from Different Grape Maturities. Journal of Agricultural and Food Chemistry, 54: 8567-8573.

In this study the effect of grape maturity on aroma compounds in Pinot noir wines produced during the 2003 and 2004 vintages were investigated using gas chromatography techniques. Grapes were harvested at three different maturities, "early stage" (21 °Brix), "middle stage" (25 °Brix for 2003 and 22 °Brix for 2004) and "late stage" (33 °Brix for 2003 and 25 °Brix for 2004). Wine was made from these grapes and analyzed. Results showed that both grape harvest maturity and year could affect the aroma composition of the wine. The concentration of terpene alcohols (floral aromas) increased with grape maturity in both years as did guaiacol and 4-ethylguaiacol (spicy, smoky notes). Higher concentrations of ß-damascenone (apple, rose, honey) and ß-ionone (berry and violet like) were also found in later maturity wines. Obvious decreasing trends with grape maturity were observed for aromatic esters perhaps explaining why the late stage of wines showed less fruity aromas. Overall, the concentration of most grape-derived aroma-active compounds increased along with grape maturity, while the opposite trend occurred for esters.

Jim Kennedy

Jessica Cortell and **James Kennedy**. 2006. Effect of Shading on Accumulation of Flavonoid Compounds in (*Vitis vinifera* L.) Pinot Noir Fruit and Extraction in a Model System. Journal of Agricultural and Food Chemistry, 54: 8510-8520.

In this study the accumulation and changes in flavonoid compounds were measured in Pinot noir in shaded and exposed treatments. The extraction of these compounds into model wine solutions was also analyzed. Flavonoids play an important role in wine because of their color, astringency, and potential role in human health. Flavonoid compounds found in grapes include proanthocyanins (condensed tannins), anthocyanins, and flavonols. The study was conducted in 2004 in a commercial vineyard on 8 year old Pinot noir vines. Light exclusion boxes were placed on pairs of clusters on the same shoot (shaded treatment), while a second set of clusters on an adjacent shoot were labeled as the exposed treatment. Fruit samples were taken at veraison and at commercial harvest. Cluster shading resulted in a substantial decrease in the accumulation of flavonols and skin proanthocyanins and minimal differences in anthocyanins. Seed proanthocyanin accumulation involved a rapid increase near 1-2 weeks after veraison followed by a decline leading to harvest. It is thought that changes in the production of flavonoids are in response to exposure to UV. With regards to skin proanthocyanins, these compounds are believed to provide an improved mouthfeel in wines as compared to seed-derived proanthocyanins. Although results showed no statistically significant difference in the total amount of anthocyanins in shaded and exposed treatments, there were significant differences in the proportions of the various anthocyanins. The extraction of flavonols, anthocyanins, and proanthocyanins

into a model wine paralleled differences in the fruit with a lower concentration of these compounds in the shaded treatment. In summary, this study showed how cluster exposure can change the accumulation and composition of important phenolic compounds as the shading treatment in Pinot noir vines resulted in changes in the accumulation and composition of flavonols, skin proanthocyanins, and anthocyanins.

James Osborne

James Osborne and **Charles Edwards**. 2007. Inhibition of malolactic fermentation by a peptide produced by *Saccharomyces cerevisiae* during alcoholic fermentation. International Journal of Food Microbiology, 118: 27-34.

The malolactic fermentation (MLF) conducted by malolactic bacteria is an important part of winemaking. MLF decreases wine acidity and is particularly important in wines produced from grapes grown in cool climates. However, this process is often difficult to induce and control due to low pH, high ethanol, temperature, and antagonistic interactions between wine yeast (*Saccharomyces*) and malolactic bacteria (*Oenococcus oeni*). In this study, the ability of *Saccharomyces* to inhibit *Oenococcus oeni* during the alcoholic fermentation by mechanisms other than SO_2 production was investigated. During fermentation in synthetic grape juice, *S. cerevisiae* strain RUBY.ferm inhibited the malolactic fermentation by *O. oeni* while strain EC1118 did not despite both strains producing the same amount of SO_2. The bacterial inhibition exerted by RUBY.ferm was diminished when the wine was treated with proteases but not through the addition of nutrients indicating a protein may have been responsible. The inhibitory protein was isolated and identified as a small peptide approximately 6 kDa in size. This protein was present in wine fermented by RUBY.ferm but was not present in wine fermented by a non-antagonistic yeast, *S. cerevisiae* strain Saint Georges S101. In summary, this research shows the importance of yeast and bacterial strain selection if you intend to have your wine undergo MLF. Some yeast strains have previously been shown to inhibit the MLF by production of SO_2, while this study has shown that other yeast strains may be capable of inhibiting the MLF by the production of antibacterial proteins.

For more information or reprints of any of these articles please contact the appropriate author.

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Conducting a Successful Malolactic Fermentation

Dr. James Osborne, Extension Enologist

The malolactic fermentation (MLF) is an important secondary fermentation of wines performed by lactic acid bacteria, primarily *Oenococcus oeni*. During this process, malic acid is converted to lactic acid by the bacteria. MLF decreases wine acidity and is particularly important in wines produced from grapes grown in cool climates such as here in Oregon as these often have high acidity. There is some evidence that the MLF can also influence the flavor, color, and mouthfeel of a wine. While an important part of the winemaking process, the MLF can often be difficult to initiate and control. This may mean large delays as you wait for the MLF to complete and also leaves wine prone to spoilage as you are unable to add SO_2 until the MLF is finished.

The major factors that determine whether you will have a successful MLF or not are SO_2 levels, pH, alcohol concentration, temperature, and the yeast used to perform alcoholic fermentation. When making SO_2 additions to the must prior to fermentation you should generally add no more than 40 mg/L total for a white and maximum 70 mg/L SO_2 for a red if you desire the wine to go through MLF. Excess SO_2 in the wine, and particularly free SO_2, will inhibit the malolactic bacteria and prevent the MLF from occurring. This is also pH dependent with SO_2 being more effective at lower pH levels. Malolactic bacteria are much more sensitive to SO_2 than are wine yeast and some wine yeast even produce appreciable amounts of SO_2 during the alcoholic fermentation. This can cause problems when conducting the MLF especially if you have already added large amounts of SO_2 to the must. This is why yeast strain selection is also an important consideration. When using commercial yeast starter cultures, it is important to note (or ask the supplier) if the yeast strain is compatible with MLF. There are some yeast strains which should not be used if you wish to conduct a MLF as they have shown to inhibit *O. oeni*, the bacteria that performs the MLF.

pH is another important wine parameter which can affect the MLF. In general, malolactic bacteria perform best in wines with a pH between 3.3-3.5. Below pH 3.0 the bacteria will struggle to grow. At higher pH levels the bacteria will grow well but the conversion of malic acid to lactic acid is optimal below pH 4.0. Also, at higher pH values spoilage bacteria are favored. *O. oeni* actually prefers malic acid over sugar as an energy source at pH values below 4.0. pH adjustments should be made prior to the alcoholic fermentation if possible. Do not adjust you pH with tartaric acid while the MLF is happening as the bacteria are sensitive to changes in their environment.

Temperature can be the dominant factor in determining whether the MLF will happen or not. Optimal temperature for the MLF is around 64-75°F. High temperatures may kill the bacteria while most strains of *O. oeni* either cease to grow or grow very slowly below 59°F. Increasing the temperature of a wine that is slow going through MLF is sometimes enough to get things going again. Often barrel room temperatures may be too cold for the bacteria and so moving the barrels to a warmer room for a while can help the MLF along. An additional concern is alcohol level. Generally, the malolactic bacteria are inhibited in wines with alcohols above 13.5 %. There are however some commercial malolactic cultures that have been developed to tolerate high alcohol wines so be aware of this if you have high °Brix musts (say above 26 °Brix).

One additional comment about conducting successful MLFs. There needs to be a high population of bacteria present in the wine for the MLF to occur. A population of around 10^6 cells per mL is required to initiate MLF. This means that natural/indigenous MLFs can have a lag phase of weeks to several months before they begin. So be aware of this if you intend to rely on naturally occurring bacteria to conduct the MLF.

As a final note I'd like to emphasize that all of the factors I've mentioned act in synergy with each other and so it is important to consider them all together. For example, at lower pH levels any SO_2 present will be more inhibitory to the malolactic bacteria while at higher temperatures, the bacteria will more sensitive to high alcohol content. Any factors which cause stress to the bacteria will make them more susceptible to other environmental pressures. For a successful MLF try and optimize the factors that influence the growth of the bacteria and remember to monitor the progress of the fermentation so that you're aware of problems when they occur. This may enable you to take remedial action so that you can get your wine through MLF.

Parameter	***Unfavorable***	***Favorable***
pH	below 3.2	3.2-3.5
Temp	above 77°F, below 50°F	64-71°F
Alcohol	above 13.5 %	below 13.0 %
SO_2	greater than 10 mg/L free	less than 5 mg/L free

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Upcoming Educational Opportunities and Events

Viticulture Lecture Series – Winter 2008

Do you want to learn more about vine physiology and vine function to help you understand your vineyard operations better? Weekly seminars are being offered by Patty Skinkis, Viticulture Extension Specialist, as part of the Hort 453: Viticulture course offered in Oregon State University's Viticulture and Enology Program. Industry members can register for individual seminars to learn about various topics of vine physiology as related to environmental stimuli. Some of the topics to be covered include: fruit set, berry development and ripening, vine balance, and more. Seminars are offered from January 10 – March 6, Tuesdays and Thursdays 8:00 – 9:30 AM, main campus, Corvallis or view at select county extension offices (location and space are limited). A list of seminar topics, dates and registration forms are available online at http://wine.oregonstate.edu.

February 10-12 Oregon Wine Industry Symposium

The annual conference and trade show for the Oregon Wine Industry is designed to provide information in both viticulture and enology for all members of the industry both new and experienced. For information and registration, please see the following link http://explorer.oregonwine.org/symposium.php

February 26 Wine Filtration Workshop

The OSU Department of Food Science & Technology, OSU Extension Service, and Pall Corp. are pleased to present "Principles and Practices of Filtration: A One Day Workshop for Winemakers" The workshop will be held at 238 Wiegand Hall, OSU, Corvallis. Register early as seating is limited. Contact James Osborne for more information. You may register online at http://oregonstate.edu/dept/foodsci/extservices/filtration08_regform.htm

March 5 Botrytis and Powdery Mildew Conference

Oregon State University Viticulture Extension presents a one-day conference focusing on powdery mildew and botrytis, two main disease pressures in Oregon. Experts Dr. Wayne Wilcox from Cornell University and Dr. Gary Grove of Washington State University will be presenting new information and findings from their research programs focusing on botrytis and powdery mildew, respectively. Industry panels will also present current practices and trends observed and lead to lively discussion. Spanish translation will be available. Registration information will be coming soon and will be posted at http://wine.oregonstate.edu. Mark your calendars NOW and plan to attend March 5, 9 am – 4 pm, OSU Corvallis campus.

Mid-April Microbial Spoilage of Wine

Building on information presented at the Oregon Wine Industry Symposium, this workshop will explore the major causes of microbial spoilage of wines including Lactobacillus, Pediococcus, and Acetobacter. Participants will learn about identifying spoilage microorganisms and the basic use of a microscope in the winery. A tasting of microbially spoiled wines will showcase the taints spoilage microbes can cause in your wines. Dates and details are still being determined but targeted towards mid-April.