OSU Wine and Grape Research and Extension Newsletter

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In this issue:

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Welcome to the October 2009 Newsletter

As the 2009 growing season comes to a close, we prepared this newsletter to provide information on several viticulture and enology issues important to the Oregon winegrape industry. We begin with the most immediate topic of this season – wine production with Dr. James Osborne and importance of wine superstars – yeast! Dr. Patty Skinkis provides a review and interpretation of the berry shrivel that has been observed in the vineyards this harvest. Dr. Vaughn Walton provides more information on vineyard insect pest scouting across the state and raises awareness of new potential insect pests to keep on our radar. Be sure to check out the insert on new Extension publications available for the Oregon industry and the upcoming events!

Cheers, *The OSU Winegrape Team*

Looking after the most important workers in the winery – Yeast

Dr. James Osborne, Extension Enologist, OSU

No offense to winemakers, but the most important workers in the winery are the millions of yeast cells hard at work converting grapes into wine. We often take these single-cell organisms for granted and usually don't pay them too much attention unless there is a problem. However, when problems do arise they are often difficult to diagnose and treat and as they say, prevention is better than cure. Therefore, it is important to be aware of the steps you can take to ensure you keep your yeast happy during fermentation and help ensure you have a successful alcoholic fermentation.

The first thing you should consider is the state of the fruit arriving from the vineyard. The must composition, especially the nitrogen content, has a definite impact on fermentation efficiency. The concentration of nitrogen (in particular yeast available nitrogen) and yeast-required micronutrients is influenced by a variety of viticultural parameters. These include grapevine nutrient deficiencies, fungal degradation and degree of fruit maturity at harvest, which is predetermined by cultivar, rootstock, crop load, canopy management, vineyard fertilization and climate. For example, some grape varieties, such as Merlot or Syrah, naturally have lower berry nitrogen content than other varieties such as Sauvignon Blanc or Pinot Noir. Of course, given the right set of circumstances all grape varieties have the potential to produce grapes with low nitrogen content. In particular, seasonal variations and vineyard management can have a major impact on the nitrogen content of the grape. When we consider the changes of nitrogen compounds in a grape berry over time we see that from véraison onward ammonium decreases, while amino acid concentrations increase. However, as extended ripening occurs there is a reduction in yeast assimilable nitrogen (YAN) that may lead to insufficient YAN concentrations in fruit that has seen extended 'hang-time'. What also occurs is that close to harvest the concentration of arginine (an important source of YAN) decreases or plateaus while the concentration of proline (an amino acid the yeast cannot utilize) increases. Therefore, the total nitrogen content of the berry may remain unchanged but the nitrogen composition of the berry has changed resulting in a decrease in YAN. High proline grape musts are often associated with increased maturity and increased vine stress, particularly moisture stress. Must nutrient deficiencies can also be a problem during wet years. If there are elevated levels of rot on the grapes this may cause a deficiency in YAN as well as important micro-nutrients. This is because the fungi growing on the grapes consume these vital nutrients. In a wet year when there is often a lot of rot nutrient additions to the must may be required to ensure the yeast have sufficient nutrients to complete the fermentation.

The problem of insufficient must nutrients can be solved by firstly being aware that there is a deficiency (measuring YAN in must prior to fermentation, see newsletter article http://wine.oregonstate.edu/files/files/VitNewsletterAug08WebVersion.pdf) and secondly, making appropriate nutrient amendments. The recommended levels of YAN in a grape

OSU Wine and Grape Research and Extension Newsletter

October 2009 http://wine.oregonstate.edu

must to have a successful fermentation (all things considered) is between 140-200 mg/L for a 21°Brix must and between 250-300 mg/L for a 25°Brix must. These are not hard and fast rules as many people may have no problems fermenting juice with much lower YAN levels then these. But these YAN levels have been found by researchers to result in fermentations with good kinetics and minimal H_2S production. Also remember that not all yeast strains are created equal so be careful when using a yeast strain that has a high nutrient requirement.

So what type of must nutrients should you add and how much is needed to keep your yeast happy so they complete fermentation and don't produce large amounts of H_2S (a rotten egg smelling compound that is often produced by yeast during fermentation under low nitrogen conditions)? Aside from diammonium phosphate (DAP), there are currently a large number of commercial yeast nutrients available. These include complex yeast nutrient mixes, yeast rehydration nutrients, yeast hulls, and pure vitamin mixes. All of these contain various mixes of nutrients and, with the exception of pure vitamin mixes, contain inactivated yeast as their base. For a more in depth review of yeast nutrients I would direct you to this excellent article http://www.newworldwinemaker.com/articles/view?id=290. Timing of nutrient additions is also important. Yeast preferentially take up ammonia (DAP) before amino acids. Therefore, one large addition of DAP at the beginning of fermentation may delay/inhibit uptake of amino acids and cause fermentation problems. It is therefore recommended that you do multiple additions of nutrients during the early to mid-fermentation stage. For example, add half the nutrients 12-24 hours after inoculation followed by the remainder of the nutrients around 1/3 sugar depletion. Adding nutrient supplements all at once can lead to too fast a fermentation rate, and an imbalance in uptake and usage of nitrogen compounds. Supplements added too late (after mid-fermentation) may not be used by the yeasts. This is because the increasing ethanol concentration reduces the ability of the yeast to uptake nutrients. In addition, adding nutrients to a stuck fermentation seldom does any good at all and may add to the problem by 'feeding' spoilage bacteria that may have caused the issue. One additional note, you should never use nutrients containing ammonia salts such as DAP or Fermaid K that contain ammonia salts during yeast rehydration. They are toxic to the yeast at high concentrations and should be prepared and added to the must separately.

Proper yeast rehydration is the next critical step in keeping your yeast happy. There are a few basic rules you should follow when rehydrating your yeast. Rehydration can be done in water or a water/juice mixture. The water should be clean and chlorine free while the juice should not contain SO_2 or pesticide/fungicide residues. The temperature of the liquid is very important. It should be between 35-40°C (95-104°F) to ensure proper rehydration. After addition of the yeast let the solution stand for between 15-30 minutes before stirring gently to break up any clumps. Slowly (over a period of 5 minute intervals) add an equal amount of juice/must to the yeast slurry. This helps the yeast adjust to the cool temperature of the must and will prevent cold shock when the yeast are added to the larger volume of must. You should avoid a difference of 10°C (18°F) or greater between the yeast slurry and the must that is being inoculated.

Now that you have inoculated your must with properly hydrated yeast the next factor to control is temperature during the fermentation. If the fermentation is too cold or too hot this will stress the yeast and may result in H_2S production and/or death resulting in a stuck fermentation. Temperature control is one reason why large amounts of nutrients should not be added at the very start of fermentation as this can cause a very rapid fermentation to occur resulting in a heat spike. Temperatures above 30°C (86°F) can start to give yeast trouble while temperatures below 13-15°C (55-59°F) can also cause problems. Some yeast strains are able to better tolerate cold or hot temperatures and so these strains should be used if you are planning to ferment at either temperature extreme. Finally, yeast are very sensitive to abrupt temperature changes and so these should be avoided during the fermentation.

Other factors that will affect the performance of your yeast include high ethanol concentrations caused by high °Brix must, excessive clarification, presence of high populations of non-*Saccharomyces* yeast (*Klockera, Candida* etc.), low initial must oxygen content (one reason why **early** aeration of fermenting must can be useful), high SO_2, and high populations of spoilage bacteria such as *Lactobacillus*. Many of these problems as well as solutions are discussed in more depth in this article http://www.newworldwinemaker.com/articles/view?id=269. In addition, please feel free to contact me with any questions regarding this article or any other questions you may have about fermentation and winemaking.

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Late season berry shriveling causes curiosity among industry

Dr. Patty Skinkis, Viticulture Extension Specialist, OSU

Those little shriveled berries that appear on clusters during the latter part of ripening are common in some regions and may not be a big deal, depending on the incidence within a cluster and throughout a vineyard block. However, vineyard managers reported occurrence of berry shriveling from western Oregon to areas of the Columbia Gorge this season where it is usually not of major concern. Berry shriveling can be observed on a regular basis in Syrah vineyards of dryer regions of southern and eastern Oregon. However, this year's observance of shriveling in Pinot Noir and other cultivars left Oregon growers and winemakers questioning the cause.

OSU Wine and Grape Research and Extension Newsletter

October 2009 http://wine.oregonstate.edu

Berry shriveling can be described in a gradation from just "flabby" looking berries to completely dried raisins (Figure 1) and can occur due to a number of management and climatic factors. It

Figure 1. Berry shriveling observed in Pinot Noir clusters during ripening. The arrow on the right shows a berry with slight wrinkling, and the left arrow shows a berry with more significant shriveling. In many cases this season, shriveling was more severe than shown here. Photo: P. Skinkis

is quite natural to think of the shriveling as related to water-stressed vines. Irrespective of the water status, the grape berry continues to transpire (lose water) throughout the ripening phase post-véraison. The level at which water is lost is relative to the cultivar, rootstock and climate. In the case of Syrah, it has been shown to not keep up with demand—the berry transpires off water more than it is taking in through the phloem (Greer and Rogiers, 2009), and the berries begin to shrivel irreversibly.

In other cases, the shriveling is more problematic and can be described as a disorder, specifically Berry Shrivel disorder (BS). With BS, berries do not ripen and are found to have low soluble solids, pH and skin anthocyanins (Krasnow et al., 2009). This has been observed in areas of California and Washington. The specific cause is not yet determined. Other acronyms of berry shrivel have been referred to different names over the years and different causes such as bunch stem necrosis and water-berry. Dr. Markus Keller of Washington State University is currently researching bunch stem necrosis and water relations and how they may play a role berry shriveling in Washington. In areas that experience this type of berry shrivel, the economic impacts are significant with yield losses and increases in cost to remove unripe fruit through multiple passes.

Luckily, the shriveled grapes observed in western and northern Oregon vineyards were progressing through ripening with adequate soluble solids concentrations (°Brix) and pH when shriveling occurred rather abruptly. The cause of most berry shriveling observed this season in Oregon's Pinot Noir and other grape cultivars is likely due to desiccation as a function of the weather fluctuations, among other factors. Fruit set was excellent this spring and clusters were larger than normal, creating tight-packed clusters. During rain events in early September, berries likely swelled and then desiccated with the following warm, dry weather, leaving berries shriveled. Water loss is common for the grape berry after véraison, as the cell walls of the pericarp begin to degrade and lose their flexibility. According to Dr. Bhaskar Bondada, an electron-microscopy and grape anatomy expert at Washington State University Tri-Cities, the berry skin cells become weak and proliferate during the latter parts of berry ripening. When berries expand with rain and shrink during sunny, warm days, as experienced this fall, the skin is not able to shrink back, leaving berries deflated or flabby in appearance.

Some vineyard managers resorted to irrigating post-véraison to mitigate this shriveling when warm weather was forecasted. However, it may be of more benefit in maintaining canopy than keeping berries turgid. The problem is that the phloem provides most of the water supply while the xylem has very little to no influx of water into the berry post-véraison (Bondada et al., 2005). If there is warm, dry weather and berries are exposed as they often are with late season leaf removal, the transpiration and loss of water increases.

The causal factors for the berry shrivel late season also played a role in higher botrytis pressures. Berry pericarp damage near the pedicel that occurred with high pressure of swelling berries in already tight clusters opened infection points for botrytis. There were many reports of botrytis infection occurring from inside the cluster.

Despite this year's conditions, there are several vineyard management factors that can lead to berry shriveling and should not be ignored. Botrytis bunch rot infections of berries early in the season can cause infected berries to raisin in dry weather conditions. Removing leaves in late summer, around véraison or later, can cause berry sun-burning and desiccation that may lead to berry shriveling. Sunburn causes significant cell wall damage to berry skin tissues and can result in increased desiccation and disease infestation. Very warm weather just after leaf pulling can also lead to significant burning and shriveling.

Some industry members question the impact of potassium-bicarbonate pesticide products on the degradation of the lipid layer leading to increased desiccation and shriveling. However, shriveling was observed in vineyards that never use these products. Dr. Jay Pscheidt, OSU Extension Plant Pathologist, who has conducted grape disease efficacy trials for years, indicates no berry shriveling side-effect was observed with use of bicarbonate-based products. Further, there are no published reports indicating that these products cause desiccation if applied at the appropriate label rate. Some research studies indicate that adjuvants applied with fungicides/pesticides to increase penetration and coverage can cause an alteration of the lipid layer (cuticle) of the grape berry that is not reversed (Rogiers et al. 2005). However, the level to which the cuticle is damaged can be somewhat irregular and possibly negligible.

In most years, shriveling observed in Oregon vineyards is not severe or widespread. However, when significant drying and shriveling occurs there can be marked yield losses and potentially lost return on the crop. Wine quality is also affected, altering aroma and flavor components. It is best to monitor your production practices to identify the cause of shriveling if it is severe in the vineyard. In most cases for Oregon, managing the canopy for disease control and proper timing of crop thinning and leaf pulling

can prevent most berry shrivel concerns.

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Vineyard Pest Management News

Dr. Vaughn Walton, Horticultural Entomologist, OSU

Mealybug trapping and mapping of leafroll virus infections in Oregon

In order to determine the importance of mealybugs as vectors of the grapevine leafroll virus in Oregon, a total of 85 vineyards cooperated with mealybug trapping during 2009. Traps specific for luring vine-, obscure-, grape- and longtailed-mealybugs as well as mixed lure traps were placed at each cooperating vineyard site for a total of more than 360 traps spread across the state.

A request was sent to growers to place traps in vineyards from July through the middle of October 2009. Traps are now being mailed back to the OSU entomology lab for ID of male mealybugs caught during this trapping period.

Preliminary results from traps show no presence of the invasive vine mealybug, (*Planococcus ficus*). The most dominant mealybug found in Oregon vineyards is grape mealybug (*Pseudococcus maritimus*). Grape mealybug is a known vector of the grapevine leafroll virus but is not as invasive as vine mealybug.

Grape mealybugs were found in locations in eastern Oregon, The Dalles, Vancouver (WA), Marion county (Salem area), Hillsboro, Yamhill (Dundee area), Umpqua (Roseburg area), and areas of Jackson county. Currently, the lowest densities based on trap counts were found in the north Willamette Valley. Grapevine leafroll viruses were identified in all areas of the state, according to Bob Martin, USDA-ARS virologist who is currently mapping the state for virus infestation. Counting of pheromone traps will continue through November before final conclusions can be made regarding risk these vectors pose in spread of the vine leafroll virus.

It is critical that growers in Oregon realize the importance of managing plant materials with care, be that harvested fruit or vines. This is required to prevent the spread of leafroll virus and its vectors in Oregon. Just last week, we received reports of open pomace disposal (uncovered, not composted) in the north Willamette Valley, and the pomace was from pressed fruit shipped from Napa County, California. Napa County is known to have infestations of the invasive vine mealybug, and now the serious European Grapevine Moth (*Lobesia botrana*). These are serious pests we want to keep out of Oregon and vineyards/wineries should make every effort to mitigate possible spread by using correct management of plant materials (see the newly released Extension bulletin on prevention of mealybug spread http://wine.oregonstate.edu/files/files/em8990.pdf).

Mealybug traps were placed in 85 vineyards throughout Oregon from July – October 2009. Photo: P. Skinkis

European Grapevine Moth, Lobesia botrana found in Napa, California

Last week, a serious pest of grapevines, Lobesia botrana, otherwise known as European grapevine moth, was found in Napa County, CA through trapping efforts. This is a pest of vineyards in Europe and feeds directly on flowers, fruit and leaves of grapevines and other host plants. There is potential for the insect to feed on mature grape berries, which can lead to infection by Botrytis. While this moth looks similar to the grape berry moth which plagues the eastern and Midwestern grape producing regions, it is not the same pest. Grape berry moth (*Endopiza vitana*) also feeds on grape berries but is native to the eastern US.

What is the action that you should take in Oregon in order to prevent invasion of this pest into Oregon vineyards?

It is important that you practice strict control over the movement of harvested crop and plant materials from infected areas such as California. The pest has been identified in Napa County to date and further monitoring is occurring in neighboring grape production regions.

The steps taken to prevent mealybug infestation in a vineyard are the same for preventing infestation of the European Grapevine Moth. This requires limiting movement of harvested grapes of infested vineyards and the movement of plant materials. Further, adequate covering and composting of pomace are required to prevent spread of this pest. Please read the Extension bulletin on preventing the spread of mealybugs and virus at http://wine.oregonstate.edu/node/232.

During this next growing season, OSU entomologists and the Oregon Department of Agriculture will have this pest on their radar and will devise a trapping protocol. If you have specific

questions or concerns with this pest, please contact Vaughn Walton, Assistant Professor and Horticultural Entomologist, Department of Horticulture, Oregon State University, Ph: 541-740-4149, waltonv@hort.oregonstate.edu.

To read more about the pest identified in Napa County, see the October 12, 2009 Press Democrat: http://www.pressdemocrat.com/article/20091012/ARTICLES/910129924/1350?Title=New-vineyard-pest-detected-in-Napa-County

Damage of grape berry from Lobesia botrana. Photo: J. Voegelé/ INRA Antibes

Lobesia botrana adult on grape leaf. Photo: Coutin R./OPIE

Recent Graduates from the OSU Enology Laboratory

Dr. James Osborne, Extension Enologist, OSU

This summer was a busy time in my lab as two MS students, Allison O'Neil and David Takush, graduated. Both David and Allison began working on their MS in Fall 2007.

David's research project involved investigating the impact of *Saccharomyces* and non-*Saccharomyces* yeast strains on Pinot noir aroma and flavor. He developed an experimental method that utilized high hydrostatic pressure to eliminate native microorganisms from grape must prior to fermentation. This meant that any interference from microorganisms on the grapes could be eliminated and only the specific yeast strain that was inoculated into the must would contribute to the development of Pinot noir aroma and flavor. Wines were produced using a number of different yeast and sensory analysis demonstrated that yeast strain had a significant effect on the sensory profile of Pinot noir wine. For example, strains EC1118 and RC212 produced wines with higher overall aroma intensities and dark fruit and jammy characteristics while MERIT. ferm produced wines with higher red fruit and floral characteristics. Wines are currently being evaluated by GC-MS to determine differences in specific aroma compounds. This project was funded by the Oregon Wine Board and the first year report can be found at http://wine.oregonstate.edu/enology.

Allison O'Neil worked on a project investigating the production of SO_2 and SO_2 binding compounds by Saccharomyces cerevisiae and the impact on malolactic fermentation (MLF) and wine lactic acid bacteria. She found that there was a wide concentration of SO_2 and SO_2 binding compounds produced by different *S. cerevisiae* strains and that acetaldehyde was the dominant type of SO_2 binding compound produced. Although it is known that free SO_2 is most antimicrobial, Allison found that bound SO_2 was also inhibitory to *O. oeni* as well as the spoilage bacteria *Lactobacillus* and *Pediococcus*. These results indicate that additional criteria need to be accounted for when determining yeast/bacteria strain compatibility. In addition, bound SO_2 has greater antimicrobial properties then previously believed. The first year report of this project can be found at http://wine.oregonstate.edu/enology.

Allison O'Niel studied the production of SO_2 and SO_2 binding compounds by S. cerevisiae yeast and impacts on MLF and wine lactic acid bacteria.

David Takush working with wine for his project investigating the impact of Saccharomyces and non-Saccharomyces yeast strains on Pinot noir aroma and flavor.

Currently, David is learning all about winemaking as a harvest intern at Sylvan Ridge, OR. He plans to travel to Chile or Argentina next year to work a Southern Hemisphere vintage before returning to Oregon for Fall 2010. Winemaking can be a good way to see the world it seems. Allison is currently back home in Indiana. She will be getting married next year to a naval helicopter pilot and moving to San Diego. She hopes to stay working in the wine industry but also has interest in working in the food or fermentation industry.

OSU Wine and Grape Research and Extension Newsletter

October 2009 http://wine.oregonstate.edu

New OSU Extension Publications

- **Field Monitoring for Grapevine Leafroll Virus and Mealybug in Pacific Northwest Vineyards** by P.A. Skinkis, A.J. Dreves, V.M. Walton, R.R Martin. July 2009. http://wine.oregonstate.edu/files/files/em8985%20proof5.pdf
  Spanish version available! http://wine.oregonstate.edu/files/files/em8985-Srev.pdf
- **Grapevine Leafroll Virus and Mealybug Prevention and Management in Oregon Vineyards** by V. Walton, A. Dreves, P. Skinkis, C. Kaiser, M. Buchanan, R. Hilton, R.R. Martin, S. Castagnoli, S. Renquist. October 2009. http://wine.oregonstate.edu/files/files/em8990.pdf
- **A New Pest Attacking Healthy Ripening Fruit in Oregon** by A. J. Dreves, V. Walton and G. Fisher. October 2009. http://wine.oregonstate.edu/files/files/drosophila%20zudikii.pdf

You can always find Extension publications, including this newsletter archived online at http://wine.oregonstate.edu.

Upcoming Events

Northwest Center for Small Fruits Research Annual Conference
December 2-4, 2009, Kennewick, WA.
Industry members are strongly encouraged to attend this event to learn more about research and help develop research goals for the Pacific Northwest. It is held each year to showcase and discuss research in the area of small fruits (including grape) within the Pacific Northwest. Researchers from Oregon that have received funding from the Northwest Center for Small Fruits will be presenting data from their projects. For more information and registration, see http://www.nwsmallfruits.org/conference.html.

OSU Online Extension Viticulture Course – Winter 2010
January 5 – March 12, 2010
Do you want more viticulture knowledge and struggle finding time to fit it into your schedule? Well, a convenient opportunity is available this winter through OSU Viticulture Extension. An Extension course, *Vineyard Production Principles*, will be offered this winter to industry/public for professional development through an interactive-online format. The topics to be covered include the "how" and "why" of vineyard management practices, focusing on production and physiology behind the practices and focusing on published research in vineyard management. For more information and registration, see http://hort.oregonstate.edu/ViticultureWorkshops.

Oregon Wine Industry Symposium
February 21-23, 2010, Eugene, OR
This is the Oregon winegrape industry's largest conference of the year and is filled with educational sessions for viticulture and enology. This year includes a mini-conference taught in Spanish! Learn more at http://symposium.oregonwine.org/. Registration opens December 1, 2009.