Enology Notes #166 **September 4, 2013**

To: Grape and Wine Producers

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1. Production Considerations for Rot- Fruit

Summer rains are the norm for the mid-Atlantic region. This season is an excellent example. As such, fruit rot issues are a common concern. Even with careful fruit sorting in the vineyard and winery rot can be a big issue.

The following are a few production considerations to keep in mind in a season where the threat of fruit rot is high. Details regarding each item listed are provided in previous *Enology Notes* found at www.vtwines.info.

- Crop level: Avoid over-cropping, which could delay maturity. Delayed maturity can increase the incidence of fruit rot and fruit pH.

- Fruit culling: Cull as much fruit rot out as possible in the field.

- Fruit sorting: Sort fruit at the winery. A very small concentration of rot can have a large impact. It is not the incidence of rot, but the level of various rot metabolites that determine how much rot is acceptable. The best rule of thumb: no rot is acceptable. Many wineries now conduct double or triple sorting to help assure only the best fruit goes into the fermenter.

- Rinse fruit: You may consider rinsing the fruit with water if the fruit delivered to the winery is high in rot and you are unable to adequately sort. That will help to lower some of the sour rot metabolites and late season spray residues. This may not be practical for large volumes but has been shown to have a positive impact. This practice can slightly lower the Brix level as a result of dilution.

- Use optimum sanitation: Sanitation is a key to successful wine production, particularly in wet seasons. Sanitation of lugs and processing equipment is essential.

- Muté production/cryoextraction: A small quantity of muté produced from non-degraded fruit can help recover and replace lost aroma and aroma intensity resulting from sour bunch rot.

- Dehydration: Only extremely “clean” fruit should be used for this style of wine production. This is an excellent option particularly if fruit maturity at harvest is not optimal.

- Pressing: Whole cluster press whites by discarding the initial juice. Press very lightly and take press fractions.

- pH adjustment: Adjust the juice pH – the lower, the better. Expect about 2.0 g/L TA will drop out during fermentation or shortly following completion. In some wet seasons, high pH values caused many to have both biological and oxidative problems. If you have compromised fruit get the pH down pre-fermentation! Not lowering the pH far enough when fruit quality is compromised is a frequent problem.

- Sulfur dioxide: Keep the initial sulfur dioxide level low during pressing. You want the low molecular weight tannins to polymerize or bind together. Then raise the sulfur dioxide, depending on the fruit condition and pH. Note that sulfur dioxide can bind thiamine-an important yeast nutrient. In rot-degraded fruit, nutrient management is essential-see below.

- Cold settle: Adequate white juice cold settling with the use of pectinolytic enzymes will help lower the level of rot metabolites.

- Tannin addition: You could add enological tannins to help clarify juice and bind with some of the rot-produced enzymes. Tannins can act as oxygen buffers and may bind with enough protein to lower the bentonite requirement needed for wine protein stabilization. This is an important consideration for rather delicate varieties such as Pinot gris and Sauvignon blanc.

- Pectinolytic enzymes: The addition of pectic enzymes aids in clarification, which is particularly important if juice is produced from compromised fruit.

- PVPP: Add PVPP inline to the juice if there is a high level of grape tissue degradation. This nylon-based fining agent has the ability to bind with small tannins which can be both harsh and bitter.

- Ascorbic acid: For varieties where the oxidation potential is large, add ascorbic acid to the juice. See Enology Notes for details on the use of this anti-oxidant.

- Nutrient management: Test the YAN (yeast assimilable nitrogen) content and make adjustments accordingly. Rots deplete YAN. Note that rots also lower the micronutrient levels. As such, the addition of a complex nutrient formulation, not simply DAP, is wise. Some complex nutrients also contain glutathione, a strong anti-oxidant (See Enology Notes). Oxygen is a yeast nutrient. Make sure that you yeast culture is properly oxygenated. Oxygenate the fermenting wine in the early stages of fermentation.

- Measure the NTUs: You want to ferment fairly-clean juice. Measure the NTUs (nephelos turbidity units) if you can. If you measure, you will want about 100 to 150. If the juice is not clarifying, you may want to add enzymes or more tannin. Don't add them together.

- Inoculation: Inoculate with a high volume of a vigorous, not too N-dependent yeast strain. Use more than the standard 24 g/hL or 2 lb/1000 gallons yeast addition rate. Make sure the starter is properly prepared, and understand that oxygen is a yeast nutrient.

- Co-fermentation: If you are planning on an MLF co-ferment. Check with your suppliers regarding yeast and MLF strain compatibility. If you do not desire an MLF, consider the use of lysozyme.

- Fermentation temperature: Begin the fermentation at a slightly warmer temperature to help lower the concentration of undesirable aroma characters, and to assure a rapid yeast fermentation.

- Mid-fermentation racking: Rack mid fermentation. This helps to remove wine from the primary lees. In the case of extreme rot incidence, more frequent racking may be desired to both remove lees and to oxygenate.

- Rack immediately post-fermentation.

- Consider short vatting reds, avoid cold soak and extended post-fermentation maceration. Use short vatting, and possibly délestage, to help remove fermenting wine from lees. Ferment in the presence of non-toasted wood and carefully review the steps listed above. If cold soak is done it should only occur with clean fruit. A cultured yeast should be added after adjustment to the cold soak temperature to avoid temperature shock.

2. A Review of Rot Metabolites

Laccase

Botrytis cinerea strains differ in the production of laccase. Perhaps of greater concern is the oxidation of aroma/flavor compounds. Laccase is resistant to sulfur dioxide, cannot easily be removed with bentonite, and is active in the presence of alcohol, including in bottled wines. Depending upon the juice or wine clarity bentonite may remove enough laccase to help minimize oxidative problems. For analytical methods to determine laccase concentration see Zoecklein et al. 1999, 2005. Levels of laccase concentrations greater than 1U/mL can cause oxidative problems.

Glycerol

Glycerol is an alcohol which is produced by molds. Owing to its relatively-high specific gravity, it may contribute to the overall organoleptic perception of body when fruit glycerol levels are high: 1.04 - 1.15% vs. 0.60 - 1.1% from sound fruit. Most of the glycerol produced by molds will remain inside the defective berry despite berry dehydration, due to the fact that glycerol is non-volatile.

Botrytis-infected fruit has about 150 mg/L glycerol per one percent change in defect level by weight (Pfeffer et al., 1985). *Aspergillus* shows about a 300 mg/L change per one percent defect. Glycerol itself possesses no significant problem for the winemaker.

Gluconic Acid

Infected fruit can contain a relatively-high (25 g/L) gluconic acid level as a result of glucose metabolism. Since gluconic acid is not utilized by yeast or bacteria, it may be used as an indicator of fruit deterioration. Gluconic acid levels in “clean” fruit, and in wines made from clean fruit, are near 0.5 g/L, whereas in wines produced from fruit infected with *B. cinerea*, levels range from 1 to 5 g/L.

The ratio of glycerol to gluconic acid indicates the “quality” of the rot. Higher ratios indicated the growth of true noble rot, whereas lower ratios suggest sour rot.

Acetic Acid

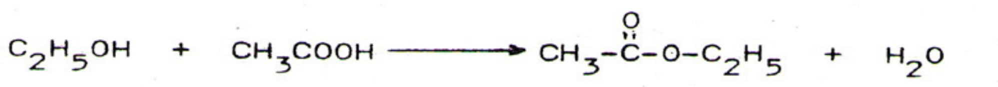
Acetic acid is a normal byproduct of yeast and bacteria. When acetic acid bacteria and yeast are combined with fungal growth, high levels of volatile acidity can be produced. Sour rot complex (production of acetic acid in the presence of bacteria and yeast) may show significant variations in acetic acid content in the fruit. Acetic acid is volatile at normal vineyard temperatures and can be detected by scent during a vineyard stroll.

In some cases, fruit enters the winery showing limited visual rot, only to have excessive acetic acid produced during fermentation. Several species of *Lactobacillus* present in the fruit can convert grape sugars to acetic acid, thus raising the VA excessively, even prior to the completion of alcoholic fermentation.

Ethyl Acetate

The volatile character or “acetic nose” is not exclusively the result of acetic acid production. Acetate esters, most specifically ethyl acetate, contribute significantly to this defect.

Ethyl acetate formation by yeast occurs by chemical esterification, as illustrated below. Ethyl acetate produced by lactic acid bacteria is the result of sugar metabolism, hence the reason that VA may increase significantly during fermentation.



Galacturonic Acid
Botrytis causes an increase in the galacturonic acid content as a result of enzymatic hydrolysis of cell wall pectin compounds. Galacturonic acid may be transformed to mucic (galactaric) acid by enzymatic oxidation, and may reach must levels as high as 2 g/L. This acid can combine with calcium to form an insoluble salt, calcium mucate. This can be a large potential problem if the winery water source has a high (> 40 mg/L) calcium level (for additional information, see Calcium Mucate in the *Enology Notes* Index at www.vtwines.info).

a. Polysaccharides and instability. One of the greatest impacts of fruit rot is the formation of polysaccharides that create clarification problems. Polysaccharides can form protective colloids in juices and wines, inhibiting clarification. Pectins (complex sugars that hold plant tissues together) are hydrolyzed by mold-produced enzymes, with the formation of soluble pectin and *beta*-1,2- and -1,6-glucans.

In wine, ethyl alcohol causes the pectins and glucan chains to aggregate, thus inhibiting clarification and filtration. Pectinolytic enzymes and glucanase enzymes are available to minimize these clarification problems. Zoecklein et al. (1995, 2005) provide two simple lab procedures for determining pectin and glucan instability. It is highly recommended that wines be evaluated for filterability and/or pectins/glucans prior to filter set-up. This will save a great deal of time and money.

b. Aroma and varietal character. In some seasons, the general environmental constraints (limited fruit maturity, uneven maturity) in part contribute to limited varietal character. Additionally, aroma compounds can be lost as a result of the oxidizing effect of fruit rots. Metabolites such as gluconic acid, oxidase enzymes, volatile esters, aldehydes, and traces of other organic compounds may alter grape aroma/flavor compounds or their aroma intensities. For an analysis of the presence of laccase, see Zoecklein et al. (1995, 2005).

Post-fermentation addition of pectinolytic enzymes may increase grape-derived aroma intensity. Most pectinolytic enzymes contain glycosidases which can convert grape aroma/flavor precursors to their odor-active forms. Additional information is available in the *Enology Notes* Index at www.vtwines.info.

3. Technical Study Tour: Alsace, Burgundy and Champagne
A 9 day technical study tour of Alsace, Burgundy and Champagne conducted by

Professors Bruce Zoecklein and Pascal Durand. The study tour will be to the most famous vineyards and will share wine from some of the most prestigious winemakers of these leading regions. Additionally, this tour will highlight regional gastronomy.

Dates: December 5-13, 2013
This is the 8th technical tour that we have conducted. Previous travels have included Bordeaux, Spain, Provence, the Loire, the Rhone, and Burgundy.

Several write-ups about our Technical Study Tours are posted at www.vtwines.info under Enology Notes.

- AOC's of Provence, Enology Notes #138
- Languedoc, the Rhone, Bandol and Casses, Enology Notes #152
- Spain and Bordeaux, Enology Notes #164

For additional information or questions regarding this tour, contact me at bzoeckle@vt.edu or call me at 540 998 9025.

Who Should Attend: This is a technical tour and is designed for commercial grape growers and winemakers.

Tour Schedule

- Thursday Dec 5 : the participants meet at Reims, capital of Champagne for a first tasting in the afternoon and a dinner at the hotel
- Friday Dec 6 : Morning at Reims for touring Mumm/Roederer/Pommery, lunch and afternoon on "Côte des rouges" touring small wineries, Tasting and dinner by Veuev Clicquot. Night in Reims
- Saturday Dec 7: Early departure for Epernay and the "Cote des Blancs". Tour and tasting at Moet/Perrier Jouet. Lunch and departure for Alsace and Strasbourg
- Sunday Dec 8: Relax morning to visit Strasbourg (Cathedral/Christmas market). Lunch and afternoon in the vineyards next to Strasbourg. Dinner and night at Strasbourg
- Monday Dec 9: The wine route of Alsace to Colmar. Stops at Ribeauvillé and Riquewihr. Winemaker dinner at Kienstein.
- Tuesday Dec 10: Early departure to Burgundy and Côte de Beaune vineyards (Puligny Montrachet/Volnay/Beaune/Corton). Night at Dijon
- Wednesday Dec 11: Day in Côte de Nuits (Gevrey Chambertin, Vougeot, Vosne Romanée).
- Thursday Dec 12: Early departure for Chablis (visit and lunch William Fevre). Farewell dinner.

- Friday Dec 13: Tour downtown Dijon in morning (farmer market...) depart for Paris airport by train.

Additional details regarding specific hotels, etc. will be forthcoming.

Cost: Cost includes all in country expenses (hotel lodging, transport, food, all expenses expect personal items). The cost is based on single vs. double room occupancy as follows:

$3800 for a single room
$3200 for sharing a room (two people per room, double beds)

Not include is transportation to and from France.

Because participants will have different airline schedules you are responsible for lining up your train transport from Paris airport to Reims (our starting point) and your return from Dijon back to Paris. Both trips are relatively short. We will reimburse each traveler 50 Euros for each trip (the cost of this transportation if lined-up a month before travel). I can help you with this booking, if needed.

Registration:

- Reservations can be made by sending a non-refundable, $250 deposit to: Dr. Bruce Zoecklein, Department of Food Science and Technology, Virginia Tech, Blacksburg, VA 24060.
- No slots will be held without a deposit check.
- Technical Study Tours are restricted to commercial grape growers and winemakers.
- The maximum enrollment is 16.

***4. Winery Planning and Design*, Edition 16, Available.**

This publication, in CD format, is the result of a number of short courses and seminars, covering various aspects of winery planning, in several wine regions around the country. While not regionally specific, the information provided is from a number of authoritative sources, covering such diverse topics as sustainable design, winery equipment, and winery economics. *Winery Planning and Design*, Edition 16, is available through the industry trade journal *Practical Winery and Vineyard* (phone 415-479-5819, email: tlv100@sonic.net). The entire index and additional information is available at www.vtwines.info.

5. Our New Research Enologist.

Amanda Stewart has joined our department as Assistant Professor of Enology and Fermentation. Amanda earned a Ph.D. in Food Science at Purdue University with a focus in Enology and a concentration in Ingestive Behavior. Her research interests include yeast nutritional status in juice and must, developing predictive models for wine fermentation, and the role of fermented foods and beverages in human health and feeding behavior. Previously, Amanda worked as a process engineer and project manager in the biofuels industry and as a winemaker in Oregon and New Zealand. She has served as a judge for regional and international wine competitions for over a decade and has assisted with study abroad courses in the wine regions of Chile, Argentina, and Italy. Amanda is very excited to join the faculty at Virginia Tech and to have the opportunity to work with the Virginia wine industry. She joins Molly Kelly our extension enology specialist.

References

Pfeffer, T.E., C.D. Clary, and V.E. Petrucci. 1985. Adaptation of HPLC to wine grape inspection. Report to the Wine Grape Inspection Advisory Committee, CDFA, Viticulture Research Center, California State University, Fresno.

Zoecklein, B.W., K.C. Fugelsang, B.H. Gump, and F.S. Nury. 1995, 2005. Wine analysis and production. Kluwer Academic/Plenum Publishers, New York, NY.