Penn State **Extension**

Fermenting with Botrytis 101

I recently learned that the fashion industry considers the month of September to be the month that people re-create themselves (fashion-wise). I have to admit that in my few years of life, I never knew this… even though I always knew *Vogue* released their largest fashion issue every September. I was always of the mind that our "re-creation" or "re-evaluation of oneself" month is January, right after New Years. However, I think the U.S. wine industry may be more like fashion than we ever thought before.

September, give or take a few weeks, marks the monumental time where it all comes together for the wine. After a quiet year of those grapes growing, we're now in the stage where we, as winemakers, can create our masterpiece. We have all the control that we need to master the art of what will be our new vintage.

Every year, I'm sure we're all hoping for the perfect growing season: rather dry with only hints of rain to sustain the grapes and allow them to mature to the optimal ripening. This thought, of course, makes our job easy. But this is the anomaly in the wine industry – so few are growing years "perfect." And then we are faced with the challenge of creating our imagined wine the way we want with the imperfection of the growing season lingering in the back of our minds. What is a winemaker to do?

One such imperfection is the incidence of *Botrytis*, which can occur with those late season rains. I should mention that prevention and management in the vineyard is really your best tool against *Botrytis*, but sometimes, it's presence is unpreventable.

In Loinger, C. et al. (1977), Semillon grapes were fermented in efforts to assess the effects of rot on chemical composition of grape must, the wine quality's sensory attributes, and the chemical composition of wine. This research showed several changes in the must and wine composition chemically, which is to be expected, but they also found several generalizations in wines produced with rot, based on the sensory characteristics (color, aroma, and flavor). Bruce Zoecklein has noted in his *Enology Notes* that *Botrytis* routinely causes a loss of fruitiness in wine, and may produce off-flavors that are "phenolic" and "iodine-like" (aka not pleasant). Loinger et al.'s guidelines on cluster rot infestation can be summed up as follows:

- 5 – 10% rot on clusters: noticeable reduction in wine quality; wine quality is still "good" (as opposed to very good with 0% rot on clusters)
- 20 – 40% rot on clusters: marked reduction in wine quality; wine quality is "low"
- >80% rot on clusters: wine is commercially unacceptable

The paper concluded, although not tested, that greater than 40% rot on clusters would create a wine in the range of low quality to commercially unacceptable. I think it's reasonable to evaluate your crop, regardless of disease or rot infestation, and decide if it is worth the time and finances to ferment the received crop.

So what is a vintner to do?

Fermenting with Rot: Emphasis – *Botrytis* (not the Noble Rot kind…)

1) **Create a sorting table and sort through diseased fruit**. This, I know, is easier said than done, especially if the winery is not set up with a sorting table. However, taking the time at harvest to carefully pull out diseased fruit can save you a lot of time and effort during and after fermentation. Remember that the rot organisms will impart themselves on the wine as it ferments, causing changes in the aroma and flavor composition and depleting the varietal characters that we work for each year. The goal is to minimize those potential flavor losses as much as possible in order to enhance the quality of your wine.

2) **Do NOT contaminate clean fruit with rot infested fruit**. Simple cleaning and sanitizing protocols NEED to be utilized when dealing with rotted fruit. Washing off crusher/destemmers with hot water IS NOT ENOUGH to decontaminate the processing equipment from the rot infestation. There are a few simple things you can do to install proper sanitation:
    a. If you are processing more than 1 variety in 1 day, process the cleanest fruit first. You should end with the "dirtiest" fruit.
    b. Wash and sanitize all equipment prior to use. There's no point in allowing dead bugs, old mildews, and dirt hit your product.
    c. Wash off equipment in between lots of grapes. This is just good practice. Use water to initially clean leftover fruit and debris from the processing equipment, and then properly sanitize. In our research winery, we use a citric acid/SO_2 rinse, but you can also use commercial sanitizers. If the sanitizer requires a neutralizing agent or water rinse, make sure you do this before putting in the next lot of fruit. And always follow supplier safety instructions.
    d. Make sure you take the time to properly wash and sanitize processing equipment at the end of the day. This keeps your equipment in good condition and minimizes chances for any external contamination.

3) **With whites and reds, limit contact time with the skins**. This will minimize the opportunity for the rot microorganisms to get cozy in your must.

4) **Whole cluster press your whites, and separate press runs**. Fugelsang and Edwards (2007) recommend separating out the first 10+ gallons that are rich in *Botrytis* metabolites. Separation of press fractions is key here, as it allows more control over the phenolic content, solids, and potential off-flavors associated with *Botrytis*.

5) **During cold settling of whites, it may be necessary to do a slight bentonite fining**. This should reduce your laccase potential. Refer to your supplier's product recommendations for this step if you think it is essential.

6) **Press lightly – this is not the time where you want to over-extract.** You will not only over-extract all the tannins, but also all the rot and its associated compounds and flavors.

7) **Use PVPP prior to fermentation to minimize color oxidation**. PVPP will help strip out potential browning compounds or their precursor forms.

8) **Do not allow a native/natural fermentation**. Remember that there are a lot of native strains on the clusters that are not common; they are part of the disease and will impart off-flavors to your wine. Inoculate with a commercial yeast strain that is recommended for *Botrysized* fruit. Most suppliers will have a recommendation for red, white, and rosé wines. Traditionally, you want a yeast strain that is robust, can handle the disease pressure, potential high acetic acid rates, and other hurdles during the fermentation.

9) **Limit your oxygen exposure to crushed fruit: use Nitrogen and Argon gas blanketing.** Although this will slightly inhibit your commercialized yeast strain, the lack of oxygen will completely knock out invasive yeasts and microorganisms, including *Acetobacter*, which are usually more prevalent in rotted grapes. Ask your supplier if the commercial yeast can handle this treatment.

10) **If you have more than 10% rot on clusters, consider getting a Laccase Test from a wine lab**. Laccase is an oxidative enzyme that is produced in higher concentrations with *Botrytis* infection. Generally speaking, it progresses the rate of oxidation (i.e. turning your wines brown or making them taste like sherry) even in very young wines. The results of the Laccase Test will tell you whether or not you need to go extreme treatments (e.g. heat treatment, early bentonite fining) to avoid rapid oxidation.

11) **Consider the use of high temperature, short time (HTST) treatments**. Some people also call this “Flash Vinification” or “Pasteurization” in which the must is heated very quickly to a high temperature and then quickly chilled back down to a reasonable fermentation temperature. The quick cool time is essential here. Too much heat for too much time will not only kill the bacteria and denature harmful enzymes, but it will also denature proteins and other compounds in the fruit. It can also cause “cooked flavors” in the final wine, which are not preferred by consumers.

12) **Add SO2 to inhibit the natural flora on the clusters**. There are several recommendations on how much SO2 to add, which is dependent on the variety (white, rosé, or red) and the extent of *Botyris*. Here, I have to point to Enartis Vinquiry’s “Winemaking Guidelines” sheet. These were created by an enologist at Enartis Vinquiry, who is originally from Pennsylvania. They are good guidelines, but know that you can sway from the outline with products from other suppliers. I have attached both the white and red guidelines to this report for your convenience.

13) **Decrease the pH of your red wines**. Decreasing the pH will help inhibit natural flora to excel during the fermentation. However this is a breaking point. You cannot go too low with the pH of you can minimize growth of the commercial yeast strain.

14) **Treat must with lysozyme**. Although this will do nothing for the Botrytis infection, it will knock back the potential lactic acid bacteria spoilage. This may be necessary if the fermentation has a hard time getting started. (I would recommend knowing the lactic acid bacteria levels in the must prior to purchasing lysozyme. You can do this by simply evaluating the must under a microscope or sending a sample to a wine lab.)

15) **Add tannins prior to red wine fermentations.** Refer to your suppliers for specific tannins that would be a valuable addition to the must, prior to fermentation, with fruit infected with *Botrytis*. Know approximately how much *Botrytis* you have to get a more specific recommendation. The use of tannins here will do several things for your fermentation:
    a. Binds with some of the active enzymes that may be destructive to your fermentation (e.g. laccase).
    b. Will allow for better color stability throughout and after fermentation.
    c. Enhances the mouthfeel of the red wine. *Botrytis* (and disease in general) tends to thin out the mouthfeel of wines, which extenuates the off-flavors associated with *Botrytis*. Building mouthfeel will off-set this phenomena.

16) **Use a β–gluconase enzyme product, especially in white wines during cold settling before fermentation**. This enzyme will help break down some of the solids associated with *Botrytis* in white wines. As we all know, a clear white wine is demanded on the market. Therefore, this enzyme should help make clarification and filtration easier, which are often huge problems with *Botrysized* white wines.

17) **Manage your free SO_2 after primary fermentation and MLF**. This may mean checking the free SO_2 concentration every week or every other week until you are ready to bottle the wine. Remember that the molecular SO_2 concentration is always changing and heavily associated with pH. It does not stay where you want it to, and the only way to monitor the concentration to make sure there is enough in the active, molecular form, is by constant checking with analysis.

18) **Manage your numbers**. I believe in a good quality control program even when you're making wines without disease pressure, but when you are dealing with *Botrysized* fruit, having no baseline numbers is asking for trouble. Get a juice panel (Brix, pH, TA, malic acid, and YAN) prior to fermentation, with, perhaps, some of the additional requirements for *Botrysized* fruit (i.e. Laccase Test). At the completion of primary fermentation, check your glucose/fructose levels (reducing sugar to ensure that your fermentation ***is actually dry***… you do not want residual sugar when dealing with diseased fruit as the disease organisms will eat this), volatile acidity (VA) as this is a time when VAs can start creeping, and malic acid. Make sure that your MLF is complete by getting the malic acid concentration checked enzymatically.

19) **Trust your palate – don't just add sugar**. Some people will add sugar to sweeten wines when less than optimal grapes were received at harvest. I don't always believe this is a good idea. If you can get the wine fermented to dryness and complete MLF, I would taste the wine over some time. If it has no residual effects from the *Botrytis* fermentation, then, if you would like to sweeten it, do a bench trial and see how it tastes. If you're not sure how it really tastes, ask someone else. Most times, I find these wines are better blended out. The reason behind this is, depending on the level of *Botrytis*, there may be some off-flavor that will not match well with sugar. Think about tasting… bread mold with a hint of sugar. (It's not a good combination.) I find that many winemakers are convinced sugar fixes everything. But this is not always true, and is probably less true than we have come to convince ourselves.

These are all suggestions that will depend on the extent of *Botrytis* infection on the incoming fruit, and what you are capable of accomplishing at your facility. If you can estimate that less than 10% of the fruit is infected, minor treatments are usually needed to ensure a successful fermentation. Going above 15% is where things start to get a bit tricky and require some real effort to make a decent wine.

Remember that clarification and filtering is a huge problem with *Botrysized* wines. This is the nature of the beast! Whatever you can to do to minimize your potential for a filtration problem later on down the road, will allow you to sleep more peaceful and have less headaches!

LITERATURE CITED

Fugelsang, K.C. and C.G. Edwards. (2007) Wine Microbiology: Practical Applications and Proceedings. (2nd Ed.) Springer: New York, NY. 393 pg.

Loinger, C., S. Cohen, N. Dror, and M.J. Berlinger. (1977) Effect of grape cluster rot on wine quality. AJEV. 28(4):196-199.

Denise M. Gardner
Penn State Extension Enologist
Department of Food Science
217 Food Science Bldg.
University Park, PA 16802
Phone: (814) 867-0431
Email: dxg241@psu.edu
August, 2011