



Enology Notes #148

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To: Grape and Wine Producers

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Subject:

- 1. Sustainability, What Does it Mean?**
- 2. Virginia Tech's Enology Service Laboratory-Metal Analysis**
- 3. Virginia Tech Remembrance**

1. Sustainability, What Does it Mean? What does sustainability mean? The word *sustainable* became common vernacular in the wine industry by 2008. Never fully defined, it meant different things to different people, which was likely part of its appeal. It added a virtuous green dimension which often represented some nebulous combination of ecology and the environment. For some, it was a new way of packaging an old idea – corporate social responsibility. For those in the wine industry, it usually meant an emphasis on energy, water, chemical, and/or packaging management. In a broad sense, a sustainable winery could be one with the following features described by Chancy 2008:

- *Ecologically Responsive*
- *Economically Viable*
- *Good Neighbor*
- *Bioregional*
- *Healthy and Sensible*
- *Operationally Efficient*
- *Aesthetically Pleasing*

Knowledgeable industry members understand our industry's dependence on energy, and the sources of those dependencies which include the following (adapted from A Guide to Energy Efficiency Innovation in Australian Wineries):

- Refrigeration: 40-60%
- Pumps, fans, drivers: 10-35%
- Lighting: 8-20%
- Packaging and bottling: 8-30%
- Other consumption: 3-15%

Winery ecological/environmental sustainability usually includes some of the practices listed below. More often than not, the activities that went under the winery sustainability banner in 2008 only tenuously related to water, energy, chemical, and/or packaging management. Many wineries appointed sustainability officers and printed brochures on recycled paper, with pictures of the beautifully-green nature of our industry, or at least worked to help maintain that image.

- LEED
- Building materials
- Earth-sheltered buildings
- Green roofs
- Building orientation/insulation
- Brise soleil/solar blocks
- Alternative energy
 - Geothermal
 - Solar
 - Wind
- Energy capture/CO₂ capture/heat recovery
- Natural lighting
- Rainwater collection
- Water recycling
- Materials recycling
- Etc.

However sustainability is defined, it is not formulaic. Environmental and ecological aspects of sustainability are site specific. The question is –what is the value and impact of your footprint at your location?

In 2009, sustainability has taken on a new meaning and/or a new definition for some, economy and employment – that is, staying in business. As recession haunts and growth continues to slow, bankruptcies and closings will rise, thus impacting our industry directly or indirectly. To sustain profits, virtually all in our industry will continue to attempt to cut costs. At the same time, consumers may become less and less prepared to pay extra for a sustainably-produced wine. In these circumstances, many may tone down their green initiatives, while still attempting to market the panache of green, all the while attempting to emphasize the value of their products and economic enhancements, such as winery tourism. The forces that motivated the wine industry to be concerned about traditional sustainability have not changed and will not disappear. They should be embraced. They relate directly to economic and employment sustainability in at least four areas, as suggested by Selfridge 2009 and McCorkle 2009:

- Can increase product differentiation. Many wineries use sustainable architectural features as a means of branding.
- Can aid in risk management. Becoming less dependent on energy and water use means that a business is buffered somewhat from the volatility of price and availability.
- Can aid in responding to government regulations. If our industry is not pro-active, we may find ourselves facing peak-use demand surcharges and use restrictions.
- Can lower production costs. Because of the direct positive correlation between ecology/environmental sustainability and economic/employment sustainability,

establishment of a sustainable feature can substantially impact winery operational costs.

Perhaps the most common example of the relationship between ecology/environmental sustainability and economic/employment sustainability is natural lighting. Artificially-lit buildings average about 1.5 Watt/SF, whereas a day-lit building would use 0.33 to 0.5 Watt/SF (Chauncy, 2008), making the saving range 1.0 to 1.22 Watt/SF.

What are the vectors for optimizing economic/employment sustainability? In my opinion, they include the following:

- Science-based decision making
- Realistic understanding of product value
- HACCP planning
- Education and technology

Philosophically and practically, what information is certain and why? How we think about knowledge, what it is, what are its possibilities, how it is acquired, what are its limits? How one goes about acquiring knowledge affects every particular aspect of human thought and, therefore, how we progress as an industry.

Leo Szilard, responsible in part for our understanding of quantum physics, once told a colleague he was thinking of writing a diary, but not for publishing. “I simply want to record the facts for God.” His colleague asked, “Do you think God doesn’t know the facts?” “Yes,” said Leo, “but he doesn’t know my version of the facts.” Dr. Richard Smart has suggested, and I agree, that for our industry to continue to grow and prosper, there needs to be a complete dichotomy between what he calls pub talk and scientifically-derived information, the true understanding of the facts. For example, he posed the following statements. Are these statements true and, if so, when and under what conditions?

- Low yields give better wines
- Small berry size is important for wine quality
- Old vines produce better wines than young vines

The point is that information derived from untested opinions must be differentiated from scientifically-derived truths. Such a differentiation is essential to enhance economic/employment sustainability.

Where and how we get our information is also an important economic/employment sustainability vector. Bishop George Berkeley, the eighteenth century empiricist, argued that our only knowledge of the world is what comes to us through our senses: *Esse est percipi*, “To be is to be perceived.” The problem, of course, is that our senses are errant, not always reliable. Even if our senses were objective and reliable, many wineries often

do not conduct sensory evaluations in concert with maximizing or optimizing their economic sustainability. Sensory evaluation should include the following:

- Standardized environment
- Representative sample
- Proper evaluation temperature
- Elimination of bias
- Sample contrasts
- Number of evaluators required to gain a true picture
- ‘Expert’ opinion vs. consumer preference
- Proper testing methods

Proper sensory evaluations are key to understanding relative value. Relative value is how the price/quality stacks up to other products in the marketplace. Contrasting refers to blind comparison of wines against others in the marketplace. Additionally, there needs to be a clear distinction made between so-called expert opinions (winemakers, wine competition judges) and consumers. There is an increasing body of evidence that suggests that expert opinions of wines are different from consumer opinions. Our knowledge of this dichotomy must increase if we are going to tailor wines to consumer preferences. Certainly, optimum sensory evaluation needs to be on an economic/employment sustainability vector.

Another economic sustainability vector, in my opinion, is HACCP planning. HACCP is the controlled integration of chemical, physical, microbiological, and sensory analyses into a formal plan (See Enology Notes Index, HACCP or On-Line Publications at www.vtwines.info for additional information). HACCP planning helps one understand the complex relationships among the kaleidoscope of grape-growing and winemaking variables. One of the universal problems is that winemakers rely very heavily upon empirical observation. If two outcomes are similar, we have a tendency to assume they must have a similar cause, which may not be correct. The importance of the core principle of HACCP goes back to Francis Bacon, who reminded us, *“Genius is like fleet of foot, method is the right path. Fleetness of foot on the wrong path never leads to knowledge.”*

Education and technology are also economic/employment sustainability vectors. How are new technologies created? How is that information transferred? Why do some people embrace changes while others do not? These are issues that our industry needs to address. The responsibility to interpret the importance of new developments, conduct research, and relay those findings to our industry falls mainly on our university systems. Yet funding for university-sponsored agricultural research and extension has not kept up. This limitation has and will continue to impact the US industry as it attempts to increase global market share.

The capacity to implement new practices and technologies is a sustainability factor. What are some of the new technologies impacting sustainability? Most will ramify around

water, energy, chemical, and packaging issues. Examples of relatively new technologies being used include the following (adapted, in part, from Boulton 2009):

- CIP (clean in place)
- Capture solutions/green chemistry solutions
- Electrical dialysis for cold stabilization
- In-line white juice flotation for clarification
- Protein adsorption columns for the elimination of bentonite
- In-line blending to aid in water use and energy efficiency

There has emerged in 2009 a new, more expansive definition of sustainability including the components of ecology and environment, economy and employment, and technology and education. The forces that motivated the wine industry to be concerned about traditional sustainability (image, popular trepidation about global climate changes, and the general need for optimum energy, water, chemical, and packaging resource management) have not and will not disappear. They are tied intimately with economic sustainability. Economic sustainability is directly tied to education and technology. It is an agglomeration that represents sustainability. That is what sustainability means.

2. Virginia Tech's Enology Service Laboratory-Metal Analysis. Virginia Tech's Enology Service Laboratory can determine metal concentrations. This is becoming increasingly important as we learn more about the reaction of metals in wines, notably iron and copper. The following is adapted, in part, from Zoecklein et al., 1999 and Zoecklein, 2008.

Grapes, musts, and to a lesser extent, wine contain trace amounts of heavy metals. The term "heavy metals" distinguishes those near the bottom of the periodic table (i.e., lead, mercury, and cadmium) and metal-like elements (such as arsenic) from the common "lighter weight" metals (such as sodium, potassium, calcium, and magnesium) present in significant amounts in grapes. Heavy metals are toxic to biological systems due to their ability to deactivate enzymes. As such, their allowable concentrations are regulated. In terms of decreasing concentrations normally seen in wine, these include iron, copper, zinc, manganese, aluminum, lead, and arsenic.

Unless exposed to significant airborne pollution, grapes accumulate only small amounts of heavy metals by translocation from the roots or by direct contact from vineyard sprays. These are normally absorbed onto the yeast cell membrane during fermentation, resulting in 0 to 50% of the original amount. Increased concentrations in wine result from contamination during post-fermentation processing. Sources include contact with non-stainless steel equipment, impurities in fining agents and filter media and direct addition.

The use of copper poses an interesting dilemma to winemakers. It can be added to a maximum concentration of 0.5 mg/L and is used to treat H₂S and some thiols. However it will reduce the concentration of desirable volatile sulfur compounds that contribute to the

varietal typicity of Sauvignon blanc, Petit Manseng, etc. Some of the considerations regarding addition of copper include the following:

- Legality/perception
- Reactivity with only certain sulfur-like off odor compounds
- Protein haze
- Timing of addition: yeast stress
- Sensory impact on varietal character and intensity
- Impact on longevity

Copper can react with some sulfur-like off odor compounds, while not others:

- H₂S and thiols react with Cu⁺²
- Disulfides and thioesters do not react with Cu⁺²
- Thioesters can degrade to thiols (and esters), which can react with Cu⁺²

In addition to only reacting with certain sulfur-like off odor compounds, copper also has the disadvantage of being a strong oxidizer, possibly impacting wine longevity. The potential oxidizing effect is illustrated by the Fenton-type reaction:



The OH*, or hydroxyl radical, is the most oxidative species. This is a potentially large problem, notably in white wines with relatively lower concentrations of oxidative buffers, such as phenols.

Addition of cupric/copper sulfate to the fermenter is a practice used by some in an attempt to limit sulfur-like off odor production. While the majority of the copper (about 60% or more) is bound to yeast and precipitates from solution, such additions are not benign.

Copper addition, either during or post-fermentation, can have a large negative impact by lowering the varietal intensity of the aromas derived from volatile sulfur compounds. As such, the varietal characters of Sauvignon blanc, Riesling, Gewürtztraminer, Petit Manseng, and Chenin blanc, are diminished due to copper's ability to bind mercapto-compounds.

More details regarding the use of copper to bind with sulfur-like off odor compounds are provided in several on-line publications at www.vtwines.info.

3. Virginia Tech Remembrance. The world-wide response to the tragedy at Virginia Tech on April 16, 2006 was overwhelming. Idealistically, we believed that a university environment, established for the pursuit of knowledge, was somehow distinct and different from the rest of society. It is not. As we approach this date and are reminded daily of the extent of violence in our society, I want to share again the following quote.

“The mindless menace of violence in America...again stains our land and every one of our lives. It is not the concern of any one race. The victims of violence are black and white, rich and poor, young and old, famous and unknown. They are, most important of all, human beings whom other human beings loved and needed.

“No one – no matter where he lives or what he does – can be certain who will suffer from some senseless acts of bloodshed. And yet it goes on and on in this country of ours. Why? What has violence ever accomplished? What has it ever created?”

“Yet we seemingly tolerate a rising level of violence that ignores our common humanity and our claims to civilization alike... This much is clear: violence breeds violence... and only a cleansing of our whole society can remove this sickness from our soul.”

“We cannot vanquish violence with a program, nor with a resolution. But we can perhaps remember, if only for a time, that those who live with us are our brothers, that they share with us the same short moment of life; that they seek, as do we, nothing but the chance to live out their lives in purpose...happiness, and satisfaction... Surely this bond of common faith, this bond of common goals, can begin to teach us something.”

Robert F Kennedy.



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