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Is There a Formula for Fine Red Wine Production?

Are these guys really tall, or are the vines really short? Two outstanding Hollanders: Kees van Leeuwen and Rutger de Vink at Chateau Cheval Blanc

Growing fine wines, and especially red wines, in the Eastern U.S. is often a startling difficult endeavor. Conditions vary dramatically across regions, and even in a good vintage like 2013, if it weren't for a last minute flush of sunshine and dry weather, a soggy summer could not have been saved. Innumerable physical, biological, chemical and environmental variables influence the outcome of every wine. Scientists, because it is how they think and work, would like to quantify this complex matrix into a less random system of the inputs into a wine. Growers prune, remove leaves, position shoots, adjust crop, apply fertilizers, pesticides, water, and all the normal practices in the vineyard, but how do each of these, in isolation or together, affect the wine?

For over a decade Dr. Kees van Leeuwen has been trying to decipher and analyze the components of *terroir* in an attempt to understand its influence on wine. He has a good test plot at Chateau Cheval Blanc in St Emilion in Bordeaux, where he is consulting viticulturist. I have tasted his 3x3 trial of Cabernet Sauvignon, Cabernet Franc and Merlot grown in gravel, clay and sand, and the results are appealingly dramatic, and for that plot of land, speak volumes of the influence of soil on wine quality. Links to two of Kees' terroir papers are listed at the end of this article.

Tasting terroir at Cheval Blance: Cabernet Franc grown in gravel, clay and sand

From his work, Kees has been able to tease out some of the elements that affect red wine quality, and in a recent conversation with Dr. Alan Lakso, the distinguished vine physiologist at Cornell University about getting Cabernet Franc fully mature in the cool Finger Lakes region, Kees presented his in dramatic and stark form. Here are his comments:

"I confirm that Cabernet franc is winter hard. In 1956 and 1985 we had big winter frosts in Bordeaux, most of the Merlot died but Cabernet franc survived. However, Cabernet franc is not an easy variety to grow. Clones is a critical issue. Intra varietal genetic diversity is great and commercially available clones (Entav) are not

exceptionally good. For this season I have undertaken a private clonal selection program for Cheval Blanc (see joint file). At the same time I have initiated the selection of new Cabernet franc clones at an institutional level and new Entav clones will be released in the next 5 years. These will be much better that the existing ENTAV clones.

Another critical issue is yield. At Cheval Blanc we grow very good Merlot at reasonably high yields, but for Cabernet franc quality suffers when we produce over 6 Tons/ha. Water status is very important. It is impossible to grow good Cabernet franc in unlimited water uptake conditions. However, severe stress can lead to stuck maturation. So ideal is moderate water deficit, say stem water potential ranges in July and August of -11 / - 13 bars. There is a clear interaction between water deficit and yield: the greater the water deficit, the more high yields become detrimental to quality.

These Cabernet Sauvignon vines managed by David Abreu at Ovid in Napa Valley are likely between -13 to -15 SWP near harvest

Nitrogen status should not be too high. Expressed in yield assimilable nitrogen, values around 100 mg/L are fine. Values over 150 mg/L lead to excessive vigor. In our best block YAN can be as low as 50 mg/L.

In terms of soil, we grow our best Cabernet franc in heavy clay soils (over 50% of clay, mainly Montmorillonite). In this clay we have low nitrogen (due to slow mineralization of soil organic matter) and perfectly balanced water uptake. The clay holds firmly the soil water, leading to moderate water deficits early in the season, but water stress is never excessive.

We also obtain good results in gravelly soils. However, with young vine quality is inconsistent due to irregular water uptake conditions. In our dry farmed conditions, water stress can be excessive in gravelly soils with young vines, but water status is balanced once the rooting system is established.

Another criteria to grow great Cabernet franc is vine age. In our oldest blocks (over 50 years old) we grow great Cabernet franc whatever the soil type.

I believe soil pH do not have another impact than its impact on soil organic matter turnover. I do not believe that mineral other than nitrogen have any impact on quality (except situation of deficiency or clear excess). Kees"

Winegrower Ed Boyce and balanced vines at Black Ankle Vineyard in Maryland. Ed seeks drainage and low YANs for his wines.

These instructions are very impressive and useful for the red wine grower. What matters are clone, timing and severity of water deficit (as related to soil quality and rainfall amount in an non-irrigated situation), nitrogen availability, yield and vine age.

My take home message from this focuses on the soil, which must have the ability to limit plant available water in late July and August enough to create a stem water potential range

from -11 to -13. If the vine achieves this level of hydric stress, it has the capability of getting a proper size crop to full ripeness within the reasonable parameters of a growing season. The other key element is nitrogen availability as measure by must yeast assimilable nitrogen (or that amount of nitrogen that is actually finding its way into the vine). While enologists may argue about the proper amount of YAN for a healthy fermentation, for fruit ripening potential, must YANs in the 75-125 mg/L range are ideal. Plant available water and yeast assimilable nitrogen are growth limiting factors and ways that the vine's vegetative cycle can be managed for wine quality. If this is the goal, I would also add rootstock selection to Kees' list, especially in lighter soils.

Dr. Mark Greenspan of Advanced Viticulture performs a stem water potential measurement by inserting a leaf petiole into a pressure chamber, cut end up, sealing and pressurizing the chamber, and watching for the first drop of sap to exude from the petiole. (Three Most Common Methods of Measuring Water Status" Practical Winery and Vineyard, Nov/Dec 2006)

Even these rules are not universal. It's not unusual in drier climes like California and Australia to achieve SWPs below -15 for red wines, but these are for sunny wines of a very different style from those of Bordeaux and the Mid-Atlantic. The challenge to the *vigneron*, of course, is finding a site that can accommodate these rather exacting requirements. From what we have learned from some of our best producers, the soils can be of varying composition but all must be well to excessively well drained, low to moderate fertility and preferably on a rather steep slope (some up to 30^{o}) with southeast to southwest orientation. Once these conditions are applied, then Kees' recipe begins to kick in and the behavior of the vine is being guided in the direction of fine wine production.

If a good vineyard site is available then it is essential to design the vineyard properly to achieve vines of proper size and balance, then apply the best possible viticulture (crop balance, disease control, vine water status balance – irrigation if necessary, canopy management, etc), all relative to the conditions of the vintage and in the field. This is where experience really pays dividends. The better the site, the less viticulture is needed to make it perform well.

Cabernet Sauvignon on low pH soil (foreground) and higher pH soil in rear panel

Based on the work by Dr. Terry Bates, Cornell viticulturist in Western New York, who manipulated soil pH on different rootstocks and cultivars, I would not easily dismiss the ability of soil pH to influence factors of vine size and growth. In Cabernet Sauvignon (photo left) there were significant visual differences in vine size and wine color and quality.

In almost a decade of working with different clones of Bordeaux red varieties, Pinot noir and Chardonnay, and some other varieties we

understand the ability of clones to affect wine quality. The best clones will probably help any wine to improve regardless of quality of *terroir*, but it is most expressive on fine *terroir*, and cannot overcome the problems created by poor vintage conditions.

I love what Kees says about vine age, but I don't understand it, other than older vines tend to self regulate yields, but if there are other indirect effects on grape quality, I am unaware of what these are or where they come from. It is part of the romance of wine, like deep roots, that we hold tightly to, but don't really understand why.

The key to achieving Kees' vision for fine red wine production is the soil. That's where it begins and it is why site selection, especially in a marginal wine growing area like Eastern North America, it is so important to producing consistently high quality wines. It is important to define marginal in the context of eastern wine growing: in arid regions climate conditions almost never result in an unsuccessful vintage, with a quite narrow range of high quality wine. In cool, humid regions, weather can have a large impact on wine quality, such as in 2011 in the Mid-Atlantic. We know from the old world that site and producer are the key variables for good wine in marginal years, but sometimes even these cannot overcome difficult conditions. It's best to start with the optimum advantage, and the cope with what nature offers each year.

As the extension viticulturist in Pennsylvania I am sometimes correctly accused of a bias for *vinifera* production in my work. Yet, during the two days with John Thull from the University of Minnesota this summer talking about cold hardy hybrid viticulture, I found it both comforting and remarkable that almost to the letter, John's advice for growing hybrids are the same as growing *vinifera*, except for the need for rootstocks and shoot positioning down instead of up. These are becoming almost universal principles for fine wine production, not matter what the cultivar or where it is being grown.

High wire cane pruned Marquette in the Endless Mtns demonstrates good balacne and shoot positioning

Perhaps by now I am stating the obvious here, but I have not seen these principles of vineyard site selection and management applied often enough in the Mid-Atlantic to believe that we are moving as a fine wine industry in this direction. However, there are some very encouraging examples. If a prospective wine grower wishes to achieve these goals, the best strategy is to find others who have made the effort to find the right land and gather the necessary information from them before embarking upon a search for the Holy Grail. I believe that if all wine growers applied these principles and practices to their vineyards, and followed even the most basic wine making rules as taught by extension enologists, the quality of wines in the region would increase exponentially overnight. The artistic part of wine growing and making, is a personal choice that allows the *vigneron* to compete at the highest level of quality. Wines in this category can be found everywhere, but for the moment, reside most generously in Virginia, Long Island, Finger Lakes and the Niagara Peninsula of Ontario. In a recent New York Times wine column, critic Eric Asimov appears to bestow his blessing on the Finger Lakes. I am a frequent visitor to the

lakes and would observe that as a wine industry, they are not even halfway to realizing their full potential, once *terroir* is fully defined and utilized, yet outstanding wines are becoming more commonplace. And an article in the Washington Post magazine hints at what is possible when *terroir* is pushed as hard as it can be in Virginia. I think even Kees and his Cheval Blanc would be impressed by the results.

Vineyards that are Putting Virginia on the Fine Wine Map, by Dana Milbank - http://www.washingtonpost.com/lifestyle/magazine/vineyards-that-are-putting-virginia-on-the-fine-wine-map/2013/11/21/347a6ffa-3dbf-11e3-b6a9-da62c264f40e_story.html

In the Finger Lakes, Devotion to Riesling Shows, by Eric Asimov - http://www.nytimes.com/2013/10/16/dining/reviews/in-the-finger-lakes-devotion-to-riesling-shows.html?_r=0

Kees' website is http://www-ecole.enitab.fr/people/kees.vanleeuwen/english_tc.htm

Terroir articles by Kees and co-authors (available on PWGN website – recommended articles):

- *Influence of Climate, Soil and Cultivar on Terroir.* Am. J. Enol. Vit. 55:3 (2004)
- *The Concept of Terroir in Viticulture*. Journal of Wine Research. Vol 17, No. 1. January, 2006.

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