Science and Nature, Part III: How Great Wine is Made, One Half of the Equation

***To my readers**: As we release the most important works of our career, Chateau Marie LaRose and Oentrepid Cabernet wines, it is incumbent on us to explain why and how these important wines came to be.*

This article is a small book. It is dense reading. I have omitted extraneous detail to keep it "consumer-friendly". Some professionals may criticize some missing details. This is my best effort to keep it user-friendly for everyone. If you have questions, come talk to me. My door is always open to everyone passionate about wine science versus wine myths. But please make an appointment. Please don't come in randomly and argue with Inwood personnel behind the counter. I am happy to engage any wine conversation personally as long as it is civil and respectful.

***Brief**: We are on the threshold of releasing the most important work of our careers to date. Chateau Marie LaRose and the Oentrepid wines will bring Texas Cabernet to the market which will eclipse our history and legacy with Tempranillo. The first of these releases will occur in July 2019 from the 2015 vintage.*

The evolution of this work has been a long journey, and in hindsight, the end success has hinged squarely on the factual necessity (and our subsequent willingness) to abandon traditional notions of "terroir", and embrace the modern, scientific applications of plant physiology and genetics.

In Parts I and II of this series, we established the premise citing many examples of inconsistencies in the old soil and climate concept and why "terroir" thinking leads to illogical and destructive winegrowing and winemaking practices among producers. We will continue to elaborate more of this by example along the way.

Parts III and IV will reveal solutions which replace the old concepts with newer and more accurate paradigms. I have subtitled these two Parts together "How Great Wine is Made", and they present the two indispensable sides of the Great Wine Equation which is:

Genetics + Precision Farming = Great Wine

Genetics provide the polyphenolic profile (flavor matrix) possible in the wine, while Precision Farming provides the concentration of flavor (intensity) of the matrix.

The Equation will be presented in reverse order because the basics of Precision Farming will need to be understood in advance of the somewhat complicated discussion involving Genetics. Therefore, Part III will address Precision Farming and Part IV will backtrack to discuss the importance of Genetics.

Science and Nature, Part III: Precision Farming

"Why would I *EVER* pay *$80* for a *TEXAS* wine?", the Sommelier shrieked in angst which everyone could hear from across the room, and probably down the block. In one fleeting moment, and only a few words used, this person managed to provide an entire case study in how virulent opinions are formed, regardless how short-sighted and prejudiced. Who needs even to taste?

Nothing important is ever considered. Like which wine? Which grapes? Who farmed them? What kind of pruning regimen? What about leaf to fruit ratios? How many times was the canopy cut? What irrigation protocol? Which genetics of which variety? How many clusters per vine? Was it correctly harvested? I could ask those questions and a hundred more. Assuming the product is not flawed and from sound fruit, every detail you taste in the wine you are considering is answered in those types of questions.

But you have to know to ask. Knee-jerk reactions do not equal knowledge. "It's from Texas, it has to suck" certainly represents the arrogance and elitism of Terroir Traditionalism but is not a professional level of specific knowledge about what makes a wine good or bad.

And, by the way, our friends in Napa Valley who produce great wine have answered every one of those questions above, which is *WHY* they produce the wine they produce. More about that below.

The Angst Continues

Recently, I testified before a Commitee at the Texas State Capitol pertaining to the proposal to use 100% Texas grapes to define Texas wine. I was the last person to speak. Before me, Texas wineries made their case that Texas wine must be $10 in the marketplace to compete, and hence the need for California grapes which are cheaper. The heads of the legislators nodded approvingly as everyone seemed to agree without addressing the ***Elephant*** in the room: Why in the world does Texas wine have to be $10? Is everyone in secret agreement that $10 is the best Texas can do? Why would we accept that *bogus premise* as an argument? What drives this kind of short-sighted thinking? *(Terroir elitism and prejudice, of course.)*

When my turn, I told them everything they did not want to hear. Texas wine does not have to be Yellow Tail. We can cut yields, employ better practices, drive quality much, much higher and make wine in any other price tier we desire. It's not a soil and climate issue...it's a human choice issue. It's not too hot in Texas to make other higher-quality wines. We have the power to choose. We just have to do it. And, hence the reason we *don't* need California grapes.

A number of news articles were published about that hearing. I saw San Antonio and Austin media, plus some national. All of the folks testifying were listed, *except one: me.* Honestly, I am used to it by now. I have been the lone voice in the wilderness for 16 years. But sometimes the evidence that the Texas wine industry, the Texas wine distribution community and even the national industry does not want my message out there is overwhelmingly obvious.

And what is that message? That the quasi-sacred and grossly over worshipped "terroir" ***does not exist***, and that great wine can be made anywhere that grapes can survive and have enough sunlight and warmth, IF the Humans will commit to doing the right things.

The uncritical acceptance of "terroir" as truth is the fabric of background prejudice that causes the legislators to *assume* that Texas must make $10 wine, because after all, it's so hot in Texas, how good can the wine ever be anyway, right? *Bad terroir, of course.*

It's the same background prejudice that justifies the sommelier's proud exclamation of disdain without any empirical verification, because they *just know* it has to be true. *Bad terroir, of course.*

In a courtroom this would be called an "assumption of facts not in evidence." In wine, irrationality is perfectly acceptable as long as you toe the line of the mainstream "terroir religion". Dare not speak out.

Napa 2015: The Final Proof and Decisive Blow to Terroir

Micro-Climates...Blah, blah, blah...Micro-Climates...Blah, blah, blah...Micro-Climates...

That pretty much sums up a day tasting in Napa Valley. It was that way on my first trip in 1975. It's been that way on every trip since for 44 years.

Then it happened. The year we never thought possible. 2015. It was hotter in Napa Valley than in Texas. The world turned upside down.

Napa reported 26 days over 100F. We had technically zero, with only 1 day at an even 100F.

I was receiving harvest reports of widespread Cabernet harvesting in Napa by September 6. Wine Spectator tells us "Harvest began in very early August, and wineries were even bringing in Cabernet Sauvignon before the month ended."

Here in Texas, we harvested Cabernet on October 22. *That's six weeks later than Napa.* Obviously not everyone picked so early there, but even a week or 10 days is a lot. Two weeks, four weeks, whatever.... this is a big deal.

Why? The implications are so far reaching it's hard to over-emphasize the meaning. For decades, the Californians and the wine world at large, have told the Texans that premium wine CANNOT be made in hot climates. *(Bad terroir).* That it is flatly IMPOSSIBLE to craft a fine wine beyond a heat threshold that promotes fast sugar production exceeding polyphenol accumulation. This has a name: asynchrony.

We will talk about this in great detail below, but here's what is important:

If the Californians can make great wine in that much heat, then the Texans should be making those same wines EVERY YEAR. NO EXCUSES. CLEAR LOGIC.

I immediately realized the global and historical implications. It took everything I had in me to not run to the computer and send out the "Better watch this" of a lifetime. But then I thought, "What if they really don't know how to deal with this? What if I proclaim that Napa will make great wines in this torrid year and prove asynchrony wrong once and for all, and the wines don't turn out to be as great as I think, and the vintage is declared a disaster? In other words, maybe I should wait and let the vintage take place first and then verify the product. In other words, what if they blow it?

I have said many times that the Californians possess some of the world's best wine talent, and that it is actually their *talent*, and not their soil and climate, that powers the success of their industry. It was this belief, that tempted me to jump the gun. But in the end, I have waited until now.

Well, the Californians did not disappoint. Robert Parker rated the vintage 97 Points with "Extraordinary" aging potential. The usual number of A-class producers like Spottswoode and Hundred Acres produced 100 Point Wines, with larger numbers of highly rated products described as "epic". Vinous described the Cabernets as "positively stunning in their beauty", continuing that "2015 is shaping up to be a vintage of opulent, voluptuous wines with real personality and character." Sure, there were a few inexperienced folks who did not know how to deal with the situation. They picked too late, got lots of raisins, made sappy wines. But by and large, the Napa folks came through very well.

So what's the secret? James Suckling wrote that "the 2015 vintage sets apart the most capable winemakers, who were able to make balanced and fresh if rich reds. They made the right decisions in the vineyards from canopy management to picking times..." Aron Weinkauf, winemaker of Spottswoode said “Picking earlier was key…" And Wine Spectator wrote "that yields in some locations are 50 to 90 percent less than average. But...the fruit that did ripen was outstanding."

There is a world of valuable information in these few quotes. But in the end, there is only one conclusion:

Asynchrony can be mitigated with advanced techniques, and great wine can be made even in severe heat if enough knowledge and skill is involved. AND, any way you look at it, the Texans can and should be making these wines EVERY YEAR. NO EXCUSES. CLEAR LOGIC.

The next question is, "How do you do it?" The answer follows.

Basic Grapevine Physiology

Grapes do not exist for wine. Grapes are the offspring of the vine. Grapes are the vine's babies. They exist to be the next generation in the grapevine lifecycle.

Grapes attached to a vine are analogous to babies attached to a Mother. When grapes are attached to a "Mother" vine, they are doing what all babies do when attached to their Mother: receiving nutritional chemistry until they reach a level of maturity sufficient to "cut the cord." The next generation is born.

This is no brilliant revelation. So much of our biological environment works the same way, all over the planet. However, wine culture among humans almost *never* considers these "facts of life."

Throughout the growing season, the "Mother" vine makes nutrition and distributes it to her babies. The particular chemistry I am referring to here is collected from the sun by and in the leaves, which act as a solar array. The energy collected is then photosynthesized into solute chemistry which is essential for flavor formation in the fruit. Studies have shown that the distribution of this chemistry is surprisingly equitable, being pretty evenly divided among all the berries in the population.

The fruit clusters could be considered to be in competition for this chemistry as it "drains" into the berries through a secondary circulatory system called a *phloem* (as opposed to a *"xylem"* from the root system). It is believed that the formation of polyphenols in the fruit is proportional to the receipt of this chemcal process, and it's importance cannot be understated since sub-categories of polyphenols are responsible for color and flavor and other overlapping elements critical to premium wine.

Much work is still being done in this area to refine all of the chemistry involved, but in practice the principle is clear:

The larger the population of berries on the vine, the less of this critical chemistry each one receives, and the result is slower accumulation of flavor in the fruit. When harvest day comes, a large population of berries/clusters will have lower flavor, the resulting wine will not taste great, but at least it can be cheap because there were lots of berries.

The smaller the population of berries on the vine, the more of this critical chemistry each one receives, and the result is quicker accumulation of flavor in the fruit. When harvest day comes, a small population of berries/clusters will have high amounts of flavor formed, the wine will taste great, but it will have to be much more expensive as there will be a lot less to sell.

Controlling the "trajectory" of flavor formation is the key to mitigating asynchrony. ***This is exactly what the really talented producers in Napa Valley did in 2015 and it is HOW they overcame the heat and still made remarkable wines.***

Moving in the Right Direction

Step One in this process is proportioning the number of clusters per vine to the correct amount which the "Mother" vine can support and thoroughly nourish in the time frame equal to desired sugar accumulation. That's not the end of the story, however. Correct execution of Step One will automatically precipitate an avalanche of Steps Two, Three, Four, etc., all of which will vary somewhat depending on the first critical number.

So unfortunately, as growers, we can't just set our fruit loads correct in the Spring/Early Summer, and then take off on a European Cruise for 3 months. There are canopies to manage, canes to cut, leaves to pull, irrigation regimens to perfect and countless other issues and tasks which hinge on fruit loads, but must be executed properly to insure that the final product will bring the market price necessary to justify the volume reductions.

In the end, the principle is clear: a "Mother" vine with too many mouths to feed will produce malnourished fruit with low phenolic flavor formation. This is the Humans' fault. It is not a soil and climate issue. In every case I have seen where a wine was ruined by improper ripening chemistry, including my own early efforts, it has always been a Human failure and not a "terroir" issue.*

This is the wider history of Texas wine, unfortunately. The climate did not produce those $10 wines. The Humans overloaded the vines and produced $10 wines. So much, in fact, that the public, the legislators, and the sommeliers think that's the only wine we can make, although we are working hard to overcome that image with vastly lower yields, all the way down to 1 cluster per vine if necessary (speaking for Inwood, that is).

**Do not confuse climate with weather events, like rain at harvest, which is routinely a culprit of bad vintages in France, occasionally in California, and remains Texas' <u>number one risk factor</u> in grapegrowing for wine. Climate is defined by the accumulation of heat units over a growing season as determined by long term data, usually at least 50 years. Climate is not an "event" like a heatwave, a rainstorm right before harvest, or even an El Nino/La Nina cycle, which themselves are patterns of events.*

Continued notation: Another common question is about how best to control fruit loads. You can manually pull flowers in the Spring or drop clusters (slightly) later. But the best way is through proper vineyard architecture. There are a thousand people, including myself, that can specify a vineyard design for a tonnage target. This is a huge labor saving step but has to be done first before ever turning a shovel.

The Classic Inwood "X" Chart

Wine tasting at Inwood is always an educational experience, with varying intensity based on the interest level of the consumer. While it may be mildly educational for some, hotly debated topics and long, detailed conversations about wine science are not uncommon.

Quite some time ago, we developed the Classic Inwood “X” Chart as a visual tool for those who are visual learners and better able to assimilate the information graphically. It has been an extremely effective teaching method and continues in use to this day. It is usually drawn by hand in real time by our instructors. It is presented in a series of evolving diagrams below.

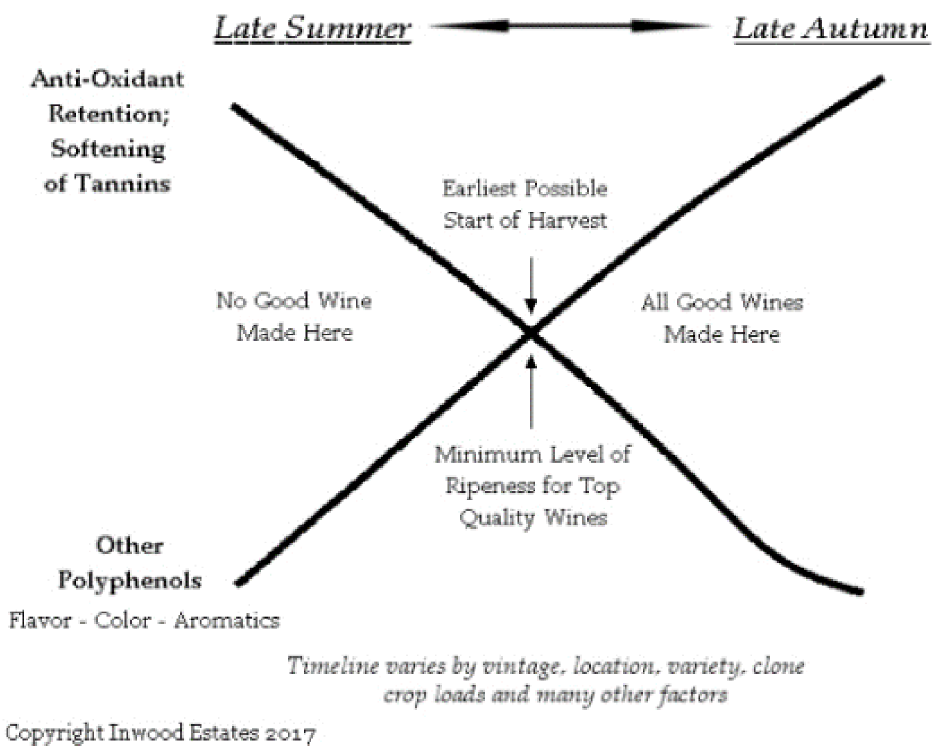

Table 1

All of the diagrams begin in Late Summer and progress through time to Late Autumn. Table 1 shows the increase in polyphenols representing flavor development starting in the lower left corner and *increasing* through time. Table 1 also shows the decline in Anti-Oxidants, in opposition to flavor-producing polyphenols, beginning in the upper left corner and *decreasing* through time. As anti-oxidants decrease, tannins soften in perception.

The crossing of the lines forming the “X” is significant. It represents the earliest point where flavor-producing polyphenols are high enough to make high quality wine, and where anti-oxidants are moderated (soft) enough to become palatable. No good wine can be made *before* this point in time. Otherwise, ugly green odors, sometimes known as C6 compounds, are present, which make red wine smell leafy, grassy or asparagus-like. These are wine faults and are unacceptable signs of malnourished fruit harvested in an immature state unready for winemaking.

All good wine is made *after* the "X" intersects. Obviously, genetics cause some varieties to ripen and harvest later than others, so the "X" varies in relation to the timeline depending on those factors. At this point, I would like to take a quick look at Table 1-A, which is the same as Table 1 with the addition of a few important notations about well known red wines from France and California.

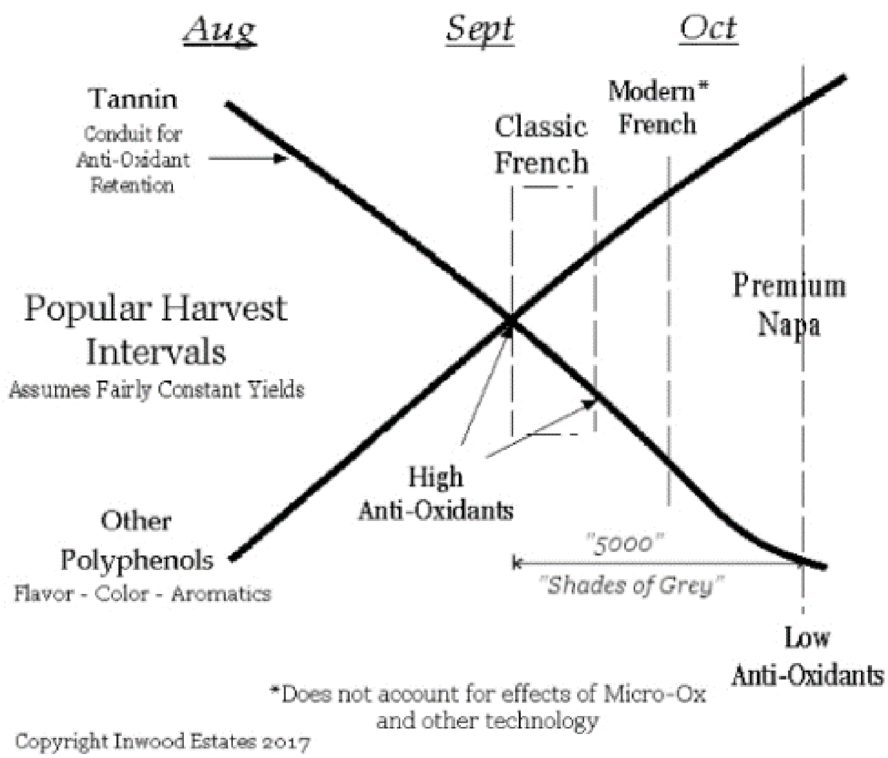

Table 1-A

Historically, French producers have been prone to begin harvest as early as possible and extend picking season only as weather permits. This is because the risk of losing a crop to Autumn rains is so great. Besides, early harvested wines age well since anti-oxidants are so high early on, and the marketing folks have turned these long aging timelines into a "respected" selling feature for French wine down through time.

In recent decades, the impact of New World wines and, most would agree, the "Robert Parker Era", have brought an appreciation for riper, softer, more fruit forward wines to the marketplace. The Californians can claim most of the credit for this evolution, although the Australians and a few others would certainly want some credit as well. These are lower anti-oxidant wines fit for quicker maturation, created by longer hang time on the vine which uses the fruit's own anti-oxidants while in the field for self preservation, leaving less for the bottle. The popularity of this style has caused the French to "move the needle" toward a longer hang time as well, often timing harvests as close to rain as possible. Of course, machine harvesting and other technology helps with this, and I intend to address more of these subjects in Part V: Vineyard and Winery Technology.

The Polyphenol Matrix

Very often, people, even wine professionals, wrongly attribute differences in wines to soil and climate, when they are more accurately defined by very fine gradients of overall ripeness. The differences are elaborated by comparing the polyphenol matrix in various wines. Sounds simple, but not so quick. Just a few years ago, we believed there were only 300 or 400 polyphenols in wine. Today, we are estimating 60,000, and we are still counting. This is a little more complicated than it appears.

First, the overall phenolic profile of the exact genetic strain in question, that is, exact variety and clone, is controlled by the genome, which acts as a "gatekeeper" determining which polyphenols (think flavor molecules) get made and which get suppressed. I refer to this as the phenolic profile. It is sort of like a DNA fingerprint, and we will cover this in far greater detail in Part IV: Genetics, which follows this article.

However, during the ripening process, the matrix itself is in a constant state of change as it develops, every hour of every day. Polyphenols that were not present on a Tuesday are coming into the sensory range by Thursday. If grapes hang too long, some important polyphenols can begin to go away. Even the exact matrix you test in the morning, can be different by afternoon. This constant state of change occurs every hour, every day as maturation proceeds, and the opportunity to harvest at this almost infinite variety of times and intervals means that the possibilities for variances in flavor are like "5000 Shades of Grey".

Think you taste "earthiness"? No such thing. It's just a lesser ripe polyphenol matrix than others. Minerality? Same thing: just a different 60,000 component matrix of flavor ingredients. Less Ripe versus More Ripe is the real question. Give the wine that is perceived as "earthy" or "mineral" another few days on vine and it all gives way to a completely different style.

But even well educated wine professionals will swear that “earthiness”, “minerality”, and countless more descriptors are a result of the soil and climate. They ARE NOT, and you can see this by progressive analysis. I can pick grapes from the same block of the same vineyard in the same year 12 different picking times and make 12 different wines to prove the point. You can witness green give way to earthy, give way to mineral, give way to floral...progressing all the way to fruit bomb at the end.

I have stated previously in these articles that I have only 24 hours per season to pick Chardonnay. After that, I lose all my crispness. Cab Franc and Petit Verdot are the same. How many times have I opened a Napa Valley Cab Franc to find just another generic red wine with no Cab Franc characteristics? You can't let those varieties hang like Cabernet or you lose the unique polyphenol matrix they are famous for. Their perfect ripening regimen is more like a bell curve than a linear figure.

The Learning Moment

At last we come to the key learning moment which is the main subject of this article: the mitigation of asynchrony and the opening of the floodgates for fine winemaking in warmer and warmer climates and conditions. By reducing crop loads to much lower clusters per vine, the load stress on the "Mother" vine is reduced to a point where she can easily "feed", i.e., provide nutritional chemistry, to the smaller population of remaining offspring. The result is a parabolic increase in polyphenol production, moving in tandem with sugar production, to achieve concentrations of flavor demanded by the marketplace for fine wine.

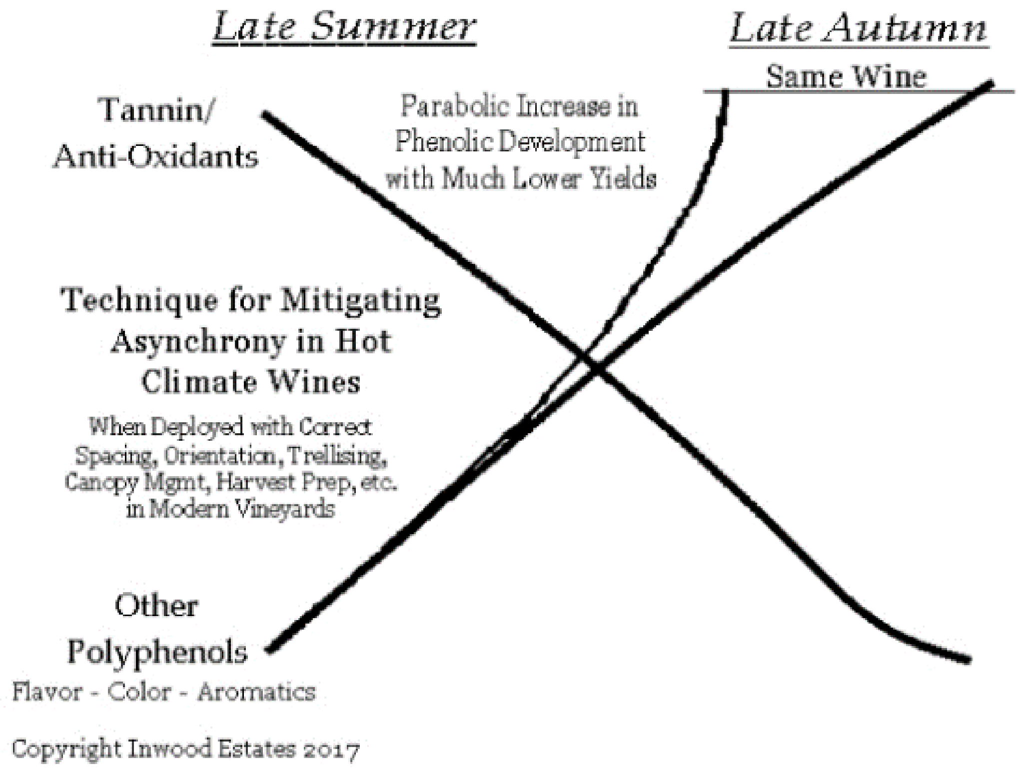

Table 2

Table 2 shows the difference between the parabolic increase in polyphenol production with low cluster counts versus the traditional linear increase with heavier fruit loads. Notice that the harvest date has now been moved to an earlier interval, which keeps flavor development in proper balance with alcohol potential. This is basically the reverse of the traditional "terroir" concept where producers always claimed to use the climate to "slow" the production of sugar and keep it in equilibrium to the flavor development. Here we are doing the opposite: we are using low fruit loads to "speed up" the production of phenolic content (flavor), but with the same effect, which is to keep it in equilibrium with the sugar development.

In the end, you get the same wine. Specifically, I am saying, the same wine with respect to ratios of flavor versus alcohol, which covers 98% of what the market wants in fine wine. If there are any lesser, technical differences, I can say I have noticed only one, and it is something that would generally be considered a "plus" for the earlier harvested, warmer location: with the shorter hangtime, the degradation of anti-oxidants is sometimes not as great, since the fruit has not "used up" its inherent anti-oxidants on the vine yet. This leaves more anti-oxidants in the wine, and can provide the "double-whammy" effect of high polyphenol flavor development PLUS aging potential.

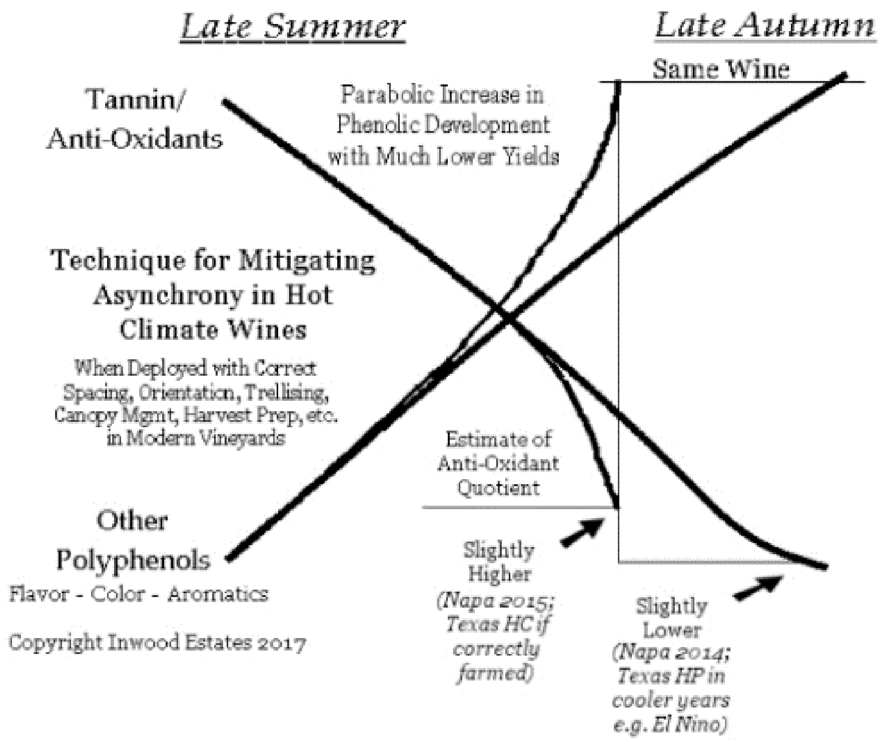

Table 3

Table 3 shows this effect: you can see how flavor develops parabolically, but anti-oxidant decline is only part of the traditional linear model. The importance of this model overall cannot be overstated:

This is a visual representation of EXACTLY how Robert Parker rated the 2015 Napa Valley Vintage at 97 Points (Great Flavor Development) WITH "Extraordinary" Aging Potential. This is how you get BOTH.

And, by the way, remember the quote from Wine Spectator: "that yields in some locations are 50 to 90 percent less than average"? Welcome to the Inwood world.

<u>One Obvious Criticism</u>

I have had this conversation numerous times with my friends in Napa. The first thing they usually say is, "I can't operate at the low yields that I had in 2015 and stay in business." Another friend said, "If you have to operate at such low yields every year to make the wine you make, then I would say that sucks for you."

Actually, I lay in wait for these moments. I replied, "No, it sucks for you because we are paying $8000 per acre or less for farmland and you are paying $300,000 to 500,000 per acre." He then made me aware that the real prices can be much higher than I even know.

So at what point does it make sense to farm more acres at lower yields in warmer areas, than to pay obscene prices for grapeland in cooler areas? Just asking...?

We have literally hundreds of thousands of acres of potential grapeland in Texas and a vast amount has water. Just asking...?

Conclusion

So, if the Texans can produce Napa quality wine every year (not ruined by rain at harvest), then why don't they? Here's my answer:

? ? ? ? ? ? ? ? ? ? ? ? ?

Honestly, I don't know. I am clueless. You would think they would want to. I always thought the object was to make the best wine possible, but apparently I didn't get the memo. I have witnessed the Texsom folks tell Texas producers not to make fine wine to their faces. I don't understand this either. I don't know if it's because they are collectively so prejudiced because of dyed-in-the-wool beliefs in the Terroir Theory that they ***assume*** it can't be done, or if they just think the market is overloaded with fine wine and prefer to have a source of cheap wine close by. I'm really not sure.

The whole point of this article is to help folks in the Texas wine community, including sommeliers, distributors, retailers and even Texas producers understand WHY Texas wine has been deficient historically and how it can be changed....that we do not have a soil and climate problem, but that we have an expertise and flawed belief problem. Hopefully someday these folks will embrace the logical flaws in the Terroir Theory and realize that solid science can easily get beyond senseless, self-imposed limitations to make wines nobody thought possible. The science is correct, and over time, it will ultimately come down to whether pride and snark, or fear of being ostracized from elite wine circles will prevent them from embracing it.

Finally, I can't tell people how to produce their vineyards. But after 39 years, 8 vineyards, 44 grape varieties and 59 clones all in Texas, I can tell you where the quality parameters are:

For Fine Wine, beginning at a minimum of $40 per bottle, which is the “Entry Level” product for Inwood Estates, production rates should be:

Texas High Plains: 3 tons per acre max

Texas Hill Country: 2 tons per acre max

For Intermediate Inwood Wine, $70-130 per bottle:

Texas High Plains: 1.5 tons per acre max

Texas Hill Country: 1.5 tons per acre max generally

(with specific Bordeaux Clones mostly at .75 - 1.2 tons)

For Ultra-Premium Inwood Wine, $200+

All Appellations: less than .5 tons per acre

some less than .3 tons per acre

That's how we do it, love us or hate us. And we are hardly alone. Termanthia is made this way. Other examples that come to mind: Chateau Musar, top quality Israeli wines, possibly Domaine Ott and surrounds. And remember the wines from Algeria which were so good they were illegally put into classified Bordeaux for years and nobody caught on until the fraud was exposed? These examples would have to be vetted for intimate details for sure, but all are good places to start looking at technique.

Of course, there's a lot more than just this. As we said above, you can't just set your fruit loads and go on vacation for 3 months. All the correct farming issues have to be properly executed until Harvest Day. These include canopy management, irrigation regimens, netting where necessary, and much more.

There are also major issues with getting the most out of the finished product by combining clones, especially where each clone is custom farmed. Science and Nature Part IV will address Genetics and why you can never produce your best wine, no matter how low your yields, if you do not start with "***The Right Stuff***". And Part V will delve into Technology. Until then. D