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Cellar Overview

The Basics

Cellaring is about aging a fermented young wine until it is mature and, hopefully, drinkable. Wine maturation is about melding different evolving flavors into a harmonious blend. We believe

1. The evolution depends significantly on the **amount** of oxygen the maturing wine is absorbing as it ages,
2. Achieving harmony depends on the **length of time** of oxygen exposure (the longer, the better), and
3. The **longer** the wine is exposed to oxygen, the higher the chance of spoilage organisms or oxygen destroying it.

So, you balance a long time to achieve harmony with a short time to prevent spoilage. All depends on how long you are willing to wait and how much effort you spend on sanitation.

Wine matures in a combination vessels with different transmission rates for oxygen and different propensities for sanitation :

- **Steel tanks**: They do not allow any oxygen transmission. But large tanks are often equipped with micro-oxygen injectors, thus enabling flexible control of oxygen uptake. Steel tanks are easy to clean and sanitize
- **Oak barrels**: Standard 60-gallon oak barrels transmit around 8 mg of oxygen per liter of wine per year (French barrel) and 11 mg/LY (American Oak), i.e., 8-11 ppm/Year. Barrels are cumbersome to clean.
- **Bottles**: Corked bottles transmit around 1 mg of oxygen per liter of wine per year. Sanitation is no issue because they are single-use.

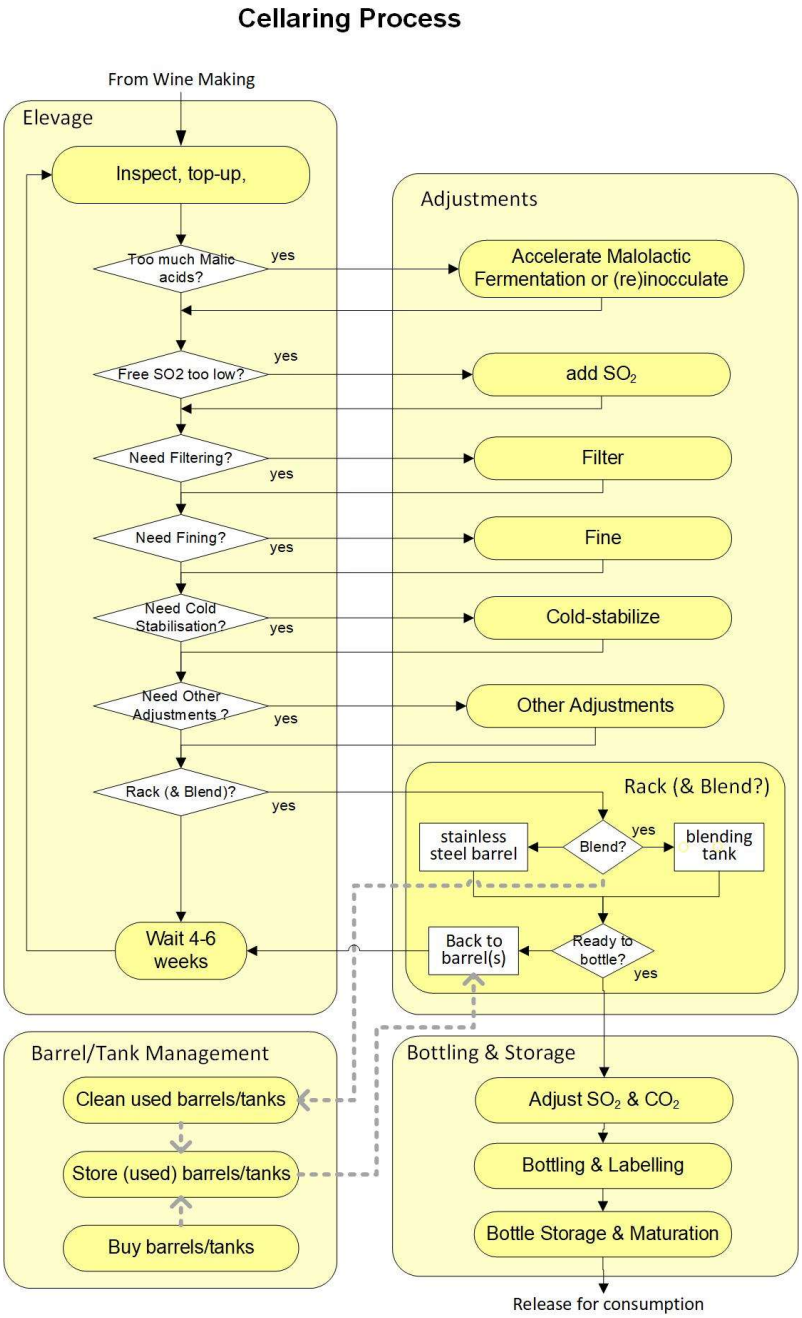
We have matured our wine in French oak barrels for around three years and corked bottles for another five years after that. We limit extra oxygen exposure during barrel maintenance, and we are meticulous about sanitation. In contrast, large-scale wineries prefer steel tanks and accelerated maturation to get their wine to market fast to limit costly inventory. We start drinking our wine only 6-8 years after the grapes are harvested, and we expect it to improve quality in the bottle for another 5-15 years. In other words, we only find out ten years after harvest and wine-making whether we did a good job (we find out much faster when we do a lousy job!) –

thus the need to keep good records and the slow learning process. This also translates our annual production of 2-3 barrels into a required cellaring capacity of 8-10 barrels and over 8,000 bottles (more than we originally anticipated).

Cellaring Process

Cellaring comprises four interlinked activities:

- **Elevage**: We age our wine for three years in barrels. During this time, the barrels need to be topped up every 4-6 weeks to compensate for evaporation. We also need to check on the progress of the Malolactic fermentation and consider adding sulfur to prevent contamination. Finally, we need to make adjustments if required.
- **Adjustments** - there are four basic types of adjustments: Filtering, Fining, Cold Stabilization, and Racking & Blending.
- **Bottling & Maturation**: Before bottling, the wine in the mixing tank needs final adjustments in SO2 (to prevent spoilage) and possibly in CO2 (to compensate for too much or too little aeration during wine-making and cellaring). Then the wine is poured into bottles, the



bottles are corked, capped, and labeled, and finally, the wine is aged in the bottles for another 3-5 years before it is ready for consumption.

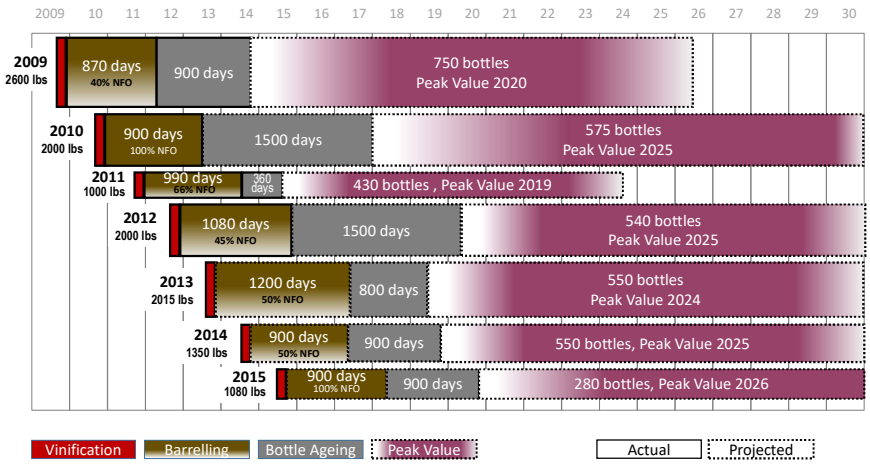
- **Barrel/Tank Management** is about selecting and buying barrels and tanks, cleaning them after use (i.e., following a Racking operation), and storing unused barrels until they are needed again.

We split this section into the following ten pages:

1. **Barrel & Tank Management**: How we select tanks and barrels, how we keep them in good shape and how long we use them.
2. **Elevage**: We monitor how the wine ages in the barrels or tanks, top up the barrels because the water in wine evaporates through the wood, and replenish the sulfur content to prevent contamination. Every 4-6 weeks, when we check, we have the opportunity to make adjustments: Filtering, Fining, Cold Stabilization, Racking & Blending, as explained in the following pages. Barrel aging is complete when the wine is judged ready for bottling.
3. **Monitoring Malolactic Fermentation**: This page describes how we monitor the progress and completion of the Malolactic Fermentation in the cellar.
4. **Fining**: We can remove specific chemical substances in the wine by adding specific fining agents which bind to these substances and aggregate into large molecules, which precipitate into sediment and can then be removed by racking
5. **Filtering**: We can filter the wine conventionally to remove large particles or process it through a reverse osmosis filter to remove only the smallest particles.
6. **Cold Stabilization**: We can remove certain chemical substances by cooling the wine to just above 30 dF. Keeping the wine at that temperature for a few days will make these chemicals crystallize and precipitate. Then we remove the sediment by racking.
7. **Other Adjustments**: This is a grab bag for dealing with other wine-faults
8. **Racking & Blending**: Racking is siphoning the wine from a barrel into a temporary holding tank, leaving the sediments behind. Then the residues are removed, the barrel is cleaned, and the wine is poured back in. Racking can be followed by blending. We can blend wine from different barrels or tanks to create more complex wines or cover up wine faults that are only apparent in higher concentrations. To blend, we rack the wine from different tanks or barrels into a blending tank, mix and then pour the mixture back into clean barrels or tanks.

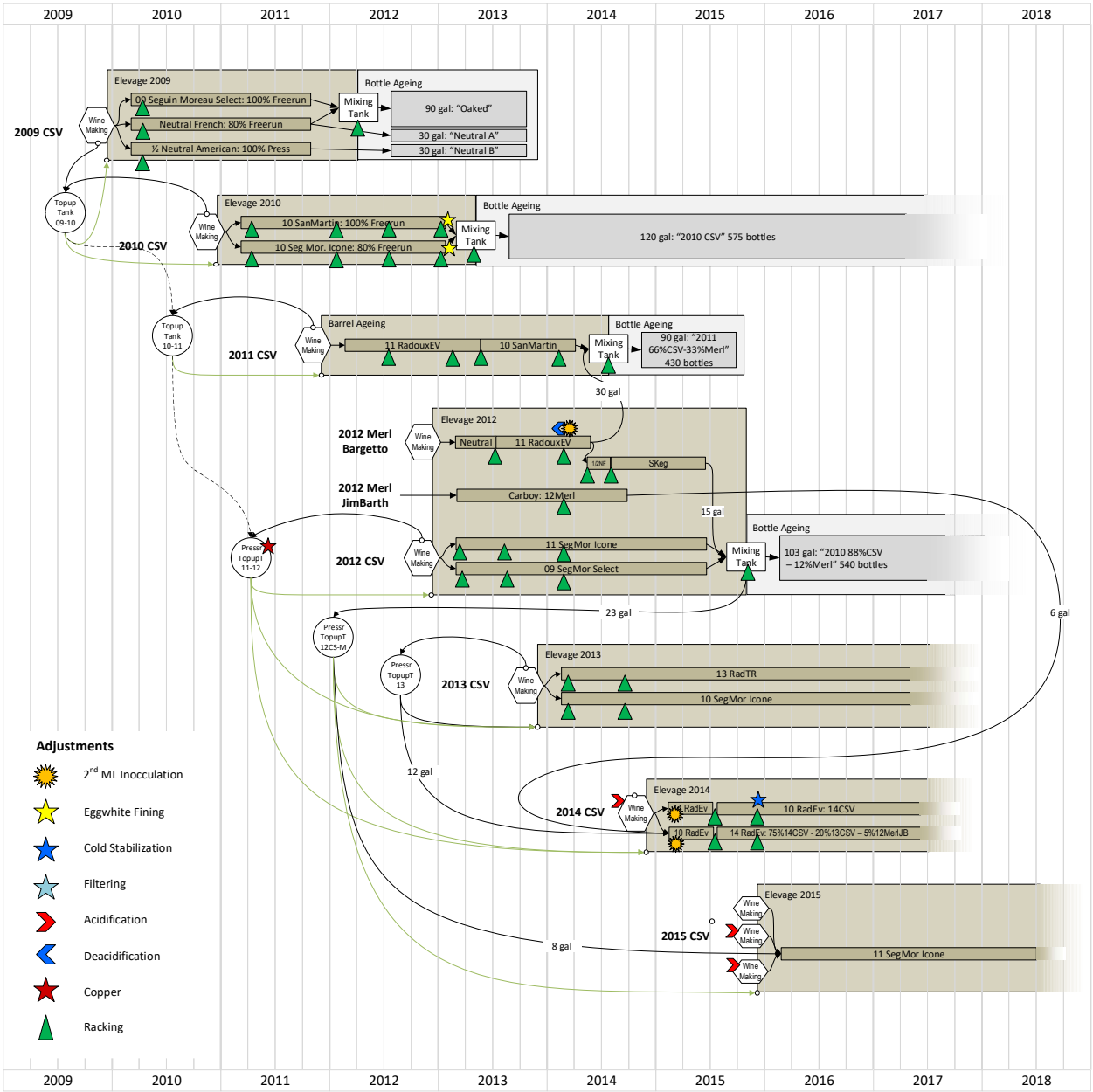
9. **Bottling & Labelling**: Before we bottle, we give the wine a final dose of SO2 and check the dissolved CO2 level. Then we transfer the wine into bottles and cork and cap the bottles. Finally, we design and print bottle labels and affix them to the bottle
10. **Bottle Storage & Maturation**: We store the bottles under temperature and humidity control for a few years until the wine is ready to drink
11. **Cellaring Summaries**: a summary of how we treated each vintage in the cellar.

Cellaring 2009 to 2020



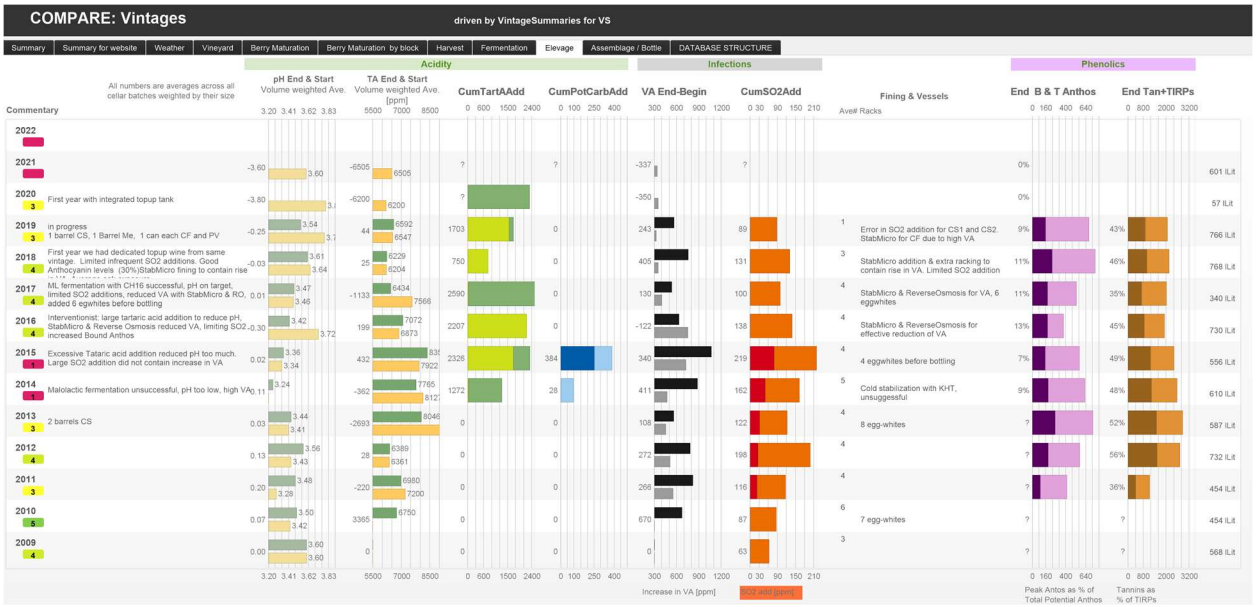
The graphic on the right illustrates the differences in the cellaring process across vintages 2009-2015. The height of each bar reflects the relative size (in lbs) of each harvest. Note that the number of bottles does not correlate well with the harvest size because we blended some vintages with purchased fruit (e.g., Merlot in 2012) or wine from other vintages. The brown and the grey fields reflect the time allocated for barrel aging and bottle aging. Note, even after release for consumption, the wine in the bottles continues to improve for years until it reaches its peak value, and after that, it slowly deteriorates. From harvest to peak value takes 8 to 15 years. The more tannic and oxygen-deprived the wine, the longer it takes to reach its full potential.

Until 2016 we used surplus wine from one year to serve as top-up wine for the subsequent vintage. We then abandoned this practice because it carried spoilage organisms from one vintage to the next. The following graphic illustrates how the different vintages from 2009 to 2015 are linked across the elevages. Top-up wines were used across vintages, and portions of wine from surplus years (e.g., 2012) were used later to compensate for shortages in years when the harvest was not big enough to fill one or two barrels. This tracking is essential for determining the final composition of the wine is when it gets bottled each year. The graphic also shows what adjustments have been made to the wine during the elevage.



Starting with the 2016 vintage, the process became more complicated. We fermented different varietals and blended them during cellaring.

We needed to replace our data management in spreadsheets with a relational database. We treat each barrel and tank as a separate "cellar batch" in the database. We then compute weighted averages by volume across all cellar batches belonging to a particular vintage. The following screenshot from the Compare Vintages layout summarizes the collected data



Note that we collected relatively little data in the early years, and the data for 2019 and later is incomplete because these vintages are still maturing in barrels.

Following is a short recap of how our cellar management evolved:

- For the 2009 vintage, our first year, we used only minimal SO2 for sanitation, and we did not inoculate for malolactic fermentation. 750 bottles.
- For the 2010-13 vintages, we slowly increased SO2 additions as we noticed some barrel contaminations, and we improved our barrel washing equipment. We also experimented with adding egg whites for fining before bottling. Bottle counts were 500, 420, 540, and 500.
- For the 2014-16 vintages, we inoculated for malolactic fermentation (we mixed results). We continued to increase SO2 additions to fight contaminations, and we added tartaric acids to compensate for the low acidity in the grapes (even overdoing it for 2015!). We fined and used a reverse osmosis filter to fight contaminations. In retrospect, too much intervention. Bottle counts were 500, 250, and 780.
- For the 2017 & 18 vintages, we intensified our sanitation efforts by introducing dedicated topup tanks and a new steam barrel washer. We continued inoculating for malolactic fermentation. We continued our fining and reverse osmosis treatments while reducing SO2 additions. Bottle counts were 440 and 860.
- The 2019-21 vintages are still in the barrels. We continued to strengthen our sanitation efforts and reduce interventions (no fining, no malolactic inoculation, minimal SO2 additions, etc.)

In a nutshell, we learned to improve sanitation and reduce interventions. The following pages provide more detail

Here is a link to a pdf-file of the Cellar section as of xx, 2021

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Last updated: May 25, 2022

Tank & Barrel Management

We cellar the wine in stainless steel tanks and oak barrels:

- **Steel tanks and steel barrels** for mixing and transferring wine are easy to clean and maintain, and they last forever.
- **French Oak barrels** for maturing wine. Up to 3-4 years old, oak barrels add desirable flavors and tannins to the wine. After four years, they are called neutral. The advantage of oak barrels is that they breathe: they allow very slow oxidation from the air that enters through the wood staves. As air enters, liquids evaporate through the wood. Consequently, the barrels need to be topped up every 4-5 weeks. A similar effect can be achieved in steel tanks by inserting oak staves or chips and injecting oxygen at an extremely slow and controlled rate (micro-oxidation).
- **Speciality steel kegs** for keeping odd lots and top-up wine are easy to clean and come in various sizes. They have a mechanism to inject inert gas.

We currently don't use micro-oxidation systems (too expensive), so all maturation is done in oak barrels or steel kegs.

Economics of oak barrels

For large wineries, stainless steel tanks are hands-down the most economical solution because they come in enormous sizes and are easy to clean and maintain. Only commercial wineries which can charge over $40 retail per bottle tend to use new oak barrels. A new 60-gallon oak barrel costs between $600 (American and East European varieties) and $1200 (French varieties). They add desirable flavors to the wine for 3-4 years; after that, they are called neutral and trade for $150-$300 in the secondary market. Neutral barrels, when properly maintained, can last for over a decade. New 60-gallon stainless steel barrels cost $500-700 and last forever. So, using new French oak barrels for every vintage would cost around $20/gallon or $3.50/bottle. Our average incremental cost for using French barrels is around $1/bottle of wine as we increasingly use neutral barrels.

We keep track of how many days we have exposed each oak barrel to each maturing wine batch to calculate how much "oak flavor" is left before they become neutral.

Choosing Oak Barrels

Barrel makers have the fanciest booths at trade shows and spend the most on brand marketing. That is because the characteristics of barrels are hard to measure and much depends on individual taste and image. On top of the difficulty of quantifying qualities, research studies indicate that characteristics of the same type of barrels from the same manufacturer vary widely.

We buy up to two new barrels every 2 to 3 years. Consequently, we have no opportunity to test a wide range. So we decided, somewhat arbitrarily, to concentrate on buying our barrels from Radoux, one of the large, well-regarded French "Tonneliers." We tried a couple of barrels from Seguin Moreau but found them to impart too intense flavors. American oak, as compared to French oak, imparts different flavors and has a slightly higher oxygen transfer rate (see the page on Elevage). As these comments indicate, we conservatively buy from an established large supplier – not much analysis or research is involved here.

Choosing Stainless Steel Tanks, Barrels & Kegs

Stainless steel containers are made to individual specifications by specialty manufacturers or bought from catalogs according to standard sizes and specifications. We are using four types of stainless steel containers in the cellar:

- **Mixing and settling tanks** hold the contents of multiple barrels for mixing or for settling out suspended particles. We shield the wine from oxygen by a "heavier than air" inert gas floating blanket. We use Argon preferably, and in less critical situations, Nitrogen or CO2. These tanks have large openings on the top and the side for easy cleaning. We use a round stationary 200-gallon tank (made to order by Santa Rosa Stainless Steel, http://srss.com/) and a square 180-gallon tank (purchased from Metalcraft, https://custom-metalcraft.com/winery-tanks-equipment/) that we can raise with a hydraulic forklift.
- **Storage & transfer barrels** with a capacity of 30 or 60 gallons are used to hold wine while cleaning a barrel. We bought our 30 & 60-gallon steel transfer barrels from

Metalcraft (https://custom-metalcraft.com/shop/accessories/stainless-steel-wine-barrels/).

- **Variable top tanks** are designed to hold varying amounts of wine. Their top floats on the surface of the wine and is sealed with an inflatable gasket to prevent exposure to air. We use them for small batch fermentations and, in the past, to hold odd amounts of young wine set aside for topping-up barrels. We bought our 100 & 200-liter variable-top tanks from Fermentation Solutions (no longer in business).
- **Pressurized kegs** are designed to hold variable amounts of wine (5-gallon Corny Kegs or 15-gallon KegMenters) under the slight pressure of an inert gas (e.g., Argon). We use them to hold young wine set aside for topping up barrels. We bought Kegland Kegmenters with a floating pickup ball from Williams Brewing (https://www.williamsbrewing.com/Home-Brewing-Equipment/Kegging-Equipment/Kegs/132-Gallon-Kegland-Kegmenter) and MoreWine (www.morebeer.com).

All of our tanks and barrels are on dollies so they can be moved around easily, and they are designed to be lifted (by hoists or forklifts) to move the contents by gravity instead of pumps.

Barrel Maintenance

Barrels need proper maintenance. They must be adequately humidified to tighten up before first use, they must be cleaned regularly of sediments and wine spoilage organisms, and they must be stored properly when not full of wine.

Cleaning is about removing sediments settling primarily on the floor of the barrel and about killing wine spoilage microorganisms (bacteria and fungi, mostly hiding in crevices and inside near the top of the barrel). There are for primary methods of cleaning:

- **Water**: Spraying the inside of barrels with cold or warm/hot water under high pressure is the most common method of washing out crud and sediments, but it is not very effective in removing spoilage microorganisms from deep crevices in the staves.
- **Steam**: Steaming barrels with pressurized, super-saturated water is very effective. We steam the barrel for 4 minutes, then bung it for 4 minutes to let the steam cool down and create a vacuum that extracts deep-seated spoilage organisms. Then we rinse the barrel out with water. Care must be taken to limit the cool-down period; otherwise, the barrel implodes.

- **Sulfur Dioxide**: Burning a pure elemental sulfur wick inside the barrel effectively keeps dry barrels sanitized during storage. As an alternative, barrels can be washed out with a weak solution of KMBS (potassium metabisulfite dissolved in water creates molecular SO2).
- **Ozone**: Fumigating the inside of a barrel with Ozone molecules (O_3) is very useful in killing harmful microorganisms (bacteria, fungi, and biofilms). It requires an ozone generator and with a diffuser.

All cleaning water used inside a barrel should first be stripped of chlorine and contaminants found in regular drinking water.

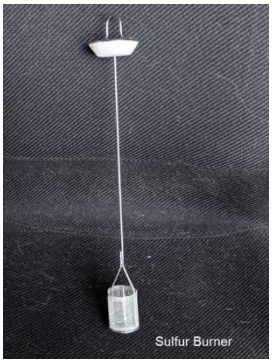
What we do when

We built a barrel washer that holds water in a basin and circulates it with a high-pressure pump through a rotating spray valve inside the barrel. The barrel sits on top so it can be rotated to insert the steaming wand of a steam generator. The barrel washer also holds an electric ozone generator with a timer (Model MP-8000 from A2Z Ozone, https://www.a2zozone.com/products/mp-8000-multi-purpose-ozone-generator). Here is our current barrel maintenance practice:

- **Initialization**: Before using any new barrel, we fill it with filtered warm water and let the staves soak up and tighten. This takes a few days. Then the barrel is rinsed out with the barrel washer, steamed, let cool down for a day, and then filled with new wine.
- **Regular cleaning** between uses. We pressure-wash the barrel and rinse it three times on our barrel washer. Then, twice, we steam it, let the steam cool down to create a vacuum, and rinse the extracted debris with cold water. For the steaming, we use a Swash Portable Steam Generator

(https://www.swashequipment.com/steam-generators-n). Then we allow the barrel to cool down and dry for a day before fumigating it for 2 hours with Ozone. Then the barrel is ready for a refill.

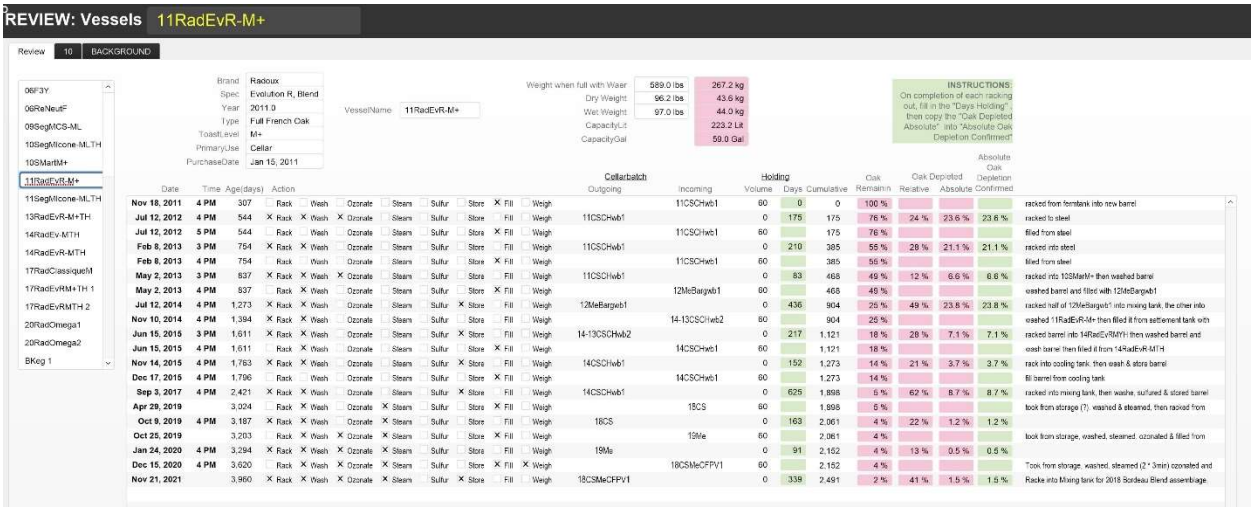
- **Storing used barrels**: if a barrel is put in storage, we burn a sulfur pill inside and close the barrel with a bung so the trapped SO2 prevents the growth of new microorganisms. The burning tablet is held in the center of the barrel in a small stainless steel basket suspended from the bunghole. If barrel storage is extended, the burning is repeated every 4-6 months. Before a barrel is reused, it is cleaned and steamed inside with the barrel washer (see above) and outside with a steam power washer used to clean the steel tanks and other equipment.


Sulfur Burner

Data Management

Because a barrel's ability to impart oak flavors to wine declines over time, tracking which barrel is used for how long with which cellar batch is essential. We assume that an oak barrel has a half-life of 1.25 years, i.e., in 450 days of continuous exposure to wine, it loses 50% of its original ability to flavor the wine.

This screenshot shows the usage of the 2011 Radoux barrel. The column Remaining Oak shows how the oak depletion progressed over ten years of intermittent use for multiple cellar batches, reaching 2% in November 2921.


REVIEW: Vessels 11RadEvR-M+

Review | 10 | BACKGROUND

06F3Y
06ReNeutF
08SegMCS-ML
10SegMIcone-MLTH
10SMartM+
11RadEvR-M+
11SegMIcone-MLTH
13RadEvR-M+TH
14RadEv-MTH
14RadEvR-MTH
17RadClassiqueM
17RadEvRM+TH 1
17RadEvRMTH 2
20RadOmega1
20RadOmega2
BKeg 1

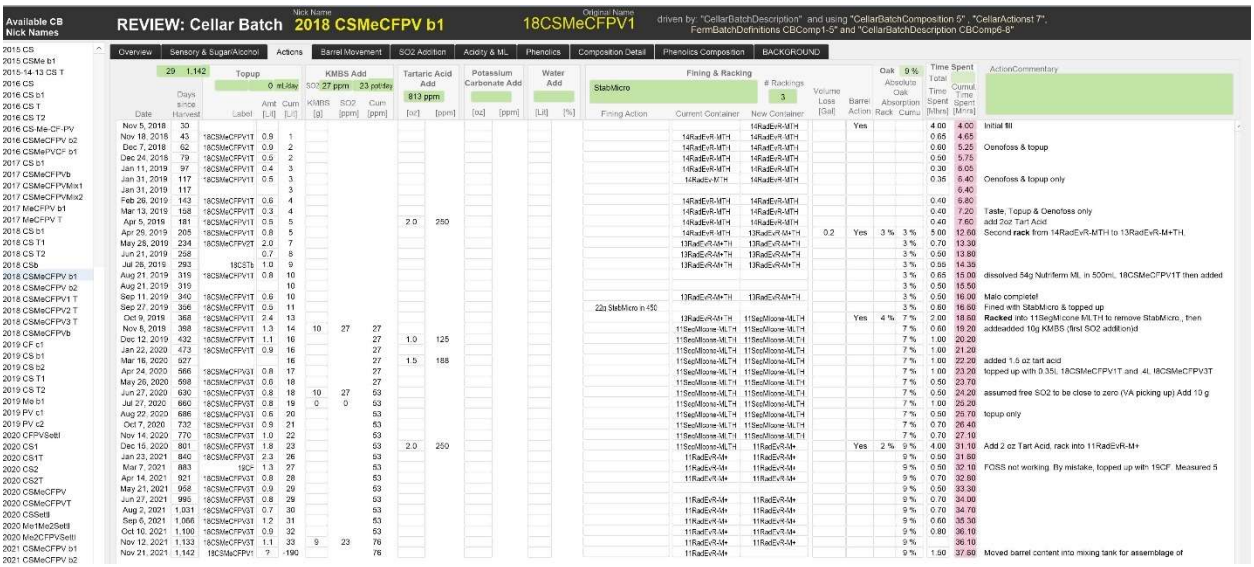
Brand: Radoux
Spec: Evolution R, Blend
Year: 2011.0
Type: Full French Oak
ToastLevel: M+
PrimaryUse: Cellar
PurchaseDate: Jan 15, 2011
VesselName: 11RadEvR-M+

Weight when full with Water	589.0 lbs	267.2 kg
Dry Weight	96.2 lbs	43.6 kg
Wet Weight	97.0 lbs	44.0 kg
CapacityLit		223.2 Lit
CapacityGal		59.0 Gal

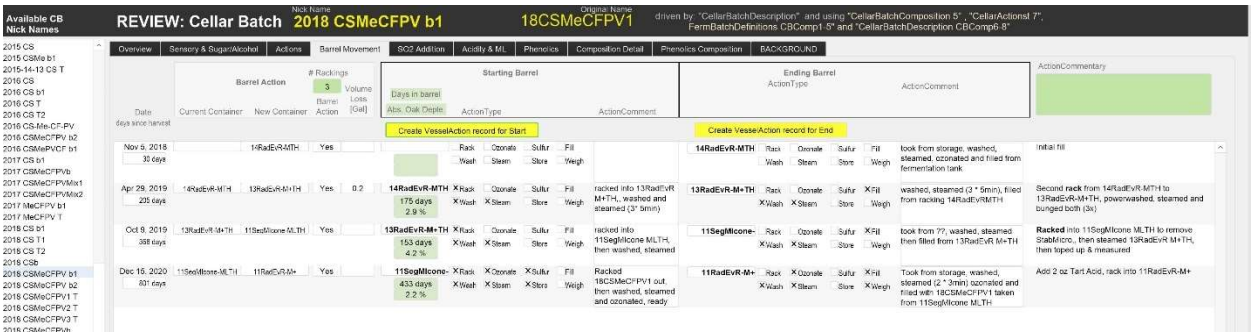
INSTRUCTIONS:
On completion of each racking out, fill in the "Days Holding", then copy the "Oak Depleted Absolute" into "Absolute Oak Depletion Confirmed"

Date	Time	Age(days)	Action	Cellarbatch Outgoing	Cellarbatch Incoming	Holding Volume	Holding Days	Holding Cumulative	Oak Remainin %	Oak Depleted Relative	Oak Depleted Absolute	Absolute Oak Depletion Confirmed	
Nov 18, 2011	4 PM	307	Rack Wash Ozonate Steam Sulfur Store Fill Weigh		11CSCHwb1	60	0	0	100 %				racked from farmtank into new barrel
Jul 12, 2012	4 PM	544	Rack Wash Ozonate Steam Sulfur Store Fill Weigh	11CSCHwb1		0	175	175	76 %	24 %	23.6 %	23.6 %	racked to steel
Jul 12, 2012	5 PM	544	Rack Wash Ozonate Steam Sulfur Store Fill Weigh		11CSCHwb1	60		175	76 %				filled from steel
Feb 8, 2013	3 PM	754	Rack Wash Ozonate Steam Sulfur Store Fill Weigh	11CSCHwb1		0	210	385	55 %	28 %	21.1 %	21.1 %	racked into steel
Feb 8, 2013	4 PM	754	Rack Wash Ozonate Steam Sulfur Store Fill Weigh		11CSCHwb1	60		385	55 %				filled from steel
May 2, 2013	3 PM	837	Rack Wash Ozonate Steam Sulfur Store Fill Weigh	11CSCHwb1		0	83	468	49 %	12 %	6.6 %	6.6 %	racked into 10SMartM+ then washed barrel
May 2, 2013	4 PM	837	Rack Wash Ozonate Steam Sulfur Store Fill Weigh		12MeBargwb1	60		468	49 %				washed barrel and filled with 12MeBargwb1
Jul 12, 2014	4 PM	1,273	Rack Wash Ozonate Steam Sulfur Store Fill Weigh	12MeBargwb1		0	436	904	25 %	49 %	23.8 %	23.8 %	racked half of 12MeBargwb1 into mixing tank, the other into
Nov 10, 2014	4 PM	1,394	Rack Wash Ozonate Steam Sulfur Store Fill Weigh		14-13CSCHwb2	60		904	25 %				washed 11RadEvR-M+ then filled it from settlement tank with
Jun 15, 2015	3 PM	1,611	Rack Wash Ozonate Steam Sulfur Store Fill Weigh	14-13CSCHwb2		0	217	1,121	18 %	28 %	7.1 %	7.1 %	racked barrel into 14RadEvRMTH then washed barrel and
Jun 15, 2015	4 PM	1,611	Rack Wash Ozonate Steam Sulfur Store Fill Weigh		14CSCHwb1	60		1,121	18 %				wash barrel then filled it from 14RadEvR-MTH
Nov 14, 2015	4 PM	1,763	Rack Wash Ozonate Steam Sulfur Store Fill Weigh	14CSCHwb1		0	152	1,273	14 %	21 %	3.7 %	3.7 %	rack into cooling tank, then wash & store barrel
Dec 17, 2015	4 PM	1,796	Rack Wash Ozonate Steam Sulfur Store Fill Weigh		14CSCHwb1	60		1,273	14 %				fill barrel from cooling tank
Sep 3, 2017	4 PM	2,421	Rack Wash Ozonate Steam Sulfur Store Fill Weigh	14CSCHwb1		0	625	1,898	5 %	62 %	8.7 %	8.7 %	racked into mixing tank, then washe, sulfured & stored barrel
Apr 29, 2019		3,024	Rack Wash Ozonate Steam Sulfur Store Fill Weigh	18CS		60		1,898	5 %				took from storage (?), washed & steamed, then racked from
Oct 9, 2019	4 PM	3,187	Rack Wash Ozonate Steam Sulfur Store Fill Weigh		18CS	0	163	2,061	4 %	22 %	1.2 %	1.2 %	
Oct 25, 2019		3,203	Rack Wash Ozonate Steam Sulfur Store Fill Weigh	19Me		60		2,061	4 %				took from storage, washed, steamed, ozonated & filled from
Jan 24, 2020	4 PM	3,294	Rack Wash Ozonate Steam Sulfur Store Fill Weigh		19Me	0	91	2,152	4 %	13 %	0.5 %	0.5 %	
Dec 15, 2020	4 PM	3,620	Rack Wash Ozonate Steam Sulfur Store Fill Weigh	18CSMeCFPV1		60		2,152	4 %				Took from storage, washed, steamed (2 * 3min) ozonated and
Nov 21, 2021		3,960	Rack Wash Ozonate Steam Sulfur Store Fill Weigh		18CSMeCFPV1	0	339	2,491	2 %	41 %	1.5 %	1.5 %	Racke into Mixing tank for 2018 Bordeau Blend assemblage.

The following two screenshots are from the REVIEW Cellerbatch layout for the 2018 Bordeau Blend barrel 1, 18CSMeCFPV1. The first shows all the actions. Note, the cumulative oak absorption over three years in the cellar was only 9%, i.e., this cellar batch was exposed to very little oak flavoring – a deliberate decision given its phenolic profile.



The second shows details on when we moved the batch from one barrel to the next.



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Elevage

The term "Elevage" comes from French and, in this case, relates to maturing or growing up. We mature our wine in new and used ("neutral") French oak barrels for three years. The new oak imparts desirable flavors and allows the intake of a small amount of oxygen (around 8 mg O_2 per Liter of wine per year, or about 3 g O_2 per barrel per year). This combination helps polymerize tannins and anthocyanins and improves the quality of the wine.

Topping up

During elevage, the wine needs to be checked regularly for changes in chemical properties and possible infections by spoilage organisms (creating "wine faults"). Barrels also need to be topped-up regularly because wine evaporates through the wood staves. However, there is a trade-off between inspection frequency and the potential for spoilage. Each time we open a container, the wine gets exposed to oxygen and microbes in the air, with the potential for spoilage. Our goal is to inspect the wine and top up each barrel every 4-5 weeks. Our process has evolved:

- From 2009 through 2016, we opened each barrel every 1-2 months and topped it up with wine from a shared top-up container. The disadvantage was that minor wine faults were carried forward from vintage to vintage. Over the years, we moved from topping up from steel tanks with floating tops and glass carboys to steel kegs pressurized with Argon.
- Starting in 2017, we opened each barrel every 4-6 weeks and topped it up with wine from the same vintage. The disadvantage was that top-up wine had to be kept in a steel container without any exposure to oxygen for three years. To prevent topping up with sediments from the topup kegs, we installed floaters with flexible tubing inside the kegs so that the topup wine would come from the surface of the wine in the keg.
- Starting in 2020, we dedicated a topup keg to each barrel and permanently connected it with a hose to its barrel; and each year, when we rack the barrel and the associated topup keg, we mix the contents. We top up every 4-5 weeks and extract a sample for inspection by a permanently installed tube. The advantages are 1) we only

open the barrel once a year, and 2) wine in the topup keg remains without any oxygen for only one year. The disadvantage is that we can only make adjustments to the wine once a year. The picture shows the setup.

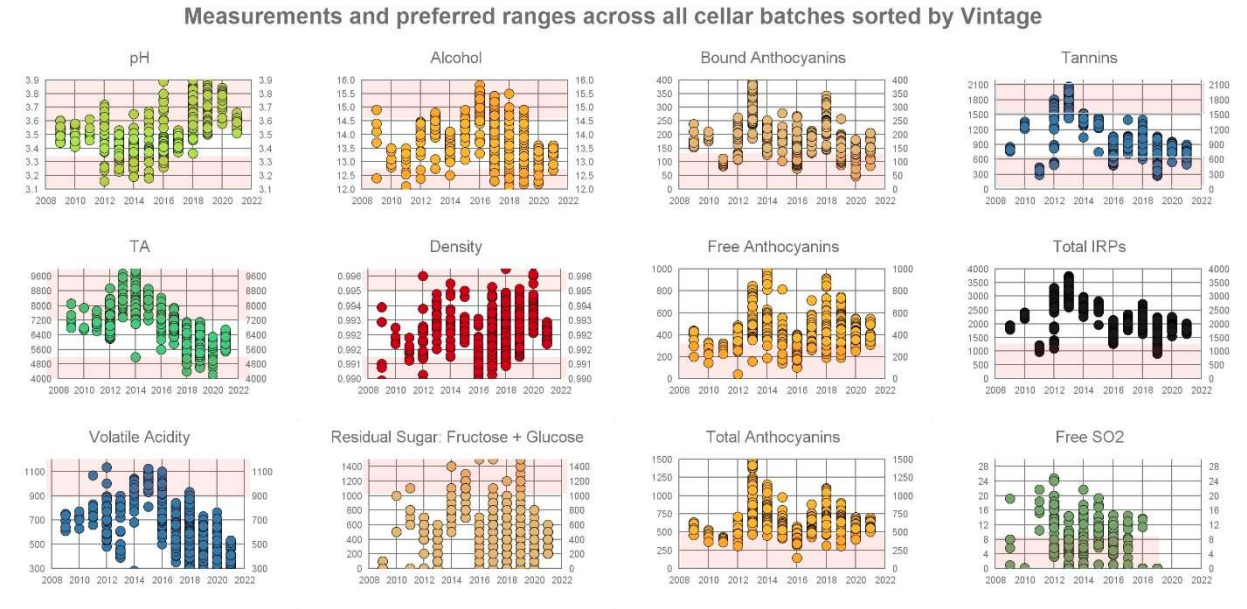
Inspection

After we extract a sample from each cellar batch (barrel or topup keg), we rate the wine for looks, nose, and taste, and we run it through our spectral analyzers for the following properties:

- **Malic** and **Lactic acids**: If we are looking for progress in malolactic fermentation, malic acids should decline from an initial level of around 1,500 ppm to zero, compensated by an equal increase in lactic acids.
- **Acidity**: We measure pH and Total Acidity (TA). Our target ranges are 3.35 to 3.55 for pH and 5,000 to 7,000 ppm for TA.
- **Volatile Acidity VA**: VA is primarily acetic acid (vinegar), a byproduct of bacterial spoilage. We monitor VA attentively; it generally rises from 300 to 800 ppm during elevage. When it rises fast or exceeds 900 ppm, we get concerned about spoilage and initiate fining and filtering.
- **Alcohol** and **Density.** We target alcohol to be in the 13% to 13.5% range. Density is usually around 0.9920.
- **Fructose** and **Glucose.** Sugars are a sign of incomplete fermentation. Acceptable ranges are 0 to 800 ppm total for both.
- **Anthocyanins.** We measure total, free and bound anthocyanins. Bound anthocyanins are anthocyanins linked to tannins – they give red wine the color and textural and sensory qualities. We hope for bound anthocyanins above 200 ppm in Cabernet Sauvignon.
- **Tannins.** Tannins are astringent and precipitate proteins – that is why tannic red wine pairs well with fatty foods. We look for tannins in the 800 to 1,600 ppm range
- **Total IRPs.** Total Iron-Reactive Phenols represent to amount of all phenolic compounds in the wine. We look for Total IRPs in the above 1,400 ppm

We cannot measure Free **SO2** with our spectral analyzers. Free SO2 is the amount of SO2 that effectively prevents microbial growth in the wine. Conventional wisdom suggests one should add SO2 when the level of Free SO2 falls below ten ppm. We have changed our strategy over the last few years and eliminated SO2 additions, except right before bottling.

The following chart shows all the measurements taken on all cellar batches for every vintage. Note that many of the measures outside the targeted ranges are from topup batches that we do not actively manage.



For a more detailed description of how we measure chemical properties, see the Laboratory section of the website.

Deciding on adjustments

Since 2017 we have run all the tests every time we topup a barrel on each involved cellar batch, i.e., vessel. The critical adjustments are driven by:

- Monitoring the progress of the malolactic fermentation
- Monitoring and, if necessary, adjusting acidity
- Detecting and correcting wine faults. We monitor increases in Volatile Acidity, which are an excellent early indicator. As described below, we rely on our noses and tastebuds to identify wine faults. We make adjustments by fining and filtering.
- Timing of racking barrels (every year), blending cellar batches, and bottling.

The following pages describe the adjustments in more detail. A trained nose can identify the off-smell of contaminated wine. The tables were adapted from an ETS Laboratories' Winemakers' Quarterly (see www.ETSLabs.com), from the British Columbia Winemakers Association website

www..bcawa.ca/winemaking/flaws.htm, and Enotools website www.enotools.com/wine-faults--whats-wrong-with-my-wine.html. They summarise key off-odors and tastes, the chemical compound responsible for them, their indicative sensory threshold, the most probable origin of the problem, how it can be prevented, and possible corrections. Treatment should always be preceded by first eliminating the original cause. All treatments with chemical additions are problematic and should be done in stages or on samples first.

Rotten Egg: Hydrogen Sulphide & Mercaptans

Odour & Threshold	Cause	Prevention	Treatment
Rotten Eggs or Hot Springs. H2S 1 – 5 ppb (microgram/L)	Yeast stressed by low nutrition in must produces excess amounts of H2S. Much of the H2S is blown off by the CO2 generated by the yeast	Measure YAN (Yeast Assimilable Nitrogen) in must – target 250 mg/L. Add nutrition to yeast at the time of hydration and add nutrition again at the beginning of phase 2.	Aerate by racking or bubbling CO2. Persistent cases may be treated with copper sulfate solution, but only after converting the untreatable H2S into thiols by adding ascorbic acid (50mg/L) – the copper binds with the thiols and can be racked or filtered out.

Cooked vegetables / Canned Corn: Disulfides

Odour & Threshold	Cause	Prevention	Treatment
Cooked vegetables or canned corn. Disulfides (DMDS,DEDS) & Dimethyl Sulfide (DMS) 10-20 (microgram/L)	Excessive aeration following H2S/Mercaptans problems; on-lees aging.	Limit aeration. Remove lees early.	Remove lees by racking.

Vinegar & Nail Polish: Acetic Acid (Volatile Acidity) & Ethyl Acetate

Odour & Threshold	Cause	Prevention	Treatment
Vinegar Acetic Acid and other volatile acids 600 - 900 ppm (milligram/L) Nail Polish Ethyl Acetate 150 – 200 ppm (milligram/L)	Most Acetic Acid develops during fermentation and elevage either a) when Acetobacter bacteria consume ethanol in the presence of oxygen or b) when Lactobacillus consumes residual sugar. Ethyl acetate forms from the reaction of ethanol and Acetic Acid.	SO2 additions kill Acetobacter and other aerobic bacteria. So must should be treated with SO2 if cold-soaking precedes fermentation and oxygen exposure is limited during elevage (by frequent topping up and gassing containers). Any residual sugars should be removed by sterile filtering or treatment with Velocrin.	First, the causes of VA production must be eliminated (Acetobacter or residual sugar). Only when ongoing VA production is eliminated should VA levels be reduced. This can be achieved by blending (with wine with less VA) or Reverse Osmosis filtering.

Barnyard, Band-Aid, Wet Dog: Brettanomyces

Odour & Threshold	Cause	Prevention	Treatment
Barnyard 4-Ethylphenol (4EP) & 4-Ethylguaiacol (4EG) 400 ppb (microgram/L)	Brettanomyces, a spoilage yeast, produces a myriad of aroma compounds (for which 4EP & 4EG are markers), particularly in warm conditions, low SO2, high pH, and residual sugars – often during ML. A little Brett is considered house-style in some Bordeau wines.	Brett comes in from the vineyard and can get established in old barrels in poor sanitary conditions. Once found in a barrel, it can hardly be eliminated, and the barrel needs to be discarded	Brett aromas can be eliminated from affected wine by reverse osmosis followed by a carbon block filter taking out the slightly larger 4EP/4EG molecules.

Popcorn, sweet butter: Diacetyl

Odour & Threshold	Cause	Prevention	Treatment
Popcorn, buttery smell and taste Diacetyl (2,3 butane dione) 0.3 - 3 ppm (milligram/L)	A product of malolactic bacterial metabolism, particularly in the absence of yeast lees which tend to neutralize the diacetyl produced. Frequently diacetyl results from the breakdown of citric acid after consuming the malic.	Keep wine on lees until malolactic fermentation is completed. Delay citric acid addition, if necessary, till after the completion of malolactic fermentation	Rack and add a batch of clean lees to the barrel.

Straw/Sherry nose & surface film: Candida – Acetaldehyde

Odour & Threshold	Cause	Prevention	Treatment
Straw-like, sherry-like, or chocolate odor; surface film Acetaldehyde 100 ppm (milligram/L)	A surface yeast, Candida Vini, an obligate aerobe, may grow on the surface of wines in storage containers - particularly when ullage is too great. At the wine's surface, the combination of available oxygen, low sulfite levels, and depleted alcohol provide suitable conditions	Minimize exposure to air while removing barrel samples and topping up. Maintain 25 ppm free SO2 levels	Remove surface film, spray the surface with a sulfite solution, and add 25-50 ppm SO2.

Topping up

Oak barrels need to be topped up regularly because a small amount of wine (called "angels' share") evaporates through the staves. The evaporation rate is usually around 3-4% p.a., depending on the humidity in the cellar. Wine components inside the barrel migrate through the wood at various speeds and evaporate from the outside surface. Assuming the migration rates of the liquid components (say 87% water and 13% alcohol) depend mainly on the differences in concentrations between the inside and outside of the barrel, the alcohol concentration in the wine changes. We keep the cellar at around 60% humidity, so the concentration differences are 27% for water and 13% for alcohol (assuming the alcohol in the cellar air is zero). Therefore at 60% cellar humidity, water leaves the barrel twice as fast as alcohol, and an assumed 3% annual evaporation consists of approximately 93% water and 7% alcohol. If you start the year with 100L wine at 13% alcohol, you end with 87-3%*93 = 84.2L of water and 13-3%*7 = 12.89L of alcohol, and the new alcohol concentration in the remaining 97.09L of wine is 12.89 / 97.09 = 13.27%, an increase of 0.27%. This calculation illustrates why barrel cellars should be kept humid.

On the other hand, whatever wine evaporates from the barrel is replaced by air sucked into the barrel by the resulting loss of volume and vacuum. The atmosphere consists of roughly 20% oxygen and 80% nitrogen. Nitrogen is nearly inert and has no influence on the wine; oxygen does. At a very low continuous rate, oxygen has a very beneficial impact on the development of the wine; too much is detrimental. Thus, oak barrels with a beneficial transmission rate are an

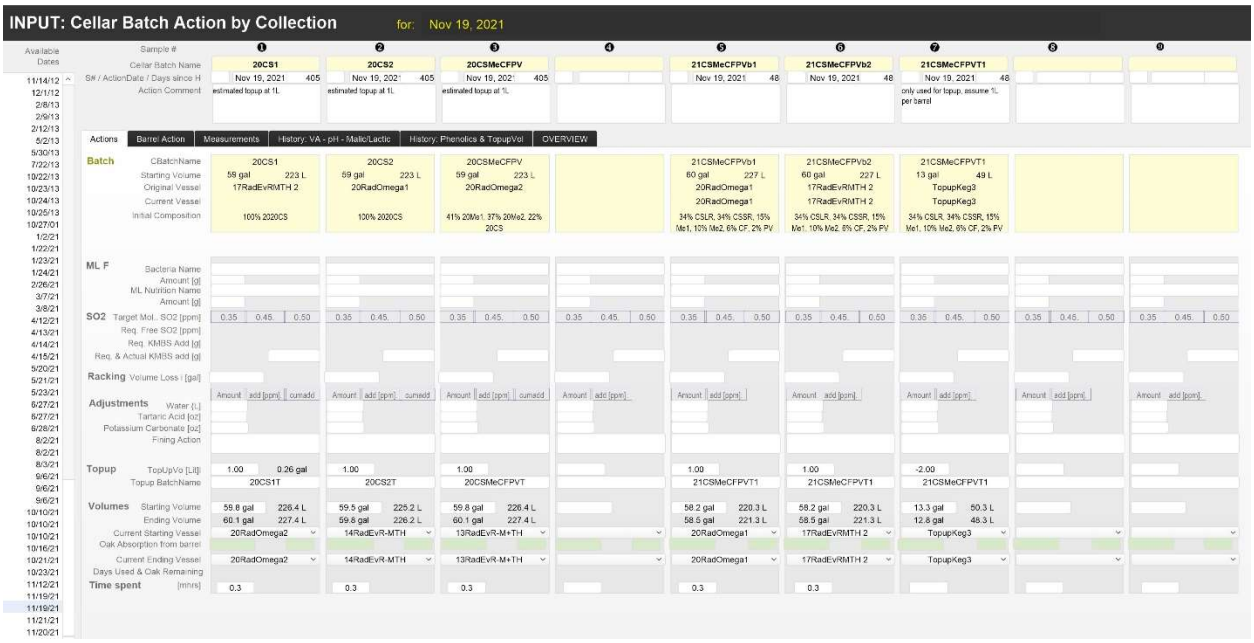
excellent vessel for maturing wine. When wine is matured in steel tanks, minuscule amounts of oxygen need to be injected (micro-oxygenation)

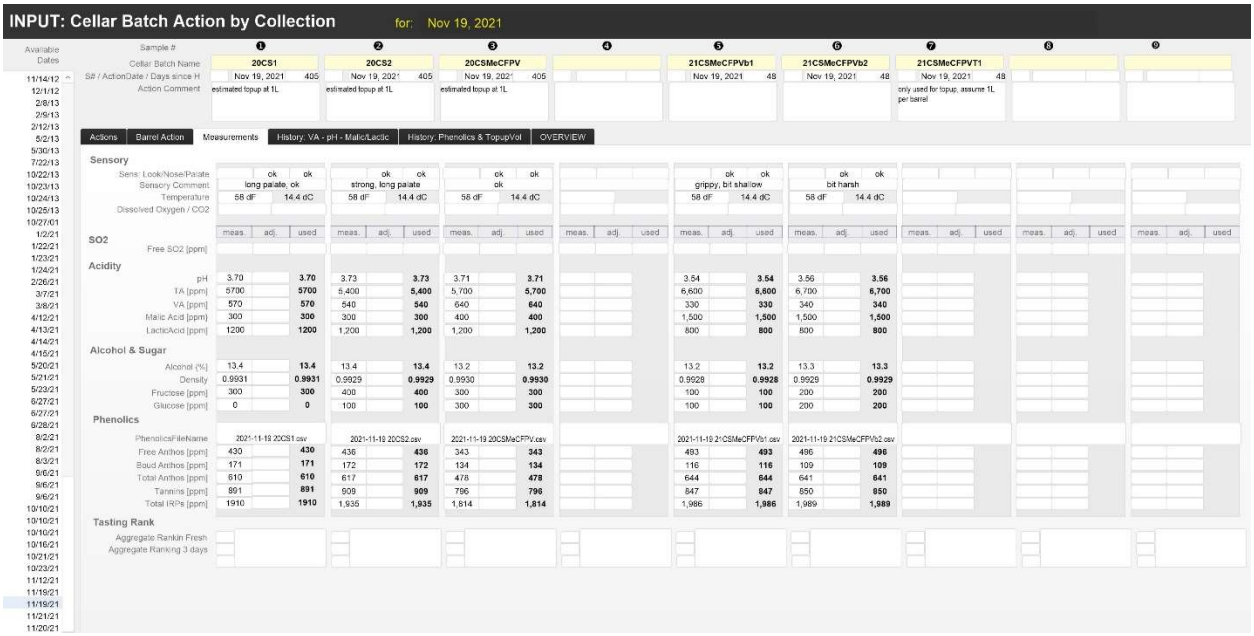
Our method of topping up has evolved significantly over the years. We started by simply removing the barrel bung, taking samples, filling the barrel back up from a shared topup tank, and putting the bung back in. The problem was contamination from the topup tank or the “dirty” air in the cellar contacting the wine while the barrel was open. The picture on the right shows the current setup. A topup tank is dedicated to each barrel and contains the same wine. A steel tank with Argon provides pressure. The topup tank links to the barrel with a plastic hose through the bung. The bung has entries for two more hoses with valves at the ends. One is to extract sample wine; the other is to let the air out of the barrel when it is topped up. When topping up is complete, we disconnect the hose leading to the barrel from the topup tank.

Data Management

We manage the elevage for cellar batches of the same vintage together. The following four screenshots of the layout INPUT: Cellarbatch Actions by Collections of November 21, 2021, shows the input for the topup of the 2020 and 2021 vintages

- The Actions tab shows the amount of the topup
- The Measurements tab shows the measurements taken
- The History VA… shows the acidity measurements in the context of past measurements
- The History Phenolics tab shows the history of the phenolics measurement and topup volumes


INPUT: Cellar Batch Action by Collection
for: Nov 19, 2021
Actions
Barrel Action
Measurements
History: VA - pH - Malic/Lactic
History: Phenolics & TopupVol
OVERVIEW


INPUT: Cellar Batch Action by Collection
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Actions
Barrel Action
Measurements
History: VA - pH - Malic/Lactic
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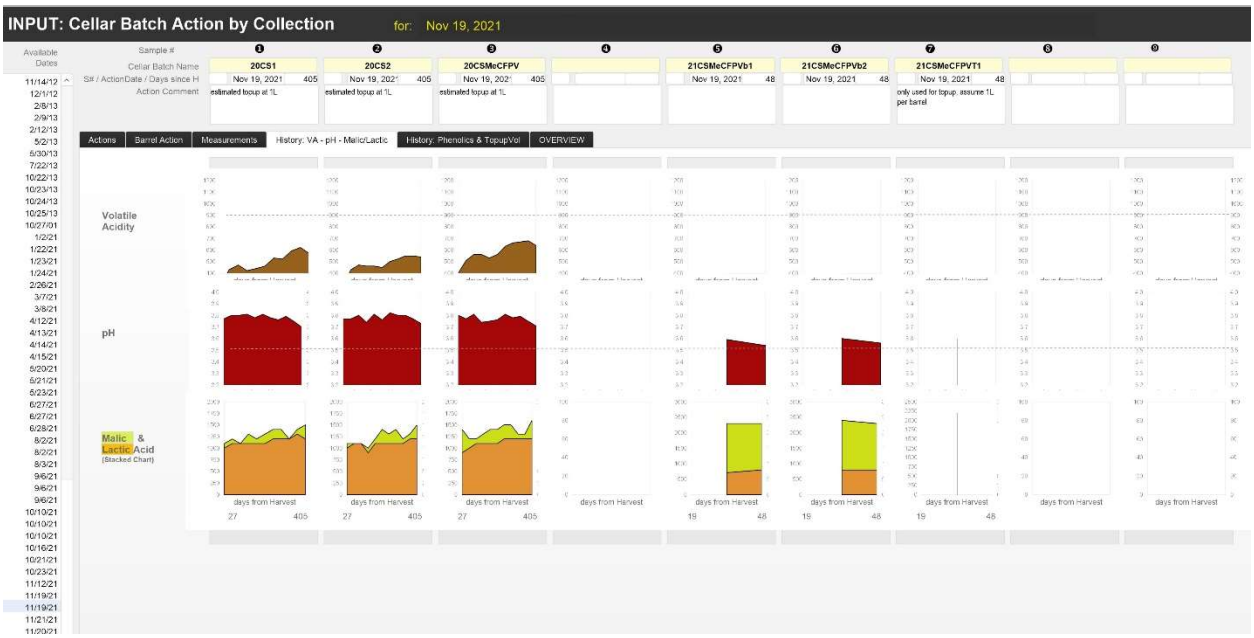

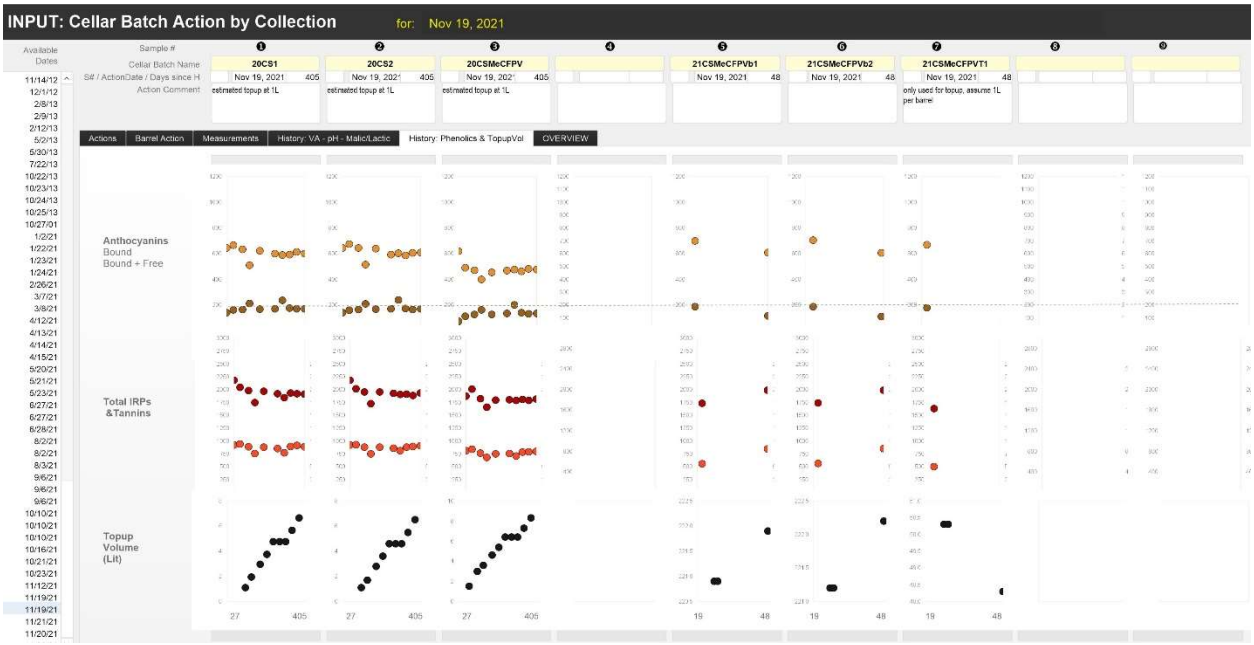

Last year: elevage during 2021

In 2021 we completed the elevage of the 2018 vintage, continued the elevage of the 2019 & 2020 vintages, and started the elevage of the 2021 vintage. The screenshot of the COMPARE: Vintages layout shows how they fared compared to previous ones. The first screenshot shows the summary for the vintages; the second shows the actions and measurements during elevage.

2018 turns out to be one of the better vintages: Phenolic content was high, second only to the record-setting 2013 vintage. Acidity was acceptable and required only a minor addition of tartaric acids. However, as the screenshot of the REVIEW Vintage 2018 – Elevage shows, in the barrels, Volatile Acidity rose early to a relatively high level, warranting fining with StabMicro

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Next page: Monitoring Malolactic Fermentation
Last updated: May 25, 2022

Monitoring Malolactic Fermentation

Malolactic Fermentation is the final step in making young wine. We cover it in the Cellar section because we manage it in the cellar. Following are key considerations

- Decide whether to inoculate the wine in the settling tanks with malolactic bacteria and add nutrition or rely on indigenous bacteria in the wine to start the malolactic fermentation on its own. Alternatively, prevent the conversion of malic acids by killing the indigenous bacteria with SO2.
- Monitor the progress of malolactic fermentation at every interaction with the cellar batch by measuring the concentration of malic and lactic acids. Malolactic bacteria require a minimum temperature of 63-65 dF, a bit higher than the average cellaring temperature; thus, the barrels will need to be heated.
- Since the malolactic fermentation creates CO2, barrels with active malo-fermentation need to have a CO2 escape valve

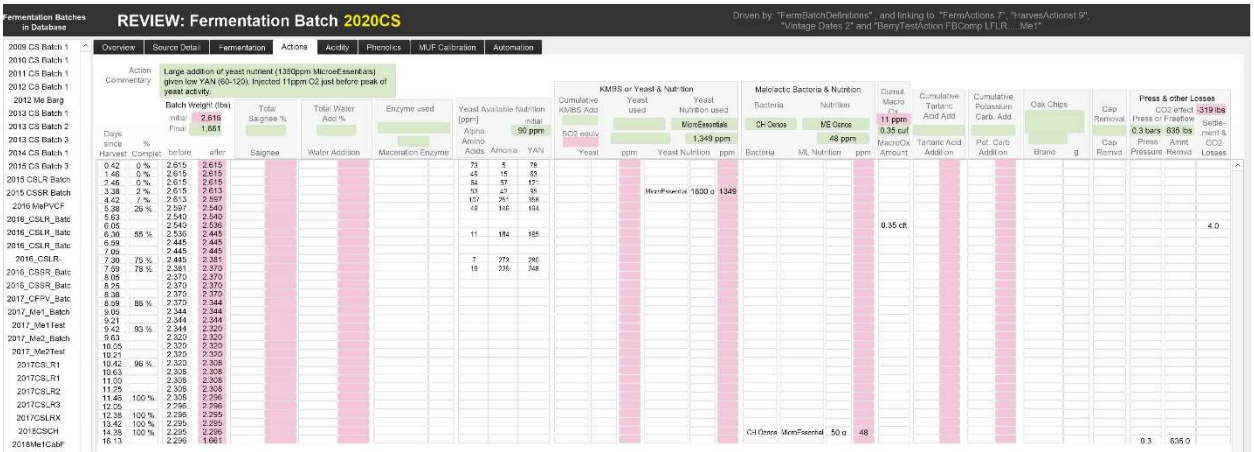
Malolactic Fermentation

Malolactic Fermentation transforms malic acids into lactic acids. It reduces the acidity and harsh fruitiness of the young red wine and helps to create a rounder mouthfeel. This fermentation is not induced by yeasts (like the Primary Fermentation) but by lactic acid bacteria. These bacteria occur naturally in the vineyard on the outside of the grape skins and find their way into the must during crush. Specialized laboratories can provide commercial ML bacteria if an earlier SO2 addition has killed the indigenous bacteria. If the Primary Fermentation was done naturally (i.e., no SO_2 was added at crush), then the Malolactic Fermentation is usually left to occur indigenously.

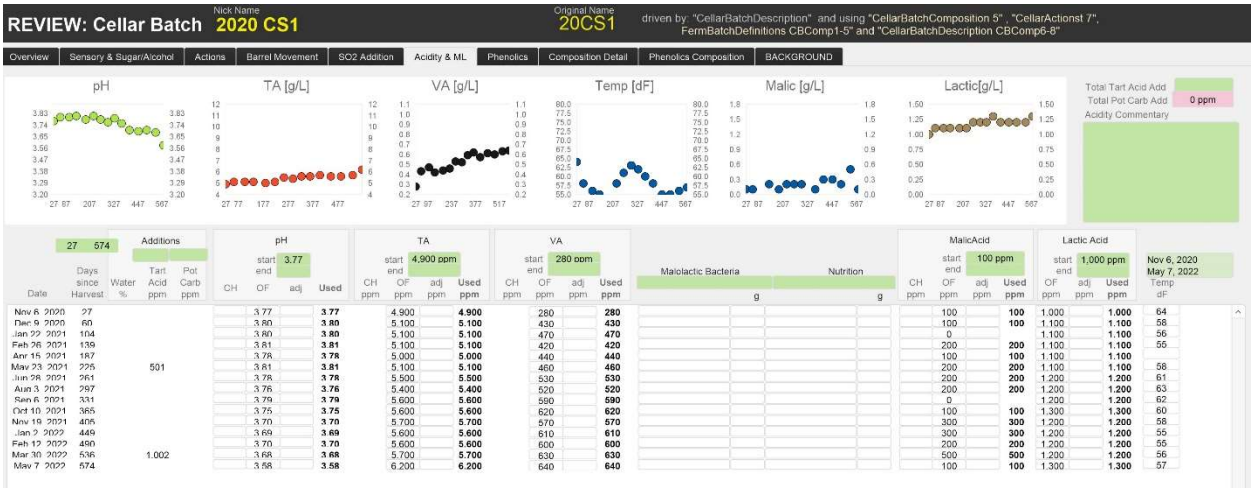
Malolactic Fermentations take one week to nine months, mainly depending on temperature. To track the progress, we measure the concentrations of malic and lactic acids. The ideal temperature for inoculated fast ML fermentations is close to 70°F. If we inoculate, we expect the fermentation to finish while the wine is still in the settlement tank. This is because the fermentation generates CO2, which must escape. Because our cellar is kept at 55-60 ºF, we experimented with heated boxes for the barrels with wine undergoing an extended ML fermentation. A heating pad slides under the barrel on a tray. We control the heat with a temperature probe inserted through the bung. The CO2 generated must be released through a special valve in the bung. Otherwise, the pressure built up pushes the bung out. We used these heating boxes only for two vintages.

Example: 2020 vs. 2021 vintage

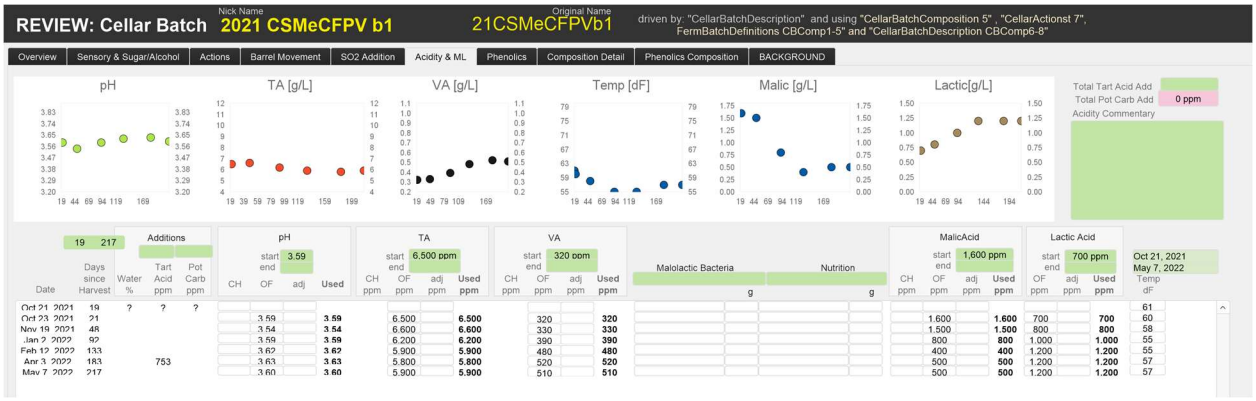
In 2020 we decided to inoculate the 2020CS fermentation batch at the end of the extended maceration period with CH Oenos 2.0 bacteria, as the Action tab in the REVIEW Fermentation Batch layout shows



Looking at the Acidity tab in the REVIEW Cellar Batch layout for the 2020CS1 barrel, we notice that the ML fermentation was completed before we filled the barrel; i.e., malic acids measured at 100 ppm, lactic acids at 1,000 ppm.



In 2021, we decided against inoculating with malolactic bacteria because we wanted to minimize interventions. Consequently, malic acids were measured still at 1,600 ppm at the beginning of the elevage. However, malolactic fermentation started on its own a few weeks later.



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Next page: Fining (with egg whites)
Last updated: May 25, 2022

Fining (with egg whites)

Fining is about extracting selected chemical compounds from wine. It works by adding a fining agent which binds to that compound and then precipitates so the sediment can be removed by racking. There are two kinds of fining agents: some hold an electrical charge which attracts large particles with the opposite charge, and others form a chemical bond with selected large particles. In large commercial wineries fining has become a sophisticated industrial process – quite an evolution from fining with egg whites practiced for over a hundred years.

Industrial Fining

With the industrialization of wine-making, we have seen a proliferation of fining agents developed and marketed by specialty chemical companies to adjust wine for a plethora of "faults."

The table on the right, extracted from the November 2015 Newsletter by Enartis-Vinquery (http://www.enartisvinquiry.com), highlights many fining agents they suggested for different effects. The list has only grown since.

Table 2 Fining Agents "What to use and when to use"

EFFECT	ACTIVE INGREDINET	PRODUCT - RATE	EFFECTIVENESS
Elimination of oxidized color	Carbon	**BLACK PF**	**++++**
	Caseinate	**PROTOCLAR**	**+++**
	PVPP	**STABYL**	**+++**
	Bentonite, PVPP, caseinate	**CLARIL SP**	**+++**
Clarification	Med- high MW gelatin	**CLARGEL PULVICLAR S GOLDENCLAR INSTANT**	**++++**
	Med MW gelatin	**HYDROCLAR 30**	**++**
	Low MW gelatin	**HYDROCLAR 45**	**+**
	Fish gelatin	**FINEGEL**	**++**
	Isinglass	**FINECOLL**	**+++**
Reduction of astringency	Low MW gelatin	**HYDROCLAR 45**	**++++ (Forefront)**
	Med MW gelatin	**HYDROCLAR 30**	**+++**
	Med MW gelatin	**CLARGEL PULVICLAR**	**++ (End palate)**
	Egg albumin	**BLANCOLL**	**+++ (Global tannic sensation)**
	High MW gelatin	**GOLDENCLAR INSTANT**	**+++ (Global tannic sensation)**
	Plant proteins	**PLANTIS AF**	**++**
Reduction of bitterness	Caseinate	**PROTOCLAR**	**+++**
	PVPP	**STABYL**	**+++**
	Isinglass	**FINECOLL**	**++**
	Bentonite, PVPP, caseinate	**CLARIL SP**	**++**
	Plant proteins	**PLANTIS AF**	**++**
Tannin & polyphenols removal	Low MW gelatin	**HYDROCLAR 45**	**+++**
	High MW gelatin	**CLARGEL PULVICLAR S GOLDENCLAR INSTANT**	**++**
	Egg albumin	**BLANCOLL**	**++**
	Isinglass	**FINECOLL**	**+**
	PVPP	**STABYL**	**+++**
Removal of proteins	Bentonite	**PLUXBENTON N PLUXCOMPACT BENTOLIT SUPER**	**+++ ++ ++**
	Tannins	**TAN CLAR**	**+**
Metal Removal Iron	Caseinate Plant proteins Blends	**PROTOCLAR PLANTIS AF CLARIL SP**	**++**
Metal Removal (Copper and Iron)	PVI-PVP and Blends with PVI-PVP	**STABYL PVI-PVP PRO XP, PRO FT**	**+++**

Fining has a long tradition, especially in Bordeaux. There, egg whites had been used for decades to tame strong tannins, reduce astringency and give the wine a rounder mouthfeel. Recently in Europe, however, regulation has been passed that forces winemakers to disclose on the bottle label any addition of animal products – e.g., egg whites. At the same time, the disclosure requirement does not apply to industrial fining agents. The

consequence is that egg whites are being replaced by industrially produced albumin, the key fining agent in egg whites.

Fining with egg whites

Egg whites are one of the oldest fining agents. The positively charged peptide linkages of the albumin and globulin proteins form hydrogen bonds with negatively charged hydroxyl groups found in large tannins. Once the two attach, they become neutralized, and the particles settle due to their heavier weight.

Process: To start, the egg whites need to be separated from the egg yokes. Then the egg whites (one-third) are mixed with a 0.7% saltwater solution (two-thirds) because globulin is only soluble in salted water. Then the solution is added to the wine and stirred in well. Finally, a week later, the wine is racked.

Timing: The opinions on when to fine vary. Some argue red wines should be fined and racked just before assemblage and bottling; others argue red wines should be fined right after malolactic fermentation is completed. We tried egg white fining for the first time in the spring of 2013, right before bottling on the 2010 vintage.

The optimal **Dosage** varies anywhere between 1 and 6 egg whites per barrel. So first, we need a test for the optimal dosage. We do this by tasting 1-liter samples of wine at concentrations equivalent to 1, 3, and 5 egg whites per barrel. We call these samples 1E-wine, 3E-wine, and 5E-wine, respectively. Because the amount of egg whites needed for 1 liter is so tiny, we first create a sample with a concentration of 22 egg whites per barrel (22E-wine) and then dilute it down. Here is the process we use to prepare the samples:

1. Mix 1 egg white (~32 g) with 65 ml of water with 0.65g of salt and stir well (the "1E-solution"); the total is ~95 g.
2. Pour 4.5 g of 1E-solution into 450ml of unfined wine to get the 22E-wine
3. Mix 45ml of 22E-wine with 955 ml of unfined wine to get a 1 l sample of a 1E-wine
4. Mix 140 ml of 22E-wine with 860 ml of unfined wine to get a 1 l sample of a 3E-wine
5. Mix 240 ml of 22E-wine with 760 ml of unfined wine to get a 1 l sample of a 5E-wine

We then taste the samples over 5 days and select the solution which tastes best.

For more background on fining with egg whites, consult the following link:

http://www.starchefs.com/cook/wine/technique/egg-white-wine-fining

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Next page: Filtering (reverse osmosis)
Last updated: May 25, 2022

Filtering (reverse osmosis)

Filtering separates a solution into two parts: the Permeate is the part that passes through (permeates) the filter, and the Retenate is the part retained by the filter.

- In conventional filtering, the Retenate is the part to be taken out, and the Permeate is the part to be kept. It removes large particles in a solution that do not readily settle (and can be taken out as sediment).
- In reverse osmosis filtering, the Permeate is the part to be taken out, and the Retenate is the part to be kept. It removes the smallest atoms or molecules in a solution.

The challenge in all filtering is the clogging up of the filter membrane. In conventional filtering, it is solved by replacing or scraping the filter. In reverse osmosis filtering, clogging is prevented by moving the solution at high speed tangentially along the filter surface under high pressure (thus its other name: Cross-Flow Filtering). Clark Smith (see https://whoisclarksmith.com) pioneered reverse osmosis filtering in 1992 to remove Volatile Acidity and alcohol reduction in wine. Since then, "reverse osmosis" or "cross-flow" filtering has become widely used, and many large wine equipment manufacturers and consultants sell or rent the equipment. One of the smallest viable cross-flow filters on the market is the Sweetspotter by VA Filtration in Napa, CA (www.vafiltration.com). We use their smallest model, the SS4-1-10. The remainder of this page is organized as follows:

- Basic Concepts: explains how we use the Sweetspotter to find the optimal alcohol level in wine and reduce Volatile Acidity.
- Description: shows the internal logic of the Sweetspotter in a flow diagram and provides pictures
- Preparation: describes how the Sweetspotter is rinsed before use
- Use for Alcohol Reduction: describes how the Sweetspotter is used for reducing alcohol
- Use for VA Reduction: explains how the Sweetspotter reduces Volatile Acidity.
- Cleaning: explains how the Sweetspotter is rinsed, cleaned, and filled before storing
- Regeneration: explains how the pH Column and the Anion Exchange Column are refreshed or regenerated.

It serves as our user manual for the Sweetspotter

Basic Concepts

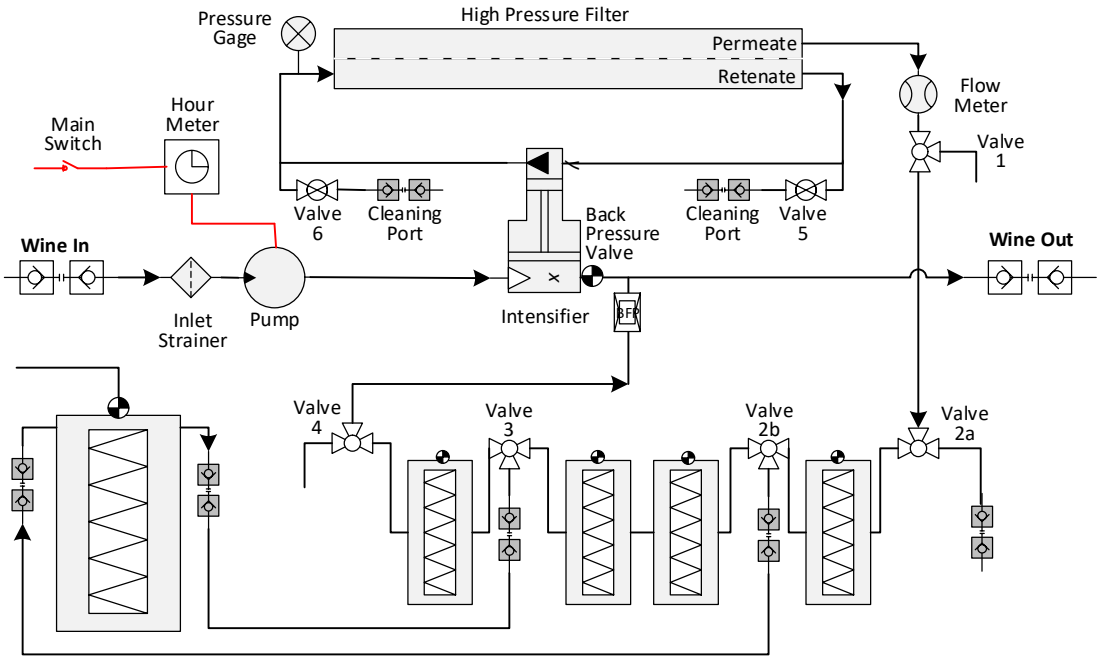
The basic idea behind a "reverse osmosis" or "cross-flow filter" is a mechanism to remove the smallest particles in a solution. The solution moves sideways under high pressure past a filter with microscopic pores. The continuous flow prevents the larger particles from clogging up the filter, and the high pressure pushes the small particles through the filter. The small particles in this application are water molecules (H_2O), small alcohol molecules (ethanol), and small acid molecules (acetic acid). The other molecules which make up the wine are much larger and remain behind the membrane. We use the Sweetspotter to reduce the ethanol concentration (i.e., alcohol) and remove Volatile Acidity (i.e., acetic acid) from the wine.

- **Reducing Alcohol:** In many regions in California, grapes get more sunshine hours and warm weather days combined with cool nights than, say, in the Bordeaux. Consequently, the grapes can be picked at higher maturity levels, implying higher sugar levels. On the one hand, the higher maturity levels translate into better phenolics and more fruit-forward wines; on the other hand, the higher sugar levels translate into more alcohol. Thus the demand for alcohol reduction. Studies have shown that wine with a given alcohol level of, say, 15% may have "alcohol sweetspots," a significantly better nose and taste at specific lower alcohol levels (say at 12.5%, 13.3%, and 14.6%). To find these sweetspots, we take a sample from the wine and reduce its alcohol from 15% to 12%. Then we create test samples in 0.1% alcohol increments from 12% to 15% by mixing the reduced alcohol sample with the original in the required ratios. Finally, we taste all 30 samples. Note that this process requires many samples because the sweetspots tend to be very narrow, i.e., the wine may taste great at 13.6% but poor at 13.5% and 13.7%.
  To remove alcohol, we need a reverse osmosis filter and a distiller. In the first step, we extract a combination of water and alcohol (the "Permeate") from the wine; the leftover "Retenate" is essentially the same wine with now lower alcohol and less water. The second step is to distill the Permeate, i.e., remove the alcohol from the water with a distiller. The third step is to recombine the remaining water left in the distiller with the Retenate.
  The challenge in this process is distillation; it requires a government license which is hard to get. Without such a license, we need to outsource the distillation. A simpler alternative to distilling is to add water back in the amount of the Permeate (note: we may lose small particles other than ethanol and water, which may have passed through the filter). A much simpler alternative to the whole process is to create the test samples by adding different amounts of water to the wine.

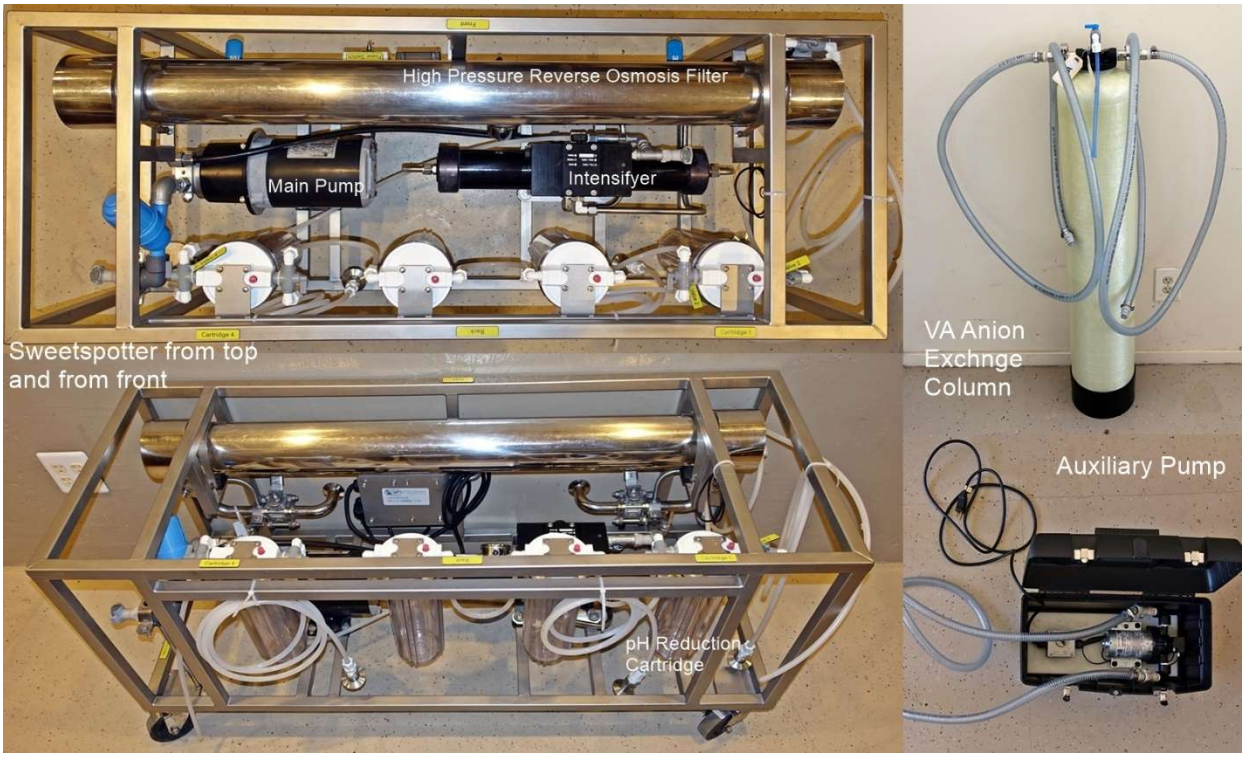
- **Correcting Excessive Volatile Acidity:** Volatile Acidity refers to the steam-distillable acids in wine. They consist primarily of acetic acid (CH_3COOH), which gives vinegar its characteristic aroma and is therefore considered a fault in wine at a concentration exceeding 900 ppm (the legal limit is 1200-1400 ppm). Volatile acids are mainly formed a) by yeasts during fermentation and b) by spoilage organisms (Acetobacter plus air, or lactic acid bacteria) during fermentation and aging.
  Acetic acids are tiny molecules; they can be removed in three steps. The first step extracts a combination of water, alcohol, and acetic acids (the "Permeate") from the wine through a cross-flow filter - the leftover "Retenate" is essentially the same wine with now lower alcohol, less water, and less acetic acids. Next, we bind the acetic acids in the Permeate to a resin in an anion exchange column leaving only the water and the alcohol. The third step is to recombine what remained (water & alcohol) in the Permeate with the original wine.

Description

The following diagram describes the flows inside a Sweetspotter. A pump delivers the wine to an Intensifier that further increases the pressure in the wine flowing past the membrane (when the Back Pressure Valve is closed) to 300-700 psi. The smallest particles pass through the membrane at this high pressure and constant flow and constitute the Permeate. The Permeate can then be collected at Valve 1 for alcohol reduction or filtered through various filters that take out the acetic acids before recombining with the wine.



The following picture shows on the left the sweetspotter from the top and the front and, on the right, the anion exchange column (for VA reduction) and the auxiliary pump (for cleaning).



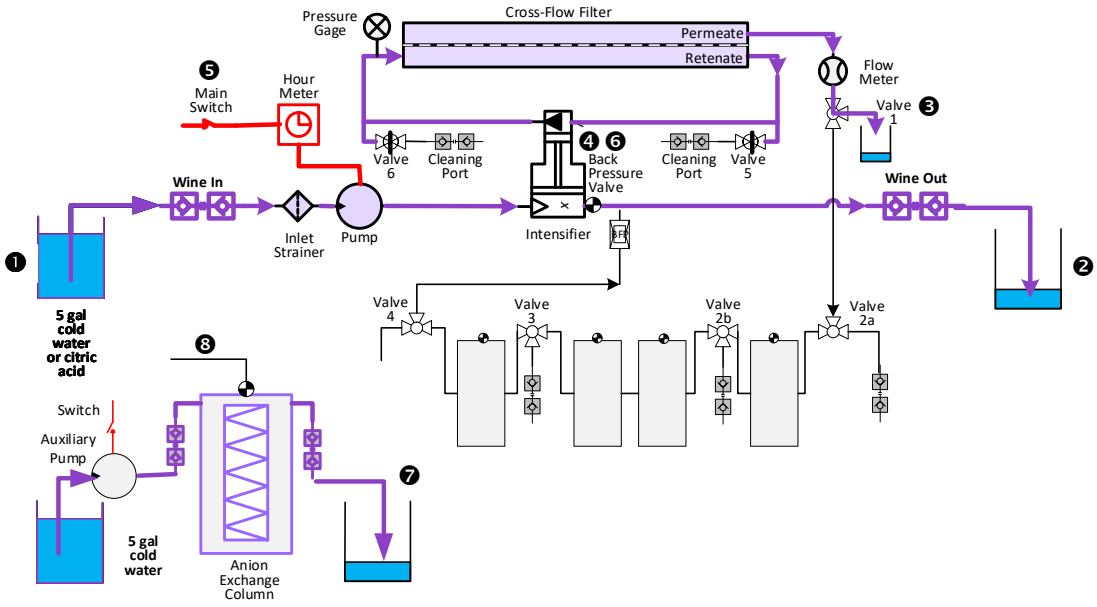
The remainder of this page is an "operations manual" for using the sweetspotter.

3. Preparation

We store the sweetspotter long-term with a 30% ethanol solution inside the reverse osmosis filter, the main pump, the intensifier, and the pipes and hoses. For short-term storage, we use a 1% solution of citric acids and sulfur (in KMBS, potassium metabisulfite). This prevents the growth of spoilage organisms inside the machine during storage. The anion exchange column is stored with KOH, potassium hydroxide, inside. Before use, we need to rinse the sweetspotter and the anion exchange column. This section describes the rinsing process before first use or between treatments of different wines

If the sweetspotter has been stored for a long time with ethanol, it needs to be blown out and the ethanol stored for reuse; then, the rinsing continues the same as when stored for a short term. This initial rinsing consists of 3 cycles: cold water rinse, followed by 1% citric acid rinse (0.5lbs citric in 5 gal water), followed by another cold water rinse. Each rinse follows the same process:

1. Place end of Wine Inlet hose into five gal bucket containing cold water or citric acid
2. Place end of Wine Outlet hose into empty five gal bucket
3. Turn Valve 1, so it points the open-ended tube into a catch bucket
4. Open Back Pressure Valve on Intensifier (2 turns counter-clockwise)
5. Turn on Main Switch and rinse for 5 minutes
6. Close Back Pressure Valve on Intensifier (2 turns clockwise) for 2 minutes to ensure complete water rinsing, then open again and let run until water exiting Wine Outlet Hose is free of taste when rinsing with water



If the system is used for VA reduction, the Anion Exchange column needs to be rinsed as well:

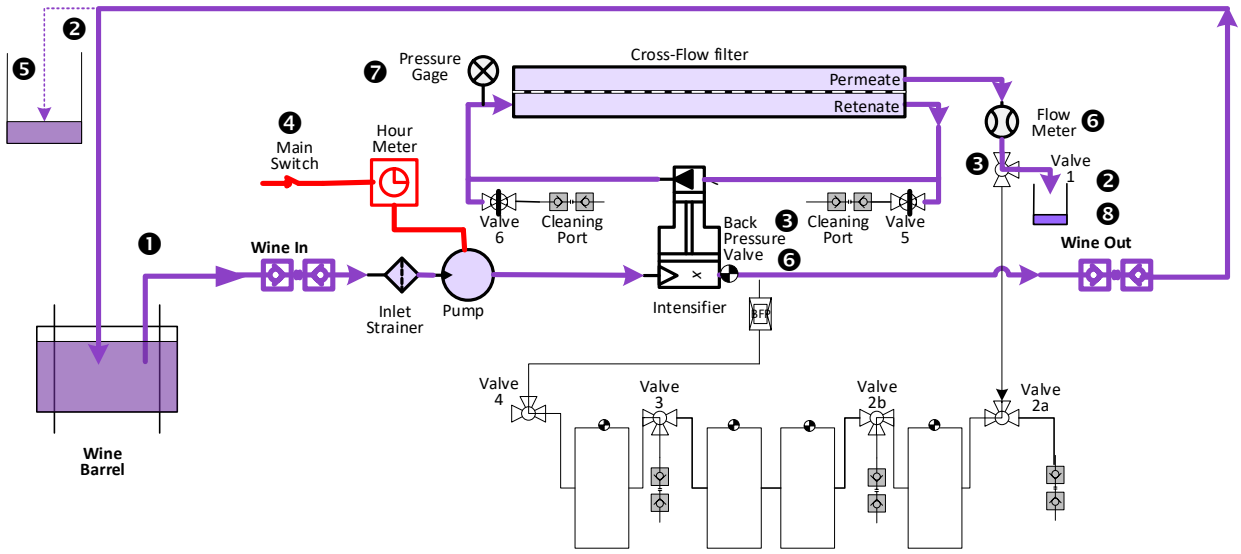
1. Blow out at 10-15 psi, then rinse until water exiting the column has reached a pH of 10.5.
2. Check that the column is full using the bleeder valve on top

4. Use for alcohol reduction

The first step in alcohol reduction is to collect a required amount of Permeate in a collection bucket. The system is started up as follows:

1. Place the end of the Wine Inlet hose into the barrel to be treated
2. Leave the end of the Wine Outlet hose in an empty five gal bucket
3. Check the valve positions:
    a. Valve 1 so the Permeate can flow into a collection bucket. The hose should be taped to the bucket because pulsation will otherwise dislocate it.
    b. Back Pressure Valve: open (2 turns counter-clockwise if closed)
4. Turn on Main Switch (turns on Pump)
5. Watch for wine exiting the Wine Outlet hose into the bucket (this takes ~10 seconds). As soon as we can taste wine at the Wine Outlet hose, we turn off the Main Switch, place the end of the Wine Outlet hose into the barrel and turn on the Main Switch again
6. With wine flowing again, close the Back Pressure Valve (turn clockwise thumb tight) and watch the flow in the Flow Meter.
7. The system will pulse as pressure builds up. Watch the Pressure Gauge; pressure should not exceed 700 psi; if it does, shut the system off and clean the Cross-Flow filter.
8. Taste the liquid exiting Valve 1 for alcohol. The rinsing water has been flushed out when we taste alcohol, and the Permeate can be collected. Change the bucket, and again

tape the hose to the bucket. Put a hydrometer in the bucket and monitor the average alcohol concentration.



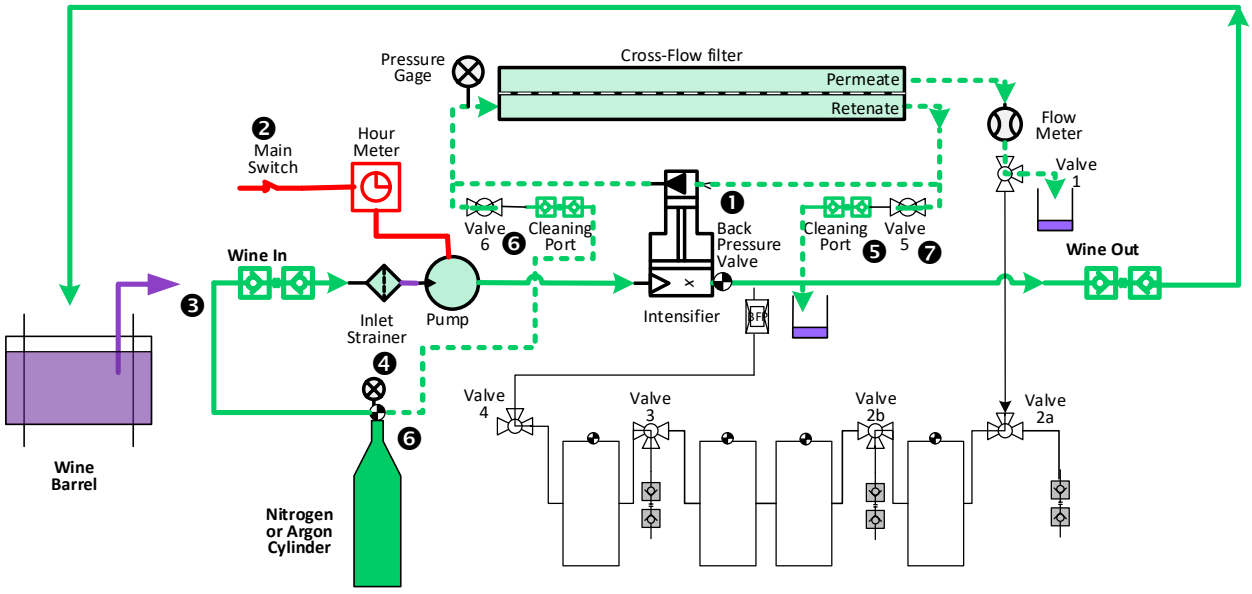
We keep the system running until enough Permeate is collected to reduce the alcohol in the wine to the target level. Suppose the alcohol concentration in the Permeate is roughly the same as the starting alcohol level in the wine, and the flow rate of the Permeate is ten gals/hr. In that case, a 10% reduction in the alcohol concentration of the wine (say from 15% to 13.5%) should take only 6 gallons of Permeate to be replaced with distilled water. Under normal circumstances, the Permeate flow is ~7 gals/hr, and the Retenate Flow is ~70 gals/hr.

Process recording: The following should be measured and recorded every 15 or 30 minutes: a) Retenate pressure, b) Permeate Flow, c) Alcohol concentration in Permeate retained, d) Cumulative volume of retained Permeate.

At the end of the Permeate production cycle, we need to flush out the system with Nitrogen or Argon to reduce the loss of wine, Retenate, and Permeate:

1. Open the Back Pressure Valve to reduce the pressure in the cross-flow filter
2. Turn off the main switch to stop the pump
3. Disconnect the Wine-In hose, attach a Nitrogen or Argon tank instead and blow out the Pump and Intensifier at 20 psi until no more wine comes out of the Wine-Out return hose.
4. Disconnect the Nitrogen tank from the Wine-In port and attach it to the Cleaning Port on the ingoing side.
5. Attach a hose to the Cleaning Port outgoing side, which leads to a collection bottle for the Retenate and open Valve 5

6. Open the pressure on the Nitrogen or Argon tank to 20 psi, then open Valve 6 to flush out the Retenate side of the cross-flow filter.
7. Close Valve 5 to fill the Retenate side with gas and flush out the Permeate side of the cross-flow filter.



Now the wine, Permeate, and Retenate are flushed out, the system is full of inert gas and is ready for rinsing and cleaning.

5. Use for VA Reduction

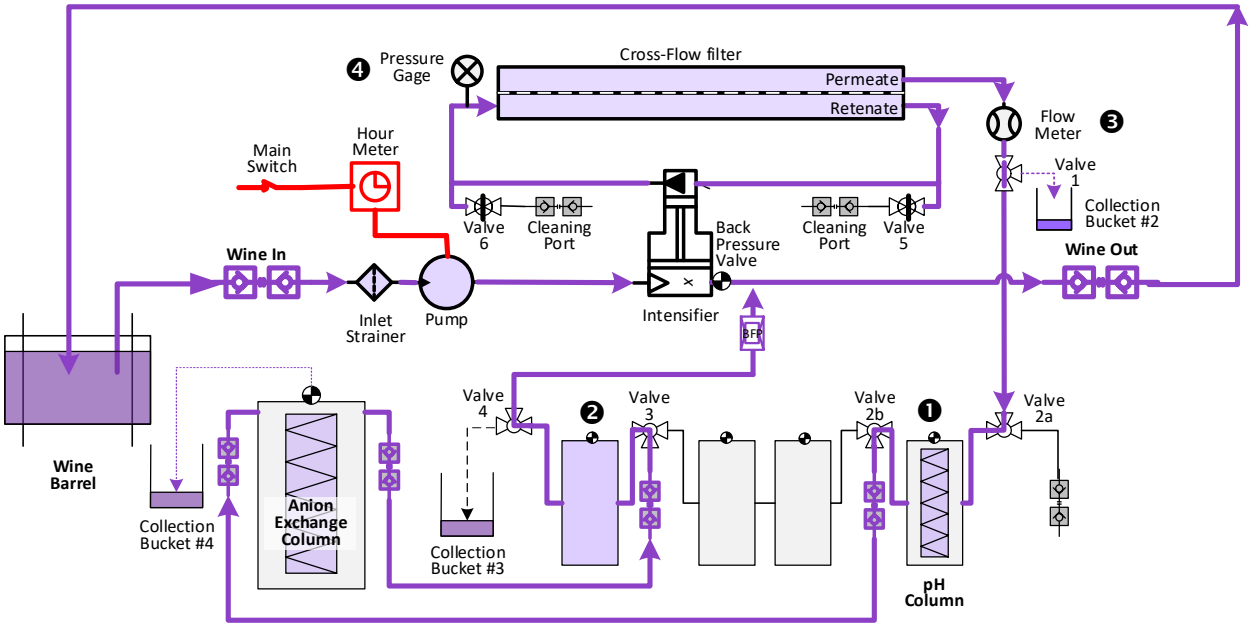
Acetic acids are tiny molecules; they can be removed in three steps.

- The first step extracts a combination of water, alcohol, and acetic acids (the "Permeate") from the wine through a Cross-Flow filter (the leftover "Retenate" is essentially the same wine, but now with lower alcohol, less water, and less acetic acids).
- The second step first reduces the pH in a pH Column and then binds the acetic acid in the Permeate to a VA resin in an anion exchange column leaving only the water and the alcohol. The VA resin is designed to remove molecular acetic acid and not the ionic form – acetate ion. When the Permeate entering the cartridges has a pH approaching 4, that Permeate needs to be run through a pH correction cartridge first, followed by the VA resin. This increases the removal rate of VA from the wine. The reason is: as the Permeate hits the resin, the pH rises due to residual KOH. As the pH increases to 4.7, the amount of molecular acetic to acetate is 1 to 1. At this point, it is typical to see only a 50% reduction in the level of VA from the Permeate. If the pHC resin is used first, this lowers the Permeate pH to less than 3, and when it hits the resin, it remains fairly low – resulting in a higher concentration of molecular acetic, which then gets adsorbed on the resin. The result of the pHC is also to balance out the pH change in the wine.

- The third step is to recombine what remains (water & alcohol) in the Permeate with the original wine.

The VA Reduction Startup Process is:

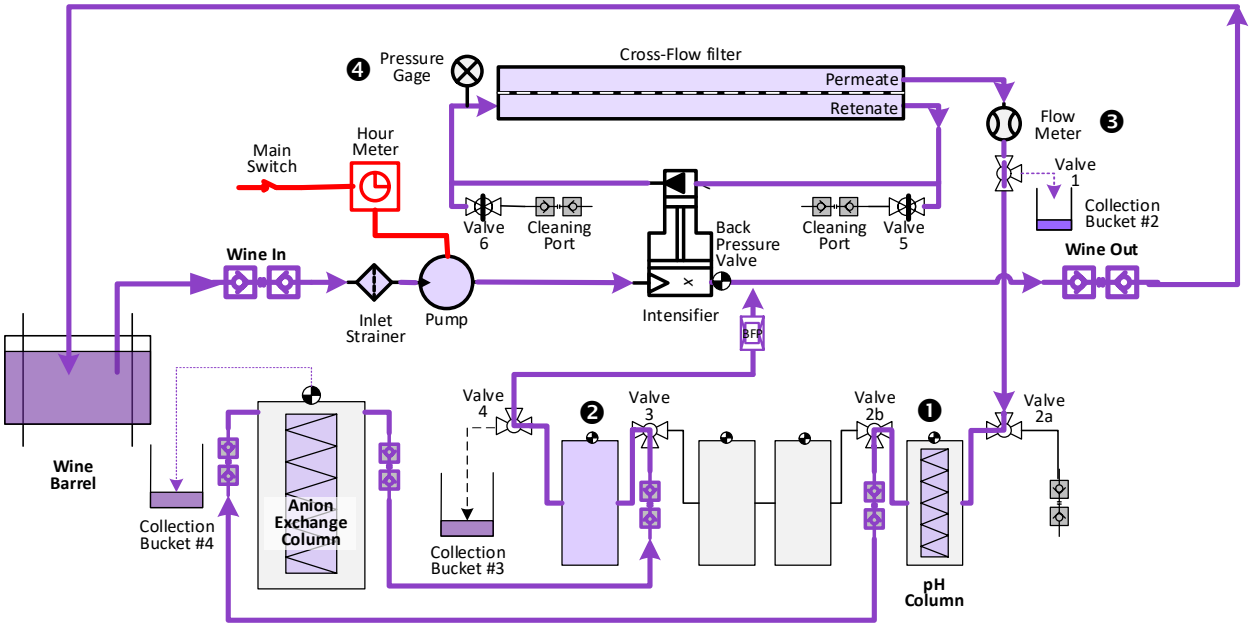
1. Place the end of the Wine Inlet hose into the barrel to be treated
2. Leave the end of the Wine Outlet hose in an empty five gal bucket
3. Insert the pH Column into filter housing 1 and connect the VA Column at Valve 2 and Valve 3 and check the Valve positions
    a. Valve 1, so the Permeate flows into a collection bucket
    b. Valve 2a, so the Permeate can flow into pH Column
    c. Valve 2b, so the pH adjusted Permeate flows to the VA column
    d. Valve 4, so the treated Retenate flows into a collection bucket
    e. Back Pressure Valve: open (2 turns counter-clockwise if closed)
4. Turn on the Main Switch (turns on the Pump)
5. Watch for wine exiting the Wine Outlet hose into the bucket (this takes ~10 seconds)
6. As soon as we taste the wine at the Wine Outlet hose, we turn off the Main Switch, place the end of the Wine Outlet hose into the barrel and turn on the Main Switch again
7. With wine flowing again, close the Back Pressure Valve (turn clockwise thumb tight) and watch the flow in the Flow Meter. The system will pulse as pressure builds up.
8. Taste liquid exiting Valve 1 for alcohol; when so, turn Valve 1 and see liquid filling up cartridge housing 1
9. Bleed the cartridge housings by pressing Red Bleeder valves on top of housings. Leave the bleeder valve on the VA column open until we see liquid exiting
10. Filling the VA column takes a long time (~20 minutes?). Taste liquid exiting Valve 4 for alcohol; when we taste the alcohol, turn Valve 4 180 degrees to return the Permeate to the Wine Out and barrel (never leave Valve 4 in a 90-degree position – otherwise, the cartridge housing will burst)



The VA Reduction can be left to run for as many hours as is necessary. To reduce VA in a single barrel by 20%, we need to treat 40% of the volume as permeate. The flow rate should be 10-12 gal/hr, so a 20% VA reduction in a barrel should take approx. 2 ½ hours. To reduce VA by 50%, we need to treat 70% of the volume as permeate – this takes approx. 4 hrs.

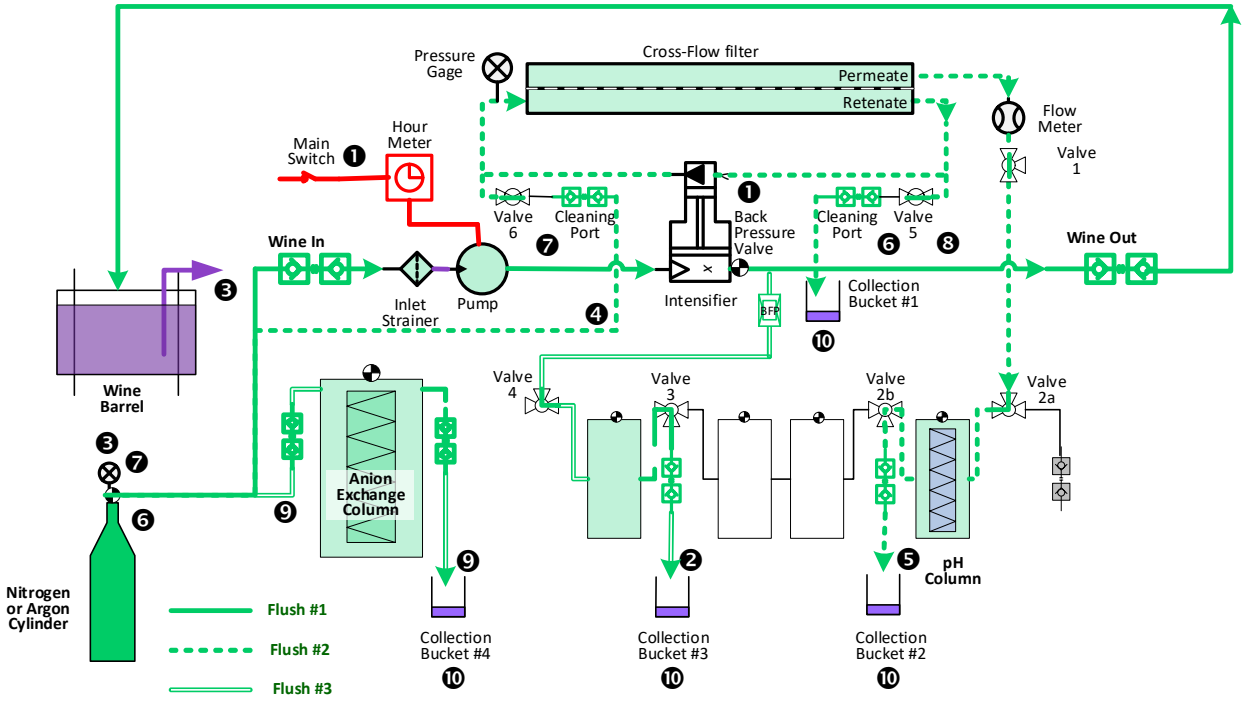
We need to take the following measurements every 30 minutes:

1. Measure the pH of the permeate exiting the bleeder valve on the column with the pH Column cartridge. The pH should be 2.5 – 3.5. When pH rises above 3.5, the pH Column is saturated and needs to be replaced. That process is:
    a. Open the Back Pressure Valve, turn off Main Switch and wait 2 minutes
    b. Close the Valves 2a and 2b. Unscrew the filter housing; pour out the Permeate, blow out and replace the pH Column; pour back the Permeate into the filter housing, and screw it back on
    c. Turn the Main Switch on, wait 1 minute, then close the Back Pressure Valve.
2. Measure the pH of the Permeate exiting the bleeder valve on cartridge 4. The pH should be 6 – 10.5. When the pH drops below 6, the VA column is saturated and requires regeneration (see VA regeneration).
3. Watch the Flow Meter. The permeate should be flowing at 10-12 gal/hr or 0.16-0.2 gal/min
4. Watch that the system is pulsing; record the permeate pressure. If the pressure exceeds 600psi, the membranes are fouled, and the system needs to be cleaned.



At the end of a VA Reduction run, we empty the contents of all Collection Buckets into the wine barrel. Then we need to flush out the system with Nitrogen or Argon to reduce the loss of wine, Retenate and Permeate. This takes three separate flushes as follows:

1. Open the Back Pressure Valve to reduce the pressure in the cross-flow filter and turn off the main switch to the pump
2. Disconnect the outgoing side of the Anion Exchange tank and pour the contents into Collection Bucket #3 at the incoming side of Valve 3
3. Flush #1: Disconnect the Wine-In hose, attach a Nitrogen or Argon tank instead and blow out the Pump and Intensifier at 20 psi until no more wine comes out of the Wine-Out return hose. Then open the empty filter container and pour the contents into Collection Bucket #3.
4. Disconnect the Nitrogen tank from the Wine-In port and attach it to the Cleaning Port on the ingoing side.
5. Disconnect the incoming side of the Anion Exchange tank at Valve 2b and put the hose into Collection Bucket #2 for Permeate exiting the pH Column.
6. Attach a hose to the Cleaning Port outgoing side, which leads to Collection Bucket #1 for the Retenate and open Valve 5
7. Flush #2: Open the pressure on the Nitrogen or Argon tank to 20 psi, then open Valve 6 to flush out the Retenate side of the cross-flow filter.



8. Close Valve 5 to fill the Retenate side with gas and flush out the Permeate side of the cross-flow filter through the pH Column into the collection bucket; then unscrew the pH Column cartridge, remove pH Column poor Permeate collected into Collection Bucket #2, and close Valve 2a.
9. Flush #3: Disconnect the Nitrogen or Argon tank from Cleaning Port at Valve 6, attach it to the incoming side of the Anion Exchange Column and blow out the Anion Exchange Column into the Collection Bucket #4.
10. Empty the Collection Buckets #1 to #4 into the Wine Barrel.

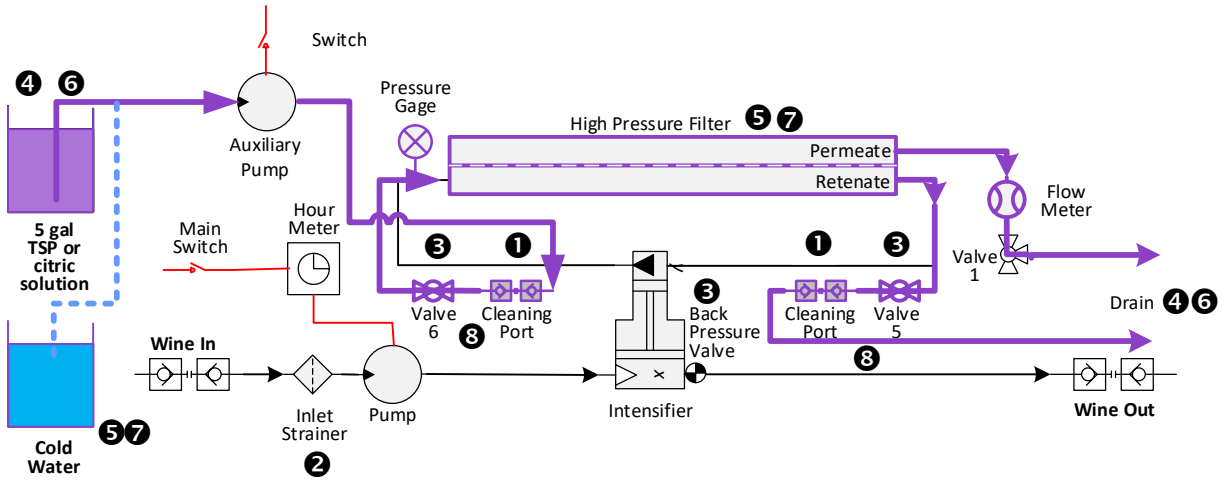
6. Cleaning

At the end of use, we need to clean the system thoroughly and then fill it with a preservative solution to prevent the build-up of spoilage organisms. The cleaning takes two steps: first, we clean the cross-flow filter on its own, then clean the pump and intensifier with the cross-flow filter in the loop. We clean the strainer, filter cartridges, and hoses separately.

The process for cleaning the cross-flow filter is:

1. Connect the external pump to the Cleaning Port 1, and the drain hose to the Cleaning Port 2
2. Open the Strainer and remove the cartridge. Rinse debris under running water and return to the housing
3. Open Valves 5 & 6 and close the pressure valve

4. TSP cycle: Dissolve 0.5 lbs of TSP in 5 gallons of 130 dF water (i.e., 1% TSP solution) in the Cleaning Solution bucket and turn the pump on to move the solution through the membranes to drain. Expect 8-10 gpm of flow. Monitor the outflow. At first, it is dark brown, then turns to light brown, and then almost transparent. When 5 gallons are used up, turn the pump off. Repeat the TSP wash at step 4 until the outflow is clear.
5. Coldwater rinse: Hook the Cleaning Port 1 to the cold water supply and flow cold water until the outside of the filter feels cool.
6. Citric rinse: Dissolve 1 lb of Citric Acid in 5 gallons of cold water (i.e., 2% Citric solution) in the Cleaning Solution bucket. Reconnect the Cleaning Port 1 to the external pump and turn the pump on to move the Citric solution through the membranes to drain. Expect 8-10 gpm of flow. Monitor the outflow. At first, it is yellow; then, it turns almost transparent. When 5 gallons are used up, turn the pump off.



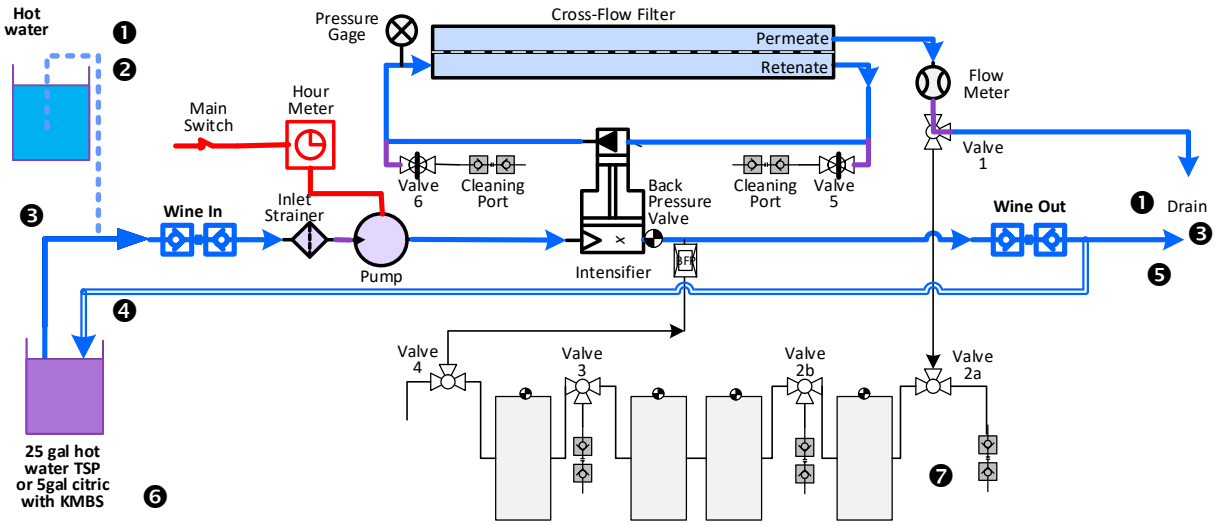
7. Coldwater rinse: Hook the Cleaning Port 1 to the cold water supply and flow cold water until the outside of the filter feels cool.
8. Close Valves 5 & 6 and disconnect hoses from the Cleaning Ports

The next step is to clean the whole system. The process is:

1. Put the Wine-In hose into the hot water bucket. Point the Wine-Out hose and the hose exiting Valve 1 to the drain
2. Flush system with hot water: Open the Back Pressure Valve; turn the main switch on; rinse for 3 minutes; close the Back Pressure Valve for 2 minutes – and repeat until the water is clear. This can take 25 gallons. Turn the main switch off and wait 1 minute.
3. Put the Wine-In hose into the bucket with 25 gallons of 1% TSP solution in hot water and flush: Open the Back Pressure Valve; turn the main switch on; rinse for 3 minutes; close the Back Pressure Valve for 2 minutes – and repeat until the water is clear. Turn the main switch off and wait 1 minute.
4. Put Wine-Out hose into the bucket with a hot water TSP solution (refilled if necessary) for circulation (clamp down hose on bucket because of pulsation): Open the Back Pressure Valve; turn the main switch on; circulate for 3 minutes; close the Back

Pressure Valve for 2 minutes. Turn the main switch off and wait 1 minute. If water is not transparent/light brown, go back to step 1.

5. Put the Wine-Out hose back to drain, connect the Wine-In hose to a hot water tap, and flush the system with hot water: Open the Back Pressure Valve; turn the main switch on; rinse for 3 minutes; close the Back Pressure Valve for 2 minutes – and repeat until the water is clear or slightly yellow. Turn the main switch off and wait 1 minute.
6. Prepare a 5-gallon 2% citric solution in a bucket and add 1% KMBS. Then put the Wine-In hose into the bucket and flush the system: Open the Back Pressure Valve; turn the main switch on; rinse for 3 minutes; close the Back Pressure Valve for 2 minutes. Turn the main switch off and wait 1 minute. All hoses are now full of citric/1%KMBS combination.
7. Clean all the filter cartridges and corresponding valves separately in TSP – water – citric – water cycle.



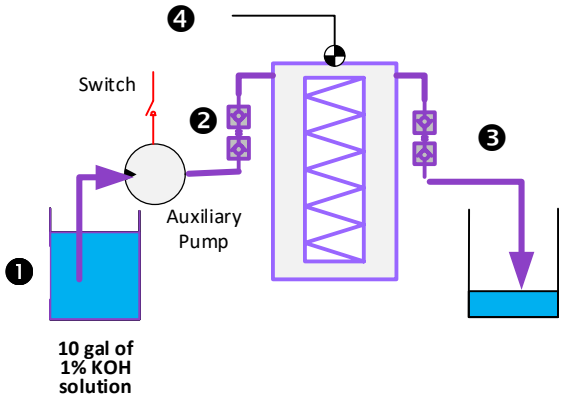
Now the system is ready for storage. If the system remains unused in storage for more than six weeks, then the citric/KMBS solution should be refreshed to prevent the buildup of spoilage organisms. For a more extended storage period, fill the system with 30% Ethanol.

7. Regeneration

The final step is to regenerate the pH Column Cartridge and the Anion Exchange Column if they have been used (for VA reduction).

The Anion Exchange Column is regenerated with KOH (Potassium Hydroxide). The process is as follows:

1. Put the inlet hose from the auxiliary pump into a bucket with 10 gallons of KOH solution (8lbs of Potassium Hydroxide)
2. Connect the outlet hose of the auxiliary pump to the inlet of the Anion Exchange Column
3. Put the outlet hose from the Anion Exchange Column into a waste bucket
4. Turn on the auxiliary pump and check that the Anion Exchange column has no air by opening and closing the bleeder valve.



The Anion Exchange Column is stored full of KOH solution.

We let VA Filtration regenerate the pH Column resin because it involves highly toxic material. (VA Filtration uses 30% Hydrochloric Acid at 22psi). Contact at VA Filtration: Sue Poynter, office: 707-552-2616 x102

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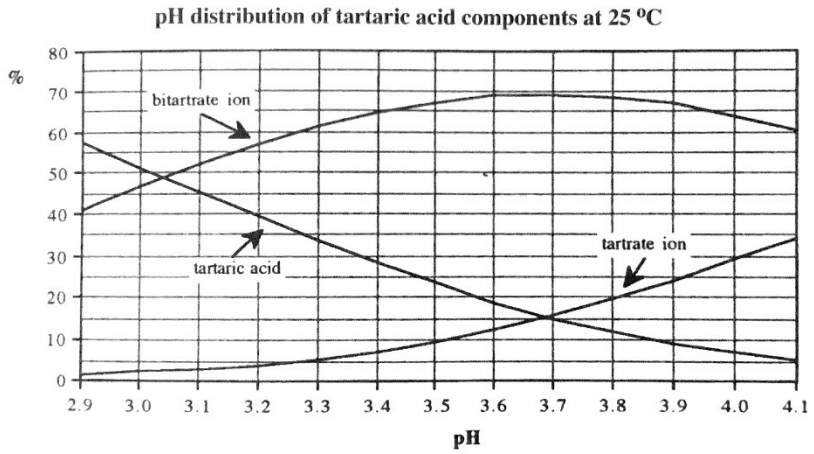
Cold Stabilization

We can use Cold Stabilization to reduce the formation of sediments (i.e., prevent the precipitation of crystals when bottles are stored at low temperatures for extended periods) and reduce the amount of tartaric acid in wine.

Theory



Tartaric Acid (H_2T) dissociates into Bitrate (HT^-) and Tartrate (T^{2-}) depending on the pH and the temperature of the wine. The chart shows the distribution at 25 °C.

In the presence of Potassium ions (K^+), of which there is plenty in wine, Bitartrate combines to form Potassium Tartrate (KHT). At high concentrations, Potassium Tartrate will crystallize and fall out as sediment. The concentration at which crystallization happens (i.e., the wine becomes unstable) depends on the pH, the temperature, and the alcohol content of the wine. The ability of a wine to hold KHT in solution increases the higher the pH, the higher the temperature, and the lower the alcohol. Consequently, tartrate crystals can form in the bottle when the wine is cooled down or stored for a long time. The crystals show up at the bottom of the cork and as sediment in the bottle. While they are not harmful or degrade the wine, some consider their appearance as crystalline sediment unattractive.

Practice

The ideal temperature T to create rapid precipitation of tartrate crystals in °C is in approximate terms: T= -A/2 + 1, where A stands for the % alcohol level in the wine (e.g., if A=13%, then the ideal temperature is minus 6.5 °C or 20.3 °F). To get there, we need a glycol-cooled vessel. To experiment, we built such a vessel: it is a 30 gal steel tank with copper cooling coils on the outside and both inserted into a plastic drum holding cooling fluid that sits inside an insulated

wood box. The cooling liquid inside the copper coils is Propylene Glycol cooled down by our chiller (Kreyer Chilly Max). The picture shows the components on the right and the fully assembled Cold Stabilization unit on the left.

The cooling fluid in the plastic drum needs to be at least 20% propylene glycol in water (which has a freezing point of -8 ºC or 18 oF) or 20% ethanol in water (which has a freezing point of -9 ºC or 15 ºF).

Cold stabilization takes longer (days instead of hours) if the wine is cooled down to only 32 ºF or slightly above. The advantage of 32 ºF+ is that water can be used instead of glycol. We can accelerate the crystallization of tartrate by seeding the process with a small amount of Potassium Tartrate (KHT) powder.

We need to take special care to limit the wine's exposure to oxygen during cold stabilization. At these low temperatures, wine can absorb oxygen more rapidly and thus may age faster. This is especially important when cold stabilization takes longer and is done in a tank that is not completely air-tight. To mitigate oxidation, we fill the airspace in the tank with Argon and seal the lid.

We cold-stabilize during the winter months. Our process is:

1. Take a barrel sample and measure critical parameters (pH, TA, phenolics)
2. Rack the wine from the barrel into the two 30-gallon cooling tanks. If necessary, top them up.
3. Expose the cooling tanks to cold winter nights until they cool down to around 45 ºF.
4. Clean the barrel and keep it ready for a refill.

5. Cool the tanks down to 35 ºF (using water in the cooling drum), then add 10g of Potassium Tartrate powder (KHT) to each tank.
6. Wait for seven days to let the KHT crystallize
7. Take a test sample and check whether Total Acidity has dropped enough. If yes, rack the treated wine back into the barrel; if no, go back to step 6.
8. Clean the tartrate sediments out of the cooling tanks.

For more details on Cold Stabilization, search for “cold stabilization” on the Pen State Extension website: https://extension.psu.edu/ . For a detailed description of the chemistry, read pages 352-360 in Yair Margalit's Concept in Wine Chemistry, 3rd edition (http://www.amazon.com/Concepts-Wine-Chemistry-Yair-Margalit/dp/1935879812) – this is also the source of the above chart.

Cold Stabilization has two negatives: The wine needs to be chilled down significantly, which takes a fair amount of energy and makes the wine vulnerable to oxidation (oxygen solubility in wine increases with low temperature). There are two alternatives to handle excess KHT: Electrodialysis (which, due to the complex machinery required, needs to be outsourced) or adding Tartrate Crystal Inhibitors.

Example

We only tried cold stabilization once – in late 2015 on a barrel of 2012 cabernet, which we judged to have too much acidity. The attempt was not entirely successful. After three weeks at a temperature between 35-40 ºF we measured only a slight increase in pH, and instead of tartrate crystals at the bottom of the tank, we found dark-red sediment. We never figured out what happened.

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Other Adjustments

This page details the treatments suggested in the tables describing common wine faults on the Elevage page. It has yet to be written

To date, we have only used exposure to copper surfaces to alleviate sulfur-related odors (rotten eggs, cabbage, onions, asparagus) to correct the 2011-12 CSV topup wine.

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Racking & Blending

Racking

Racking stands for taking the wine out of a barrel, cleaning the barrel, and then putting the wine back into the same or another barrel. We rack wine for multiple reasons. First and foremost, to remove sediments in a barrel. Secondly, to aerate the wine to remove dissolved gasses from fermentation and import oxygen to accelerate aging in very tannic wines. Thirdly, racking always precedes mixing wines from different barrels or moving the wine from one barrel to another. We can rack a barrel by sucking the wine out with a pump or force of gravity or pushing it out with an inert gas. We do not use pumps as some argue that even the gentlest pumps can be detrimental to wine. We use gravity flow whenever possible and inert gas in rare circumstances.

Racking is always combined with cleaning the barrel. We describe the cleaning process on the page "Tank & Barrel Management."

The following picture shows the steps in racking two different barrels while moving the contents between the barrels. It illustrates a barrel switch that we decided to do for the 2014 Cabernet Sauvignon in early 2015 to give the wine in both barrels some exposure to new oak.

Blending

We rack different barrels into a blending tank, let the mixture integrate for a few days, and then move the blend back into barrels or the bottling machine. Blending is essential in large wineries where the winemaker has access to various barrels of various characteristics that may complement each other. In our case, we did not have that many options to blend because we produced only between one and three barrels and only in 2012 had Merlot in addition to Cabernet Sauvignon. This changed in 2016 when the second vineyard started to produce Merlot, Cabernet Franc, and Petit Verdot. By 2019 the 2016 vintage was ready for bottling. So beginning in 2019, we must decide whether to bottle a single blend consisting of all the varietals harvested or bottle multiple blends with different portions of Cabernet Sauvignon, Merlot, Cabernet Franc, and Petit Verdot.

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Bottling & Labeling

Before bottling, we make final adjustments to the SO2 and CO2 levels in the wine. Then, when the desired blend of wine is ready in the mixing tank,

- we sparge each bottle and then fill it with wine
- we insert a cork
- we cap the top of the bottle with a foil
- we put a printed label on each bottle

We sparge, fill, cork and cap a bottle in a continuous process. This takes about 50 seconds a

bottle for a single person. For two people working together, It takes around 30 seconds per bottle, i.e., 100-120 bottles per hour. Labeling is done later. The picture on the left shows the sparger at the bottom connected to an argon bottle and the bottler filler on top of the sparger. The picture on the right shows a friend, Jost von Allmen, in action with the Sparger (bottom left), the Bottle Filler (left), the Corker (middle), and the Foil Spinner (top right). This page explains the final adjustments and the four bottling steps.

Final adjustments in SO2 and CO2

We make one, possibly two, final adjustments to the wine just before it is bottled. The first is adding SO2 to enhance its resilience against spoilage organisms; the second is increasing the level of dissolved CO2 to enhance the perception of fruitiness if desired.

We target a level of molecular SO2 at 0.50 ppm right before bottling. We discussed the reasoning for SO2 additions in the Winery section, Step #8: Adding SO2. Since we stopped adding SO2 during elevage, we can safely assume there is no free SO2 in the wine before this final adjustment. We calculate the amount of KMBS (Potassium Metabisulfite) that needs to be added to reach the target level for molecular SO2 of 0.5 ppm. The Laboratory Section explains the details on page "Measuring and Adjusting SO2.".

If we decide that the perceived fruitiness of the wine needs a boost, then we measure the dissolved CO2 in the wine with a Carbodoseur. For Bordeau-style red wines, 400-800 ppm is a reasonable target range. To increase dissolved CO2, we add dry ice, which is frozen CO2. The amount of dry ice added depends on the volume of wine to be treated and the assumed uptake of the CO2 gas as it bubbles through the wine. The "Measuring Dissolved CO2" page in the Laboratory section describes the Carbodoseur and the formula. We start by adding 30%-50% of the required dry ice and retest before adding more.

Filling the bottles

We buy standard greenish Bordeau bottles from regional distributors by the pallet. (e.g. Vitroval USA, www.vitrovalusa.com). In bulk, they cost around $0.50 per bottle.

The wine flows from the elevated mixing tank by gravity to the bottling machine. We sparge the bottles (i.e., filled halfway with Argon) before filling them with wine. Sparging has two purposes: first, it reduces the wine's contact with oxygen as it pours into the bottle. Second, it fills the headspace; the airspace is left to make room for the cork, with the inert gas, to reduce oxygen contact while the wine matures in the bottle.

The bottles are placed by hand under one of two spouts, and the filling machine (Zambelli Tivoli2, http://www.zambellienotech.it/index.php/en/products/enologia/item/filling-machine-tivoli,

purchased from Napa Fermentations) automatically fills each bottle to a predefined level. Each bottle is handed to the person operating the corker and the foiler when full.

Corking

As we plan for extended bottle aging, we buy high-end corks. Our supplier is Portocork in Napa, http://www.portocork.com, and we end up paying around $0.75/piece for natural corks.

Our corking machine (Zambelli Bacco Vacuum Corker, http://www.zambellienotech.it/index.php/it/zambelli-prodotti-enologia/enologia/item/linee-di-imbottigliamento, purchased from Napa Fermentations) is fully pneumatic. A vacuum is created before the cork is pushed in, and the pushing action is initiated by pressurized air. So we need both a compressor and a vacuum pump to operate the corker.

Capping with a Foiler

Foils are put over the top of the bottle to protect the cork from mold formation. While mold is no longer a significant threat, foil tops mainly survived for aesthetics. Foils are today made from thin heat-shrinking plastic or metal slightly larger than the bottle top. They shrink and form a tight seal when the Foil Spinner is lowered over the bottle top.

Our Foil Spinner is Italian-made (Binello - Alba); we purchased it from Napa Fermentation. We buy our foils in boxes of a thousand from Ramodin USA in Napa (www.ramondin.es/en/).

Labeling

We decided to design and print the labels in-house and affix them to the bottles ourselves, as with all other steps. This requires equipment choices (label printer, software, and labeler). Because we do not sell our bottles, we have the freedom to design labels without artistic or content restrictions – for commercially distributed wines, the government specifies what can and must be on each bottle label.

Equipment Choices: We purchased a special-purpose label printer in 2012 (Zeo!

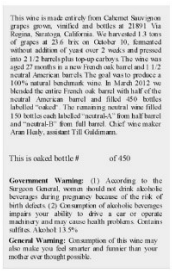
from QuickLabel Systems, www.quicklabel.com) with an associated spooler, label design & printing software, plus rolls of label stock. This was a poor choice because the software and the printer are poorly designed, and the company refuses to upgrade the software to work on Windows operating system beyond XP – thus, we need to maintain an old PC running Windows XP dedicated to the printer! The company introduced a new printer at twice the price - lousy customer service. In recent years we have thus switched to an external label-printing service Fernqvist Labelling Solutions in Mountain View, CA (www.fernqvist.com/); the material and printing costs for a simple design are around 50 cents per label.

We bought a basic electric labeler (Bottle-Matic II, from Dispensa-Matic, www.dispensamatic.com/bottle-matic/) which works very well, is ideal for our requirements, is reliable, and is easy to operate. With it, we can easily label around 150 bottles per hour.

Labels Produced

We decided to produce very classic labels with a fair amount of information about how the wine was made on the back label. We also manually number each bottle.

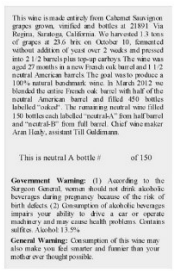
2009: we produced three very similar labels: one for each type of cellaring we tried out. "2009 oaked" for the 450 bottles we got out of mixing the contents of the new French oak barrel with half the contents of the neutral American barrel. "2009 unoaked A" for the 150 bottles we got out of the neutral American half-barrel, and "2009 unoaked B" for 150 bottles we got out of the remaining half of the neutral American oak barrel.


This wine is made entirely from Cabernet Sauvignon grapes grown, vinified and bottles at 21891 Via Regina, Saratoga, California. We harvested 1.3 tons of grapes at 23.6 brix on October 10, fermented without addition of yeast over 2 weeks and pressed into 2 1/2 barrels plus top-up carboys. The wine was aged 27 months in a new French oak barrel and 1 1/2 neutral American barrels. The goal was to produce a 100% natural benchmark wine. In March 2012 we blended the entire French oak barrel with half of the neutral American barrel and filled 450 bottles labelled "oaked". The remaining neutral wine filled 150 bottles each labelled "neutral-A" from half barrel and "neutral-B" from full barrel. Chief wine maker Aran Healy, assistant Till Goldmann.

This is oaked bottle # of 450

Government Warning: (1) According to the Surgeon General, women should not drink alcoholic beverages during pregnancy because of the risk of birth defects (2) Consumption of alcoholic beverages impairs your ability to drive a car or operate machinery and may cause health problems. Contains sulfites. Alcohol 13.5%

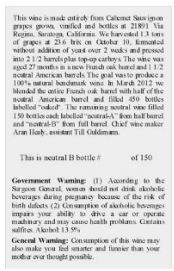
General Warning: Consumption of this wine may also make you feel smarter and funnier than your mother ever thought possible.


This wine is made entirely from Cabernet Sauvignon grapes grown, vinified and bottles at 21891 Via Regina, Saratoga, California. We harvested 1.3 tons of grapes at 23.6 brix on October 10, fermented without addition of yeast over 2 weeks and pressed into 2 1/2 barrels plus top-up carboys. The wine was aged 27 months in a new French oak barrel and 1 1/2 neutral American barrels. The goal was to produce a 100% natural benchmark wine. In March 2012 we blended the entire French oak barrel with half of the neutral American barrel and filled 450 bottles labelled "oaked". The remaining neutral wine filled 150 bottles each labelled "neutral-A" from half barrel and "neutral-B" from full barrel. Chief wine maker Aran Healy, assistant Till Goldmann.

This is neutral A bottle # of 150

Government Warning: (1) According to the Surgeon General, women should not drink alcoholic beverages during pregnancy because of the risk of birth defects (2) Consumption of alcoholic beverages impairs your ability to drive a car or operate machinery and may cause health problems. Contains sulfites. Alcohol 13.5%

General Warning: Consumption of this wine may also make you feel smarter and funnier than your mother ever thought possible.


This wine is made entirely from Cabernet Sauvignon grapes grown, vinified and bottles at 21891 Via Regina, Saratoga, California. We harvested 1.3 tons of grapes at 23.6 brix on October 10, fermented without addition of yeast over 2 weeks and pressed into 2 1/2 barrels plus top-up carboys. The wine was aged 27 months in a new French oak barrel and 1 1/2 neutral American barrels. The goal was to produce a 100% natural benchmark wine. In March 2012 we blended the entire French oak barrel with half of the neutral American barrel and filled 450 bottles labelled "oaked". The remaining neutral wine filled 150 bottles each labelled "neutral-A" from half barrel and "neutral-B" from full barrel. Chief wine maker Aran Healy, assistant Till Goldmann.

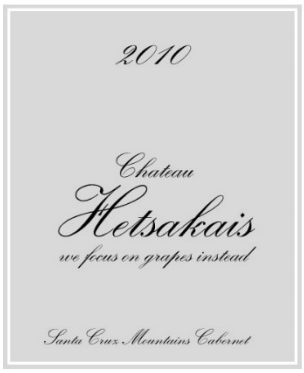
This is neutral B bottle # of 150

Government Warning: (1) According to the Surgeon General, women should not drink alcoholic beverages during pregnancy because of the risk of birth defects (2) Consumption of alcoholic beverages impairs your ability to drive a car or operate machinery and may cause health problems. Contains sulfites. Alcohol 13.5%

General Warning: Consumption of this wine may also make you feel smarter and funnier than your mother ever thought possible.

The back label texts were similar; for the "2009 oaked," it read: This wine is made entirely from Cabernet Sauvignon grapes grown, vinified, and bottled at 21891 Via Regina, Saratoga, California. We harvested 1.3 tons of grapes at 23.6 Brix on October 10, fermented without the addition of yeasts over 2 weeks, and pressed into 2 ½ barrels plus top-up carboys. The wine was aged for 27 months in a new French oak barrel and 1 ½ neutral American barrels. The goal was to produce a benchmark wine. In March 2012, we blended the entire French oak barrel with half of the neutral American barrel and filled 450 bottles labeled "oaked." The remaining neutral wine filled 150 bottles, labeled "neutral A" from the half barrel and "neutral B" from the full barrel. Chief winemaker Aran Healy, assistant Till Guldimann. / This is bottle # of 450. / Government Warning: (1) According to the Surgeon General, women should not drink alcoholic beverages during pregnancy because of the risks of birth defects. (2) Consumption of alcoholic beverages impairs your ability to drive a car or operate machinery and may cause health problems. Contains sulfites. Alcohol 13.5%. General Warning: Consumption of this wine may also make you feel smarter and funnier than your mother ever thought possible."

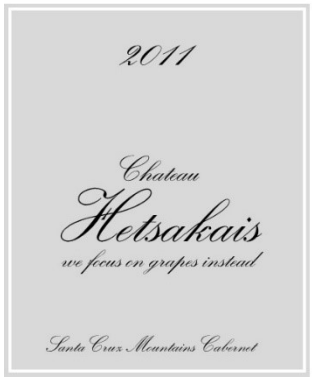
We kept the same front label for 2010 through 2014 vintages but adjusted the back label to reflect the different harvests, fermentation, and elevage strategies. The following pictures show

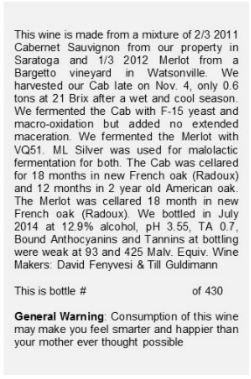


This wine was made entirely from Cabernet Sauvignon grapes grown, vinified and bottled at Via Regina 21891, Saratoga, California. We harvested 1.2 tons on October 20 at 22 Brix / pH 3.5, crushed, added 50g of LaFasse GrandCru enzyme and cold soaked for 8 days. We fermented with EM4x4 yeast for 14 days and extended skin exposure with 7 days of cold maceration. We pressed at 0.2 bar and completed malolactic fermentation in 150 days with Viniflora Oenos bacteria. We cellared for 30 months in new oak barrels (one American San Martin, the other French Seguin Moreau) and fined with 3 ½ egg whites before bottling in June 2013 at 12.8% alcohol, pH 3.43 and TA of 0.67. Winemakers: Aran Healy & Till Guldimann.

This is bottle # of 575

General Warning: Consumption of this wine may make you feel smarter and happier than your mother ever thought possible



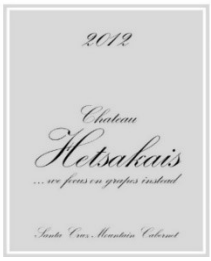

This wine is made from a mixture of 2/3 2011 Cabernet Sauvignon from our property in Saratoga and 1/3 2012 Merlot from a Bargetto vineyard in Watsonville. We harvested our Cab late on Nov. 4, only 0.6 tons at 21 Brix after a wet and cool season. We fermented the Cab with F-15 yeast and macro-oxidation but added no extended maceration. We fermented the Merlot with VQ51. ML Silver was used for malolactic fermentation for both. The Cab was cellared for 18 months in new French oak (Radoux) and 12 months in 2 year old American oak. The Merlot was cellared 18 month in new French oak (Radoux). We bottled in July 2014 at 12.9% alcohol, pH 3.55, TA 0.7, Bound Anthocyanins and Tannins at bottling were weak at 93 and 425 Malv. Equiv. Wine Makers: David Fenyvesi & Till Guldimann

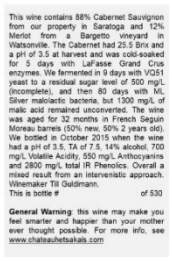
This is bottle # of 430

General Warning: Consumption of this wine may make you feel smarter and happier than your mother ever thought possible

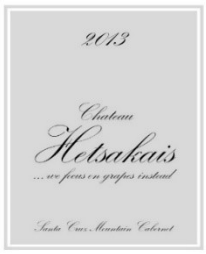
the labels for 2010 and 2011.

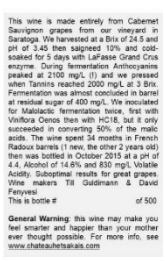
Starting in 2012, we changed the design of the front label slightly and started using an external printing service (www.fernqvist.com/contact-us)



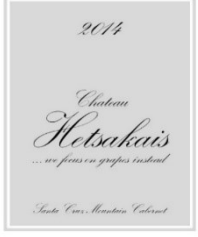

This wine contains 88% Cabernet Sauvignon from our property in Saratoga and 12% Merlot from a Bargetto vineyard in Watsonville. The Cabernet had 25.5 Brix and a pH of 3.5 at harvest and was cold-soaked for 5 days with LaFasse Grand Crus enzymes. We fermented in 9 days with VQ51 yeast to a residual sugar level of 500 mg/L (incomplete), and then 80 days with ML Silver malolactic bacteria, but 1300 mg/L of malic acid remained unconverted. The wine was aged for 32 months in French Seguin Moreau barrels (50% new, 50% 2 years old). We bottled in October 2015 when the wine had a pH of 3.5, TA of 7.5, 14% alcohol, 700 mg/L Volatile Acidity, 550 mg/L Anthocyanins and 2800 mg/L total IR Phenolics. Overall a mixed result from an interventistic approach. Winemaker Till Guldmann.
This is bottle # of 530

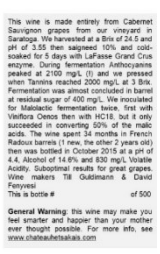
General Warning: this wine may make you feel smarter and happier than your mother ever thought possible. For more info, see www.chateauhetsakais.com




This wine is made entirely from Cabernet Sauvignon grapes from our vineyard in Saratoga. We harvested at a Brix of 24.5 and pH of 3.45 then salgneed 10% and cold-soaked for 5 days with LaFasse Grand Crus enzyme. During fermentation Anthocyanins peaked at 2100 mg/L (!) and we pressed when Tannins reached 2000 mg/L at 3 Brix. Fermentation was almost concluded in barrel at residual sugar of 400 mg/L. We inoculated for Malolactic fermentation twice, first with Viniflora Oenos then with HC18, but it only succeeded in converting 50% of the malic acids. The wine spent 34 months in French Radoux barrels (1 new, the other 2 years old) then was bottled in October 2015 at a pH of 4.4. Alcohol of 14.6% and 830 mg/L Volatile Acidity. Suboptimal results for great grapes. Wine makers Till Guldimann & David Fenyvesi
This is bottle # of 500

General Warning: this wine may make you feel smarter and happier than your mother ever thought possible. For more info, see www.chateauhetsakais.com




This wine is made entirely from Cabernet Sauvignon grapes from our vineyard in Saratoga. We harvested at a Brix of 24.5 and pH of 3.55 then salgneed 10% and cold-soaked for 5 days with LaFasse Grand Crus enzyme. During fermentation Anthocyanins peaked at 2100 mg/L (!) and we pressed when Tannins reached 2000 mg/L at 3 Brix. Fermentation was almost concluded in barrel at residual sugar of 400 mg/L. We inoculated for Malolactic fermentation twice, first with Viniflora Oenos then with HC18, but it only succeeded in converting 50% of the malic acids. The wine spent 34 months in French Radoux barrels (1 new, the other 2 years old) then was bottled in October 2015 at a pH of 4.4. Alcohol of 14.6% and 830 mg/L Volatile Acidity. Suboptimal results for great grapes. Wine makers Till Guldimann & David Fenyvesi
This is bottle # of 500

General Warning: this wine may make you feel smarter and happier than your mother ever thought possible. For more info, see www.chateauhetsakais.com

In 2022 we redesigned the front labels for the vintages of 2015 and beyond. The central idea was to add more information about the weather patterns influencing each. We boiled the weather data down to three critical parameters:

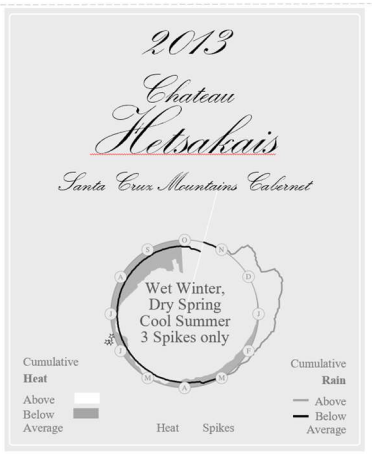
Relative Rainfall: how much rain fell during the vintage year (for the 2015 vintage, this would be from November 2014 through October 2015) and relative to the average for all years on record (2013 through 2021)? This measure summarizes the availability of water.

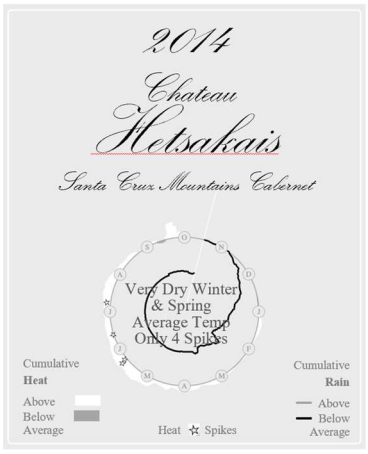
Relative Sunshine/Temperature: what was the Cumulative Growing Degree Days (CGDD) for the vintage year, and how did it accumulate relative to the average for all the years on record? This measure summarizes the presence of sunshine.

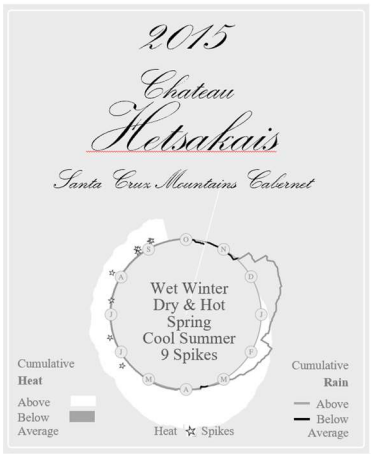
Distribution of Heatspikes: When did the average hourly maximum temperature during the day exceed 95 degrees F. Heat spikes show when excessive temperatures force the plant to shut down.

Note, what matters most for characterizing how the weather influenced each vintage is the deviation from the “average weather.” The absolute weather is a characteristic of the location and part of the “terroir.” The deviation from average is a characteristic of the vintage in that “terroir.” All the data was collected from Davis weather stations located in the vineyard (for more details on our collection of weather data, see the page on Weather Monitoring in the Vineyard Section)

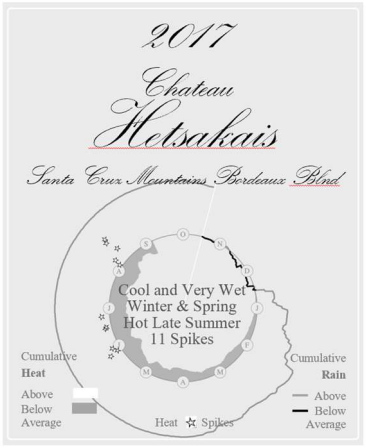
With the help of Gregory Niemeyer, Professor of Media Innovation at UC Berkely (https://www.gregniemeyer.com), we developed a circular graphic to represent a visual thumbprint of the relative weather conditions for each vintage. The following pictures show the new labels incorporating this graphic for the 2013 – 2021 vintages. The 2013 and 2014 labels are shown for comparison only. Note the wide range of weather patterns across the vintages.

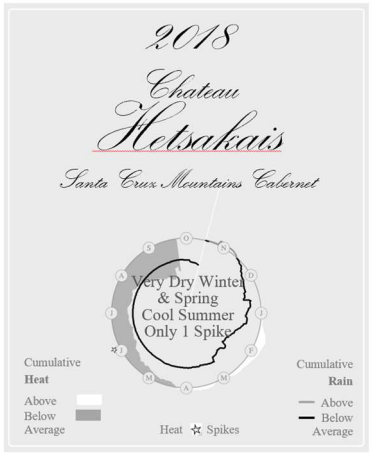

2013
Chateau
Hetsakais
Santa Cruz Mountains Cabernet
Wet Winter,
Dry Spring
Cool Summer
3 Spikes only
Cumulative
Heat
Above
Below
Average
Heat
Spikes
Cumulative
Rain
Above
Below
Average

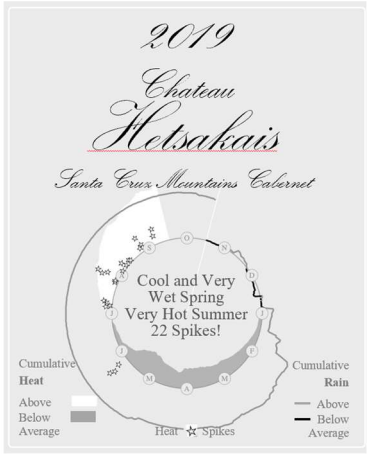

2014
Chateau
Hetsakais
Santa Cruz Mountains Cabernet
Very Dry Winter
& Spring
Average Temp
Only 4 Spikes
Cumulative
Heat
Above
Below
Average
Heat
Spikes
Cumulative
Rain
Above
Below
Average


2015
Chateau
Hetsakais
Santa Cruz Mountains Cabernet
Wet Winter
Dry & Hot
Spring
Cool Summer
9 Spikes
Cumulative
Heat
Above
Below
Average
Heat
Spikes
Cumulative
Rain
Above
Below
Average

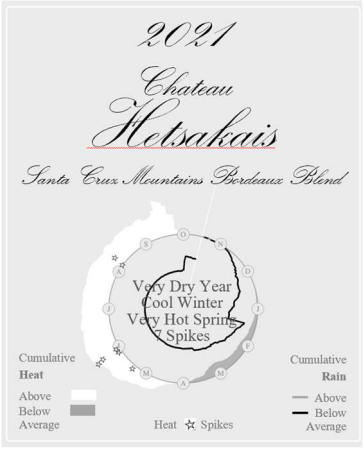

2016
Chateau
Hetsakais
Santa Cruz Mountains Cabernet
Wet Spring
Very Cool
Summer
Only 3 Spikes
Cumulative
Heat
Above
Below
Average
Heat
Spikes
Cumulative
Rain
Above
Below
Average


2017
Chateau
Hetsakais
Santa Cruz Mountains Bordeaux Blend
Cool and Very Wet
Winter & Spring
Hot Late Summer
11 Spikes
Cumulative
Heat
Above
Below
Average
Heat
Spikes
Cumulative
Rain
Above
Below
Average


2018
Chateau
Hetsakais
Santa Cruz Mountains Cabernet
Very Dry Winter
& Spring
Cool Summer
Only 1 Spike
Cumulative
Heat
Above
Below
Average
Heat
Spikes
Cumulative
Rain
Above
Below
Average


2019
Chateau
Hetsakais
Santa Cruz Mountains Cabernet
Cool and Very
Wet Spring
Very Hot Summer
22 Spikes!
Cumulative
Heat
Above
Below
Average
Heat
Spikes
Cumulative
Rain
Above
Below
Average


2020
Chateau
Hetsakais
Santa Cruz Mountains Cabernet
Wet Winter
Very Dry Spring
Average Temps
14 Spikes
Cumulative
Heat
Above
Below
Average
Heat
Spikes
Cumulative
Rain
Above
Below
Average


2021
Chateau
Hetsakais
Santa Cruz Mountains Bordeaux Blend
Very Dry Year
Cool Winter
Very Hot Spring
7 Spikes
Cumulative
Heat
Above
Below
Average
Heat
Spikes
Cumulative
Rain
Above
Below
Average

Previous page: Racking & Blending
Top of page: Go
Next page: Bottle Storage
Last updated: July 16, 2022

Bottle Storage

Our wine takes 3-8 years to mature in the bottle until it becomes good enough to drink. After that, it can take another 5-10 years to reach its peak. We produce around 600 bottles per year. Thus we need a storage capacity above 5000 bottles. Bottles are ideally stored in a dark room at a temperature of approximately 55 ºF and 50-70% relative humidity. When we built the winery, we did not adequately plan for this storage space in the cellar, so we needed to retrofit and air-condition a room in the barn a few years later. By 2021 we ran out of storage space again, so we built another cellar in the main house to accommodate the overflow.

Previous page: Bottling & Labelling
Top of page: Go
Next page: Cellar Summaries
Last updated: June 2, 2022

Cellar Summaries

This page reviews our cellar activities for then thirteen vintages cellared to date. Before 2017 we used a spreadsheet to track the sensory qualities, the laboratory results, and the actions taken approximately every 1-2 months as we monitored each vessel. In 2017 we switched to a relational database. This page shows the screenshots of the summary tab in the Cellar Batch Reviews for each vintage (note, the commentaries in the database are not yet complete). The laboratory measurements showed up only later as we became more diligent with chemical analysis and recording. In summary:

- **2009**: with the help of an experienced nose & palate (Aran Healy), we took a minimalist approach (only two rackings) and recorded very little of the few lab tests taken.
- **2010**: we changed to regular racking to soften the tannins through more oxidation; the young wine was over-extracted in fermentation. We continued to rely on Aran's tasting experience for monitoring and only recorded very few lab tests.
- **2011**: we were challenged by a poor harvest and the departure of the nose. I failed to rack and monitor the top-up wines properly and introduced wine faults that may have affected the barrels. We bottled a mix of 66% 2011 Cabernet with 33% 2012 Merlot.
- **2012**: the harvest was excellent, but our cellaring continued to be challenged by the lack of a professional "nose," poor laboratory analysis/recording, and faulty racking practices on the top-up wines. We combined all top-up wines and struggled with the resulting cross-contamination.
- **2013**: a great harvest combined with corrected barrelling practices. We welcomed a new nose (David Fenyvesi in late 2012) and significantly improved laboratory practices. There is hope. We decided to extend barrel aging for this vintage from our standard three to four years.
- **2014**: the harvest was good in quality but 30% less in volume, so we had to add 12 gallons of 2012 CSV topup wine and 6 gallons of Jim Barth's Merlot to fill the second barrel. Acidity was low, so we added tartaric acid, but it turned out too much, and we struggled through barrel aging until we cold-stabilized.
- **2015**: the harvest was poor in quality and volume. We could fill one barrel only by adding 8 gallons of the 2012CSV blend to be bottled. Our cellar management was equally poor. We added too much Tartaric Acid to reduce the pH and then had to compensate by adding Potassium Carbonate to bring the pH back up. Significant additions of SO2 did not contain contamination as Volatile Acidity increased to over 1100 ppm.

- **2016**: the harvest was plentiful and included, for the first time, the Merlot, Petit Verdot, and Cab Franc from the upper field, but phenolics were poor. We free-flowed into three oak barrels. We successfully fought barrel contaminations with fining and cross-flow filtration. We bottled with 3.4pH, 15%+ alcohol, 880 bottles.
- **2017**: the harvest was poor both in volume and quality. We free-flowed into one full and one half-barrel. This is the last vintage in which we used topup wines from previous years, a probable source of contaminations which we fought with fining and reverse osmosis filtering.
- **2018**: the harvest was excellent in volume and quality. We inoculated for malolactic fermentation and used less SO2. Cellaring was mostly in neutral barrels. We added Tartaric Acid to reduce the pH. All topup wine was from the same vintage kept in steel tanks for three years. We produced 280 bottles of pure Cab and 580 bottles of Bordeau blend.
- **2019**: a rainy winter and hot summer produced the largest harvest to date with clean fruit but skewed maturation: 23.7 Brix, 3.7+ pH, and lack of nitrogen. Malolactic fermentation completed naturally. We started cleaning barrels with hot steam. Improved sanitation reduced contaminations. *More to come*
- **2020**: the weather was dry but with many heat spikes in a hot summer. Harvest volume was down, and quality reduced: pH averaged 3.75 at Brix of 23.5. Cellaring was in 2 barrels for pure Cab and 1 barrel for Bordeau blend with dedicated topup tanks from the same vintage. Malolactic fermentation completed naturally. *More to come*.
- **2021**: the weather was miserable: a dry winter followed by a hot summer and spikes. Harvest volume was down 50% from the 2018 peak quality was OK at 3.4 pH and 21.5 Brix, but lack of nitrogen required a large addition of nutrients for fermentation. We cellared in two barrels of Bordeau blends with identical topup wine. *More to come*

The following paragraphs describe each vintage in more detail.

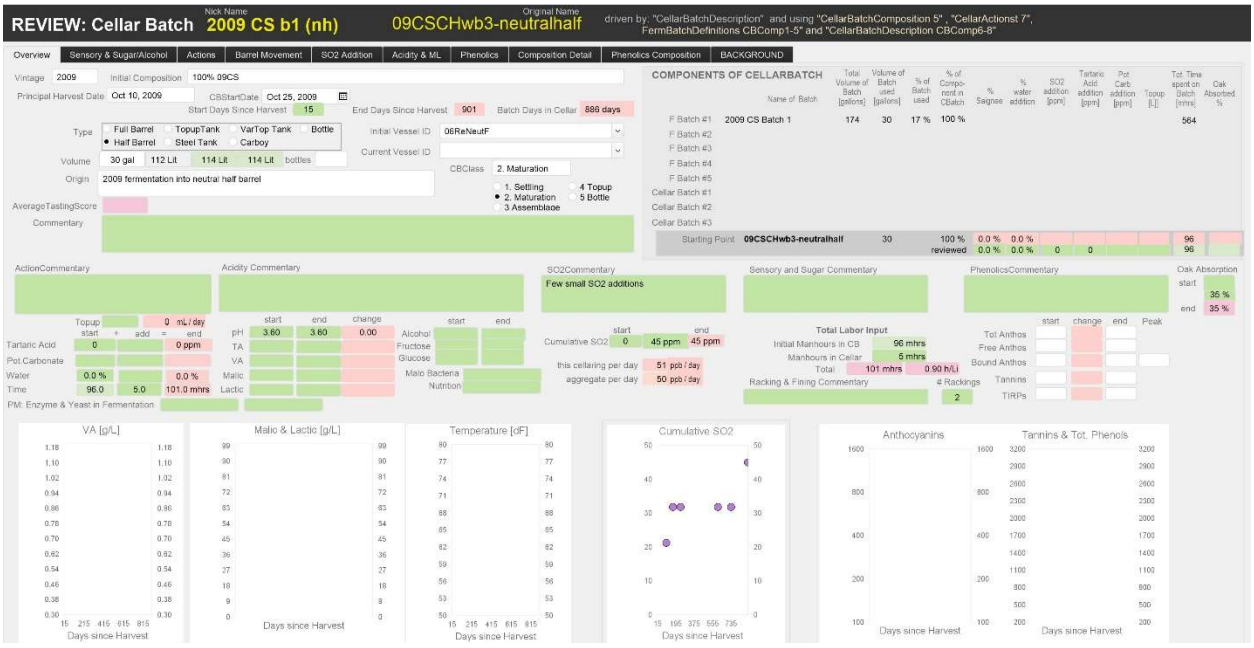
2009 Vintage

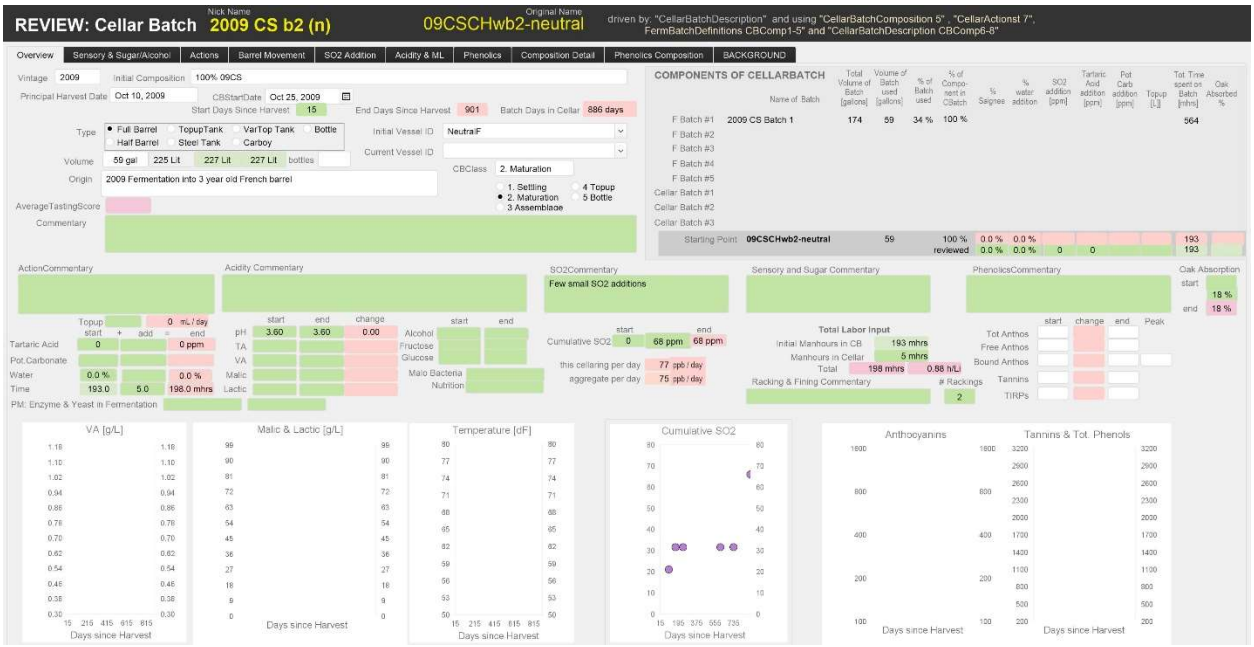
2009 was our first year of wine-making and cellaring. We continued the minimalist wine-making approach into barrelling. The process remained very basic: On completing Malolactic fermentation in the barrels, we added a 25ppm dose of sulfur and maintained a level above eight ppm, checking quarterly. We racked the barrels only twice, the first time six months after harvest, the second time just before bottling. We took minimal measurements and judged

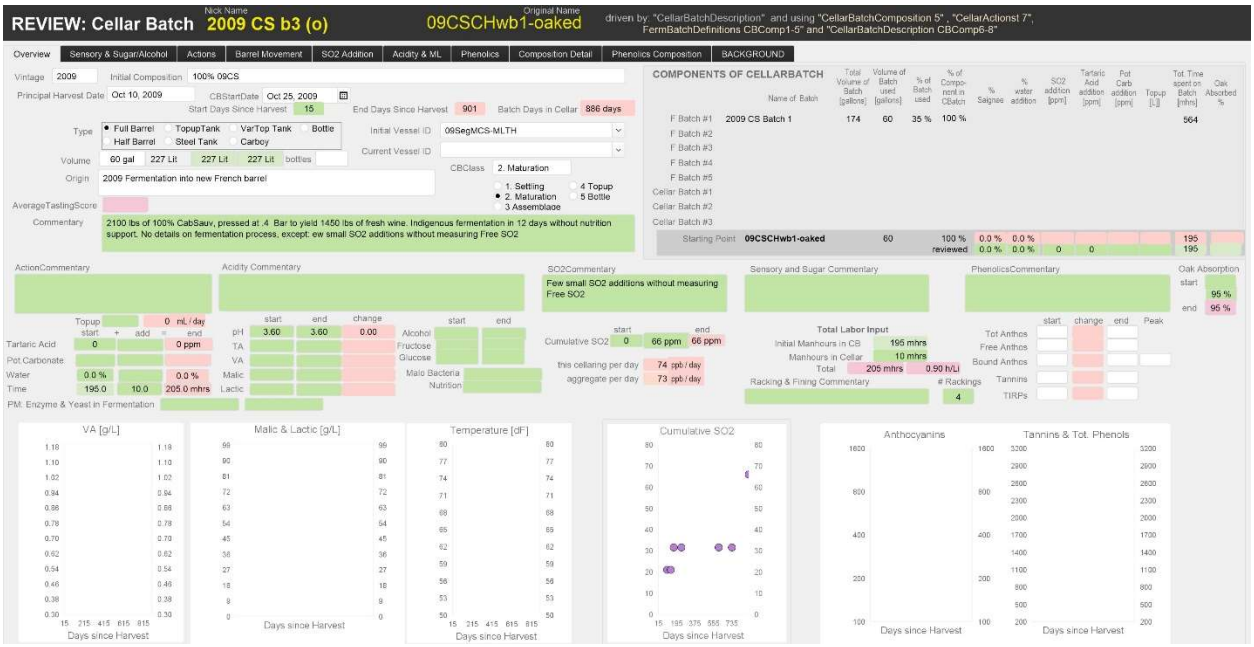
progress mainly by smelling and tasting (mostly Aran Healy's nose and palate). We kept extra wine in a few glass carboys (between 1 and 6 gallons each) and topped up the barrels every 3-6 months.

We used one new French oak barrel (Seguin Moreau Select Cabernet ML), one neutral American barrel (unknown provenance), and a refurbished half-barrel (unknown provenance). We had a recording gap between June 2010 and October 2011 and didn't remember how many times we adjusted SO2 and topped up.

Following are screenshots of the Cellar Batch Reviews for the three 2009 barrels:







After 27 months in the barrel, we decided to bottle in 3 separate batches so we could continue to see the effect the different barrels had on the wine:

Oaked: we mixed the entire contents of the French oak barrel with 30 gallons of the used American barrel and put them into 450 bottles labeled 2009 Oaked.

Unoaked A: we put the remaining 30 gallons of the used American barrel into 150 bottles labeled 2009 Unoaked A

Unoaked B: we put the entire content of the refurbished / neutral half-barrel into 150 bottles labeled Unoaked B.

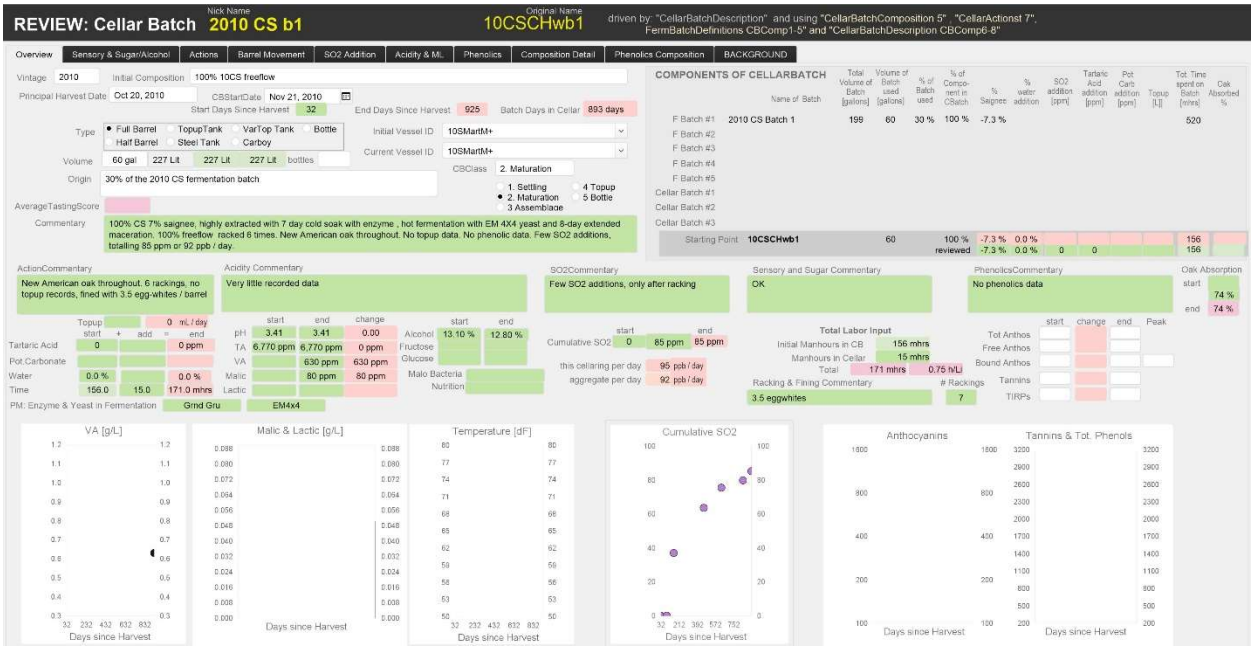
2010 Vintage

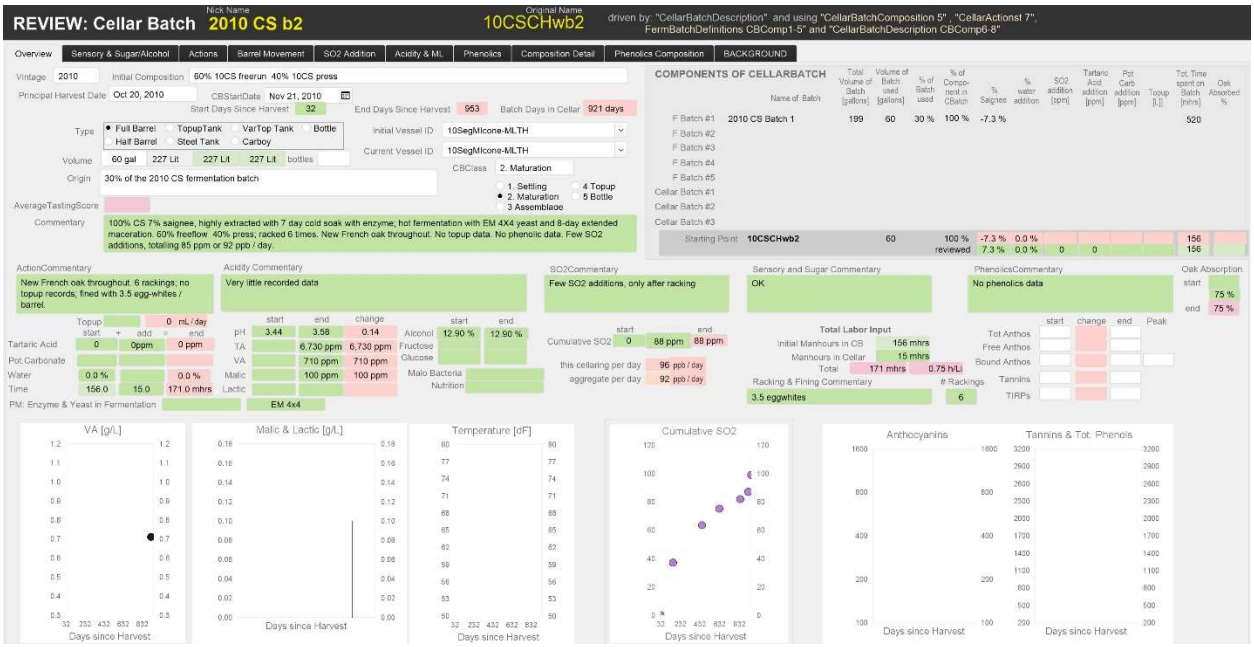
In contrast to 2009, we became far more interventionist: We decided to rack more frequently (every 3 to 6 months) to expose the young wine to more oxygen. We also decided to fine the wine with 3 1/2 egg whites just before bottling. We used a new French oak barrel (Seguin Moreau Icone) and a new American oak barrel (Saint Martin M+) to evaluate the difference in oak.

We mixed the remaining 2009 topup wine with the 45 gallons of press wine from 2010 and kept the lot in a 50-gallon steel tank with a variable top lid. We traded juggling the heavy glass carboys with a steel tank which tended to attract fruit flies and microbial infections at the seal of the variable top lid.

We continued to rely on Aran Healy's nose and palate to judge progress and did not record the few laboratory tests we took other than the SO2 measurements required to calibrate the sulfur additions. The exception was in May 2013 when we brought samples to Fermentation Solutions for a test panel based on their new OenoFoss spectral analysis instrument.

Following are screenshots of the Cellar Batch Reviews for the two 2010 barrels:



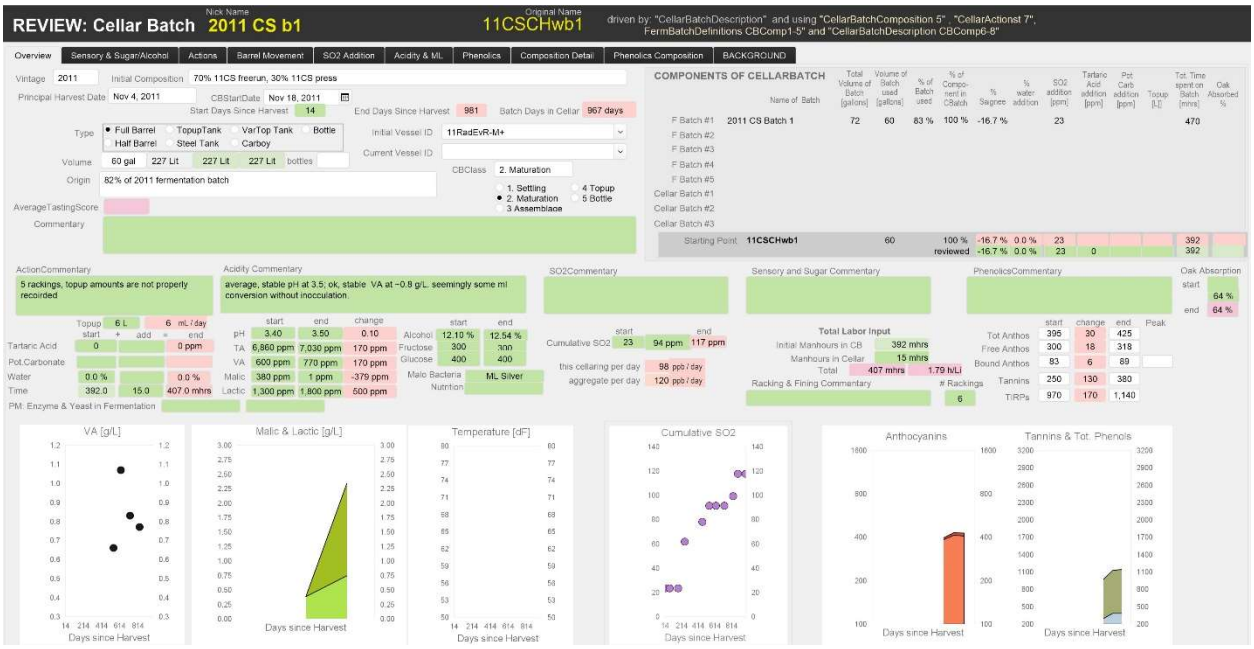


After 30 months in the barrel, we decided to mix the wine from the 2 barrels, tame the excessive tannins with an egg-white fining, and bottle in a single lot of 48 cases (570 bottles). The flavor profiles of the French and American oak complemented each other. The wine was over-extracted during fermentation and will take a long time in the bottle to mellow out.

2011 Vintage

2011 was a problematic harvest (low yield, not fully ripened fruit). The challenges kept compounding in the winery as Aran Healy's nose and palate, on which we relied to judge progress, departed in early 2012 (together with Aran himself) and left me struggling without the support of an experienced winemaker for over a year. We used a French Oak barrel (Radoux Blend Evolution R) and set the second barrel (Seguin Moreau Icone), which we had already purchased, aside for next year. We combined the little amount of 2011 excess wine with the leftover 2010 topup wine. After 1 ½ years in the French oak, we racked the wine into an American oak barrel (Saint Martin M+) to cover up the green apple character (pyrazine).

In retrospect, the trouble started when I forgot to rack the topup steel tank in 2012 and did not pick up any fault until July 2013 while using that wine all along to top up the 2011 barrel. We then compounded the problem by adding to it the bulk of the contents of the 2012 topup tank, which had similar issues. As a result, we lost half the topup wine and may have polluted the 2011 barrel.



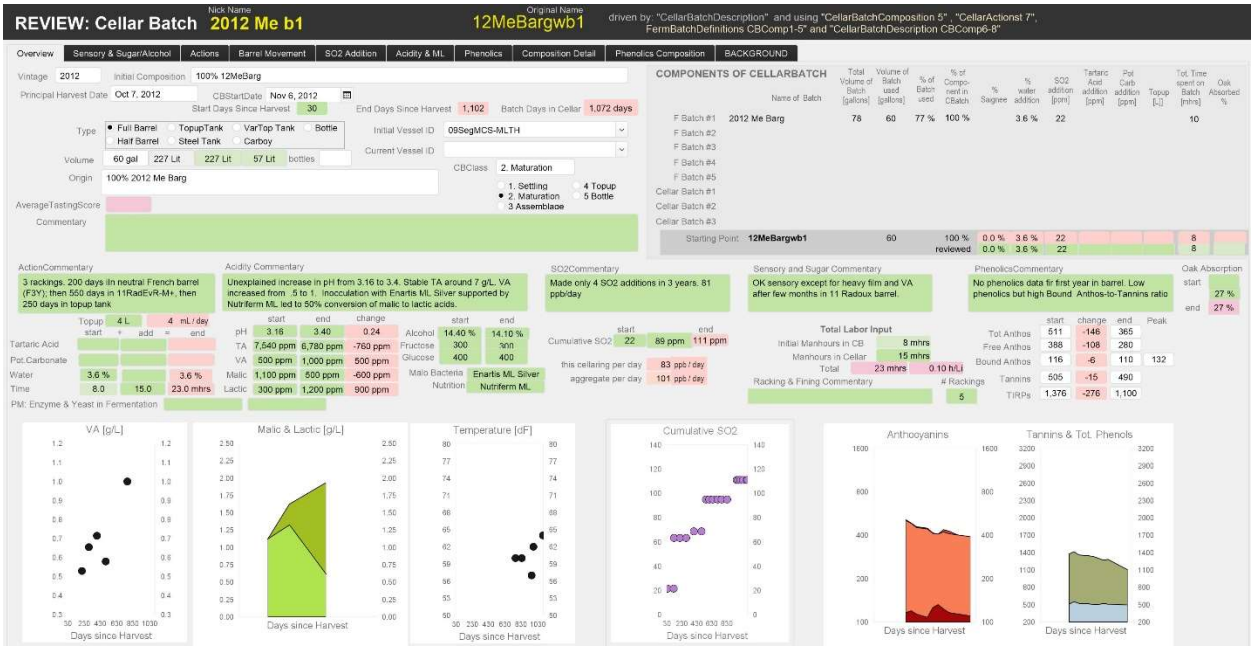
By February 2014, we concluded that the 2011 Cabernet was not strong enough to stand on its own and decided to mix it with half a barrel of the 2012 Merlot from Bargetto (see next paragraph). The problem with that Merlot was that it did not complete its malolactic fermentation (even after a second inoculation). So we ended up with a weak Bordeau mix (Anthocyanins at 93) with a high level of malic acids. As we store the bottles at 55dF, the risk of a late ML fermentation in the bottle is minimal.

2012 Vintage

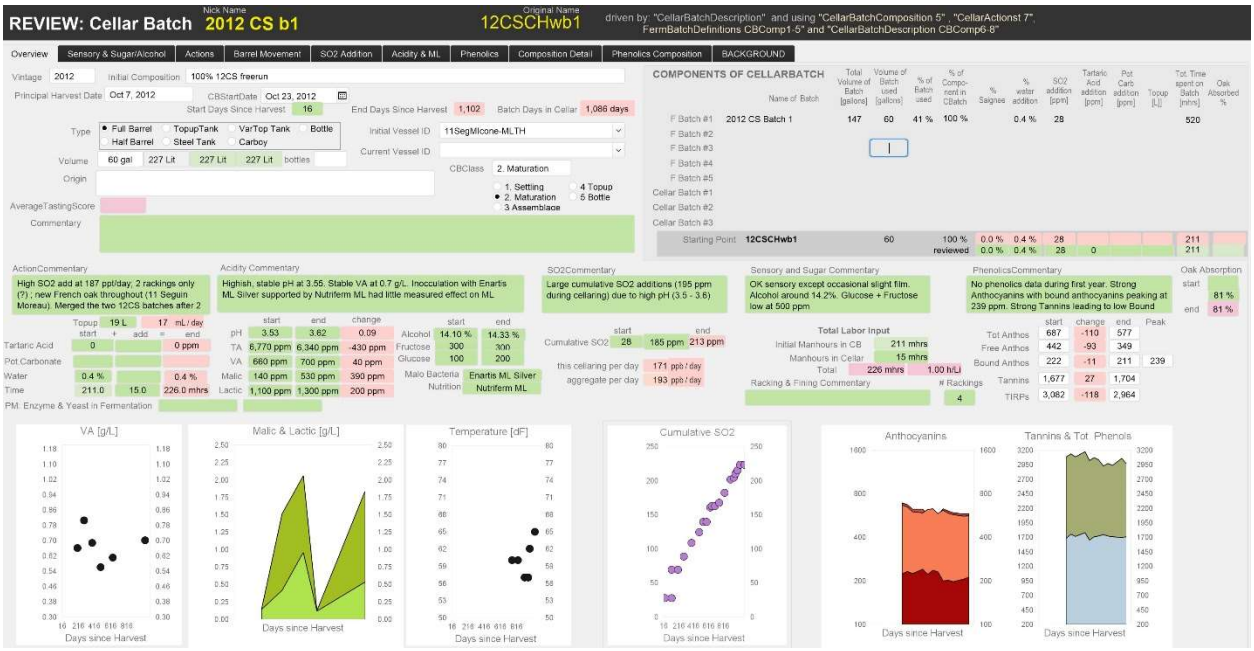
2012 was an excellent vintage, both regarding quality and yield. We produced two barrels of Cabernet from our fruit, purchased half a ton of Merlot grapes from Bargetto to yield another barrel, and traded in a carboy of Merlot wine from Jim Barth. The idea behind the Merlot purchases was to get an option for blending down the road. By mid-2013, we had introduced a solid quarterly cellar review process that produced reasonable laboratory figures. We started to benefit from the experienced nose and palate of our new live-in winemaker, David Fenyvesi, and we introduced phenolic analysis in the 3rd quarter.

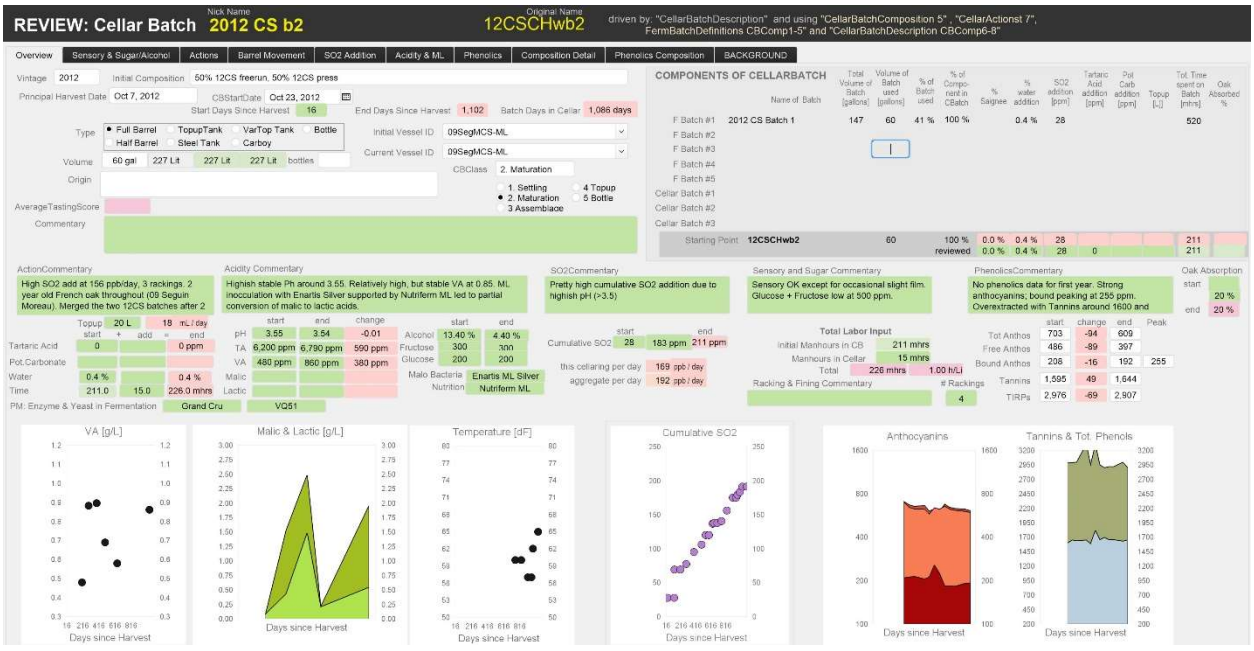
Merlot: We put the Bargetto Merlot first into a neutral french barrel and changed six months later to a French barrel used for two years (2011 Radoux Evolution R). We only noticed in early 2014 that it never went through malolactic fermentation. We treated it with 225g of potassium bicarbonate to increase the pH to 3.5 and re-inoculated it with Viniflora CH16 bacteria. In the

summer of 2014, we used half the barrel to blend with the 2011 Cabernet Sauvignon and moved the rest to a neutral half-barrel. By September 2014, that half-barrel proved to be problematic – the wine developed a foul smell and high Volatile Acidity; so we decided to discard that half-barrel and move the Merlot to a pressurized steel keg and carboys.



Cabernet Sauvignon: We barreled the wine into two French oak barrels, one new leftover from 2011 (Seguin Moreau Icone) and one used previously for the 2009 vintage (Seguin Moreau Select). We merged 24 gallons of topup wine with the remaining 10 gallons of the 2011 topup wine; then, we moved the topup wine from the variable top steel tank into two new pressurized steel topup tanks. Again, we did not check the SO_2 levels in the topup tanks, and we missed to rack it for the first nine months. Consequently, we may have polluted one of the two barrels, but the rotten egg smell disappeared after another racking of the barrels and KMBS additions





We merged the two Cabernet barrels with the remaining 15 gallons of the 2012 Barghetto Merlot for bottling. Because by then, we were running out of the top-up wine, we moved 15 gallons of this mix into a pressurized topup tank as 12CSMerCHBargTopup and bottled the rest in 45 cases as 12CSMeCHBargb.

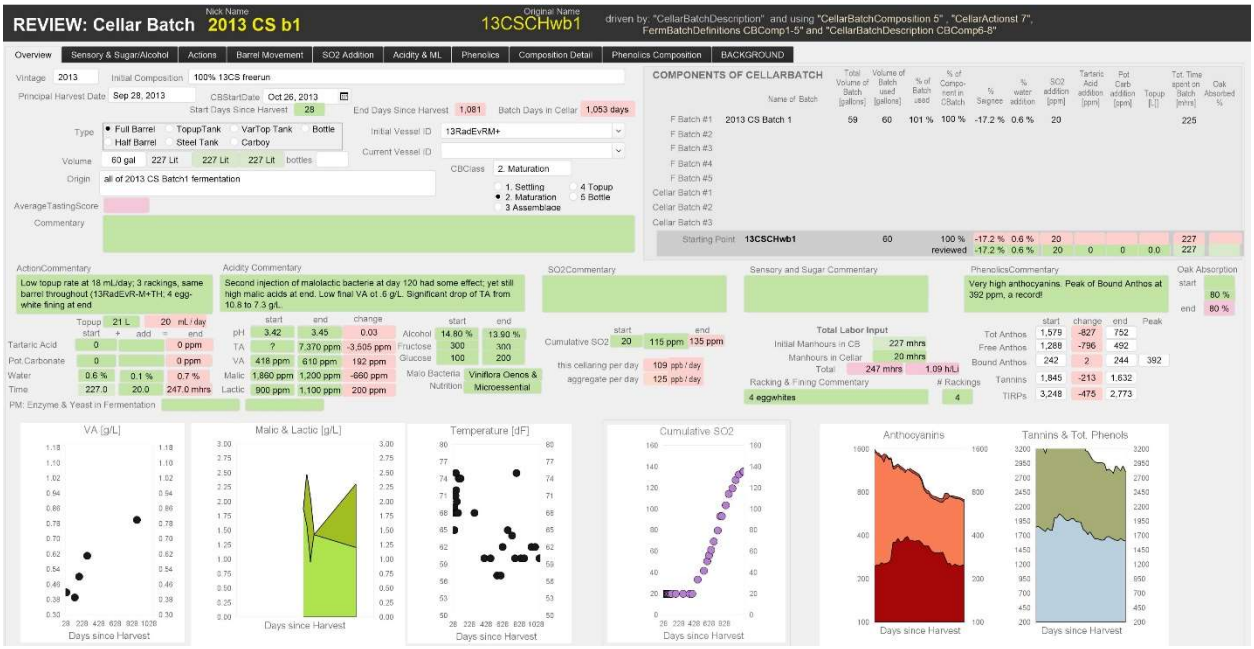
2013 Vintage

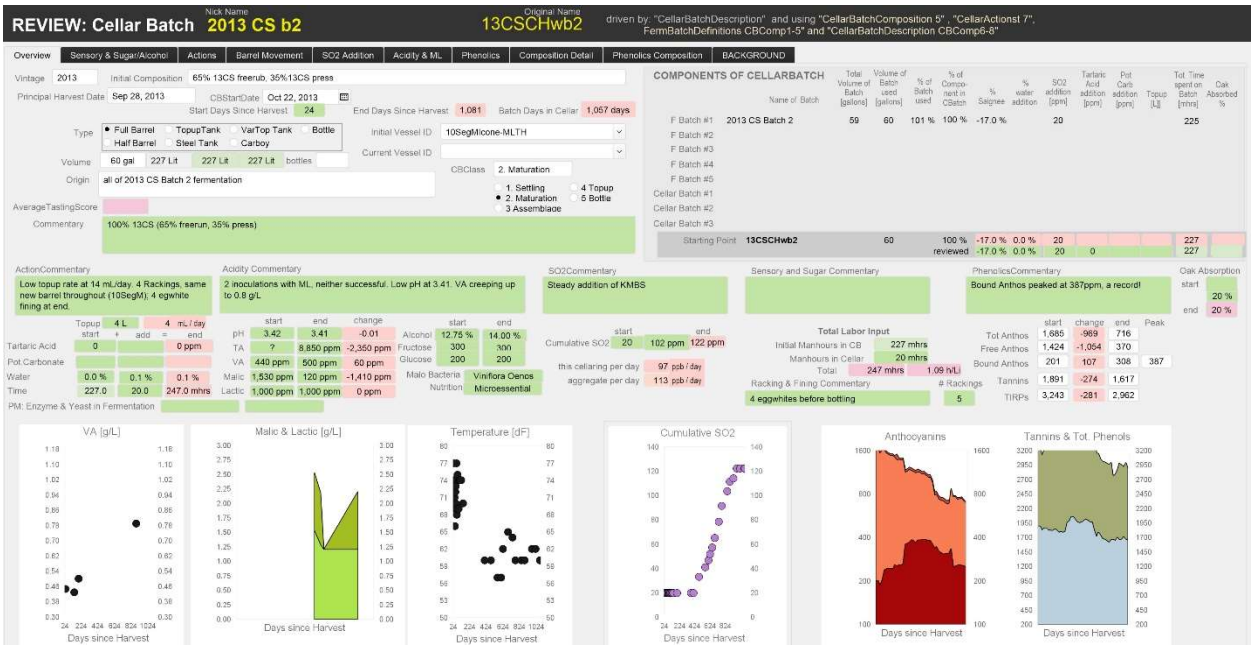
2013 was a splendid vintage with good yields and excellent berry quality. This is the first year we tracked the phenolics from the start (see Winery section) and thus better understand their evolution. We used a new French oak barrel (Radoux TR M+) and recycled a 3-year-old French barrel used for two years (2010 Seguin Moreau Icone). We had 20 gallons of extra press wine which we kept in the 200-liter variable-top steel tank. We detected a slight off-nose in the second barrel, which may have resulted from a microbial infection from its prior use. So we racked the wine into a steel barrel while treating the empty barrel with a KMBS solution and sulfur fumigation.

By February 2014, malolactic fermentation had not progressed, so we decided to re-inoculate all wine with Viniflora CH16 while keeping the temperature elevated at ~70dF. By July 2014, we noticed a slight decrease in malic acid and a slow buildup of lactic acid, which gave us hope that malolactic fermentation was restarted, albeit weak. We kept the barrels at close to ~70dF. By late 2014 the malolactic fermentation looked complete.

We found significant film in the 2013 top-up tank in late January 2014, which we scooped out, judging it as dead yeast brought to the surface due to the slight vacuum in the headspace created by sampling. To protect, we added 15 ppm of SO2 as a preventative measure, although malolactic fermentation was incomplete, and we moved the topup wine into a freed-up pressurized steel tank. By April 2014, the 2013 topup wine had developed a strong rotten egg smell, and we decided to treat it with a heavy dose of KMBS and move it aside into carboys; after that, we used the leftover 2012 topup wine for topping up the 2013 vintage. The 2013 topup wine recovered by the end of 2014, and we used it to fill up the second barrel in the 2014 vintage, which was a little short.

The Bound Anthocyanin levels peaked in mid-2015 at slightly over 380 (ppm ME), a record. By late 2015 the wine developed well, except for the relatively high level of Volatile Acidity at 800 ppm.

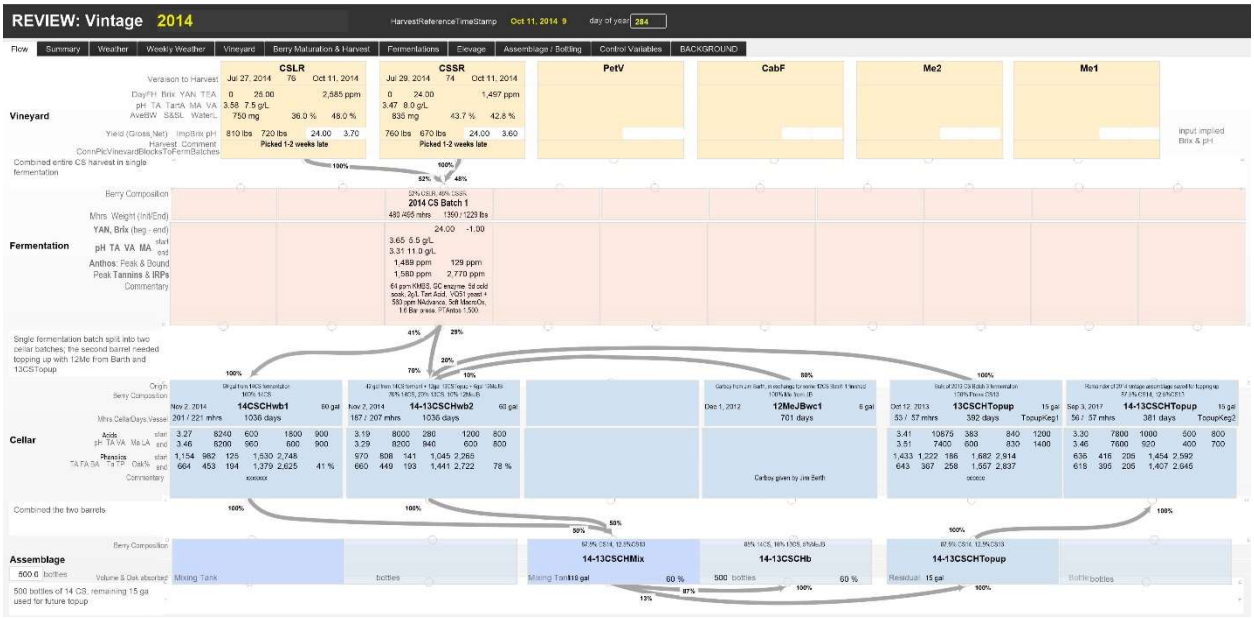




On September 24, 2016, we bottled 42 cases as 13CSCHb and kept 15 gallons in topup tank 13CSCHTopup

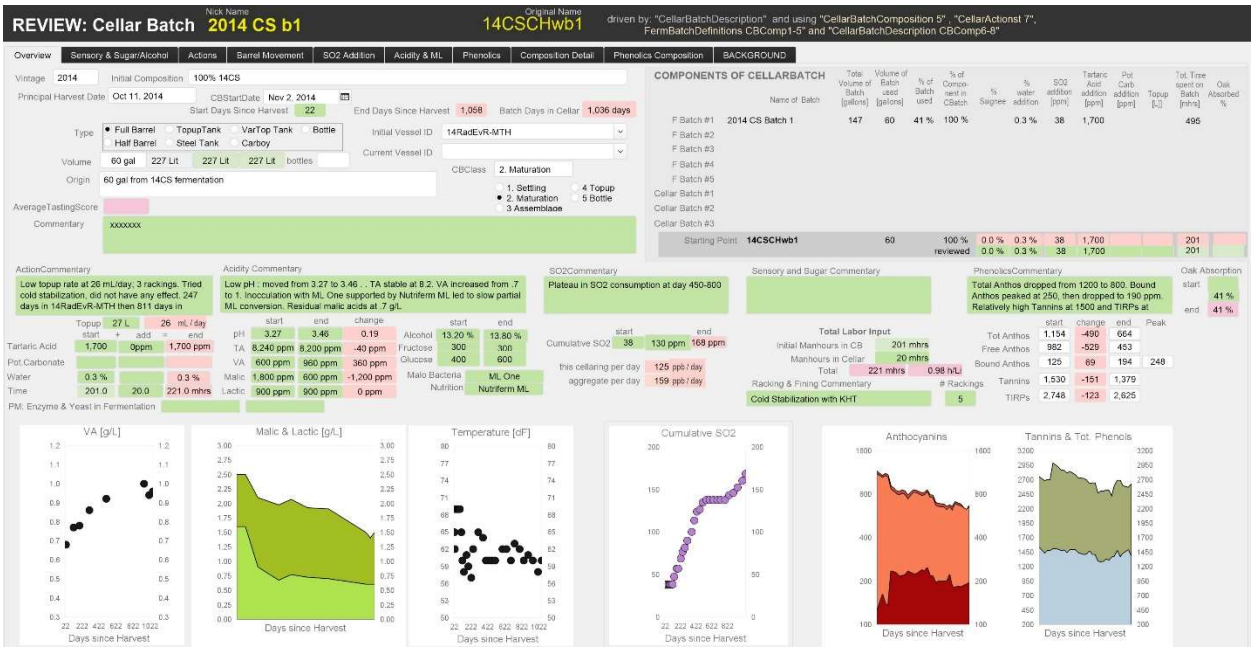
2014 Vintage

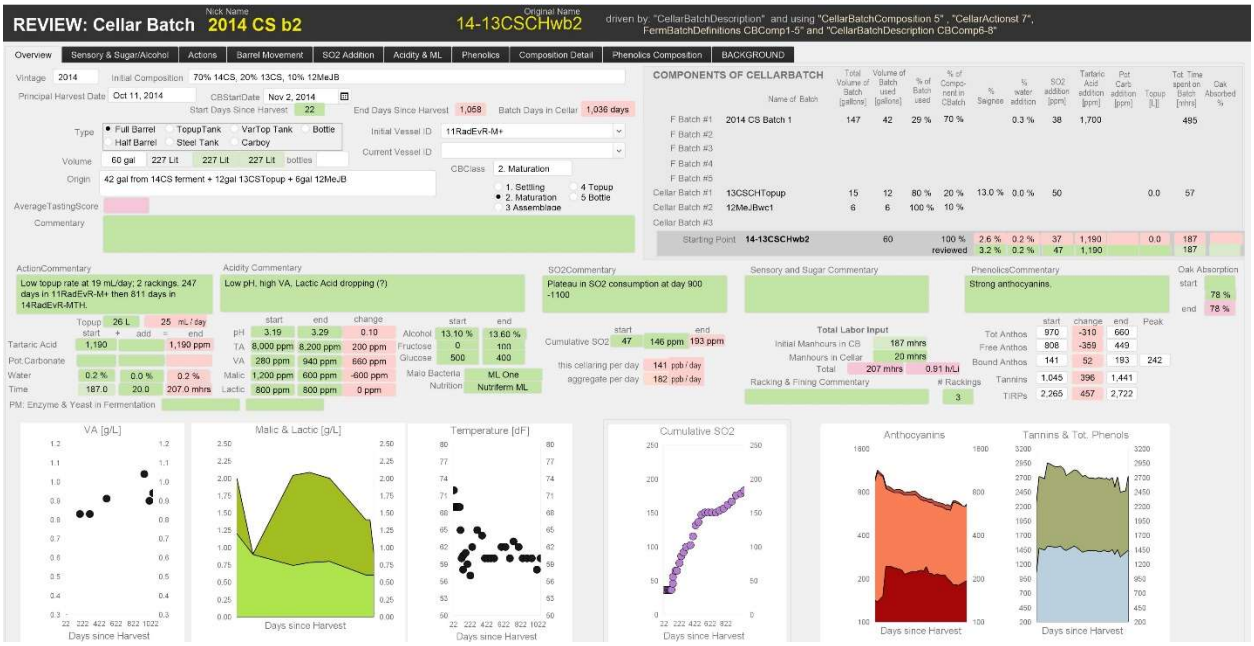
The 2014 vintage was average, quality-wise, and poor on volume as we continued to fight the Eutypa infection. We could barely fill the second barrel by adding 12 gallons of the 2012 CSV top-up and 5 gallons of the 2012 Merlot from Jim Barth. This screenshot shows the overall flow:



The Malolactic fermentation was again slow, probably a cause of the relatively high acidity. The more diligent cellaring routines showed promising results: we had hardly any microbial infections in either barrel compared to previous vintages. After nine months, we decided to rack and switch the new and the 3-year-old barrels to even out the impact of the new oak. The Bound Anthocyanin levels have peaked at around 250 (ppm ME) after one year in the barrels.

In November 2015, we experimented unsuccessfully with cold stabilization on one barrel to reduce acidity. We added 20g of Potassium Tartrate and reduced the temperature to 35 dF for a month to precipitate tataric acid. It did not work because we could not cool down the wine blow 30 dF.

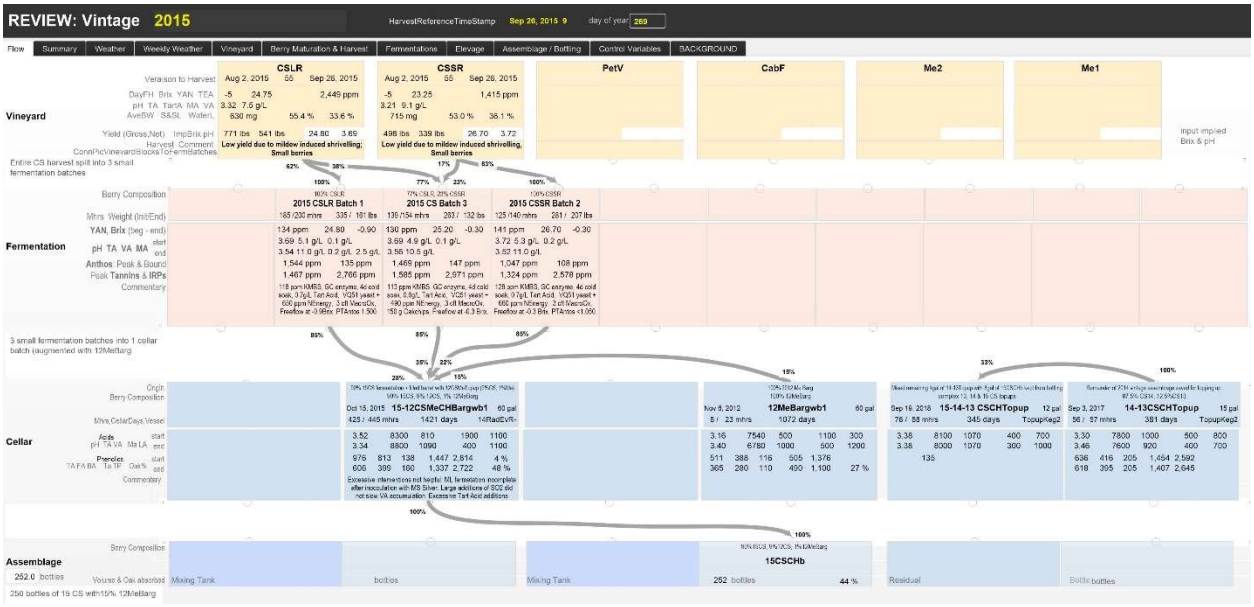




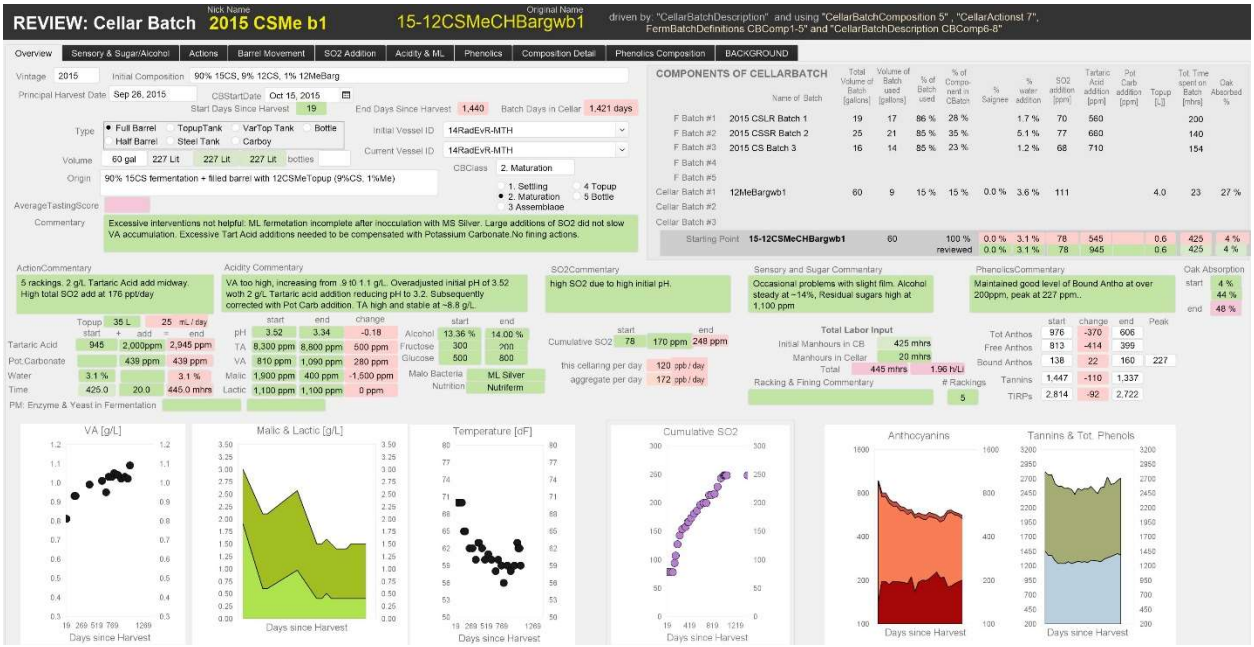
In September 2017, we put the two barrels into Mixing Tank, added 1 lb (1 ppm) of Potassium Carbonite to adjust the pH to 3.55, then bottled 42 cases as 14-13CSCHb leaving 14 gallons for topup as 14-13CSCHTopup. Unfortunately, we failed to stir the wine in the Mixing Tank properly, so early bottles came out with a pH of 3.7 and late bottles with a pH of 3.35!

2015 Vintage

2015 was poor in volume (less than a ½ ton of fruit) and quality (a fair amount of shriveled berries due to a mildew infection). We could fill one barrel only by transferring 8 gallons of the 2012 Bargetto Merlot. We also had to put aside 15 gallons of that blend for top-up wine as we had exhausted other top-up sources.



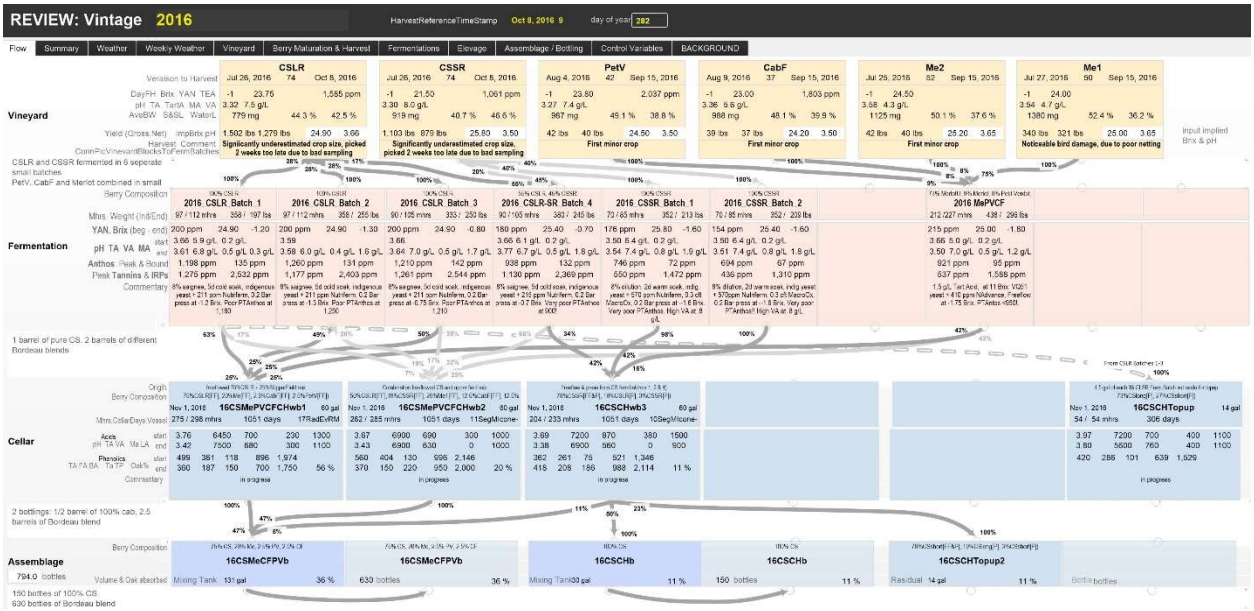
We made too many interventions during cellaring. In December 2016, we added too much Tartaric Acid to reduce the pH, only to compensate in January 2018 by adding 400 ppm Potassium Carbonate. We added a fair amount of SO2 throughout but still could not contain contamination – Volatile Acidity increased to 1100 ppm. Contamination probably came from the topup wine, a 2013, 14 & 15 Cabernet Sauvignon mixture.



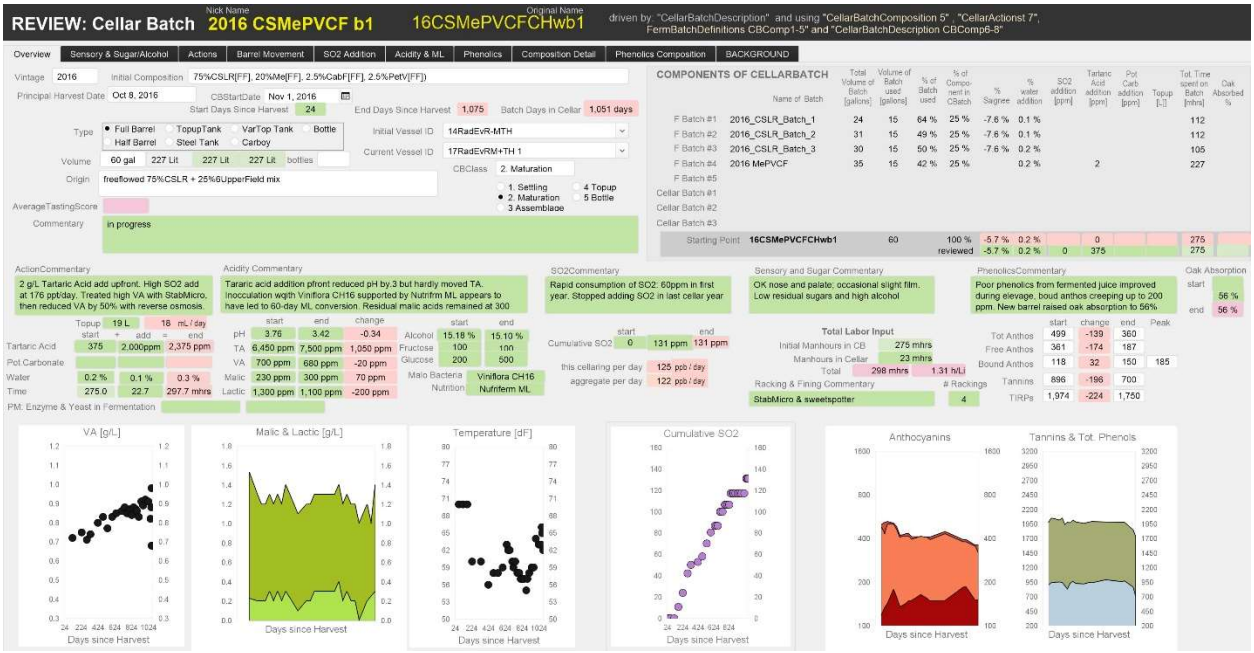
In September 2019, we fined with four egg whites, bottled 21 cases, and saved the remaining 10 gallons for topup.

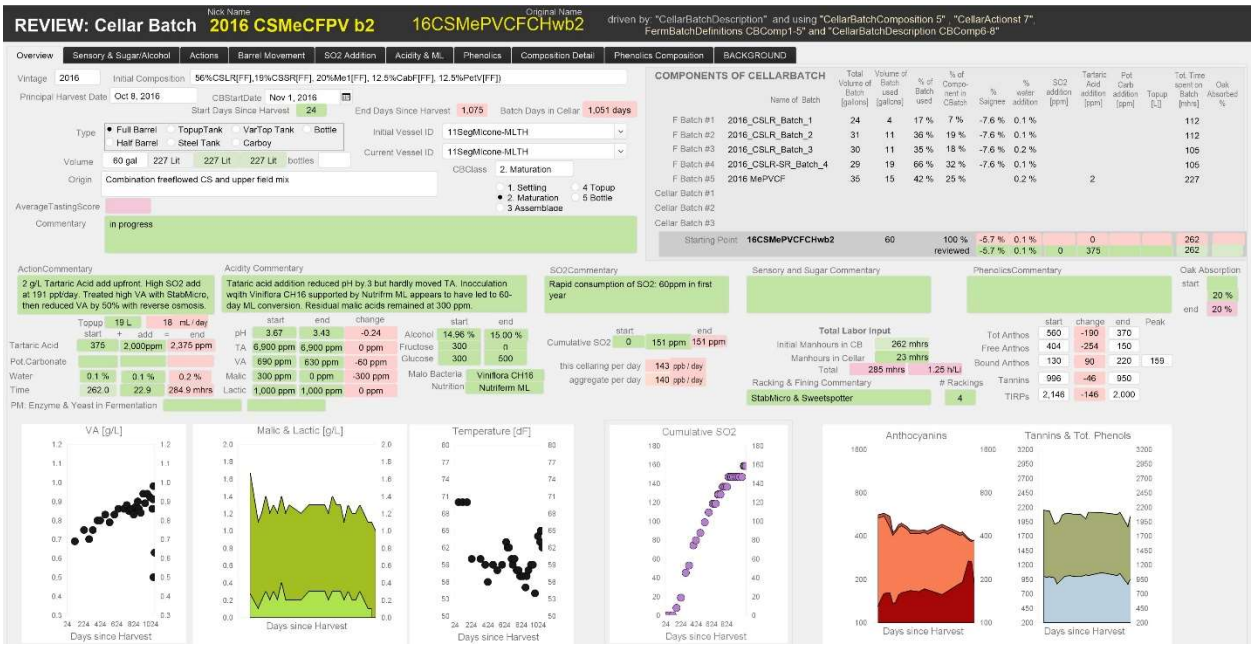
2016 Vintage

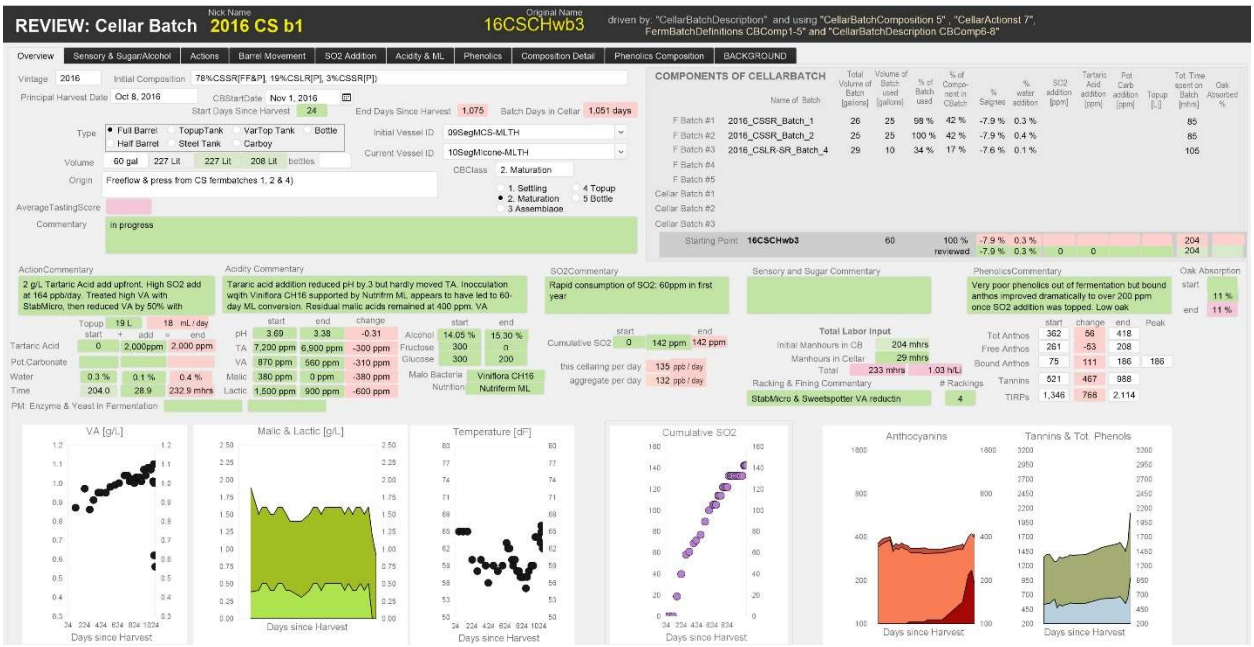
The 2016 vintage included the Merlot, Petit Verdot, and Cab Franc grapes from the upper field for the first time. The yield was above expectation, and the fruit was somewhat overripe. We fermented it in 7 separate batches and free-flowed it into 3 barrels. The first barrel had a mix of Long Row CS plus half the Me-PV-CF crop; The second had a blend of Short and Long Row CS plus the other half of the Me-PV-CF crop. The third mainly had Short Row CS.



We used almost neutral barrels throughout cellaring, so there was limited takeup of tannins. In December 2016 and January 2017, we added close to 1000 ppm Tartaric Acid to each of the three barrels reducing the pH from ~3.7 to ~3.4. We topped up with with relatively old vintages (2013 to 2015), probably the source of contamination. Volatile Acidity reached 1100 ppm, and we decided to fine all barrels with StabMicro and then raked and reduced VA with reverse osmosis filtering in August 2019. Surprisingly, the treatment seemed to lift the Bound Anthocyanin levels to over 200 pm.



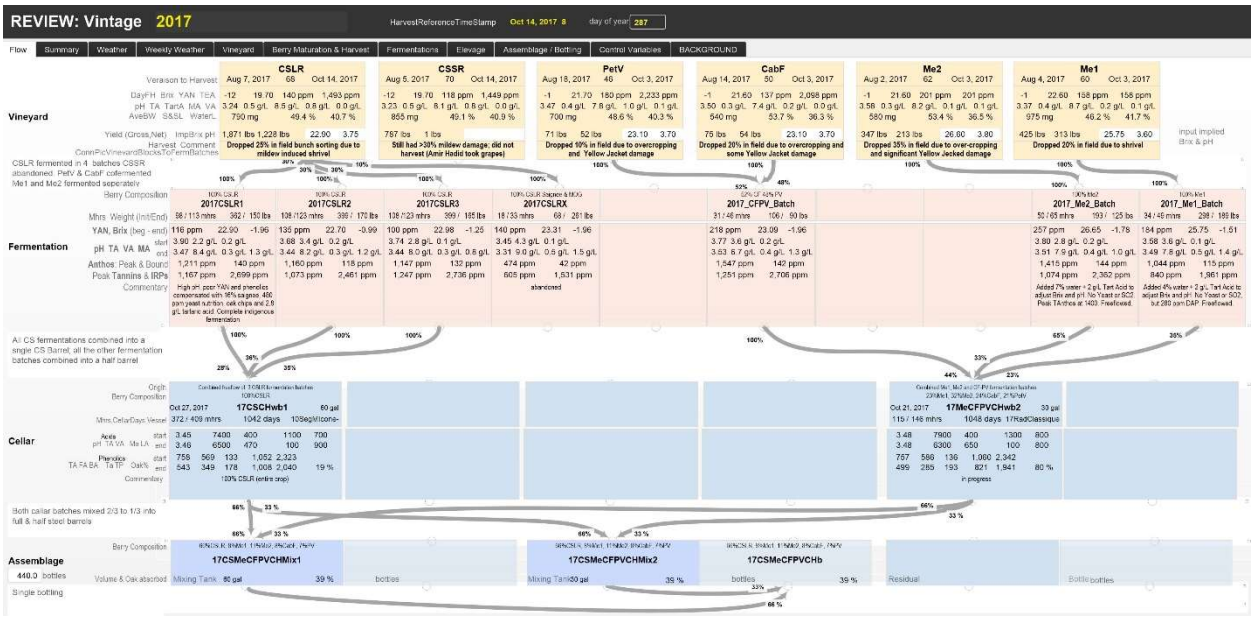




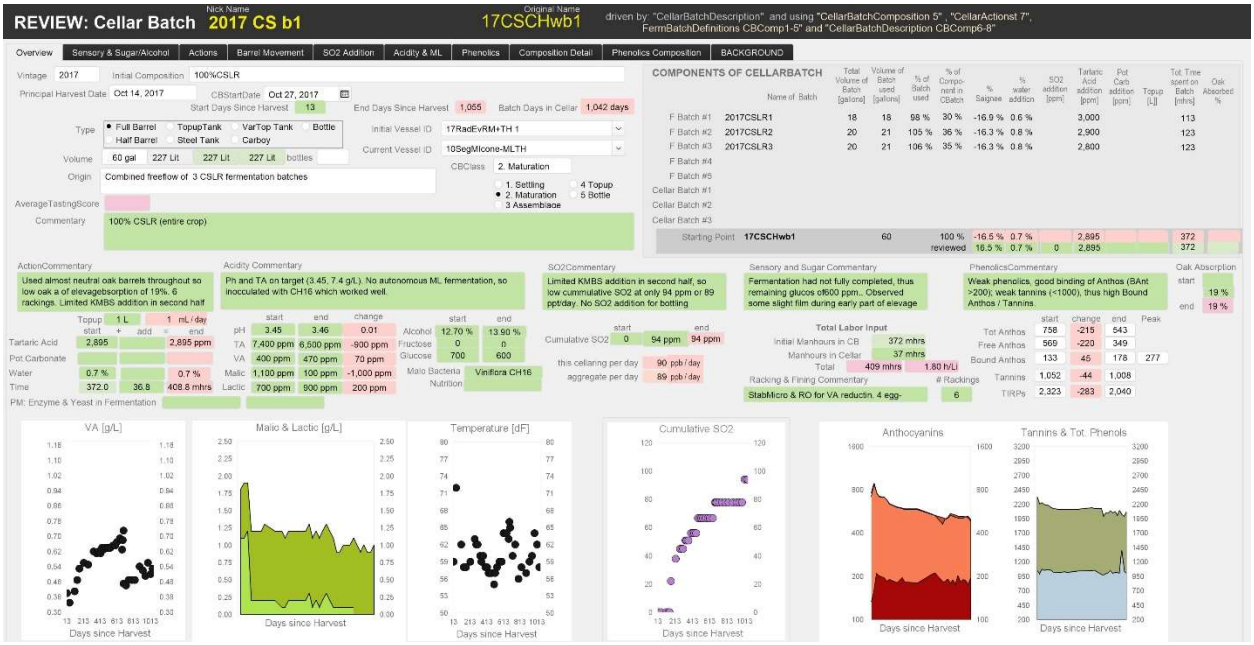
We bottled half of the pure Cabernet Sauvignon barrel (150 bottles) and mixed the remaining barrels for a Bordeau blend (630 bottles). The pure Cabernet Sauvignon bottles were measured at 3.4 pH, 760 ppm VA, 15.3% alcohol, 190 ppm Bound Anthocyanins, and 2100 ppm TIRPs. The Bordeau Blend bottles measured very close at 3.4 pH, 700ppm VA, 15.2% alcohol, 160 ppm Bound Anthocyanins, and 1800 ppm IRPs.

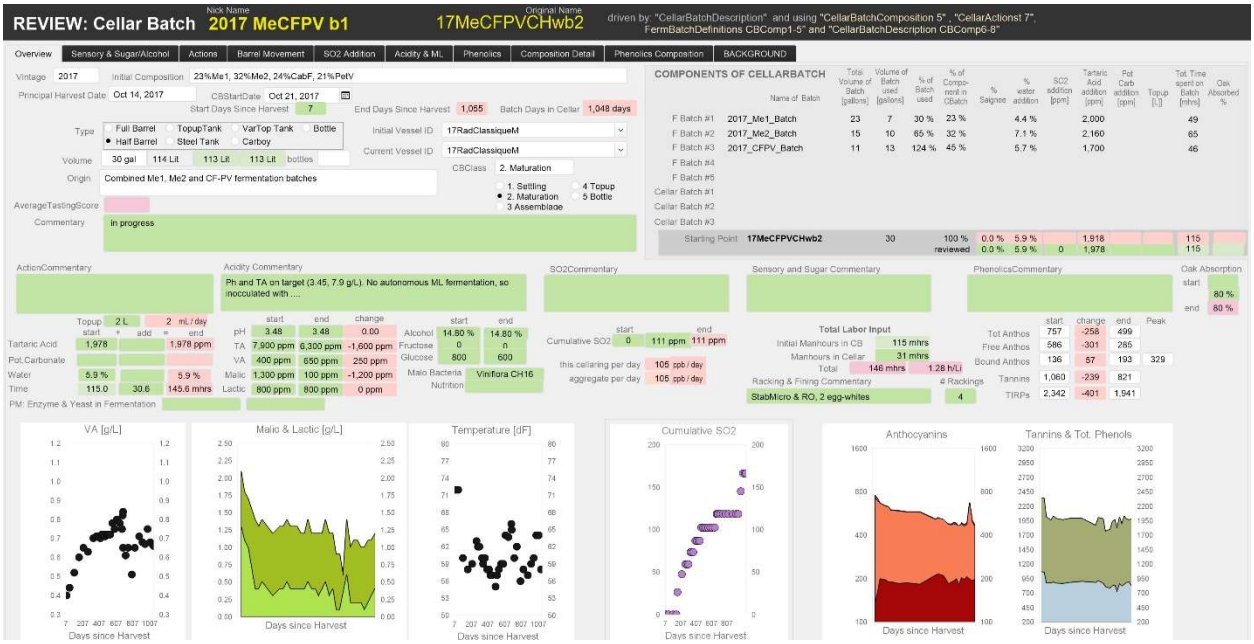
2017 Vintage

The 2017 vintage was poor in volume and quality, primarily because of mildew and severe heat spikes in the summer. We abandoned the Short Row block in the lower field and picked only the Long Row Cabernet, which yielded one barrel. The upper field produced a half barrel of Me-PV-CF mix. We did all fermentations in small batches with indigenous yeast and ended up with an entire barrel of Cabernet Sauvignon from the long rows and a half-barrel mix of Merlot, Cab Franc, and Petit Verdot from the upper field.



We used mostly neutral barrels for the Cabernet Sauvignon, thus yielding a low oak extraction of only 19%, but we used a new half barrel for the Me-CabF-PetV mix resulting in an oak extraction of 80%. We added Viniflora CH16 bacteria without nutrition supplements and completed Malolactic fermentation successfully within a few weeks. We did not have to add any tartaric acid as the pH levels were adequate given our adjustments during fermentation. 2017 was the last vintage in which we used topup wine from previous years, and that may have been the cause for some contaminations. The contaminations prompted us to fine both barrels with StabMicro and then use the reverse osmosis filter to reduce the Volatile Acidity.

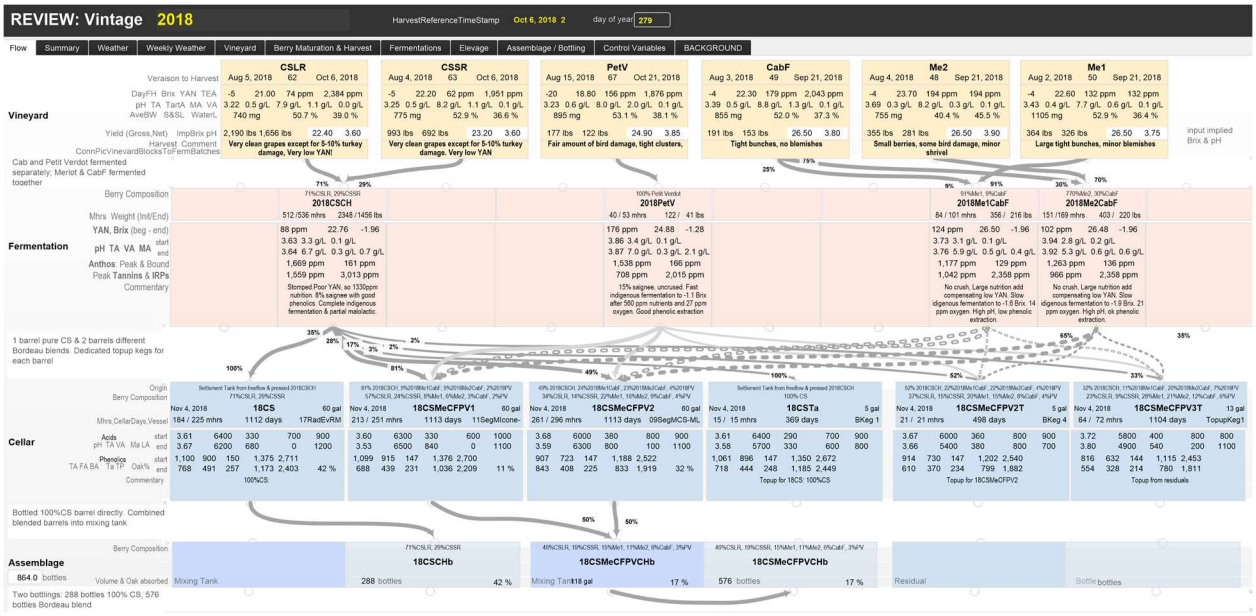




In September 2020, we combined the contents of the two barrels in the mixing tank without adding any SO2 before bottling. We ended up with 440 bottles of a Bordeaux blend at pH of 3.40, TA of 6,800 ppm, Volatile Acidity of 550 ppm, Alcohol of 14,7%, and residual Glucose of 600 ppm. The phenolics measured Bound Anthocyanins of 190 ppm, Tannins of 930 ppm, and TIRPs of 2,000 ppm.

2018 Vintage

The 2018 vintage was excellent in volume and quality, partly due to good weather with only one heat spike. In the winter, soil amendments (mushroom compost & oyster shell lime) and foliar nutrient sprays in spring may have helped. Harvest yield was 3,200 lbs net after less than 25% losses in berry sorting and destemming. We had three picks and fermented the Cabernet in one big batch, the Merlot and Cab Franc together, and the Petit Verdot last. Then we filled 3 barrels (one pure Cabernet, the other two Bordeaux blends). This screenshot illustrates the overall process.



We inoculated with malolactic bacteria (Viniflora Oenos 2) and nutrients in August of 2019. The malolactic fermentation completed in all three barrels. To reduce the chance of contaminations, we used only 2018 wine to top up, and we bought a barrel steamer to more thoroughly disinfect the barrels after each racking. We still needed to fine with StabMicro in September 2019, which contained Volatile Acidity to 800-900 ppm despite a 50% reduction in SO2 additions. We adjusted the pH from 3.65 to 3.45 with four small additions of Tartaric Acids (total ~ 800 ppm). We mainly used neutral barrels, so the accumulated oak extraction was relatively low (42%, 11%, and 32% for the Cab and the two blend barrels, respectively)

REVIEW: Cellar Batch — Nick Name: 2018 CS b1 — Original Name: 18CS

driven by: "CellarBatchDescription" and using "CellarBatchComposition 5" , "CellarActionst 7", FermBatchDefinitions CBComp1-5" and "CellarBatchDescription CBComp6-8"

Overview | Sensory & Sugar/Alcohol | Actions | Barrel Movement | SO2 Addition | Acidity & ML | Phenolics | Composition Detail | Phenolics Composition | BACKGROUND

Vintage: 2018 — Initial Composition: 71%CSLR, 29%CSSR

Principal Harvest Date: Oct 6, 2018 — CBStartDate: Nov 4, 2018 — Start Days Since Harvest: 29 — End Days Since Harvest: 1,141 — Batch Days in Cellar: 1,112 days

Type: (•) Full Barrel ( ) TopupTank ( ) VarTop Tank ( ) Bottle ( ) Half Barrel ( ) Steel Tank ( ) Carboy

Volume: 60 gal | 227 Lit | 227 Lit | 227 Lit | bottles

Origin: Settlement Tank from freeflow & pressed 2018CSCH

Initial Vessel ID: 17RadEvRMTH 2 — Current Vessel ID: 17RadEvRMTH 1

CBClass: 2. Maturation — ( ) 1. Settling ( ) 4 Topup (•) 2. Maturation ( ) 5 Bottle ( ) 3 Assemblage

AverageTastingScore:

Commentary: 100%CS:

COMPONENTS OF CELLARBATCH

Name of Batch	Total Volume of Batch [gallons]	Volume of Batch used [gallons]	% of Batch used	% of Compo-nent in CBatch	% Saignee	% water addition	SO2 addition [ppm]	Tartaric Acid addition [ppm]	Pot Carb addition [ppm]	Topup [L/]	Tot Time spent on Batch [mhrs]	Oak Absorbed %
F Batch #1 2018CSCH	174	60	34 %	100 %	-8.0 %	0.4 %					536	
F Batch #2												
F Batch #3												
F Batch #4												
F Batch #5												
Cellar Batch #1												
Cellar Batch #2												
Cellar Batch #3												
Starting Point 18CS	60		100 %		-8.0 %	0.4 %					184	
reviewed					8.0 %	0.4 %					184	

ActionCommentary: Added 250 ppm Tartaric acid, then first rack n day 200. Rising VA (raching 700ppmnecessitated fining with StabMicro

AcidityCommentary: Added 250 ppm tartaric acid with limited lasting effect. Fast ML fermentationafter inducing with Viniflora Oenos 2.0 supported by Nutriferm ML

SO2Commentary: No SO2 until Nov 2019!. Therafter limited to total 53ppm SO2 equiv.

Sensory and Sugar Commentary: Relatively low alcohol (13.6%). Minor build up of Glucose (zero to 500ppm), no fructose

PhenolicsCommentary: Strong binding of Anthocyanins peaking at 340ppm, then falling off to respectable 230ppm

Oak Absorption: start 42 % — end 42 %

Topup: 0 mL / day

	start	+ add	= end
Tartaric Acid		750ppm	750 ppm
Pot.Carbonate			
Water	0.4 %		0.4 %
Time	184.0	40.7	224.7 mhrs

PM: Enzyme & Yeast in Fermentation:

	start	end	change
pH	3.61	3.67	0.06
TA	6,400 ppm	6,200 ppm	-200 ppm
VA	330 ppm	680 ppm	350 ppm
Malic	700 ppm	0 ppm	-700 ppm
Lactic	900 ppm	1,200 ppm	300 ppm

	start	end
Alcohol	13.20 %	13.60 %
Fructose	0	n
Glucose	0	500
Malo Bacteria Nutrition	Viniflora Oenos 2.0	Nutriferm ML

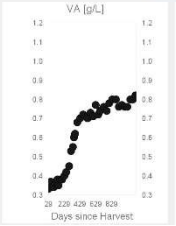
	start	end
Cumulative SO2		53 ppm 53 ppm
this cellaring per day	48 ppb / day	
aggregate per day	46 ppb / day	

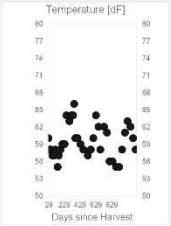
Total Labor Input

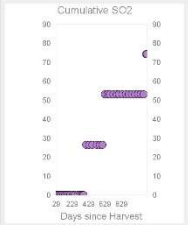
Initial Manhours in CB	184 mhrs	
Manhours in Cellar	41 mhrs	
Total	225 mhrs	0.99 h/Li

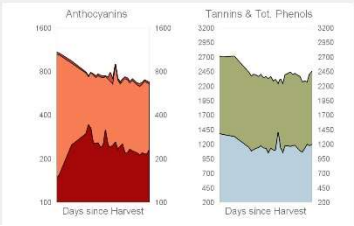
Racking & Fining Commentary: StabMicro — # Rackings: 5

	start	change	end	Peak
Tot Anthos	1,100	-332	768	
Free Anthos	900	-409	491	
Bound Anthos	150	107	257	320
Tannins	1,375	-202	1,173	
TIRPs	2,711	-308	2,403	









REVIEW: Cellar Batch — Nick Name: 2018 CSMeCFPV b1 — Original Name: 18CSMeCFPV1

driven by: "CellarBatchDescription" and using "CellarBatchComposition 5" , "CellarActionst 7", FermBatchDefinitions CBComp1-5" and "CellarBatchDescription CBComp6-8"

Overview | Sensory & Sugar/Alcohol | Actions | Barrel Movement | SO2 Addition | Acidity & ML | Phenolics | Composition Detail | Phenolics Composition | BACKGROUND

Vintage: 2018 — Initial Composition: 57%CSLR, 24%CSSR, 8%Me1, 6%Me2, 3%CabF, 2%PV

Principal Harvest Date: Oct 6, 2018 — CBStartDate: Nov 4, 2018 — Start Days Since Harvest: 29 — End Days Since Harvest: 1,142 — Batch Days in Cellar: 1,113 days

Type: (•) Full Barrel ( ) TopupTank ( ) VarTop Tank ( ) Bottle ( ) Half Barrel ( ) Steel Tank ( ) Carboy

Volume: 60 gal | 227 Lit | 227 Lit | 227 Lit | bottles

Origin: 81% 2018CSCH, 9%2018Me1CabF, 9%2018Me2CabF, 2%2018PV Settlement Tanks

Initial Vessel ID: 14RadEvR-MTH — Current Vessel ID: 11SegMIcone-MLTH

CBClass: 2. Maturation — ( ) 1. Settling ( ) 4 Topup (•) 2. Maturation ( ) 5 Bottle ( ) 3 Assemblage

AverageTastingScore:

Commentary:

COMPONENTS OF CELLARBATCH

Name of Batch	Total Volume of Batch [gallons]	Volume of Batch used [gallons]	% of Batch used	% of Compo-nent in CBatch	% Saignee	% water addition	SO2 addition [ppm]	Tartaric Acid addition [ppm]	Pot Carb addition [ppm]	Topup [L/]	Tot Time spent on Batch [mhrs]	Oak Absorbed %
F Batch #1 2018CSCH	174	49	28 %	81 %	-8.0 %	0.4 %					536	
F Batch #2 2018Me1CabF	26	5	20 %	9 %	-10.0 %	0.2 %					101	
F Batch #3 2018Me2CabF	26	5	20 %	9 %	-5.0 %	0.3 %					169	
F Batch #4 2018PetV	5	1	20 %	2 %	-15.0 %	0.1 %					53	
F Batch #5												
Cellar Batch #1												
Cellar Batch #2												
Cellar Batch #3												
Starting Point 18CSMeCFPV1	60		100 %		-8.0 %	0.3 %					213	
reviewed					7.9 %	0.3 %					213	0 %

ActionCommentary: Stab Micro addition to fight VA increase after 1 year. Limited oak addition. 800ppm Tartaric Acid addition. Limited oak exposure at 11%

AcidityCommentary: Added 250 ppm tartaric acid with limited lasting effect. Fast ML fermentationafter inducing with Viniflora Oenos 2.0 supported by Nutriferm ML High VA at 900 ppm

SO2Commentary: No SO2 until Nov 2019!

Sensory and Sugar Commentary:

PhenolicsCommentary:

Oak Absorption: start 0 % — 11 % — end 11 %

Topup: 0 mL / day

	start	+ add	= end
Tartaric Acid		813ppm	813 ppm
Pot.Carbonate			
Water	0.3 %		0.3 %
Time	213.0	37.6	250.6 mhrs

PM: Enzyme & Yeast in Fermentation:

	start	end	change
pH	3.60	3.53	-0.07
TA	6,300 ppm	6,500 ppm	200 ppm
VA	330 ppm	840 ppm	510 ppm
Malic	600 ppm	0 ppm	-600 ppm
Lactic	1,000 ppm	1,100 ppm	100 ppm

	start	end
Alcohol	12.80 %	12.20 %
Fructose	0	n
Glucose	0	0
Malo Bacteria Nutrition		

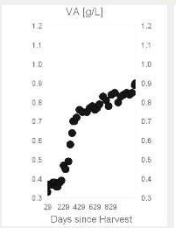
	start	end
Cumulative SO2		27 ppm 27 ppm
this cellaring per day	24 ppb / day	
aggregate per day	23 ppb / day	

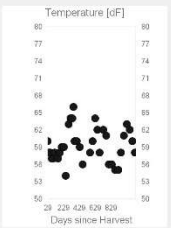
Total Labor Input

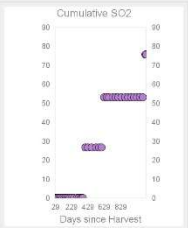
Initial Manhours in CB	213 mhrs	
Manhours in Cellar	38 mhrs	
Total	251 mhrs	1.10 h/Li

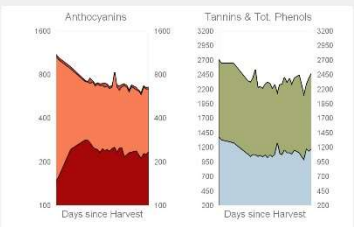
Racking & Fining Commentary: StabMicro to fight contamination signaled by — # Rackings: 5

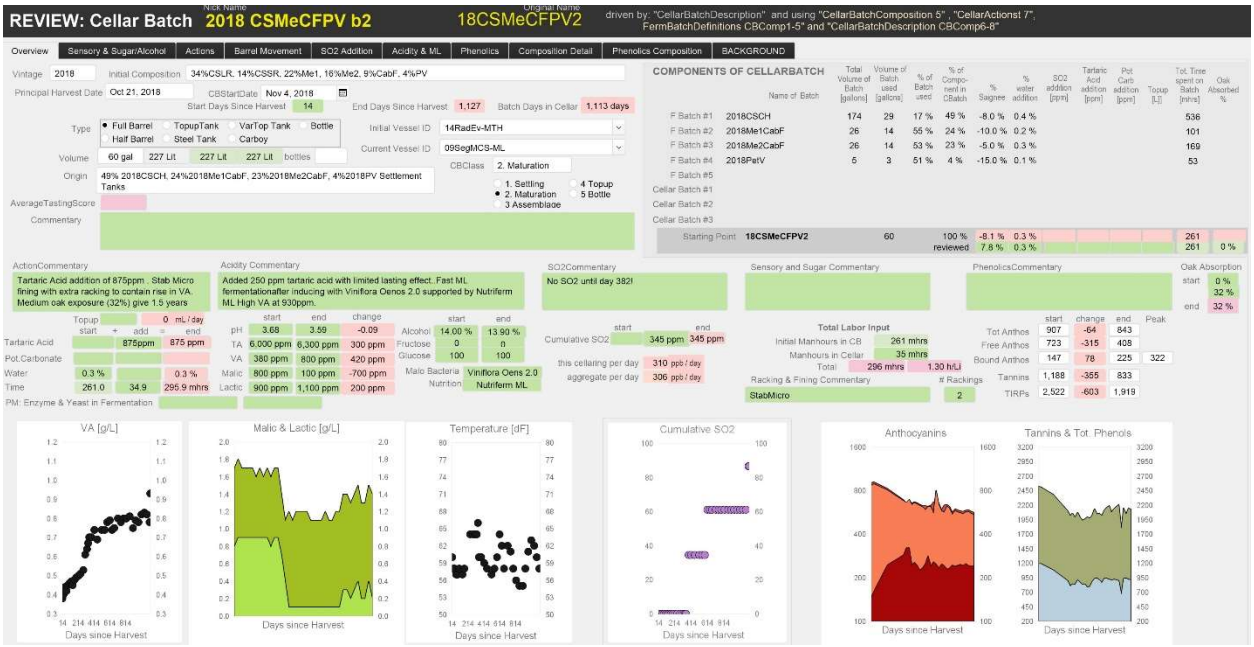
	start	change	end	Peak
Tot Anthos	1,099	-411	688	
Free Anthos	915	-476	439	
Bound Anthos	147	84	231	341
Tannins	1,376	-340	1,036	
TIRPs	2,700	-491	2,209	







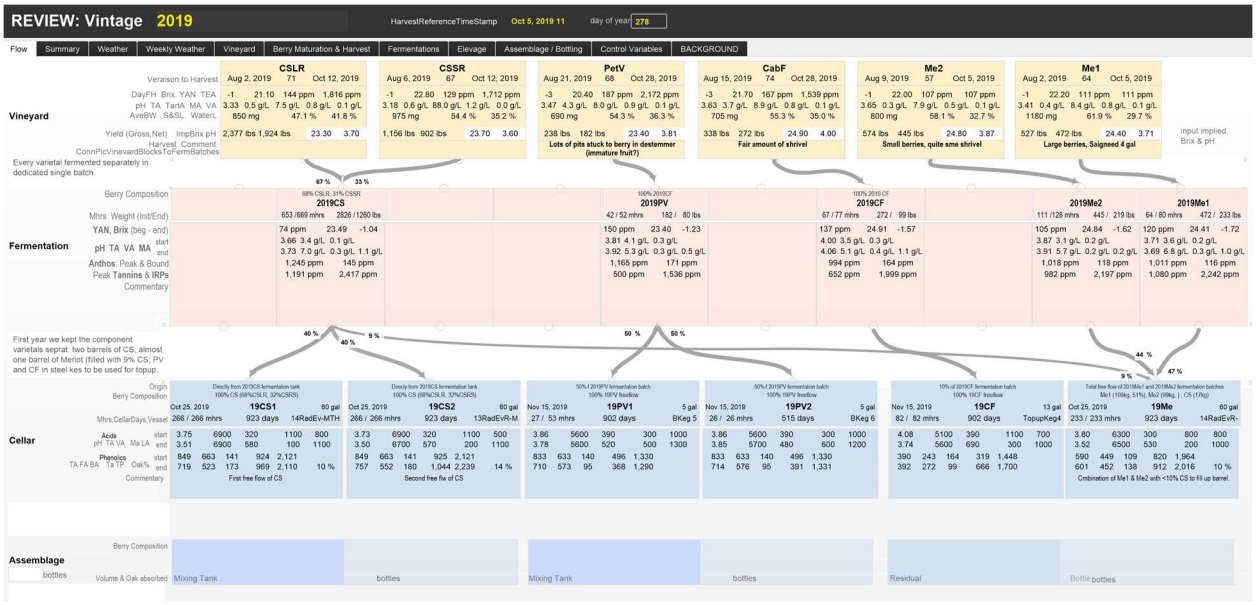




In late November 2021, we racked the pure Cabernet Sauvignon barrel directly into 280 bottles at 3.47 pH, TA of 6,700 ppm, and Volatile Acidity of 870 ppm. Alcohol was 14% with residual sugar at 300 ppm. Phenolics were excellent at 240 ppm of Bound Anthocyanins,1,200 ppm of Tannins, and 2400 ppm of TIRPs. A few days later, we racked the two Bordeau Blend barrels into a mixing tank and then saved the blend into 580 bottles at 3.65 pH, 6500 ppm TA, and 890 ppm Volatile Acidity. Alcohol was 14.5%, with residual sugars at 700 ppm. Phenolics were excellent with Bound Anthocyanins at 235 ppm, Tannins at 1,000 ppm, and TIRPs at.2,400 ppm

2019 Vintage

The 2019 vintage was a mixed blessing. We had a lot of rain in the winter, followed by a hot summer with lots of heat spikes. At over 5,200lbs, we had the largest crop since 2009 with clean fruit, netting 4,200 lbs in the fermentation tanks. Berry maturation was skewed: at Brix of 23.7, we had an average pH of over 3.7. We fermented each varietal separately with its natural yeasts but had to add significant amounts of nutrition to compensate for the low nitrogen level in the must. We put the Cabernet in two separate barrels for cellaring and combined the Merlot ferments into a third barrel adding a bit of Cabernet to fill it up. We cellared the Cab Franc and the Petit Verdot in steel tanks. In addition, we kept two topup steel tanks of Cabernet. We used the topup and steel tanks for topping up the barrels. By May 2022, all these tanks were empty except the Cabernet Franc tank.



The Malolactic fermentation completed without adding any bacteria or nutrition. We started the elevage with a stupid mistake for the Cabernet barrels: we intended to add Tartaric Acid to reduce the pH. Instead, we added KMBS powder, translating into a 150 ppm initial shock of SO2. The plan was no addition of SO2 at all. We added around 1,500ppm of Tartaric Acid in 5 installments through June 2020 to all three barrels and the steel tanks, reducing the pH from ~3.75 to 3.50. We used neutral barrels, so the accumulated oak extraction was less than 15% in all three barrel lots. The increased efforts in sanitation (barrel steaming, only using current vintage wine for topup) paid off in slower increases in Volatile Acidity, topping out at 650 ppm. Only the Cab Franc in the steel tank required some fining, with StabMicro in January 2020 and Bactiless in December 2020.

REVIEW: Cellar Batch — Nick Name: 2019 CS b1

Original Name: 19CS1

driven by: "CellarBatchDescription" and using "CellarBatchComposition 5" , "CellarActionst 7", FermBatchDefinitions CBComp1-5" and "CellarBatchDescription CBComp6-8"

Overview | Sensory & Sugar/Alcohol | Actions | Barrel Movement | SO2 Addition | Acidity & ML | Phenolics | Composition Detail | Phenolics Composition | BACKGROUND

Vintage: 2019 | Initial Composition: 100% CS (68%CSLR, 32%CSRS)

Principal Harvest Date: Oct 12, 2019 | CBStartDate: Oct 25, 2019

Start Days Since Harvest: 13 | End Days Since Harvest: 936 | Batch Days in Cellar: 923 days

Type: (•) Full Barrel ( ) Half Barrel ( ) TopupTank ( ) Steel Tank ( ) VarTop Tank ( ) Carboy ( ) Bottle

Volume: 60 gal | 227 Lit | 227 Lit | 227 Lit | bottles

Origin: Directly from 2019CS fermentation tank

AverageTastingScore:

Commentary: First free flow of CS

Initial Vessel ID: 13RadEvR-M+TH | Current Vessel ID: 14RadEv-MTH

CBClass: 2. Maturation

( ) 1. Settling ( ) 4 Topup
(•) 2. Maturation ( ) 5 Bottle
( ) 3 Assemblage

COMPONENTS OF CELLARBATCH

Name of Batch	Total Volume of Batch [gallons]	Volume of Batch used [gallons]	% of Batch used	% of Compo-nent in CBatch	% Saignee	% water addition	SO2 addition [ppm]	Tartaric Acid addition [ppm]	Pot Carb addition [ppm]	Topup [L]]	Tot. Time spent on Batch [mhrs]	Oak Absorbed %
F Batch #1 2019CS	151	60	40 %	100 %	-16.0 %	0.0 %		260			669	
F Batch #2												
F Batch #3												
F Batch #4												
F Batch #5												
Cellar Batch #1												
Cellar Batch #2												
Cellar Batch #3												
Starting Point 19CS1	60		100 %	-16.0 %	0.0 %		260				266	
reviewed				-16.0 %	0.0 %		280				266	

ActionCommentary: Significan Tartaric Acid add (1500ppm) to get pH down from 3.8 to 3.5. Very limited oak exposure (10%) given use of old barrels

Acidity Commentary: Reduced pH from 3.75 to 3.5 by adding 1500 ppm Tartaric Acid. Only limited increas in TA. VA well contained at 600ppm. 70% Malolactic conversion upront.

SO2Commentary: Overdose SO2 addition upfront (added 140ppm instead of 16ppm). No further SO2 additions after. VA levels well contained at

Sensory and Sugar Commentary:

PhenolicsCommentary:

Oak Absorption: start 10 % | end 10 %

Topup: 0 mL / day

	start	+ add	= end
Tartaric Acid	280	1,524ppm	1,804 ppm
Pot.Carbonate			
Water	0.0 %		0.0 %
Time	266.0		266.0 mhrs

	start	end	change
pH	3.75	3.51	-0.24
TA	6,900 ppm	6,900 ppm	0 ppm
VA	320 ppm	580 ppm	260 ppm
Malic	1,100 ppm	100 ppm	-1,000 ppm
Lactic	800 ppm	1,100 ppm	300 ppm

	start	end
Alcohol	13.00 %	12.80 %
Fructose	0	0
Glucose	0	0

Malo Bacteria Nutrition:

PM: Enzyme & Yeast in Fermentation:

	start	end
Cumulative SO2		148 ppm 148 ppm

this cellaring per day: 160 ppb / day
aggregate per day: 158 ppb / day

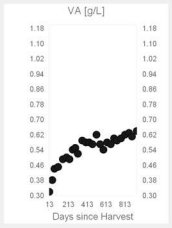
Total Labor Input

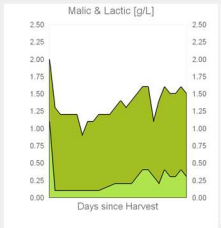
Initial Manhours in CB	266 mhrs	
Manhours in Cellar		
Total	266 mhrs	1.17 h/Li

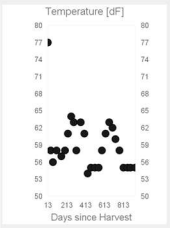
Racking & Fining Commentary:

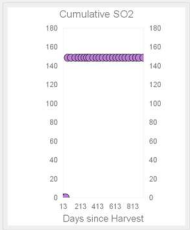
Rackings: 1

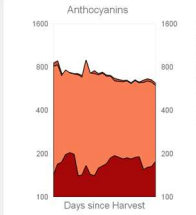
	start	change	end	Peak
Tot Anthos	849	-130	719	
Free Anthos	663	-140	523	
Bound Anthos	141	32	173	
Tannins	924	45	969	
TIRPs	2,121	-11	2,110	

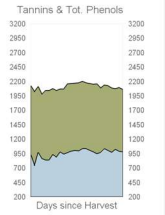












REVIEW: Cellar Batch — Nick Name: 2019 CS b2

Original Name: 19CS2

driven by: "CellarBatchDescription" and using "CellarBatchComposition 5" , "CellarActionst 7", FermBatchDefinitions CBComp1-5" and "CellarBatchDescription CBComp6-8"

Overview | Sensory & Sugar/Alcohol | Actions | Barrel Movement | SO2 Addition | Acidity & ML | Phenolics | Composition Detail | Phenolics Composition | BACKGROUND

Vintage: 2019 | Initial Composition: 100% CS (68%CSLR, 32%CSRS)

Principal Harvest Date: Oct 12, 2019 | CBStartDate: Oct 25, 2019

Start Days Since Harvest: 13 | End Days Since Harvest: 936 | Batch Days in Cellar: 923 days

Type: (•) Full Barrel ( ) Half Barrel ( ) TopupTank ( ) Steel Tank ( ) VarTop Tank ( ) Carboy ( ) Bottle

Volume: 60 gal | 227 Lit | 227 Lit | 227 Lit | bottles

Origin: Direcly from 2019CS fermentation tank

AverageTastingScore:

Commentary: Second free flw of CS

Initial Vessel ID: 17RadEvRMTH 2 | Current Vessel ID: 13RadEvR-M+TH

CBClass: 2. Maturation

( ) 1. Settling ( ) 4 Topup
(•) 2. Maturation ( ) 5 Bottle
( ) 3 Assemblage

COMPONENTS OF CELLARBATCH

Name of Batch	Total Volume of Batch [gallons]	Volume of Batch used [gallons]	% of Batch used	% of Compo-nent in CBatch	% Saignee	% water addition	SO2 addition [ppm]	Tartaric Acid addition [ppm]	Pot Carb addition [ppm]	Topup [L]]	Tot. Time spent on Batch [mhrs]	Oak Absorbed %
F Batch #1 2019CS	151	60	40 %	100 %	-16.0 %	0.0 %		260			669	
F Batch #2												
F Batch #3												
F Batch #4												
F Batch #5												
Cellar Batch #1												
Cellar Batch #2												
Cellar Batch #3												
Starting Point 19CS2	60		100 %	-16.0 %	0.0 %		260				266	
reviewed				-16.0 %	0.0 %		280				266	

ActionCommentary: Significan Tartaric Acid add (1500ppm) to get pH down from 3.8 to 3.5. ILmited oak exposure (14%) given use of old barrels throughout

Acidity Commentary: Reduced pH from 3.75 to 3.5 by adding 1500 ppm Tartaric Acid. Only limited increas in TA. VA well contained below 600ppm. 75% Malolactic conversion upront.

SO2Commentary: Overdose SO2 addition upfront (added 140ppm instead of 16ppm). No further SO2 additions after. VA levels well contained at

Sensory and Sugar Commentary:

PhenolicsCommentary:

Oak Absorption: start 14 % | end 14 %

Topup: 0 mL / day

	start	+ add	= end
Tartaric Acid	280	1,580ppm	1,860 ppm
Pot.Carbonate			
Water	0.0 %		0.0 %
Time	266.0		266.0 mhrs

	start	end	change
pH	3.73	3.50	-0.23
TA	6,900 ppm	6,700 ppm	-200 ppm
VA	320 ppm	570 ppm	250 ppm
Malic	1,100 ppm	200 ppm	-900 ppm
Lactic	500 ppm	1,100 ppm	600 ppm

	start	end
Alcohol	13.80 %	14.00 %
Fructose	0	0
Glucose	0	300

Malo Bacteria Nutrition:

PM: Enzyme & Yeast in Fermentation:

	start	end
Cumulative SO2		148 ppm 148 ppm

this cellaring per day: 160 ppb / day
aggregate per day: 158 ppb / day

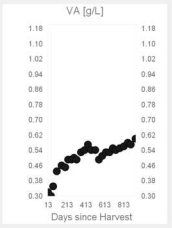
Total Labor Input

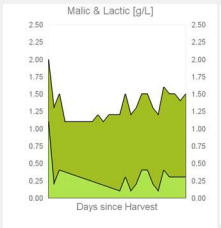
Initial Manhours in CB	266 mhrs	
Manhours in Cellar		
Total	266 mhrs	1.17 h/Li

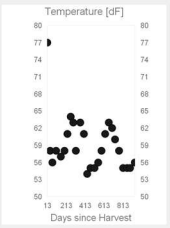
Racking & Fining Commentary:

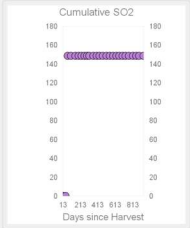
Rackings: 4

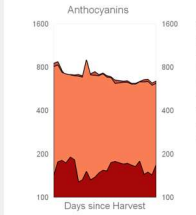
	start	change	end	Peak
Tot Anthos	849	-92	757	
Free Anthos	663	-111	552	
Bound Anthos	141	39	180	
Tannins	925	119	1,044	
TIRPs	2,121	118	2,239	

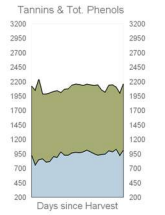












REVIEW: Cellar Batch

Nick Name: **2019 Me b1**

Original Name: 19Me

driven by: "CellarBatchDescription" and using "CellarBatchComposition 5" , "CellarActionst 7", FermBatchDefinitions CBComp1-5" and "CellarBatchDescription CBComp6-8"

Overview | Sensory & Sugar/Alcohol | Actions | Barrel Movement | SO2 Addition | Acidity & ML | Phenolics | Composition Detail | Phenolics Composition | BACKGROUND

Vintage: 2019 | Initial Composition: Me1 (106kg, 51%), Me2 (99kg,) , CS (17kg)

Principal Harvest Date: Oct 5, 2019 | CBStartDate: Oct 25, 2019

Start Days Since Harvest: 20 | End Days Since Harvest: 943 | Batch Days in Cellar: 923 days

Type: Full Barrel / Half Barrel / TopupTank / Steel Tank / VarTop Tank / Carboy / Bottle

Volume: 60 gal | 227 Lit | 227 Lit | 227 Lit | bottles

Origin: Total free flow of 2019Me1 and 2019Me2 fermentation batches

AverageTastingScore:

Commentary: Cmbination of Me1 & Me2 with <10% CS to fill up barrel.

Initial Vessel ID: 11RadEvR-M+ | Current Vessel ID: 14RadEvR-MTH

CBClass: 2. Maturation (1. Settling / 2. Maturation / 3 Assemblage / 4 Topup / 5 Bottle)

COMPONENTS OF CELLARBATCH

Name of Batch		Total Volume of Batch [gallons]	Volume of Batch used [gallons]	% of Batch used	% of Compo-nent in CBatch	% Saignee	% water addition	SO2 addition [ppm]	Tartaric Acid addition [ppm]	Pot Carb addition [ppm]	Topup [L]]	Tot. Time spent on Batch [mhrs]	Oak Absorbed %
F Batch #1	2019Me1	28	28	100 %	47 %	-0.8 %	0.2 %					80	
F Batch #2	2019Me2	26	26	100 %	44 %	-2.0 %	0.2 %					128	
F Batch #3	2019CS	151	6	4 %	10 %	-16.0 %	0.0 %		260			669	
F Batch #4													
F Batch #5													
Cellar Batch #1													
Cellar Batch #2													
Cellar Batch #3													
Starting Point	**19Me**	60		100 %		-2.8 %	0.2 %		25			233	
				reviewed		-2.5 %	0.2 %		25			233	

ActionCommentary: Significan Tartaric Acid add (1500ppm) to get pH down from 3.8 to 3.5. Very limited oak exposure (10%) given use of old barrels

Acidity Commentary: Reduced pH from 3.8 to 3.55 by adding 1500 ppm Tartaric Acid. Only limited increas in TA. VA well contained at 600ppm. 70% Malolactic conversion upront.

SO2Commentary: No SO2 additions throughout. VA well contained below 650ppm

Sensory and Sugar Commentary:

PhenolicsCommentary:

Oak Absorption: start 10 % | end 10 %

Topup: 0 mL / day

	start	+ add =	end
Tartaric Acid	25	1,507ppm	1,532 ppm
Pot.Carbonate			
Water	0.2 %		0.2 %
Time	233.0		233.0 mhrs

	start	end	change
pH	3.80	3.52	-0.28
TA	6,300 ppm	6,500 ppm	200 ppm
VA	300 ppm	530 ppm	230 ppm
Malic	800 ppm	200 ppm	-600 ppm
Lactic	800 ppm	1,000 ppm	200 ppm

	start	end
Alcohol	14.40 %	4.50 %
Fructose	0	0
Glucose	450	700

Malo Bacteria Nutrition:

PM: Enzyme & Yeast in Fermentation:

Cumulative SO2: start | end

this cellaring per day: 0 ppb / day

aggregate per day: 0 ppb / day

Total Labor Input

Initial Manhours in CB: 233 mhrs

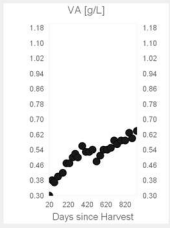
Manhours in Cellar:

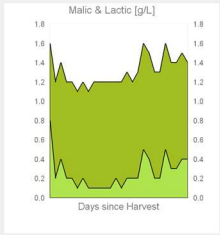
Total: 233 mhrs | 1.03 h/Li

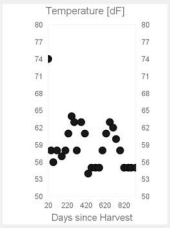
Racking & Fining Commentary:

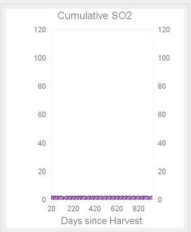
Rackings: 4

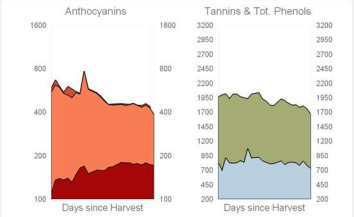
	start	change	end	Peak
Tot Anthos	590	11	601	
Free Anthos	449	3	452	
Bound Anthos	109	29	138	
Tannins	820	92	912	
TIRPs	1,964	52	2,016	











REVIEW: Cellar Batch

Nick Name: **2019 CF c1**

Original Name: 19CF

driven by: "CellarBatchDescription" and using "CellarBatchComposition 5" , "CellarActionst 7", FermBatchDefinitions CBComp1-5" and "CellarBatchDescription CBComp6-8"

Overview | Sensory & Sugar/Alcohol | Actions | Barrel Movement | SO2 Addition | Acidity & ML | Phenolics | Composition Detail | Phenolics Composition | BACKGROUND

Vintage: 2019 | Initial Composition: 100% 19CF freeflow

Principal Harvest Date: Oct 28, 2019 | CBStartDate: Nov 15, 2019

Start Days Since Harvest: 18 | End Days Since Harvest: 920 | Batch Days in Cellar: 902 days

Type: Full Barrel / Half Barrel / TopupTank / Steel Tank / VarTop Tank / Carboy / Bottle

Volume: 13 gal | 47 Lit | 47 Lit | 42 Lit | bottles

Origin: 10% of 2019CF fermentation batch

AverageTastingScore:

Commentary:

Initial Vessel ID: TopupKeg4 | Current Vessel ID: TopupKeg4

CBClass: 2. Maturation (1. Settling / 2. Maturation / 3 Assemblage / 4 Topup / 5 Bottle)

COMPONENTS OF CELLARBATCH

Name of Batch		Total Volume of Batch [gallons]	Volume of Batch used [gallons]	% of Batch used	% of Compo-nent in CBatch	% Saignee	% water addition	SO2 addition [ppm]	Tartaric Acid addition [ppm]	Pot Carb addition [ppm]	Topup [L]]	Tot. Time spent on Batch [mhrs]	Oak Absorbed %
F Batch #1	2019CF	12	13	105 %	100 %							77	
F Batch #2													
F Batch #3													
F Batch #4													
F Batch #5													
Cellar Batch #1													
Cellar Batch #2													
Cellar Batch #3													
Starting Point	**19CF**	13		100 %		0.0 %	0.0 %					82	
				reviewed								82	

ActionCommentary: no oak exposure

Acidity Commentary:

SO2Commentary: OnSO2 addition of 32ppm after 1.5 years to contain further VA increases (worked)

Sensory and Sugar Commentary:

PhenolicsCommentary:

Oak Absorption: start | end

Topup: 0 mL / day

	start	+ add =	end
Tartaric Acid		2,093ppm	2,093 ppm
Pot.Carbonate			
Water	0.0 %		
Time	82.0		82.0 mhrs

	start	end	change
pH	4.08	3.74	-0.34
TA	5,100 ppm	5,600 ppm	500 ppm
VA	390 ppm	690 ppm	300 ppm
Malic	1,100 ppm	300 ppm	-800 ppm
Lactic	700 ppm	1,000 ppm	300 ppm

	start	end
Alcohol	14.10 %	14.20 %
Fructose	200	200
Glucose	1,100	1,300

Malo Bacteria Nutrition:

PM: Enzyme & Yeast in Fermentation:

Cumulative SO2: start | end

this cellaring per day: 0 ppb / day

aggregate per day: 0 ppb / day

Total Labor Input

Initial Manhours in CB: 82 mhrs

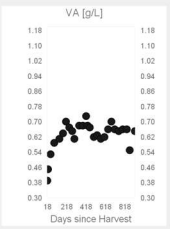
Manhours in Cellar:

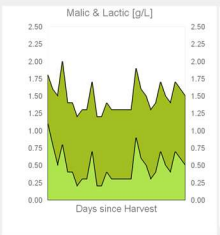
Total: 82 mhrs | 1.73 h/Li

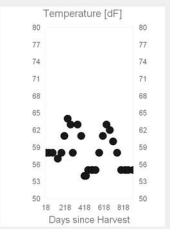
Racking & Fining Commentary: StabMicro

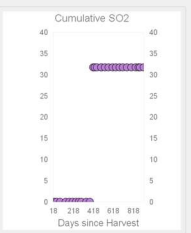
Rackings: 4

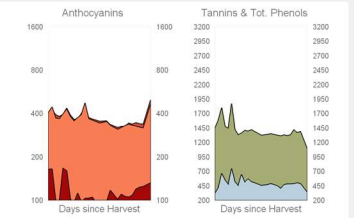
	start	change	end	Peak
Tot Anthos	390	2	392	
Free Anthos	243	29	272	
Bound Anthos	164	-65	99	
Tannins	319	347	666	
TIRPs	1,448	252	1,700	

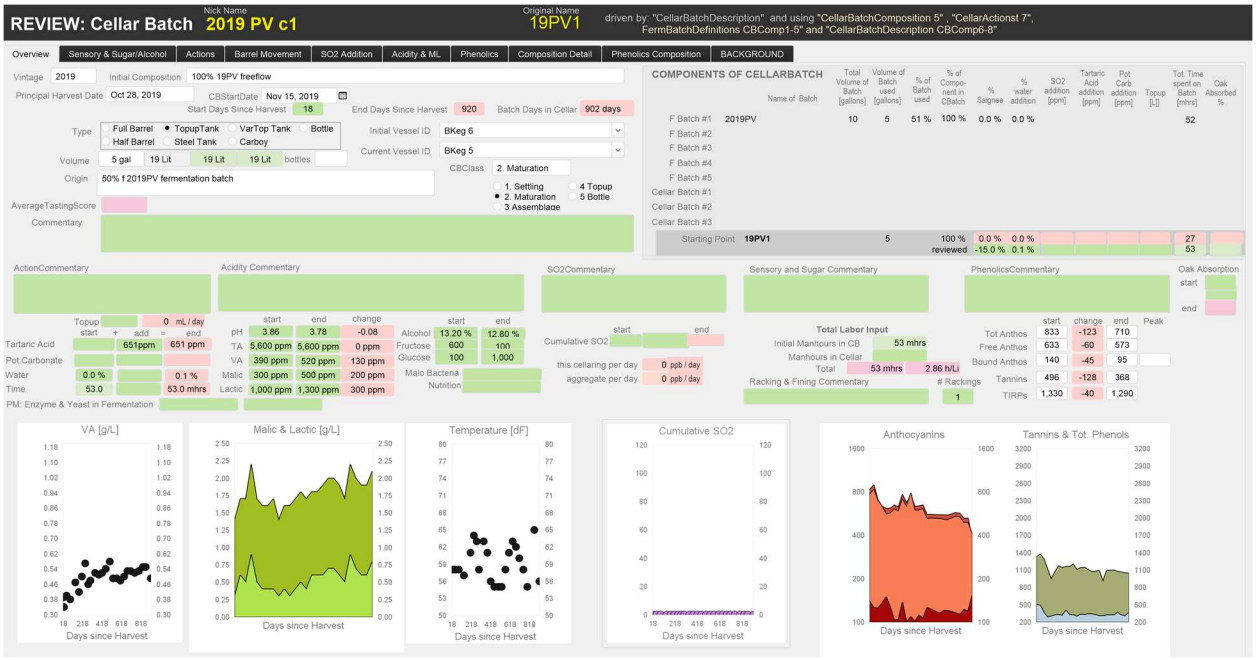








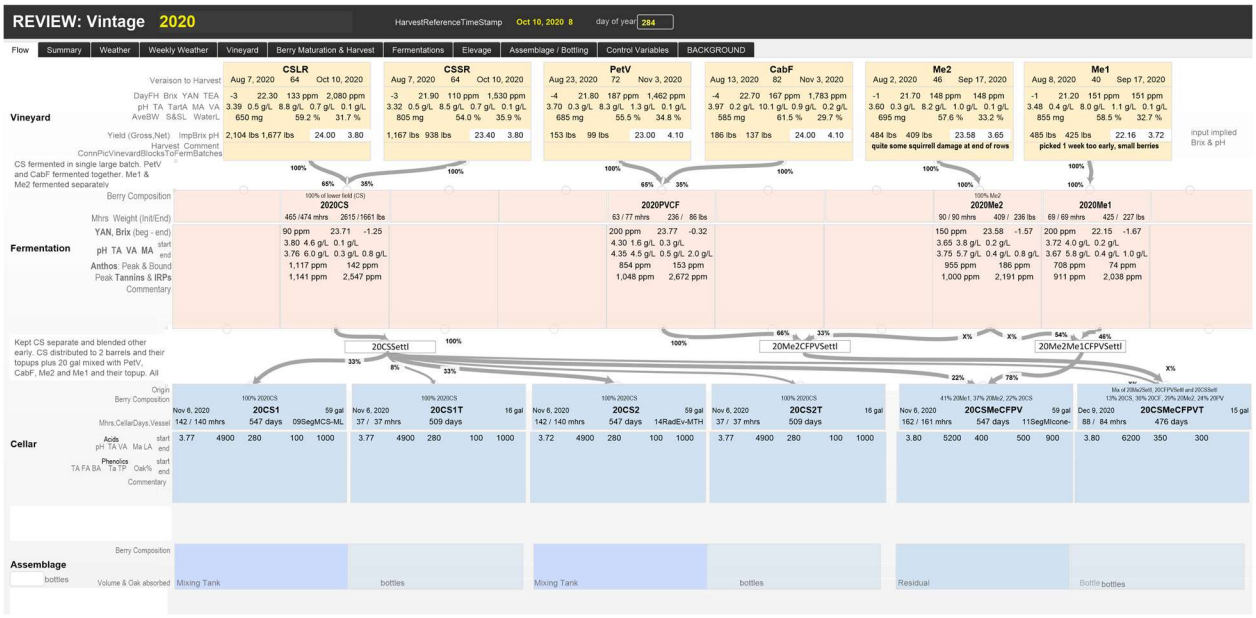




More to come

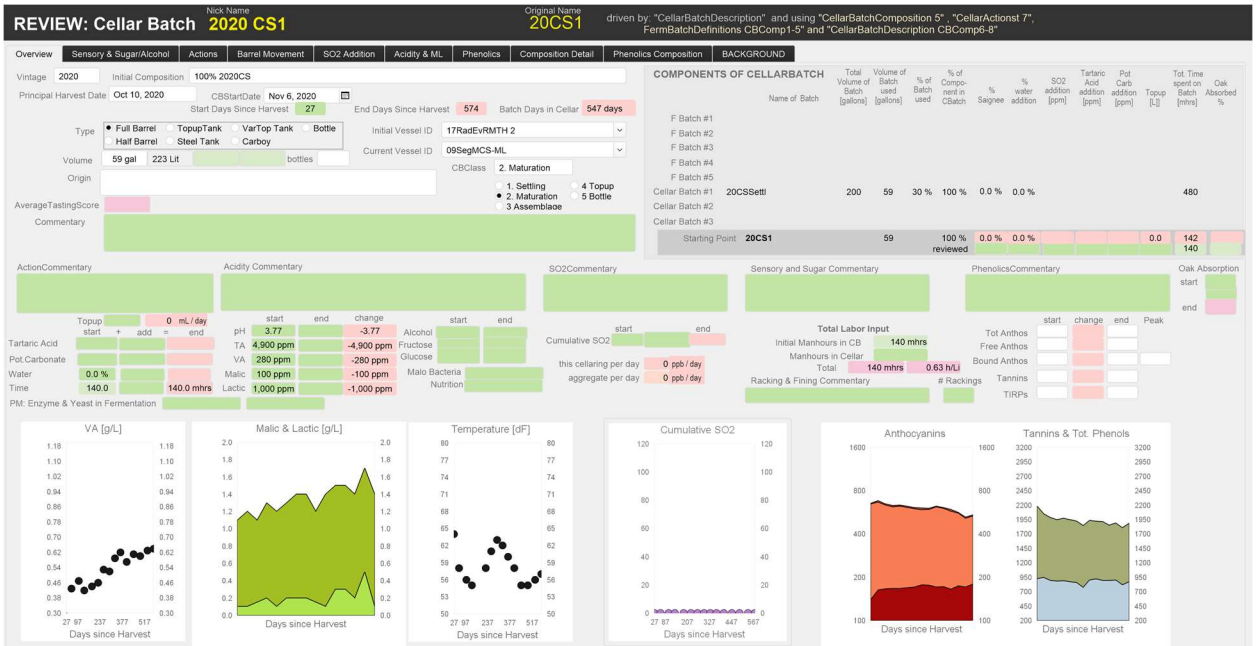
2020 Vintage

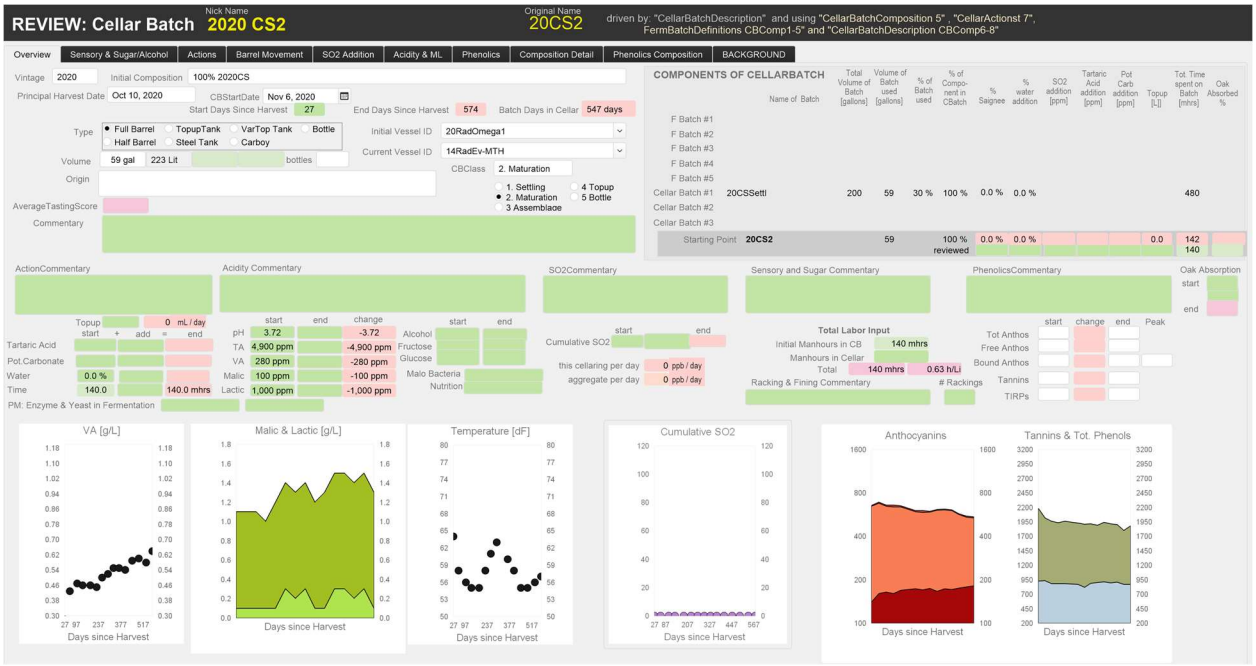
The weather for the 2020 Vintage was dry and cool in winter and spring but punctuated by lots of heat spikes (14) in the summer. Harvest volume was down, and berry quality reduced: low Potential Anthocyanins and a very high average pH of 3.79 at 23.6 Brix. We fermented with indigenous yeast in four batches: Cabernet Sauvignon, Cab Franc & Petit Verdot combined, and two batches for Merlot. The Cabernet fermentation required a lot of nitrogen nutrition and then went out of control, over-boiling at a peak temperature of 99dF, the others remained cool and all completed. Extraction of Anthocyanins was poor throughout. We settled each fermentation in a settling tank before filling 3 barrels: two for 100% Cabernet Sauvignon, one for a Bordeaux blend dominant in Merlot. The Malolactic fermentations completed naturally in the settlement tanks without adding bacteria and nutrition.

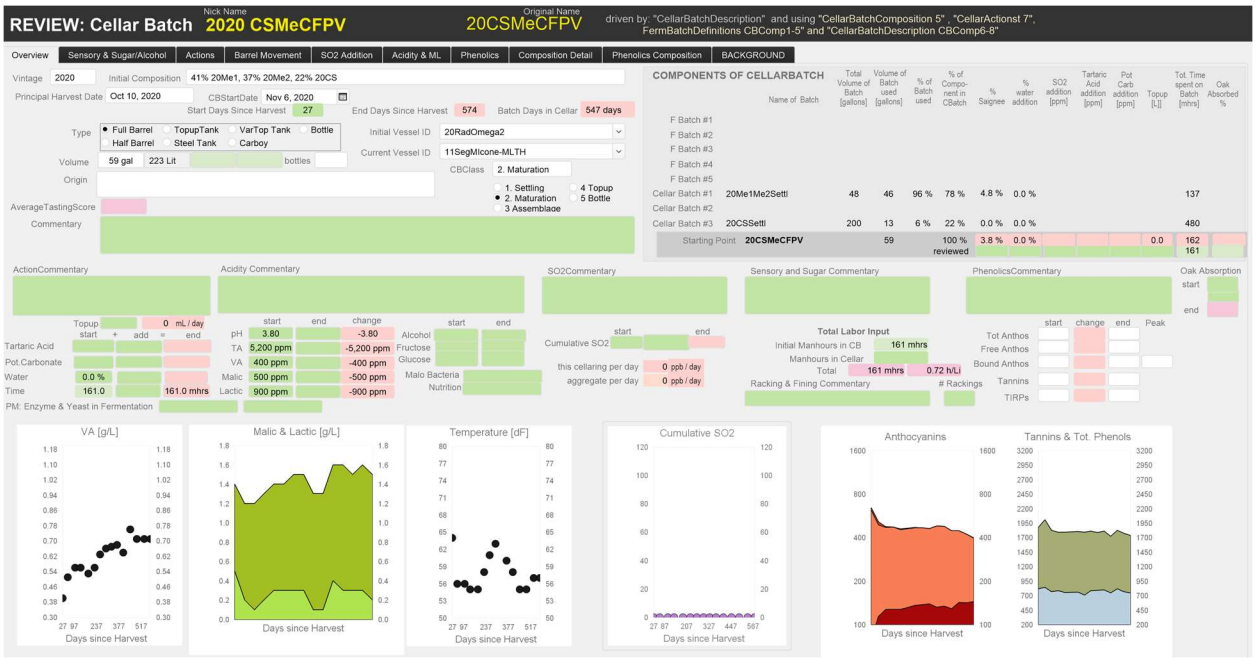


For the 2020 vintage, we experimented with a new cellaring process. Each barrel has a dedicated and permanently connected topup tank, and at each racking, we mix the remaining topup wine with the respective barrel. This process ensures that no component is ever not exposed to micro-oxidation through the barrel staves for more than a year. We kept the topup wine in the steel tanks in previous vintages for three years of cellaring.

We refrained from adding any SO2. We increased acidity at the second racking in February 2021 by adding 1000 ppm of Tartaric Acid to all barrels and topup tanks. *More to come*.



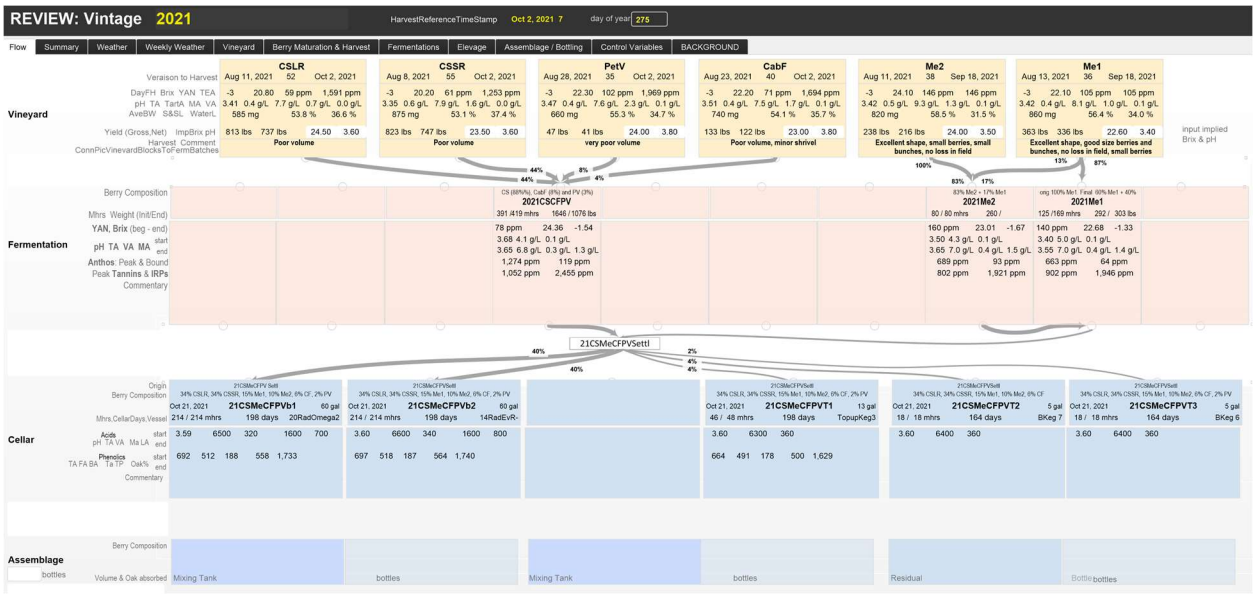




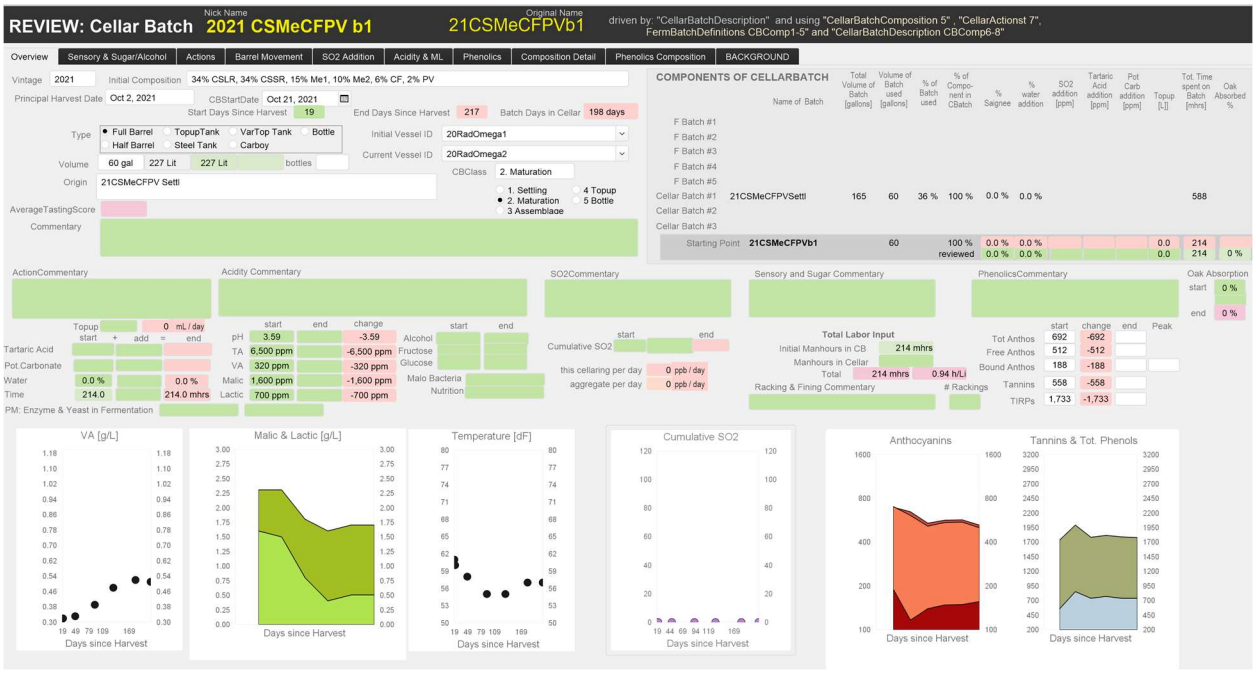
More to come (assemblage).

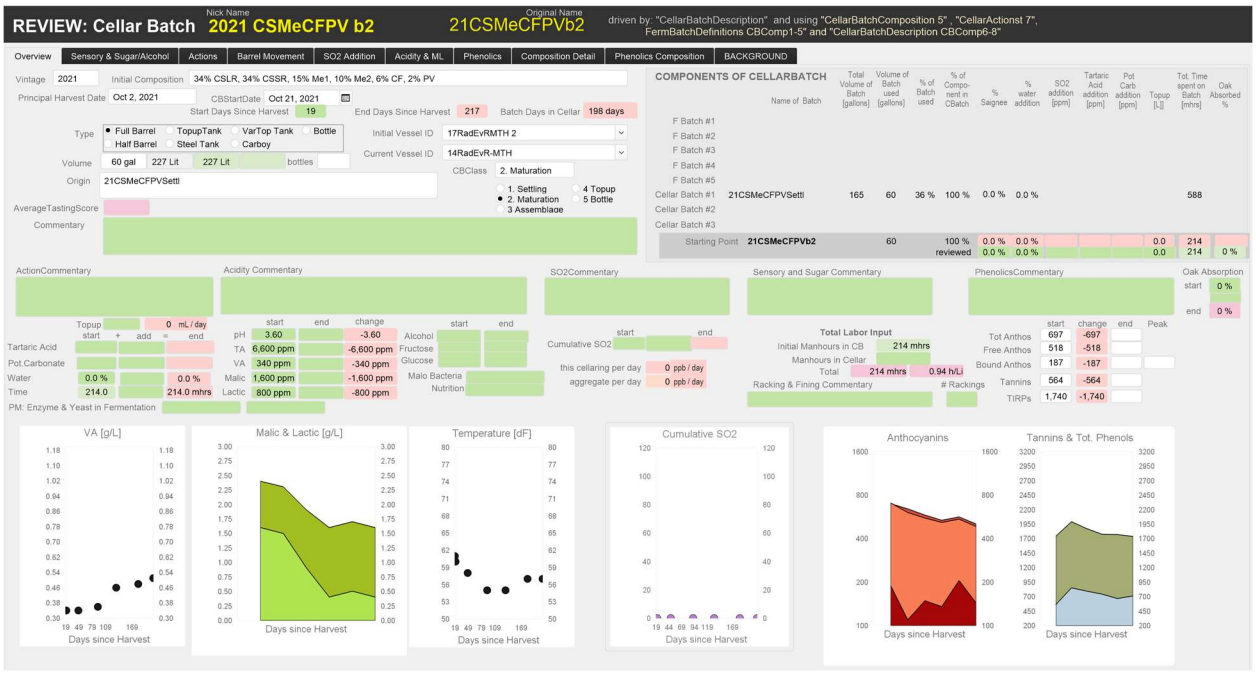
2021 Vintage

The weather for the 2021 vintage was miserable: an exceptionally dry winter followed by a hot summer with a fair number of heat spikes (7). The situation was exasperated by not having watered the vineyard after the 2020 harvest. The harvest was poor, both in terms of volume (net 2,200 lbs) and quality: we picked with low potential Anthocyanins (1,500 ppm), had small berries but good acidity (pH average 3.4) at Brix of 21.5. We fermented the Cabernet Sauvignon with the Petit Verdot, the Bab Franc, and the two Merlots separately – all with indigenous yeasts. We added significant nitrogen to compensate for low nutrients in the Cabernet. We merged all in a settlement tank and then filled two barrels and three steel tanks with dedicated topup wine.



Malolactic fermentation progressed slowly over three months without bacteria or nutrition, one in a neutral, the other in a relatively new barrel. We added 750 ppm Tartaric Acid in April 2022 for the first time when we racked all containers. *More to come*





More to come

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Last updated: June 2, 2022