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Winery Overview

Winemaking is about transforming healthy and clean grapes into young, immature wine, a 3-4 month process. This is the step after growing quality grapes, an annual endeavor. The step after winemaking is cellaring, which is about maturing the young wine in barrels, bottling the wine, and maturing the bottles – that takes 5-8 years.

This section is organized as follows:

- On this page, we explain the general concepts and processes used. We start with a simplistic view, then describe our winemaking facility and then summarise the 15 individual process steps. We conclude with a summary of how we made the wine in each of the past eleven years, 2009 2020.
- On the following pages, we describe the process steps in more detail and how they apply in the last harvest (2020), what decisions we made and what we learned.

A very simplistic view

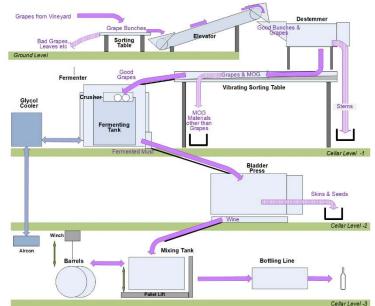
In a very simplistic view, making red wine has three distinct phases:

- Phase 1 from grapes to sweet must:
 - First, we decide when we pick grape bunches in the vineyard. Then we sort out the bad bunches, destem the remaining good ones, sort out debris and dirt and crush the grapes into a sweet must. Must is a slurry of grape juice, grape skins, and seeds. Phase 1 takes 6-8 weeks of monitoring grapes in the field and a few hours of picking and processing the grape bunches.
- Phase 2 from sweet must to alcoholic must
 We ferment the sugar with the help of yeasts into alcohol. During this process, many valuable organic compounds are extracted from the skins, pulp, and seeds. These compounds give the wine its characteristic odors, taste, and mouthfeel. This phase takes 2-3 weeks and is the most critical and challenging of the three.
- Phase 3 from alcoholic must to juvenile wine
 We separate the now alcoholic juice from the skins and seeds by pressing the must into settling tanks. This takes a few hours

The facility

To go through these three phases, we need a special-purpose facility: a winery. We built our facility on four levels, so we do not need to use pumps – we rely on gravity to move the product and winches or lifts when required. The rationale is to prevent the rough physical treatment of juice, skins, and seeds inside a pump. This graphic illustrates the sequence:





A brief explanation covering the entire winemaking and cellaring process:

- On the **Bunch Sorting Table**, we sort out the damaged bunches and leaves coming in from the vineyard
- The **Elevator** moves the sorted bunches to the mouth of the destemmer
- The **Destemmer** separates the grapes from the stems
- On the **Berry Sorting Table**, we pick out the "Material Other than Grapes" or MOG, mostly small stem and leaf pieces
- As the berries leave the Sorting Table and fall into the Fermenter; we have the option of inserting a **Crusher** which breaks their skin so valuable compounds can be extracted more efficiently during fermentation
- In the **Fermenter**, we convert Grapes into Fermented Must (i.e., sugar into alcohol). The Fermenter is temperature-controlled by a **Glycol Cooler** pumping cold or warm glycol through the Fermenter walls.
- The **Press** separates the juice (i.e., wine) from the grape skins and grape seeds.

• Finally, we drop the young wine into a **Mixing Tank** in the cellar. During the cellaring process, covered in the next section, the young wine is moved back and forth between Barrels until it is matured and bottled. The mixing tank and barrels can be moved up or down to allow gravity-flow between them. The temperature in the cellar is kept at 55-60 dF by the **Glycol Cooler** pumping cold glycol through an air-conditioner.

To the left of the graphic is a picture of the physical layout. You can see the ground level outside through the window, and you can see cellar levels -1 and -2. Half the floor between level -1 and -2 is removable to connect the fermenting tank with a bridge to the press. This is shown on the page explaining the press. Cellar level -3 is below. We move the wine by a hose through holes in the floor to the mixing tank and barrels below.

Overview of the process

Here is the next level of detail: a closer look at the three phases described above. Note, this process has evolved significantly over the years; what follows is our process for the 2020 vintage and after. Before we start any activity, and at the end, we need to clean all equipment and facilities thoroughly – this is step #0. The flowchart on the right shows 19 process steps that follow and the decisions which link them:

1. **Measure Berry Ripeness**: We measure the progress towards grape maturity in the vineyard and then decide when to harvest.

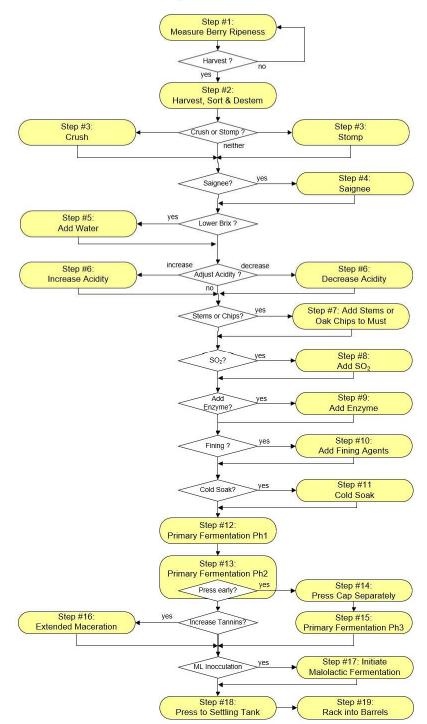
2. Harvest, Sort & Destem: We pick the grape bunches, sort out the dirt, destem them, sort the berries end up with clean grape berries in a fermentation tank.

3. Crush or Stomp: We

decide whether we want to break the skins of the grapes

with rollers (crush) or with our feet (stomp) or not at all (i.e., Full Berry Fermentation)

Wine Making Process Overview 2020



4. **Saignée?** We decide whether we want to increase the concentration of flavors in the wine artificially. We do this by increasing the "skins & seeds"-to- "liquids" ratio by siphoning off some juice. We can use this excess juice to produce rosé wine.

5. Adjust Brix: We decide whether we need to lower the sugar level by adding water.

6. **Adjust Acidity**: We decide whether we need to adjust the pH up (add carbonates) or down (add tartaric acid). This adjustment can be made upfront (i.e., as step 6) or later (i.e., during fermentation or cellaring) in increments.

7. **Add Stems or Oak Chips**: We decide whether we want to add back some of the stems to adjust the flavor profile or add Oak Chips to adjust the phenolic extraction.

8. **SO₂ or native Fermentation**: We decide whether we want to ferment with yeasts and bacteria native in the vineyard and winery or with cultured yeasts purchased from external providers. If we decide to use cultured yeasts, we add SO₂ to kill off all native non-saccharomyces yeasts and bacteria.

9. **Enzymes**: We decide whether we want to add enzymes to break down cell walls. This speeds up the extraction of desirable components from the skin, pulp, and seeds into the must. An alternative, but less effective, is to add blocks of dry ice – freezing on contact shatters the skins.

10. **Add Fining Agents**: We decide whether we want to add antimicrobial agents to bind and precipitate spoilage bacteria.

11. **Cold Soak**: We decide whether we want to extract desirable components of the skin and pulp into the grape juice before fermentation is converting the juice into alcohol. Again the idea is to get more aromas and flavors. We soak at a low temperature of around 50-55 °F to limit spoilage.

12. **Fermentation Phase 1**: Now, we raise the temperature of the must to 70 dF and decide whether to start fermenting with native yeasts living in the vineyard and the cellar or industrial yeasts purchased from third parties. We generally prefer native fermentations; we simply wait for the fermentation to start on its own. Alternatively, we mix in a bucket of must, which we had set aside a week or so earlier and successfully started fermenting on its own. If we decide for industrial, we inoculate the must with cultured yeast. In either case, we consider adding nutrients for the yeast, depending on the level of Yeast Available Nitrogen (YAN) in the must.

13. **Fermentation Phase 2**: After the fermentation accelerates and the sugar level has fallen by around a third, we have a few decisions to make. If we started with native yeasts, we might decide to finish with industrial yeasts and inoculate. Also, more yeast nutrients and an injection of oxygen may be required. Because fermentation releases thermal energy, we may also need to cool the tanks so the temperature stays below 90 °F. At the same time, we need to start watching the amount of phenolics extracted from the skins and pulp. If the tannins extracted exceed the anthocyanins extracted by more than 10-20% before the fermentation is complete, we decide to press the cap separately to limit further tannin extraction while completing the primary fermentation (steps 14 & 15). Alternatively, we proceed to step 16.

14. **Press Cap Separately**: We scoop out the cap (mostly skins floating on top of the must), press it, and then pour the resulting juice back into the fermentation tank.

15. **Primary Fermentation Phase 3**: we complete the primary fermentation, i.e., wait until all the sugars have been converted to alcohol.

16. **Extended Maceration**: If the fermentation has completed before tannins have reached 110% of peak anthocyanins, we decide whether to extend the time the now fermented juice is exposed to the grape skins - and, more importantly, the seeds - to extract even more phenolics (i.e., primarily tannins).

17. **Malolactic Fermentation**: We decide whether we want to innoculate the now young wine with malolactic bacteria to convert the malic acids into lactic acids. To facilitate the malolactic fermentation, we raise the temperature to around 65dF.

18. **Press**: We separate the juice from the skins and seeds by first letting the young wine flow out of the fermentation tank into the settling tank (called "Free Flow") and then pressing the remaining wet must into the same tank and other containers (called "Press Run"). We dispose of the remaining, now dry, skins & seeds in the field to fertilize the soil.

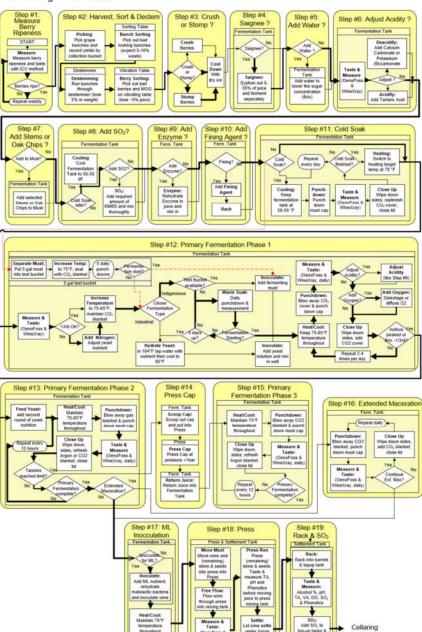
19. **Rack into Barrels**: After letting the wine settle for a few days in the mixing or other settlement tanks, we rack the juice into barrels and topup tanks, leaving the sediment behind.

Steps 1 through 19 take between 10 and 30 days.

Up to 2015, we implemented this process for a single grape variety, Cabernet Sauvignon. In 2016 we started dealing with four different grape varieties (Cabernet Sauvignon, Merlot, Petit

Verdot, and Cabernet Franc), each possibly reaching harvest maturity at a different date. So we have up to four processes running simultaneously, slightly staggered timewise.

Following is a detailed flowchart of the process and the decisions taken for each of the four harvests in 2020. The only purpose of showing this chart upfront is to illustrate how the steps and decisions described in the following pages fit together. The bold arrows indicate the decisions taken. We describe the individual steps in the pages which follow.



Wine Making Process 2020

Wine Making 2009 through 2020

The following table summarises how we made wine during the first seven years, 2009 – 2015

During the first three years, I relied heavily on Aran Healy, who helped me decide what equipment to buy and taught me how to use it and make wine. We took relatively few measurements, relying mostly on Aran's experience and tasting skills. The first year was about setting a benchmark: producing the wine with minimal additions and interventions in a 100% natural fashion. In the second and third year, we started experimenting with established winemaking techniques (like using commercial enzymes and yeasts). In the third year, we were particularly challenged by a bad harvest (low volume and quality of grapes)

Wine Making Summary 2009-2015

	g Summary 200	2009	2010	2011	2012	2013	2014	2015
		Measure- o ments (at 2 end of	Measure- 5 ments 2 (at end of	Measure- 5 ments 22 (at end of	Measure- 5 ments 2 (at end of	Measure- 5 ments Comment 2 (at end of	Measure- G ments Comment g (at end of	Measure- 5 ments (at Comment 2 end of
	JCV Score Brix	23.6 Focus solely or	G period) Comment	21.00 Focus solely on	3.75	3.55	5 period) 3.58 24.50 ICV &	3.58 ICV &
	DH Total Acidity [mg/L] Date	Brix 10-Oct	20-Oct	4-Nov	24.75 Started ICV 3.32 8100 7-Oct	25.00 ICV 3.48 28-Sep	3.53 Phenolics 6000 11-Oct	3.53 clone
	Weight harvested (Ibs) Brix pH	2600 23.6	2000 22	21.5 poor late harvest	2000 Clean grapes; 24.75 16 people 3.5 3.46 hrs	2150 Clean grapes, 25.00 2 hrs, 15 3.48 people	1349 Clean grapes, 24.50 2 hrs, 18 3.55 people	1080 24.50 3.70 5000 5000 5000 5000 5000 5000 5000 5
Bunch Sorting Grape Sorting	Total Acidity (mg/L) Weight after bunch sort (lbs) Weight after grape sort (lbs)	in field none	in field none	in field Vib table	on tables Vib table	2100 extensive 1900 Vib table	5400 1334 extensive 1148 Vib table	5000 Participant 1027 extensive 837 Vib table
4 Crush or Stomp	Brix pH Total Acidity (mg/L)	्रे ह ह	23.00 g 3.50 Stomp	22.50 g 3.34 Stomp g 6500	25.25 g 3.47 Stomp g 7900	24.25 g 3.53 Stomp	24.00 Stomp & 40lbs	25.50 40lbs dry ice, 3.70 no crush/stomp \$ 5100
	Amount [g KMBS] Water [L]	none	? KMBS	21 g KMBS	72 g KMBS	50 g KMBS	40 g KMBS	5
5-6 Adjustments 7 Saignee	Tartaric Acid (q) Potassium Percarbonate [g] Weight after saignee [lbs]		none			1900 on Vib table	1050 g acidity	250 g 1030 on Vib table
i e e e e e e e e e e e e e e e e e e e	Amount saigneed [gallons] Enzyme (g)		20 gals 50 g LaFasse GrandCru	20 g LaFasse GrandCru	30 g LaFasse GrandCru	200 Chi Vib dalic 35 g LaFasse GrandCru	40 g LaFasse GrandCru	21 g LaFasse GrandCru
11 Cold Soak	Temp (dF)		~55 dry loe	्र 55 dry ice इ ए daily	55 cooling jacket	्र इ. cooling jacket इ. daily	55 cooling jacket	43 cooling jacket
	Punch-down YAN Free Anthocyanins		6		μ μ	160 889	709	135 365
	Inocculation (g) Nutrition	none native	150 g EM4x4 none	90 g F-15 none	200 g VQ51 60 g Nutriferm Energy	200 g F-15 90 g Nutriferm Energy	245 g VQ51 175 g Nutriferm Energy	141 g VQ51 51 g Nutriferm Energy
Primary 12 Fermentation Phase 1	Macro-oxidation Punchdowns	none daily	none daily	1 min @ daily 20 psi 2/day	ອີ ອີ 2/dav	୍ଟ୍ରି 1 cft daily ତ 3/day	ຊື່ 1 cft daily ທີ່ 3/dav	g 0.2 cft daily co 3/day
	Temp (dF) Free Anthocyanins Brix	4 days	4 days	days	88 heating	83 heating 1598 15.00	75 heating 1106 16.00	74 heating 860-1100 16-18
Primary	Nutrient Punch-downs	daily	daily	daily	200 g Nutriferm Advance 2/day	200 g Nutriferm Advance 2/day	175 g Nutriferm Advance 2/day	120g NAdvance + +45g DAP 2/day
13 Fermentation Phase 2	Temp (dF) Peak Total Anthocyanins Free Anthocyanins Tannins				λέρ 71 9	第 76	79 50 1489 1253	දි 76 ශ 1050-1540 870-1210
16 Extended	Brix Punch-down	0	7 daily	0	0	1955 0.15	1441 2.80	1130-1450 1.8-5.5
Maceration	Temp (dF) Freeflow volume (L) Press volume (L)	350 280	420 130 0.2 bar	110 115 0.6 bar	350 180 0.2-0.3 bar	350 180	0 36	0 36
Press Cap	pH Total Acidity [mg/L] Malic Acids [mg/L]	day.	day	day	3.41 ਦ	3.41	3.30 At 2.6 Brix 10.5 pressed 80%	3.30 at 3-5 Brix 10.5 scooped out ≩ cap and
14 Separately	Lactic Acids (mg/L) Vol Acidity (mg/L) Free Anthocyanins (mg/L)	same	same	same	e amo	0.2 bar into barrels	reurned 36L of juice to 1045 fermentation	pressed each batch in manual 880-1210 press and
	Bound Anthocyanins (mg/L) Tannins (mg/L) Total IRPs (mg/L)					212 1869 3205	126 tank1.6 bar 1357 2517	87-125 returned juice 1200-1500 2380-2880
	Temp [dF] Alcohol [%] Residual Sugar (mg/L)					79 14.60% 450	69 14.00% 500	75 0.00% 500
	pH Total Acidity [mg/L] Malic Acids [mg/L]					3.42 11044 in 2 barrels & 考 variable top	3.31 10950 in Fermentation	3.52 11000 g in Fermentation
in From Trust	Lactic Acids (mg/L) Vol Acidity (mg/L) Free Anthocyanins (mg/L)					teel tank 1285	on 1085	49 Tank 875-1210
	Bound Anthocyanins [mg/L] Tannins [mg/L] Total IRPs [mg/L]					243 1836 3230	109 1564 2770	100-147 1130-1450 2300-2800
	Freeflow volume [L] Press volume [L] pH						300 100 Pressed at 0.5 3.27 bar into Mixing Tank then filled	300 100 3.52 Hand pressed
17 Final Press	Total Acidity [mg/L] Malic Acids [mg/L] Lactic Acids [mg/L]						8240 Tank, then filled 8240 one barrel with 900 100% 2014 800 and second 680 barrel with 70%	8300 remaining caps 1900 in manual press 1100 and combined 610 through sieve
	Vol Acidity (mg/L) Free Anthocyanins (mg/L) Bound Anthocyanins (mg/L) Tannins (mg/L)						962 2014 plus 25% 125 2012	813 into barrel, add 138 7gal 2012CSV 1447
	Total IRPs [mg/L]	0 native	3 bags Viniflora Oenos	2.5 g ML Silver	ML Silver	2 bags Viniflora Oenos	2748 CSVtopup 2748 20 g Enartis MLOne	2814 5g + 5g MLSilver + Osmobaci
	Nutrition	0 none	0 none	0 none	Nutriferm ML	30 g Microessential Oenos	Nutrifer ML & 135g & 9g Nutriferm Osmobacti	55g Nutriferm ML
18- Malolactic	Alcohol [%] Residual Sugar [mg/L] pH	§ 3.3	13.1 ទី 3.41	12.10% 400 9 3.48	13.50% 450 දී 3.35	14.00% 终 400 寄 3.32	13.60% 700 要 3.4	13.08% 700 寄 3.52
	TA (mg/L) Malic Acids (mg/L) Lactic Acids (mg/L) Vol Acidity (mg/L)	55	6720 100 671	8 6860 380 658	6600 110? 600		7650 760 1250 845 incomplete	8300 970 1600 990 incomplete
	Free Anthocyanins [mg/L] Bound Anthocyanins [mg/L] Tannins [mg/L]		671	636	507 212 1600	470 with Viniflora 355 CH16 1750	525 malo! 230 1418	533 malo! High VA 533 194 1259
	Total IRPs (mg/L)		12.80%	12.90%	3030	3170	2720	2496
	Residual Sugar (mg/L) pH TA (mg/L) Malic Acids (mg/L)		0 3.43 6750 75	600 3.55 7010 850 incomplete	500 3.62 6340 530 incomplete	500 3.41 7900 1160 incomplete	750 3.55 7550 500	1100 3.23 8800 400
Cellaring to Bottle	Lactic Acids (mg/L) Vol Acidity (mg/L) Total Anthocyanins (mg/L)	2	67	1400 malo! 770 g 431	1300 malo! 800 № 860	1000 malo! 830 686	950 980 8 661	1000 1050 606
(days incl. Malolactic Fermentation)	Free Anthocyanins [mg/L] Bound Anthocyanins [mg/L] Tannins [mg/L]	870 days	306 measured 1.5 182 years after 1332 hottling	10 320 00 93 poor! 06 425	₩ 677	θ 432 high Anthos, Ω 235 controlled Q 1529 Tannins!	원 451 우 191 두 1418	399 00 160 01 1337
	Total IRPs (mg/L) Barrels used # Rackings	2.5 50% new 09SegMo	2412 Dotaing 2.5 50% new 09SegMor 3	1204 1.5 50% new 11Rad 4	2950 ? 2 3	2761 2 3	2713 2 2+	2722 1 2
	Cummulative SO2 add (ppm) Filtering # Bottles	42 ?? 860	1287 7 eqqwhites 860	1211 420	2612 540	1874 8 eqqwhites 500	1136 add PotCarb 524	135
	Highlights	Native fermentation	Enzymes + Yeasts + Bacteria, Cold soak + Extended Maceration; Eggwhites fining	Poor late harvest, Berry Sorting, Enzymes etc, 35% '12 Merlot	Good harvest. Monitoring berry marurity (ICV). New tank with cooling jacket	Good harvest; high phenolics, pressed before fermentation finished; Eggwhite fining	Phenolic measurement in vineyard, Poor harvest	Very poor harvest, Manual press,
Commentary	Room for improvement	Data Collection	Berry Sorting, Temperature Management, Extraction Limit	Temperature Management, Yeast Nutrients. Incomplete	Incomplete malolactic fermentation. High Volatile Acidity	Incomplete malolactic fermentation. High Volatile Acidity	Overadjusted acidity, Residual sugar & incomplete malolactic fermentation. High Volatile	Residual sugar & incomplete malolactic fermentation. High
				Malo, Volatile Acidity	Construction regin volatile Addity		Acidity. Incomplete mix for bottling	Volatile Acidity

During the following two years, 2011 & 2012, after Aran left, we became more numbers-oriented and diligently collected more data.

In 2013 David Fenyvesi joined, contributing his Hungarian winemaking experience. We started to measure phenolics with the help of WineXray, a service that converts spectral absorbance measurements into estimates of phenolic compounds in the wine. This, in turn, allowed us to fine-tune the fermentation process. We also started to document the winemaking process with a detailed flowchart and collected data more diligently.

In 2014 we started to measure the phenolics in grapes after veraison to help to time the harvest better. We pressed the cap separately and before fermentation was finished to limit the uptake of tannins.

In 2015 we fermented the different clones separately in bins within the fermentation tank – this proved that the 337 clone was of higher quality than the Rixford clone (in term of extractable Anthocyanin concentrations)

By 2016 the new Upper Vineyard started to produce and, because Merlot matures a month earlier, we started running two harvests and two rounds of fermentations in sequence. We introduced new smaller fermentation tanks to fit inside the large tank to handle smaller lots, and we built a small crusher because stomping in new tanks became infeasible. Nicolas Vonderheyden replaced David, adding his Bordeau winemaking experience to the mix. This and input from UCDavis encouraged me to return to the more natural approach we had used in 2009: no enzymes, no sulfur, and no commercial yeasts.

The process became more complicated. The graphic illustrates the difference between 2015 and 2016. In 2015 we had one harvest (cabernet), split the grapes into three fermentation buckets (by clone), and combined the fermented juice at press into a single barrel. In 2016 we harvested and fermented the grapes in the Upper Field (Merlot, Cab Franc & Petit Verdot) first in a single tank, used only the freeflow, and set the wine aside. Then we harvested the Lower Field. The long row grapes (337 clones) were saigneed and fermented in 4 separate fermentation tanks, and their freeflow combined with the free flow from the Upper Field into 2 barrels. The grapes from the short rows (Rixford clone) received the saignee from the long row grapes, were fermented in 2 separate fermentation tanks, then pressed together with the remaining skins of the long row grapes and filled one barrel.

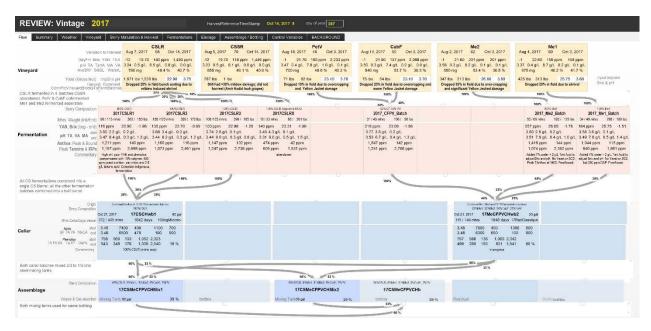
Wine Making Summaries 2015 & 2016

	2015	2016
	CabSaur - 337 on Freedom CabSaur - Rixford on 110R CabSaur - 337 on 4453 Messure- generits Messure- comment Messure- generits Messure- generits Messure- generits § ments Comment Gate Messure- generits Comment § (at end of Gate Gate Gate Messure- generits Comment	C:-38 marky flav on 1180 G:-LR-marky 310 an Freedon Market Liversites (2) and 1180) Market (15/18/1 an 191-14) Peer Verder Coherent France Measure- g (at end of the of o
Step JCV Score	☐ period)	ă period) ă period) ă period) ă period) ă period) 3.78 voura 3.83 voura 3.20 voura 3.22 voura 3.16 voura 3.31 voura
Berry Testing PH Total Acidity [mg/L]	24.75 Phenolics 23.25 Fibernalics 24.00 Fibernalics 3.32 by clone 3.32 by clone 6000 by clone 6000 26-Sep Shrivelied 26-Sep Shrivelied 26-Sep Shrivelied	21.50 Phenolas 23.75 Phenolas 24.00 Phenolas 24.50 Phenolas 23.00
1 Weight harvested (lbs) Brix pH	611 grapes, 2 384 grapes, 2 85 grapes, 2 24.50 hrs, 16 24.50 hrs, 16 24.50 hrs, 16 3.70 people, by 3.70 people, by 3.70 people, by	1079 shrivel, 1531 shrivel, 340 40 39 42 2 2.51. volume > 1/2 325 volume > 1/2
Total Acidity (mg/L) Bunch Sorting Weight after bunch sort [Grape Sorting Weight after grape sort []		1000 setimate 5 500 setimate 1 1039 minimal 1401 minimal 319 n/neward 33 n/neward 40 1020 Vb tabe 1460 Vb tabe 1
DISTRIBUTE into Fermentation bins	≥ only 337 on Freedom ≥ only Rixford on 110R ≥ 337 on 4453 & other	Continue rules single Ferrencetation task 30% Meriot. 10% Feet Verdot, 10% Cab Fear Destribute rules 31/2 Ferrencetation Taska Destribute rules 31/2 Ferrencetation Taska CS-SR River SR Roun 1100 SSR River State 1 tank CS-SR River State 1 tank SSR River State 1 tank
4 Crush or Stomp pH	8 285 10 259 17 292 2 24.80 40bs dry 8 26.70 40bs dry 8 25.20 40bs dry 3 3.69 ice, no 8 3.72 ice, no 3 3.69 ice, no	25.82 25.38 24.90 426 3.50 3.50 3.66 3.66 3.66
Total Acidity (mg/L) 8 SO2 Addition Amount (g KMBS) Water (L)	5090 crush/stomp 5280 crush/stomp 4860 crush/stomp 15 g KMBS 15 g KMBS 15 g KMBS 0 5 0	64 639 585 585 550 8 8 8 8 8
5-6 Adjustments Tartaric Acid (g) Potassium Percarbonate	g] 85 78 85	8 8 8 8 8 9
7 Saignee Weight anter saignee (us Amount saigneed (gallon 9 Enzyme Addition Enzyme (g)		5 5 0 -10
11 Cold Soak Punch-down	g 43 cooling jacket g 43 cooling jacket daily g 43 cooling jacket daily daily	55 201bs dry 55 201bs dry 55 50 10
YAN Free Anthocyanins	δ 134 δ ⁰ 141 δ ⁰ 130 365 365	
Inocculation [g] Nutrition Primary	47 q VQ51 47 q VQ51 47 q VQ51 17 g Nutriferm Energy 17 g Nutriferm Energy 17 g Nutriferm Energy 17 g Energy	native native<
12 Fermentation Macro-oxidation Phase 1 Punchdowns	응 0.2 cft daily 용 0.2 cft daily 명 0.2 cft daily g 0.2 cft dai	Twice of twi
Temp (dF) Free Anthocyar Brix	17.00 16.50 18.00	70 70 78 warm water 78 warm water 80 14.00 14.00 14.25 114.50 15.50 15.50
Nutrient Primary Punch-downs Temp (dF)	44 g NAdvance 41 g NAdvance 44 g NAdvance 16 g + DAP 15 g + DAP + 16 g + DAP g 2/dav g 2/dav g 2/dav 9 76 76 76 10 g 10 g	80g too Nutiferm 10g Nutiferm 30g Nutiferm 80g Nutiferm much) Advance much) Advance 30g Nutiferm 4dvance 80g Nutiferm Advance 80g Nutiferm 80g 80g 80
13 Fermentation Phase 2 Free Anthocyan Tann	ns 👏 1212 👏 874 🖻 1127	C 602 poor C 575 poor 2 576 poor 2 1210 poor 2 576 poor 5 576 poor 5 530 poor 5 514 phenolical 418 phenolical 120 phenolical 120 phenolical 520 530 poor 5
16 Extended Maceration Temp (dF)		1.50 1.50 1.130 1.40 1.80 3 55 daily 3 daily 7 55 daily
Freeflow volume [L] Press volume [L] pH	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	
14 Press Cap Seperately Viol Acids (mgL) Lacic Acids (mgL) Lacic Acids (mgL)	11250 out cap and b pressed e ach batch b ach batch	
Vol Acidity (mg/L) Free Anthocyanins (m Bound Anthocyanins (m Tannins (m	LI 111 returned 97 returned 125 returned	
Total IRPs [m] Temp [dF] Alcohol 1%1		
Residual Sugar (mg/L) Complete Primary Total Acidity (mg/L)	500 500 500 500 500 3.52 3.52 3.52 11000 in g 11000 in	
15 Fermentation in Ferm Tank Vol Acids (mg/L) Vol Acidty (mg/L)	명 Fermentatio 명 Fermentatio 이 Fermentatio 이 Tank 이 n Tank 이 n Tank	
or Barrel Free Anthocyanins (m Bound Anthocyanins (m Tannins (m Total IRPs (m	L 109 92 123 L 1465 1324 1585	
Merge Freeflow volume [L] Press volume [L]	Hand 107 pressed 101 pressed 103 pressed	pressed together with skins from short rows 145 170 170 110 0 0 0 0 0
pH Total Acidity (mg/L) Malic Acids (mg/L) 17 Final Press Lactic Acids (mg/L)	3.54 remaining 3.52 remaining 3.56 remaining 11000 caps in 1000 caps in 1000 caps in 10500 caps in	3.53 wth skins 3.68 3.60 3.47 7400 from tarks 6550 6570 670 1800 #1.4 and 1720 free flow 6150 6170 1800 #1.4 and 1720 free flow 6150 6170 1900 pressed 9750 from tarks 900
17 Final Press Lactic Acids (mg/L) Vol Acidity (mg/L) Free Anthocyanins (mg Bound Anthocyanins (mg	L) 1166 sieve into 109 barrel, add 92 barrel, add	800 presend 750 from tanks 850 from tanks 9 900 7 50 97.8.4 2 850 from tanks 2 860 from tanks 2 8 620 439 439 439 439 439 439 70
Tannins (m; Total IRPs (m; Merge	L) 1465 7gal 1324 7gal 1585 7gal	425 orfly) 1130 1160 528 1250 1512 1512 1512 1512 1512 1512 1512
Inocculation	5g + 5g MLSilver + 5g - 5g Samobaci 55g ML	Virifiora Virifiora Virifiora Virifiora 1.5g CH16 1.5g CH16 CH16 Sog Nutriferm Sog Nutriferm Sog Nutriferm
Acohol [%] Residual Sugar [mg/L] 18- Malolactic	13.90% 750 ≥ 3.55	14.70% 15.20% 14.90% 300 500 200 2 3.4 5 3.47 5 3.45
20 Fermentation TA[mgL] Lactic Acids [mgL] Vol Acidty [mgL]	8 7550 500 950 980	평 7500 명 6900 명 7500 당 500 명 200 명 200 1100 100 명 200 9750 750 750
Free Anthocyanins [mg] Bound Anthocyanins [mg/L]] 661 L] 451 191	280 299 320 97 160 170 620 970 950
Total IRPs (mg/L) Acohol (%) Residual Sugar (mg/L)	1418 14.50% 1100	
pH TA (mgL) Malic Acids (mgL)	3.23 8800 400	
Cellaring to Bottle (days incl. Malolactic (days incl. Malolactic		
Fermentation) Bound Anthocyanins [mg Tannins [mg/L] Total IRPs [mg/L]	1337 2722	
Barrels used # Rackings Cummulative SO2 add (p Filtering & Adjustments	vm) 1 2 TartAcid 135 add	
Assemblage & Assemblage Bottling # of bottles		
Highlights	Very poor harvest. Manual press	Good harvest volume. First year with upper field fuit. Low acidity due to late pick. First year with small fermentation tanks allowed separate fermentations. Minimal intervention (no enzymes, native fermentations).
Commentary Room for improvement	Residual sugar & incomplete malolactic fermentation. High Volatile Acidity	Sampling error in berry testing led to late harvest and low phenolics.
L		

In 2017 we reached a limit in what we could handle with spreadsheets and decided to replace them with a relational database. The following pictures show screenshots of the "REVIEW Vintage"-layout for 2016 through 2020. Each shows in the orange top row the different harvest blocks, in the pink second row the different fermentation batches, and in the blue third row the different cellar batches. The boxes in the rows are connected with arrows indicating the flows between them. Each box shows critical measurements at the beginning and end of each step.

- We include the 2016 vintage to illustrate the process differences from vintage to vintage. In 2016 we fermented the Cabernet Sauvignon in 6 small batches and the Petit Verdot, Cabernet Franc, and the two Merlot blocks in a single small mixed batch. We pressed the wine into 3 barrels and one vessel for topup wine.
- In 2017 we fermented the Cabernet Sauvignon (CS) long-row block in four small fermentations (we abandoned the short-row block), we fermented the Petit Verdot (PV) and Cabernet Franc (CF) blocks together. We fermented the Merlot (Me1 & Me2) blocks separately. We then pressed the CS into one barrel, and we combined the PV-CF and the two Me fermentations into another barrel. The topup vessels are not shown
- In 2018 we combined the two CS blocks in one large fermentation batch, we fermented the PV block on its own, and we combined the CF and Me blocks in two small fermentations. Then we pressed into three barrels and three topup vessels, one pure CS, the other two, different mixtures of CS, PV, CF, and Me.
- In 2019, we again combined the two CS blocks in a single large fermentation batch, but we fermented the other four blocks separately. We then pressed the CS fermentation into two barrels, the Merlot fermentation combined with a bit of CS into a third barrel, and we PV and CF fermentation s into topup tanks.
- In 2020 decided to create separate dedicated topup tanks, one for each barrel. So, we
 fermented the CS blocks together and pressed them into two barrels, and attached
 topup tanks. We fermented the PV and CF blocks together and the Me blocks
 separately, and then we combined all with the left-over CS into a mixed barrel and
 dedicated topup.tank

REVIEV	V: Vintage 20)16		HarvestRefere	nceTimeStamp Oct	8, 2016 9 0	lay of year 282							
low Summ	ary Weather Vineyar	d Berry Maturation & H	iarvest Fermenta	tions Elevage Asse	mblage / Bottling 🕴 C	Control Variables	BACKGROUND							
	Veraiso	in to Harvest Jul 26, 201	CSLR 74 Oct 8, 20		55R 74 Oct 8, 2016	Aug 4, 2016	PetV 42 Sep 15, 2016		CabF 37 Sep 15, 2016	Jul 25, 2016	Me2 52 Sep 15, 2016	Jul 27, 2016	Me1 50 Sep 15, 2016	
neyard	pH TA Ta	C YAN TEA -1 23.5 etA MA VA 3.32 7.5 g/l GL WaterL 779 mg	5 1,585 44.3 % 42.5	3.30 8.0 g/L	1,061 ppm 40.7 % 46.6 %	-1 23.80 3.27 7.4 g/L 987 mg	2,037 ppm 49.1 % 38.8 %	-1 23.00 3.36 5.6 g/L 988 mg	1,803 ppm 48.1 % 30.9 %	-1 24.50 3.58 4.3 g/L 1125 mg	50.1 % 37.6 %	-1 24.00 3.54 4.7 g/L 1380 mg	52.4 % 36.2 %	
		ImpBrix pH 1,502 lbs 1,2	derestimated crop size.	picked Significantly und	25.80 3.50 erestimated crop size, late due to bad sampling	42 lbs 40 l Fir	bs 24.50 3.50 at minor crop	39 lbs 37 lbs First	24.20 3.50 minor crop	42 lbs 40 lbs First	25.20 3.65 minor crop	340 lbs 321 Noticeable bird	los 25.00 3.65 damage, due to poor netting	input implied Brix & pH
nall batches	R fermented in 6 seperate	103%	20% 28% 28%	a 17% -		0% _ 45%	190%	102%			THOPS	100%	~	
	Berry Composition	2016_CSLR_Batch_1 97 / 112 mtrs 358 / 197 it	2016_CSLR_B		Batch_3 2016_C	SLR-SR_Batch_4	2016_CSSR_Batch_1 70765 mbrs 352/ 213 8	2016_CSSF a 70/85 mbs			72% Medal) ins Send, d% P 2016 MePVCF 212/227 mins 4367			
rmentation	YAN, Brix (beg - end) pH TA VA MA end Anthos: Peak & Bound Peak Tannins & IRPs	200 ppm 24.90 -1.20 3.66 5.9 g/L 0.2 g/L 3.61 6.8 g/L 0.5 g/L 0.3 g 1.198 ppm 1.35 ppm 1.275 ppm 2,532 ppm 5 secret 5 ppd task, nicen	200 ppm 24.90 3.59 1, 3.58 6.0 g/L 0.4 1,260 ppm 1,177 ppm 2, 5 5 searce 5 doubt so	 -1.30 200 ppm 24. 3.66 3.61 3.64 7.0 g/L 0. 31 ppm 1.210 ppm 403 ppm 1.261 ppm 1.261 ppm 4.03 ppm 1.261 ppm 	90 -0.50 180 ppm 3.66 6 1 5 g/L 1.7 g/L 3.77 6.7 142 ppm 938 pp 2.544 ppm 1,130 p 2.544 ppm 5.545 pp	25.40 -0.70 p/L 0.2 p/L g/L 0.5 g/L 1.8 g/ pm 132 ppm ppm 2,369 ppm	176 ppm 25.80 -1.60 3.50 6.4 g/l, 0.2 g/l, 1. 3.54 7.4 g/l, 0.8 g/l, 1.9 g 746 ppm 72 ppm 550 ppm 1.472 ppm 550 ppm 1.472 ppm	 154 ppm 2 3.50 6.4 gH, 0 4. 3.51 7.4 gH, 0 694 ppm 436 ppm 654 diator, 20 yan 	5.40 -1.60 12 g/L 88 g/L 1.8 g/L 67 ppm 1,310 ppm n scek indig yeast		215 ppm 25.00 3.66 5.0 gt. 0.2 gt. 3.60 7.0 gt. 0.5 gt. 921 ppm 95 537 ppm 1.58 1.5 pt. Ten Acid. at 11 pm	-1.50 1.2 g/L ppm 3 ppm x V091		
parrel of pure	CS. 2 barrels of different	oress at -1.2 Bits. Poor PTAntres 1,80 62%	yeast + 21 ppm Nutri press # 13 Brix Fear (25)	PTAribos al press al 0.75 Brs. F 1211	ter PTAntes at press at 01	7 Brix, Very soor PTAnths at 102	yeess + 573 gpm Nur ferm, 335 Kentox, 02 Bar oreas at -18 Ba Very soor PTAnfres 4 at, at, at, at, at, at, at, at,	x 0.2 Bar aress at -1	6 Bris, Very poor		yessi + 410 pon NAdrance at -1.75 Brx PTArtos - 42%	9501	< From GBA Baches 11	
		285	5% 25%	10% 17% 7%		43	195						From CSLR Batches 13	r 75
		Texture 79128.8 + 29 755034.911_20546[71_255 for 1, 2016 16CSMePV 275 / 296 mbrs 1051 c	ser(17),235Pen(17) FCHwb1 60 gal	Continuo fuelhaid (8). 595 (5). (8) (1) (1) (5) (5) (7) (20 Aur Nov 1, 2016 16CSMePV 262 / 285 mbrs 1051 (1011, 12550361911 1255 CFCHwb2 80 gal	76%CSSR[17&	chorOf herbitasi (23-5 9) renosuspij sviossepij 16CSCHwb3 rengel 1051 days 105egbilcore-							
llar	Adds start pHTAVA MeLA end tAFABA TaTP Oaks end Conventiary	499 361 118 89	1,750 56 %		300 1000 0 1000 8 2,146 1 2,000 20 % e	3.69 7200 3.38 6900 362 261 75 418 208 186	870 380 1500 560 0 500 521 1,346 988 2,114 11 % in progress						3.97 7200 700 3.80 5800 780 420 286 101 63 in step	
		160% 47%		10	DN	11X	53N 23N							
semblage	Berry Composition	755-05, 205 Kb 25 16CSMeC	SPV 25% (3)	798 (S. 205 Mc. 255 16CSMeCF			100% 100%.05 16CSCHb		1604 CS	155	CsecqHAP (05CSKojP) 3 16CSCHTopup2	scSaartP(r		
	Volume & Oak absorbed	Mixing Tankt 31 gal	36 %	630 bottles	35 %	Mising Tank30 gal	11.%	150 bottles	1	1% Residual	14 gal	11 %	Buttle porties	
50 bottles of 1 30 bottles of B														



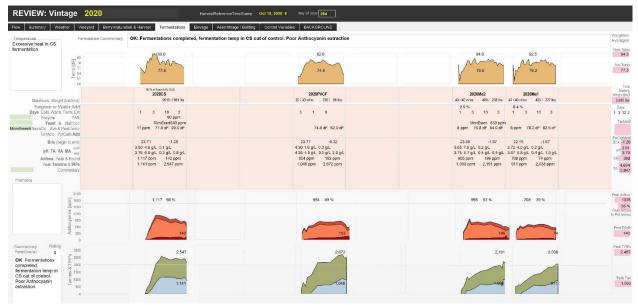


Summary	Vieather Vineyard	Berry Maturation 8	Harvest Ferment	ations Fle	wage Assemblad	e / Bottling	Control Variables	BACKGROUND							
aannaiy	22 13	to Harvest Aug 7, 20	CSLR		CSSR			PetV 0 72 Nov 3, 2020		CabF 82 Nov 3, 2020	Aug D 2020	Me2 45 Sep 17, 2020	Aug 8, 000	Me1 20 40 Sep 17, 2	
	DayFH Brix	YAN TEA -3 22 th MA VA 3.39 0.5 c	2.30 133 ppm 2,080	ppm <	3 21.90 110 pp 32 0.5 g/L 8.5 g/L	m 1.530 ppm	-4 21.8	0 12 Nov 3, 2020 10 187 ppm 1,462 ppm . 8.3 g/L 1.3 g/L 0.1 g/L	-4 22.70	167 ppm 1.783 ppm 1 g/L 0.9 g/L 0.2 g/L	-1 21.70	148 ppm 148 ppm 1.2 g/L 1.0 g/L 0.1 g/L	-1 21.	20 40 dep 17,2 20 151 ppm 151 p 1, 8.0 g/L 1.1 g/L 0.1	m
yard	AveBW S&S	SL WaterL 650 mg	59.2 % 31.	7%	805 mg 54.0	0% 35.9%	685 mg	65.5 % 34.8 %	585 mg	61.5 % 29.7 %	695 mg	57.6 % 33.2 %	855 mg	58.5 % 32.7	16
Co		mpBris pH 2.104 bs 1 Comment ermBatches	1,677 lbs 24.00	3.80 1.1	167 lbs 938 lbs	23.40 3.80	153 lbs 9	9 lbs 23.00 4.10	186 lbs 137 lbs	\$ 24.00 4.10		bs 23.58 3.65 rell damage at end of rows	485 lbs 4 picked 1 v	25 lbs 22.16 3 week too early, small berri	
ermented in sing	gle large batch. Petv		100%	35%	107%			102%	-	100%		100%		10DN)	
	Berry Composition		10% of over fit 202005 170 / 178 mbrs 25	5				2020PVCF				2020Me2		2020Me1 mhrs 425/ 227 lbs	
	Mhrs Weight (Init/End) YAN, Brix (bog - end)		90 ppm 23.7					23.77 -1				23.58		22.15 -1.67	
entation	pH TA VA MA staft end Anthos: Peak & Bound		3.60.4.6.gl, 0.1 3.76.6.0.gl, 0.3 1,117.ppm	g/L 0.8 g/L				4 30 1.6 g/L 0.3 g/L 4 35 4 5 g/L 0.5 g/L 2.0 854 ppm 153 pp				3.65 7.8 g/L 0.2 g/L 3.75 5.7 g/L 0.4 g/L 955 ppm 186	0.8 g/L 3.67 5	10 gil 0 2 gil 58 gil 0 4 gil 10 gil ppm 74 ppm	
	Peak Tannins & IRPs Commentary		1,141 ppm 2	2,547 ppm				1,048 ppm 2,672 pp	sm			1,000 ppm 2,19	1 ppm 911	ppm 2,038 ppm	
CS separate ar															
CS distributed s plus 20 gal m	I to 2 barrels and their hixed with PetV, I and their topup. All		_	20CSS				160%	L	20Me2CFPVSettl			A conservation	46% Me1CFPVSettl	XS
CS distributed s plus 20 gal m	I to 2 barrens and their nixed with PetV, I and their topup: All Drigin Berry Composition Nec		CS1 59 gal	33% #	etti 5 33% 20% datos 20CS1T	16 gal	Nov 8, 2020	1005 XXICS 20CS2 58 g	al Nov 6, 2020	20Me2CFPVSettl 10:6203008 20CS2T	10 gal Nov 8, 1	22% 78 41% 20% 12% 20% 78 020 20CSMeCFI	20Me2h	Me1CFPVSettl Hc0358/2041 Eth 3013 3952 C Dec 9, 2020 200	20PVEntine2COSet CF_2652AA222553PV CSMeCFPVT 15 g
CS distributed s plus 20 gal m , Ne2 and Net	I to 2 barress and their nixed with PerV. I and their topup. All Barry Composition Net Mitris CallarDays Vessel 34 Asias alter	w 6, 2020 20		33% # Nav 6, 2020 37 / 37 mh	etti 8 33% = 0.0% AD0.5 20CS1T rs 160 days	16 gal 100 1000	Nov 8, 2020 1407 140 mins 3.72 4900	10% abacs 20CS2 56 g 160 days		20Me2CFPVSettl			20Me2h	Me1CFPVSettl Rcx1378d2set 105.2013 305.21	20PVettind 2009et 01: 2052062, 245 XPV CSMeCFPVT 15 p 127 daya
CS distributed s plus 20 gal m Ne2 and Met	I to 2 barrels and their nixed with PetV, I and their topup. All Drigh Berry Composition Ne Mirrs.CellarDays, Vessel 39	w 6, 2020 20	CS1 59 gal	33% # Nav 6, 2020 37 / 37 mh	etti 8 33% = 0.0% AD0.5 20CS1T rs 160 days		140 / 140 mbrs	10% abacs 20CS2 56 g 160 days	al Nov 6, 2020	20Me2CFPVSettl 10:6203008 20CS2T	161 / 1	22% 78 41% 20% 77 020 20CSMeCF1 61 mhrs 160 days	20Me2h rs 5203 PV 56 pa	Me1CFPVSetU H (xi 33 koset 195 3053 3953) Dec 9, 2023 200 64 / . 94 mhrs	20PVettind 2009et 01: 2052062, 245 XPV CSMeCFPVT 15 p 127 daya
CS distributed s plus 20 gal m Me2 and Me1	Lia 2 barresis and their nixed with PetV, and their topup. All Digin Berry Composition Ners CelarDays Vessal Ph TA VA Ms LA end Phosiss All Ta TP Cast's end	w 6, 2020 20	CS1 59 gal	33% # Nav 6, 2020 37 / 37 mh	etti 8 33% = 0.0% AD0.5 20CS1T rs 160 days		140 / 140 mbrs	10% abacs 20CS2 56 g 160 days	al Nov 6, 2020	20Me2CFPVSettl 10:6203008 20CS2T	161 / 1	22% 78 41% 20% 77 020 20CSMeCF1 61 mhrs 160 days	20Me2h rs 5203 PV 56 pa	Me1CFPVSetU H (xi 33 koset 195 3053 3953) Dec 9, 2023 200 64 / . 94 mhrs	20PVettind 2009et 01: 2052062, 245 XPV CSMeCFPVT 15 p 127 daya
CS distributed s plus 20 gal m Ne2 and Met	Lia 2 barresis and their nixed with PetV, and their topup. All Digin Berry Composition Ners CelarDays Vessal Ph TA VA Ms LA end Phosiss All Ta TP Cast's end	w 6, 2020 20	CS1 59 gal	33% # Nav 6, 2020 37 / 37 mh	etti 8 33% = 0.0% AD0.5 20CS1T rs 160 days		140 / 140 mbrs	10% abacs 20CS2 56 g 160 days	al Nov 6, 2020	20Me2CFPVSettl 10:6203008 20CS2T	161 / 1	22% 78 41% 20% 77 020 20CSMeCF1 61 mhrs 160 days	20Me2h rs 5203 PV 56 pa	Me1CFPVSetU H (xi 33 koset 195 3053 3953) Dec 9, 2023 200 64 / . 94 mhrs	20PVettind 2009et 01: 2052062, 245 XPV CSMeCFPVT 15 p 127 daya

The next two screenshots are again from the "REVIEW: Vintage"-layout, but they show the Berry Maturation and the Fermentation tabs for more detail on the 2020 vintage

- The Berry Maturation tab shows how the different vineyard blocks matured and how the Potential Anthocyanins, PH, Brix, and average berry weight developed during the last weeks of berry maturation these measures defined the selection of the respective harvest dates
- The Fermentation tab shows more details on each fermentation batch: the development of fermentation temperatures, and the extraction of Anthocyanins (bound and total) and other phenols (tannins and total)





The final screenshots are from the "COMPARE Vintages"-layout and show average data for each vintage since 2009. The screenshots rate each vintage and provide a short commentary.

- Berry Maturation: shows the timing of Budbreak, Flowering, Mid-Veraison, and Harvest in days of the year. And for each harvest block, it shows Potential Anthocyanins, pH, starting Brix, and Average Berry Weight. From this perspective, 2009, 2013, and 2018 were the best vintages
- Harvest Volumes: shows for each block average Berry Weight, Net Yield (after sorting), Net Yield as % of Gross Yield (before sorting), Potential Anthocyanins, Brix (in the field and tank), and pH (in the field and tank). Note, we tend to underestimate the Brix in the field by 1-2 Brix and the pH in the field by around 0.3. Again, 2009, 2013, and 2018 ranked the best.
- Fermentations: show weightd average numbers across all fermentations in a given vintage: final Brix (target is smaller than -1.25), days of skin contact, average and peak temperatures, extracted Anthocyanins, Tannins and TIRPs (Total Iron-Reactive Phenols), pH, Total Acidity and Tartaric Acid additions as well as final Volatile Acidity. From a fermentation perspective, 2018 ranked the best and 2013 the worst (we mishandled that fermentation)

COMPARE: Vinta	iges				driven by Vin	tageSumma	ries for VS			
tummary Summary for website	Weather Vineyard Berry Maturation	Harvest	Ferment	tation Eleva	ge Assembl	lage / Bottle	DATABASE STRUCTURE			
	285, high Potential Anthocynins, pH 2.5 - 23.5 range, Berry Weight below						CSI	R CSSR PotV CabF	Mo2 Me1	
800mg	57.0 - Xoro render, printy weight below.		Budbreak		g Veraison	Harvest	Pot. Antos (ppm)	pH in Tank	Brix in Tank	Berry Weight (mg)
Commentary		0 20	40 60 80	100 120 140 1	60 180 200 220	240 233 293 30	0 1000 1400 1800 2200	3 30 3 42 3 54 3 65 3 78 3 90	3 21 22 23 25 26 27	0 200 600 1000 1400
21										
20 Poor: Low Potential Anthocy 2 bernes	anins, very high pH, Brix in target range, small	284	84	60	75	60	1838	3.79	23.6	717
19 Good: Poor potential Anthoc 3 upper field, large bernes	vanins, very high pH,Brix on farget except	265	•	3	70	68	1768	3.72	23.8	892
18 Excellent Excellent Potent except upper field, OK Berry v	ar Anthoyanins, pH too high, Brix on larget reight	279	9	2 45	75	59	2194	3.66	23.6	797
Poor: Vey low Potential Arth significant mildew. Dropoed >>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>	covanins, small, shrivelled berries du to 50% of fruit.	267	78	-	90	65	1680	3.73	23 8	767
16 Mixed Large berries, fee bl	imishes but very poor anthocyanins.	282	74	65	71	70	1443	3.60	25.2	912
15 Good: Excellent level of pole 3 Very low net volume	ertial Anthocyanins in CSLR but not in CSSR	269	66	(6)	90	55	2051	3,70	25.5	663
14 Good: First year of berry les 3 Anthocyanins, pH too high, Br	ting before harvest, Excellent Potential x a bit high	284	67	-	99	75	2060	3.65	24.0	791
13 Excellent: Exceptionally from fermentation): good ;	high Polential Anthocyanins (info H, Brix too high	271	79	40	86	65	0	3.45	25.0	0
Good: good pH, Brix on larg	at	261	85	- 40	93	63	0	3.46	23.0	0
Poor: Frut did not fully deve	lop due to weather. Poor volume	305				30	0	3.40	22.9	0
10 Poor: Fruit did not develop 1	uly due to weather. Poor Brix	293				293	0	3.60	22.0	0
5 Excellent Excellent volume	and on-target Brix & pH	283				283	0	3.50	24.0	0

Summary Summary for website Weather Vineyard	Berry Maturation Harvi	st Fermentation Elevage	Assemblage / Bottle DATA	BASE STRUCTURE					
summary summary for website theather timeyord	Derry Maturatori Harvi	Volume		CSSR PetV CabF Me2 Phenolics	Met	gar	Acidity		
	Berry Weight (mg)	Net Yield (lbs)	Net % Gross Yield	Pot. Antos (ppm)	Brix in Field	Brix in Tank	pH in Field	pH in Tank	
	0 200 600 1000 14	00 0 1000 2500 4000	50 60 70 80 90 100	1000 1400 1800 2200	18 19 20 22 23 24	21 22 23 25 26 27	3.10 3.22 3.34 3.46 3.58 3.70	3 30 3.42 3.64 3.66 3.78 3.90	
21									
Very Good, particularly in looks (minimal amount dropped in vineyard) but pH way too high	717	3,685	80	1838	22	24	3.44	79	
 Good: Clean berries, limited bird damage, good anthocyanins, some dehydration, low acdity 	892	4,198	81	1768	22	24	3,37	72	
118 Excellent: Fair amount of sorting out,great Anthos, ok acidity	797	3,229	76	2194	72	24	3 30	66	
Very Poor: Mildew, large sorting losses, low Anthocyanins in CS	767	1,881	52	1690	21	24	3.31 3	73	
Good: Clean grapes, poor anthocyanins., high Brix, Fair amount of shrivel	912	2,598	85	1443	23	25	3,34	60	
Very Poor: Despite strong anthos, miserable harvest due to mildew and shrivelling.	663	880	69	2051	24	26	3.28	70	
Excellent: Very high Anthocyanins	791	1,350	89	2080	26	24	3 53 3	65	
S Excellent: Best color ever	0	2,031	86	o	0	25	3.00 3	45	
Good Good	0	1,874	85	0	D	23	0.00 3	46	
Very Poor: Weak anthocyanins	0	998 - 1	74	a	D	23	3.00 3	40	
Good: Smaller crop due to Eutypa, low brix	0	2,228	87	0	0	22	0.00 3	60	
09 Excellent: Big crop, very little sorting losses,	0	3,980	90	0	D	24	0.00 s	50	

ummary Summary for website Weather Vineyard	Berry Maturation Harvest	Fermentation	Elevage	Assemblage / Bottle	DATABASE STRUCTURI	.						
		Su			Extraction					Acidity		Infections
mmentary	CommentaryFlow/Ferment	Final Vol Weigl	hted Ave	Skin Contact Vol Weighted Average [days] 0 6 12 15 24 30	Temperature Average & Peak+ [VWA, dF]] 65 71 77 83 89 95	Bo	cted Anthos ind & Free VA, ppm]] 80 320 1280	Tans & TIRPs 0 800 2000 3200	pH range 3 30 3 48 3 66 3 84	TA range 0 4.000 8.000	Tart Add (ppm) 0 800 1600 2800	Final VA (ppm) 0 120 300 48
2021						9%						
200 Poor: Fermentations did not all complete fully, fermentation temp in CS out of control. Poor Anthocyamin extraction	CS fermented in single large batch. PetV and CabF fermented together. Me1 & Me2 fermented responses.		-0.85	16	77 17		140 (185	1093 1364	0.02	,163	0	308
Very good: termentations atmost completed good temp control and Anthocyanin extraction, low final Va	Every varietal fermented separately in dedicated single batch		15	15	76 8	88%	144	9191 1093 1224	0.07	.217	197	305
Excellent: After stormp and 2-4 days warm soak, indigenous fermentation to -1.98nx in 7-11 days below Solid: Lowesh YAN (90-1880ppm) compensated by Numferer (SUL1500ppm), Lotter S.27ppm	Cab and Pett Verdot fermented separately, Mortol & CabF fermented together	-1.93		14	77 8	7196	155 1405	90% 1395 1495	0.01	.228	0	347
Small lot fermentations using indigenous yeasts. 2-3 day warm soak 9-11 day fermentations, 1,500-3,000 ppm Tartanc Acid addition	CSLR fermented in 4 batches CSSR abandoned. PetV & CabF cofermented Me1 and Me2 fermented separately	- 1.50		13	82 6	71%	128 1007	95% 1133 1420	0.30	137	2653	312
2016 Good: Six small batch fermentations for CS. Single first small batch for upper field. Long skin contact at low temps with poor phenolic extraction. High VA	CSLR and CSSR fermented in 6 separate small batches PetV, CabF and Marlot combined to small ferment	-12		22	71 13	0996	110	91% 896 <mark>1120</mark>	-0.02	.576	0	666
2015 Poor: Inocculated with VQ51 at low temperatures. Poor color extraction despite maceration enzyme	Entire CS harvest split into 3 small fermentation batches			17	70 8	122221	130 1223	107% 1497 1311	-0.16	,769	637	a0
2014 Good: Fermentation almost completed, Long skin contact led to high tannins, low temperature and poor temperature control	Combined entire CS harvest in single fermentation		1.00	22	35 H	72%	and the stand stands	105% 1550 1180	0.34	.500	1700	0
2013 Very Poor Grand Cru maceration enzyme for cold soak and Zymattor F-15 yeast supported by Nutriterm Formeritations barely completed, due to poor temp control avyraseba MarcmCr2 Prassed hefre				25	72 13	9%	230 1966	83% 1978 1322	-0.04		0	0
Poor: Incomplete termentation long cold soak	Combined CS harvest into single fermentation. Bought Meriot from Bargetto & fermented separately			16	73 .17	0%		3	0.06		0	0
3 Good	Put entire CS harvest into single fermentation		1.00	13		0%		2			0	0
010 Good: Extreme approach with maceration enzyme, long cold sock, extended maceration - possibly overextracted	Put entire CS harvest into single fermentation tank		1.00	29		0%		2			0	0
Very good:	Put entire CS harvest into sngle fermentation		1.00	15		-0%		2			0	0

A pdf file of the Winery Section as of May 30, 2021, is available here

Previous page: Home Top of this page: Go Next Page: Cleaning & Sanitation Last updated: May 11, 2021

Step #0: Cleaning & Sanitation

Most faults in wine quality are a consequence of juice or wine coming in contact with dirt and spoilage microbes in the air and on contact surfaces (vessels, piping, tools, etc.). Therefore we spend a significant amount of energy and time keeping the winery and cellar clean and sanitized. In this context, "cleaning" refers to the physical removal of organic and inorganic soils, "sanitation" means inactivating 99.9999% of spoilage microbes.

On this page, we describe:

- The five steps of cleaning
- The equipment we use for cleaning, and

The five steps of cleaning

In general, the cleaning and sanitation process has five steps:

- 1. Warm water rinse to loosen up and remove debris
- 2. Cleaning cycle
- 3. Water rinse to remove cleaner residue and loosened debris
- 4. Sanitizing cycle
- 5. Cold water rinse, if necessary, to remove sanitizer.

We clean equipment each end of the day after it has been utilized (steps 1-3), and we clean and sanitize all equipment when it is taken out of storage before we use it. This page describes how we clean all harvesting and winery equipment; a particular page in the Cellar section explains how we clean barrels.

Water power-washes and rinses

We distinguish between three levels of purity in water used for cleaning, rinsing, and sanitation:

 Regular city water contains a fair amount of chlorine and should not be used on surfaces that come in contact with juice or wine. Chlorine can result in chemical reactions resulting in TCA, which is known as cork taint. We use regular city water only to powerwash floors

- Softened water: we dechlorinate all our city water used in the winery with a Kinetico 4040 salt-based, regenerative ion-exchange system (see www.Kinetico.com)
- Distilled or purified water

We use softened cold water in power washers to remove sugars and proteins, and we use softened hot water in power washers to remove tartrate buildups.

Cleaning cycle

We distinguish between three types of cleaners

- Caustic: NaOH, KOH
- Non-caustic / alkaline-based: sodium carbonate, potassium percarbonate, trisodium phosphate (TSP). We need to use citric acid to rinse after to neutralize alkaline residues.
- Acid Cleaners: Phosphoric / Nitric acid based

We use the following chemical solutions:

- Potassium Hydroxide / Caustic Potash (KOH)
- Sodium Percarbonate Na₂H₃CO, Dissolved in water, sodium percarbonate yields a mixture of hydrogen peroxide (which eventually decomposes to water and oxygen, sodium cations Na+, and carbonate CO2
- Trisodium Phosphate (TSP) Na₃PO₄

Note, biofilms are resistant to many chemical cleaners, so casual rinsing or washing is not sufficient. It is best to remove the films by scrubbing, brushing, or high-pressure washers.

- We use brushes to clean stainless steel surfaces
- Use scrubbing foam balls to clean the inside of hoses
- We circulate cleaning solutions through hoses with electrical pumps

We have used ultrasonic baths (generally used for jewelry) in the past but found maintaining the equipment cumbersome.

Sanitizing cycle

There is a wide choice of chemicals for use in the sanitizing cycle:

- Potassium-Metabisulfite (KMBS), citric acid
- Chloride (CI) based compounds
- Iodine (I) based compounds
- Sodium dioxide (SO₃) solutions; they need to be acidified to pH~3 and are corrosive
- Peracetic Acid (CH₃CO₃H) is also corrosive
- Star San: proprietary formulation including phosphoric acid and surfactants. No rinse is necessary. It should be used at a dilution of 0.15% or 1.5 mL per L.
- Food-grade Ethanol 70% is suitable for sanitizing punchdown tools, pipettes just before use

Our go-to sanitizing chemicals are Citric Acid, KMBS, Star San, and Ethanol, which we keep handy in spray bottles. When we clean oak barrels, containers with hard-to-clean crevices, or large equipment, we use ozone dissolved in water or as a gas or superheated steam

Equipment

Power washer

We use a regular gas-powered pressure washer for general cleaning of floors, walls, and general equipment.

Electric power washer with superheated steam

We use an electric power washer with a diesel-heated steam boiler to wash and sanitize large equipment (destemmers, sorting table, presses, tanks, etc., especially after harvest. The Delco DH2305 Electric power washer we use (<u>https://manualzz.com/doc/24175308/delco-</u> db22059/ E29/ 809/ 02 direct drive?/ E29/ 809/ 02 period) is period.



longer available. It is beneficial for cleaning/washing off tartar



films on crushing equipment and general clean-up. It is not 100% stainless steel, so residual rust particles can potentially be harmful to wine if not rinsed off subsequently.

Electric steam power washer:

We use a Swash Deluxe Steam Generator from Electrosteam we bought from ARS Enterprises in Calistoga, CA (https://www.electrosteam.com/applications/winerysteam/). It is not a pressure washer like the Delco mentioned above; it provides superheated steam and is built using stainless steel throughout. So its primary use is for sanitizing oak barrels (see Cellar section) and floors, walls, large winery equipment, etc.



Handheld steamer

We use a PurSteam handheld electrical steamer purchased from Amazon for spot sanitizing valves and other small items with crevices. Any low-cost household steamer does an excellent job.



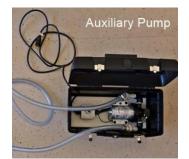
Ozone generator

We use an ozone generator from A2Z Ozone Inc (it is currently sold at Walmart) for sanitizing rooms and oak barrels after being washed and steamed. We also use it for deodorizing and sanitizing entire rooms.



Auxiliary pump

We use a Sureflow diaphragm pump assembly purchased from VA Filtration in Napa, CA (<u>www.vafiltration.com</u>) designed to clean the Sweetspotter (see Filtering – Reverse Osmosis in the Cellar section). For cleaning hoses, the pump circulates cleaning, rinsing, or sanitation solutions from a bucket through the hose back to the bucket.



Scrubbing ball

We use scrubbing sponge balls to clean and sanitize hoses. Scrubbing sponge balls come in various sizes and types (soft, semisoft, and hard). We insert them into hoses filled with cleaning solutions and drive them through with a pump.



Barrel washer

We built a special washer to wash, steam, and ozone oak barrels, because we could not find equipment that recirculates the washing fluid (and thus minimizes water usage) and fits into our small space. It is basically a wash-basin on wheels with an electric pump that feeds water to a spray-ball inside the barrel sitting on rollers above the basin. See Cellar Section for details on how it is used in the racking process.



Previous page: Winery Overview Top of this page: Go Next Page: Step #1: Assessing Grape Maturity Last updated: May 15, 2021

Step #1: Assessing Grape Maturity

Picking the grapes at the right time is critical. Timing depends on the maturity of the grapes, the outlook for inclement weather, and a picking crew's availability. The most vital aspect is grape maturity assessment; it takes weeks.

Ideally, all grapes reach the same final level of maturity at the same time. In reality, they do not. Proper pruning and canopy management can narrow the time window of final maturity so we can harvest all grape bunches on the same day. We sample the grapes in the vineyard every week and test them – when the average reaches specific characteristics, we pick. There are four aspects to consider in getting to the picking decision:

- 1. **Weather and soil humidity**: how much sunshine have the grapes received over the growing season and how much water was added through irrigation to fine-tune the grapes' condition during the last 4-5 weeks?
- 2. **Sampling**: How do we sample the grapes to be analyzed so the sample represents the range of maturity in the entire vineyard?.
- 3. **Chemical Analysis**: what chemical measurements do we take to decide whether the grapes have reached maturity and how will the results affect our winemaking process?
- 4. **Taste Analysis**: how can we consistently evaluate the taste of the grapes during their final weeks of maturation?

Finally, we try to forecast, as we measure, when we will likely end up picking and what volume we can expect from the harvest. Quality, date, and volume forecasts help us organize the picking crew/party and decide on the subsequent fermentation processes.

The following paragraphs explain what we do in detail.

Weather and soil humidity

On the last page in the vineyard section, we described how we monitor weather conditions during the growing season. A critical weather-related leading indicator for maturity used throughout agriculture is Cumulative Growing Degree Days ("CGDD"). We track this number throughout the year and pay particular attention during the last four weeks. The goal is to reach around 2000 CGDDs before picking.

We can increase soil humidity with irrigation. We do not irrigate the vineyard except in very dry seasons and during the final weeks of maturation if we need to prevent sugar from shooting beyond our target of 24 Brix before the grapes have reached physiological maturity (as measured by Taste Analysis). Consequently, we track CGDDs, temperature lows and highs, humidity lows and highs, and irrigation amounts during the final weeks.

Sampling

The second task is to decide how we sample. The goal is to sample in the areas which provide the full range of berry maturities. The best time to easily spot degrees of berry maturity is during veraison, when the berries turn from green to blue. So we look at

- The planting map to make sure we sample all the different clones
- The veraison map when 90% of the berries are blue to make sure the maturity differences are representative for the entire vineyard, and
- The projected crop load map to make sure we have enough fruit to sample

In 2017 we selected, as in 2016, six sample areas.

- In the Lower Field: the north-east corner of the long rows to sample the "Freedom" and "4453" roots with 337 cabernet clones. In the northeast corner of the short rows to catch the "110R" roots with "Dr. Emmet Rixford" cabernet clones, and the boundary between the short and long rows to capture the 2009 replantings, i.e., clone 337 on 4453 roots.
- In the Upper Field: The first half rows for each varietal. The graphic below shows the three maps and the selected sampling areas. The assumption is that differences in the maturity levels now, near picking, would be similar to the readily observable differences during version.



In 2018 we changed the selection of sampling areas because, both in 2016 & 2017, the sample results did not match well with the observations at harvest (for one, the final projected Brix levels were 2-4 Brix lower than what we got at harvest). So, in 2018 we sampled each block in the lower field uniformly, and we sampled the middle row of each block in the upper field.

Sample size: We collect weekly samples of 110 berries each, 100 berries for chemical analysis, and 10 berries for taste analysis for each block.

Chemical Analysis

We take a whole range of measurements and, from them, calculate sample averages.

- Sugar content (Brix): The sugar content of grape juice is the most straightforward measure of maturity. The industry norm is to pick when the sugar level has reached 22-28 Brix, depending on the style of the wine desired. Our target is 23.5 Brix when the juice is in the fermentation tank, but we focus more on maximizing potential Anthocanins (see below)
- Acidity (pH and Total Acidity, TA): At maturity, we expect a pH range of 3.3 to 3.5 and a TA range of 6 to 9 [g/L]. We also capture Tartaric, Malic & Gluconic Acids but are unsure what we do with the numbers. Finally, we capture Volatile Acidity to detect bacterial infestations.
- Nutrients (Alpha Amino Acids and Ammonia, which sum up to YAN, Yeast Assimilable Nitrogen): These are vital benchmarks for nutrition available for yeasts during

fermentation. We target YANs of 250 ppm; below that, we need to add nitrogen during fermentation.

 Projected Anthocyanin content (tANT): Anthocyanins are responsible for the finished wine's color intensity and mouthfeel. We press the sampled berries, then expose the skins and seeds to an alcohol solution at 130 °F for 2 hours, then press again and measure the phenolic components extracted by the alcohol solution. Our goal is to pick at the peeck of tANT, prefereably above 2,000 ppm.

We describe the laboratory processes in the Laboratory Section.

Physical Analysis

An alternative measure is to assess the maturity of the grapes by tasting their skin, pulp, and seeds individually. L'Institut Cooperatif du Vin (ICV), a wine advisory cooperative in Montpellier, France, has developed a handy methodology that we used in the past. It requires judgment for rating 18 different characteristics on a scale from 1 to 4. See the table below for the form we used:

Date:

	E	8		Score D	escription		My s	core of sa	ample
			1	2	3	4	: A	В	C
-	1	Berry Softness	Hard: bursts under strong pressure	Elastic: changes shape slighty under pressure but reverses quickly	Plastic: changes shape easily, takes a moment to get back to original shape	Very soft: changes shape easily under slight pressure, even squeezing			
Visual	2	Skin Color around stalk	Pink, pale red	Rød, lightpenetrates berries	Dark red: but not evenly colored around stalk	Blackish red: evenly colored	63.04		
a	3	Stalk removal	Difficult: stalk tears the skin, takes pulp out	Moderate: stalk comes off with parts of the green pulp	Easy: stalk and brush includes only a little of the uncolored pulp	Very easy: stalk and pulp without pulp attached, brush is red			
Pulp Tasting squeeze pulp into mouth and separate out seeds	4	Pulp detachment & juiciness	Limited: pulp adheres strongly to skin, pulp mostly g <u>elatine</u> .	Some: film of pulp adheres to skin and/or seeds, evident melting	Easy: pulp film only slightly visible on skin, juice is released from skin when squashed, almost complete melting	Total: no film of pulp on skin or seeds, no release of juice when squashed, complete pulp liquefaction			
日日間	5	Sweetness	Lightly	Some	Pretty	Very			
dia	6	Acidity	High	Significant	Some	Low			
Puese	7	Herbaceousness	Very Intense	Significant	Some	Absent	53 52	94 - 9	
Š.e	8	Fruit Aroma	Absent	Weak	Strong	Intense, jammy	0		
p	9	Disintegration after 15 chews	Very difficult small hard ball after 15 chews	Difficult evident fragments after 15 chews	Fairly easy mixture almost homogenous	Easy homogenous, solids gone before 15 chews		s?	
tegrate	10	Tannin Intensity run tongue overpalate	High tongue sticks to palate	Significant tongue slides with difficulty	Low tongue sticks slightly	Very Low tongue slides effortlessly			
Skin Tasting chew skins till disintegrated	11	Astringency between lips & gum	Strong lip sticks, strongburning	Significant some burning	Moderate lip sticks slightly	Very Low lip slides			
kins skins	12	Skin Acidity	Strong	Significant	Moderate	Low			
Schews	13	Herbaceousness	Intense	Significant	Some	Absent	- S	89 G	2
8	14	Fruit Aroma	Absent	Weak	Strong	Intense, jammy	- S	88 G	2
D E E	15	Seed Color	Green or yellow-green	Grey-brown with green traces	Grey-brown withoutgreen traces	Dark brown			
Seed Tasting chew only if no green traces, otherwise lick	16	Seed Hardness	Soft & elastic can be marked with nails	Soft outside, seed crashes like fresh almond	No soft outside most seeds are hard and cracks easily	All seeds are hard crack quickly and are crunchy			
w onl	17	Tannin Intensity	High	Significant	Low	Very Low			
tac the	18	Astringency	Astringent when licked already	Astringent at beginning of chewing	Some during chewing	None	202	8)	

ICV Detail Berry Sensory Analysis Scoresheet

The process is:

- Step 1: Visual Inspection. Inspect the 4-5 berries and rate 1) the elasticity of the berry, 2) the color of the skin around the stalk, and 3) how easy it was to remove the stalk.
- Step 2: Pulp Tasting. Squeeze the pulp of the 4-5 berries into your mouth, separate the seeds with your tongue, and keep the seeds for the last step. While doing that, evaluate 4) how easy the pulp detached from the skin, 5) the sweetness of the juice, 6) its acidity, 7) its herbaceousness (herbal aroma), and 8) its fruit aroma. This takes some experience as all the ratings have to be done within 10 seconds.
- Step 3: Skin Tasting. Put the skins into the mouth and chew them hard 15 times or until they have entirely disintegrated into mush. Then evaluate 9) the level of disintegration after 15 chews, 10) the tannin intensity, 11) the astringency, 12) the skin acidity, 13) the herbaceousness, and 14) the fruit aroma.
- Step 4: Seed Evaluation. First, rate 15) the color and 16) the hardness of the seeds. If the rating is 3 or 4, chew the seeds and rate 17) their tannin intensity and 18) their astringency.

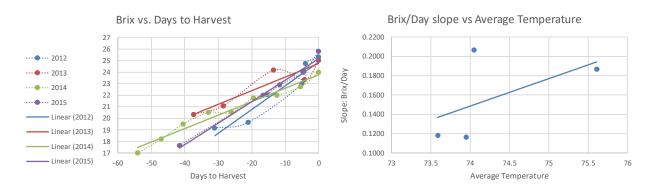
As the berries mature, the ratings move from 1 towards 4. Not all ratings reach 4 before the Brix level of the berries becomes excessive, or the weather turns too cold to finish maturation, and the grapes need to be picked regardless. The final scores provide input to winemaking to adjust the fermentation and maceration styles. We used this ICV process from 2013-2016 and then concluded it was inappropriate for our situation. We have far too few samples to benchmark our judgments accurately. So in 2017, we returned to a more straightforward approach: we rate how berries look, feel and taste using a range of 1 to 4 (from immature to fully mature). Essentially, we use an abbreviated ICV process.

In summary: We endeavor to pick when the CGGD passed 2000, the sugar levels have passed 24 Brix, the average of average ICV scores exceeded 3.5, and the Anthocyanin levels are peaking.

Forecasting quality, date, and volume of harvest

Our quality forecasts are based mainly on the physical appearance of the bunches (e.g., mildew damage, bird damage, shrivel) and the projected potential Anthocyanin levels.

Our harvest date forecasts are based on the observed Brix level and the historical experience on how fast Brix levels increase over time at given ambient temperatures. The graphic on the right shows that in 2012 through 2015, the sugar levels have increased on average between 0.8 to 1.4 Brix/week. However, as shown in the graphic, there is no convincing correlation between that number and the average temperature during the week.



We also consider the observed evolution of potential Anthocyanin content and estimate when the peak will likely occur. Our gross volume forecasts are based on estimates for each vine at veraison how big the current fruit load is as a percentage of estimated maximum load and averaging these numbers over each row. Then we estimate the full fruit load per plant in pounds for each varietal and multiply it with the average observed fruit load to get to an estimated harvest volume per row.

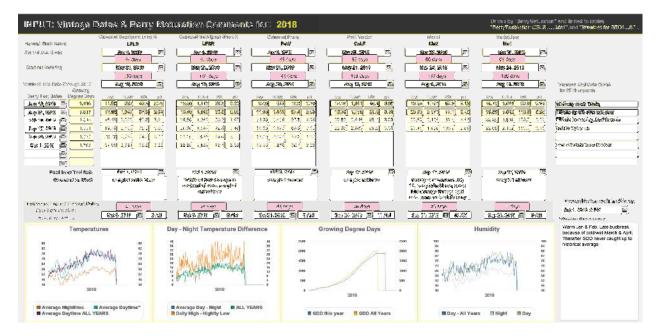
The quality and date forecasts are updated every week as we take and analyze our samples.

Data Management

We record observations for our six vineyard blocks in a single layout. The following screenshot shows, for illustration, the recordings on September 10, 2018. Since 2016, we use an Oeno FOSS analyzer to measure the acidity, sugar, and nutrient levels. For estimating potential anthocyanins, we use WineXRay. The Laboratory section provides details on the measurement protocols.

INPUT: Berry Tes	Dis los Text Date fo	r Vintage: 2018		BenyTestAction LFUB TE	Driven by "Berryklatur ,detet TC" and "HarvestBl	ation" and linked to tablea oakDefinition by Vinlage",
aokai Bany Tant Berg Bergitern ber 1	0, 2018	seuristie Berry Tesé Dales fr Galantei Busiyaan Daut Rest	Ang 16, 2018 - 5ap 10, 1 Ang 21, 2018 - 5ap 17, 1 Paik kanad		knaut	EScient/See
Harometer and Manage	LELR	广大发展	Path	Call?	itia2	No.
HALVEST TIME STATES	和新年 自制率 多大國	0000,2018 6.AM	OS 21, 2013 S.MI	\$\$\$\$\$ 251,33515 11	8499 241, 22 918 18	Sep 21, 2010-3 AM
Test Rate	tap 10, 2042	((10,2018)	free (v), 2010	Sep 13, 2918	869 19, 2018	Sage 10, 2010
Somerry Land Fedra	2.9	2.5	4.0	8.5	4.0	4.0
Fact Robins	4.6	4.0	2.5	4/3	4.0	(4.0)
TRACKS FRANKING	<u> </u>	<u> </u>	<u> </u>	3.6	4.5*	(8.6)
Sastally Number at Earthea	160	100	100	120	100	166
WARDEN AT BOOTLASS	78.0 g	74.5 g	7%.Q g	83.6 g	78.3 g	112.8 g
Julke Velume	24.5 ml.	39.0 ml.	87.6 mL	38.3 mi.	\$4.0 ml.	64.8 mi.
。此後的時代	37.9 6	39.0 g	28.0 g	41.8 g	39.8 5	54.6 g
AGMIN BRI	3.01	3.07	3.05	3.25	3.03	3,36
T.A. [42]278771.]	0.73	0.03	0.08	0.91	0.32	0.46
Tadants dateda	8.2 g/L	0.1 g1	ឆ ទ ត្រូវ	8.9 g/L	3442	8.1 ga
因金融专人的利益	2.6 01	າ.ອ ູກ.	2. 8 gH.	2.0 g/L	0.7 gf.	ાર હતા.
Alexania Asia	0.5 gt.	0.3 g1.	04 g/L	C.C g/L	0.2 g/L	0.1 gA
铋	6.06 g/L	0,04 gft.	0.13 g/l.	0.11 gA	0.28 g/L	8.57 gr.
Bugar & Mairiceis Bus	18.49	18,89	14.90	20,80	22.60	22.20
- Destalty	1.3751 g/mL	1.07788 g/ml.	1.0972 gant.	1.03402 (18%).	1.45566 genal.	1.0538 gant.
大振荡 马斯尔德马斯	-49 ppm	30 japani	64 spm	000 \$FED	- 667 (\$\$200 j	stā japan
AB10016	a bhu	200 ppm	লগ্ হথ্য	88 yes	181 years	लाब्द्य पर
[برعية)	गड़ा हर	777 Blan	154 poin	(181 pan	108 <u>2681</u>	1202 (5570
hall the second s	173 ppm	THE THEN	178 peac	181 ppm	183: pppi	រនិនី ខ្លះហ
NAMES OF CONTRACTOR	2012-08-18 1947-091-75-ap 89	STOD 40- IS SPURCESTFRAM AR	203419-18-2006F-66/P-18-29	2716-48-19 X888 369 PMp 64	3719-33-02.00910303*ub-65	215-08-0933169:01999-98
Insubation Buttlet Valume Addrei	asta mit	28.0 mL	37.0 74	29.0 ml	24.3 mL	52.5 m.
leavanded white where	48.8 mL	ં નગર છા.	48.0 m2.	49.5 ml.	43.5 281.	35.0 mt .
track. Juice Artheoperine	\$,026) ppers	1.814 ppm	1,240 3500	1.58% ppm	1.8527 2020	1,763 (590
Republic of Participation of the State of th	2590-09-10 20190-00.148 ary 514	2019-69-00 3040395 3Bery 686	9903-96-12 23 2846 25 ap 48	2743-33-48 2018223FBang 783	2016-00-14-2818法运路由空经	2518-07-19 25122 % 18 ory #2
Techicommet	swy part this	very pasor CAN	logging in maiorily	barna kini demoga	lates kolen nater etnesant. es brighte hand bring to	
Wire Spent	(1.25 her)		1.58 bre	1.28 (#24	1.25 hrs	1.22 krs

We monitor the progress of berry maturation and adjust the projected harvest dates after entering the berry test results. This screenshot shows the layout to review and adjust the dates on October 1, 2018:



Tracking Results for the 2020 crop

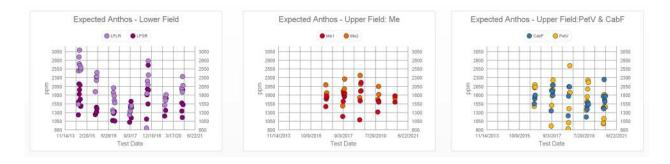
The first tab in the layout "REVIEW: Weather & Berry Maturation" shows the maturation dates and Bric and pH levels measured in the berry tests for each block. Note, we started berry testing a bit late, so there were only two tests for the Merlot blocks

rview Berry Composition	BACKGROUND					
eather	Temperatures	Day - Nig	ht Temperature Difference	Growing Degree Da	ys Temper	ature Spikes (daily high > 93 F)
	AND		2020	3005 3005 4	2000 10 2000 10 1000 8	14 14
	Average Nighttime Aver Average Daytime ALL YEARS		9 Day - Night 📕 ALL YEARS gh - Nightly Low	2020	a	2025
sturation Dates Start of Bud Break Start of Flowering Version Md-Date	Cabernet Sauvignon Long Row: LFLR C Mar 29, 2020 May 25, 2020 Aug 7, 2020	Cabernet Sauvignon Short Row: LFSR Mar 29, 2020 May 25, 2020 Aug 7, 2020	Petit Verdot: PetV Mar 18, 2020 May 29, 2020 Aug 23, 2020	Cabernet Franc: CabF Mar 14, 2020 Mary 25, 2020 Aug 13, 2020	Meriot: Me2 Mar 10, 2020 May 20, 2020 Aug 2, 2020	MeriotUbor: Me1 Mar 15, 2020 May 20, 2020 Aug 8, 2020
est Date / Days from Veraison Comment on Block	Oct 10, 2020 🔲 64 days	Oct 10, 2020 🔲 64 days	Nov 3, 2020 🔲 72 days	Nov 3, 2020 🔲 82 days	5ep 17, 2020 🔲 46 days	Sep 17, 2020 🔲 40 days
	28 28 24	28 26 26	2 2 2	28 29	21 25 24	28 28 34
Brix [g Suc /100mL]	211 215 205 214 223	21 21 23 18 18 18 18 18 18 18 18 18 18 18 18 18	21.6 10 11 11 12 12 18 18 18 18 19 19	22.7 19 5/0 4 0 4 0 6 0 4	23.3 21.7	21.5 21.5 21.2 21.2
рH	34 54 52 52 52 52 52 52 52 52 52 52 52 52 52	54 54 52 26 33 32 33	14 54 52 53 53 53 54 55 55 55 55 55 55 55 55 55 55 55 55	35 JF 35 38 37 48 00	3.6 376 3.0 3.4 3.2 3.0	24 24 32 39
rvestReferenceTimeStamp I 10. 2020: 8 AM	Days to Harvest	-28 -24 -17 -10 -3 Days to Harvest	Days to Harvest	Days to Harvest	Days to Harvest	Davs to Harvest

The second tab in the same layout shows the estimated levels of Potential Anthocyanins.the berry composition, the acid components and the nutrient levels.

	Cabernet Sauvignon Long Row: LFLR	Cabernet Sauvignon Short Row: LFSR	Petit Verdot: PetV	Cabernet Franc: CabF	Meriot: Me2	MeriotUber: Me1	
Comment on Black							
	3500	200	Mar	Met	Ma	100	
Potential Inthos ME]	3000	3000	3000	3000	3100	3933	
	2500	2560	1900	2500	250	2503	
	2000	2000	200	2000	2000	2002	_
	1500	1500 mmi 1881	······································		15te BMC (DH	1444	• Π.
	1000 500	1000 000 1000	300 844 851 854	500	3.000 MO	1000	
rry Composition Berry Bris Seeds er	1500	1900 1	1300 1	1300 1	1500 7	1500	
	1200	1250	1220 1	1250 1	1200 1	1250	
	900	230	79]	750	300 E	700	-
	600				500	700	
	300	290	20	20	300	29	
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The following chart shows the Extractable Anthocyanin measurements over the last six years (four years for the upper field). Note how 2018 stands out with high Anthocyanin levels.



The layout "REVIEW: FieldLocations – Fruitload" shows how we estimated fruit loads and harvest volumes for 2020.



In summary, our Grape Maturity Assessment led us to:

- Pick the Merlot blocks on September 17, with Potential Anthocyanins peaking around 1600. We estimated sugars around 21-22 Brix and pH relatively high in the 3.5-3.6 range. With an estimated 100% fruit load on Merlot Uber at 12 lbs/vine and Merlot at 7 lbs/vine, we estimated gross harvest yield at 480 and 450 lbs, respectively.
- Pick the Lower Field on October 10 with Potential Anthocyanin levels having peaked one week earlier at a high 2000-2300 ppm. Three days before harvest, the sugar levels reached around 22 Brix, and the pH remained low at 3.3 3.4. YAN levels were low at 120 130. With an estimated 100% fruit load yield of 15-16 lbs/vine, we estimated gross harvest yield at 2100 and 1200 lbs for the long and the short rows, respectively.
- Pick the Petit Verdot on November 3. Brix measured 21.8 and pH 3.7. We estimated 100% fruit load yield at 12 lbs/vine, resulting in an estimated gross harvest yield of 195 lbs.

The next page will show that some of these estimates were significantly off the mark: actual Brix and pH levels turned out almost 10% higher.

Previous page: Sanitation Top of page: Go Next Page: Step 2: Harvest & Sort Last updated: November 30,, 2021

Step #2: Harvest, Sort & Destem

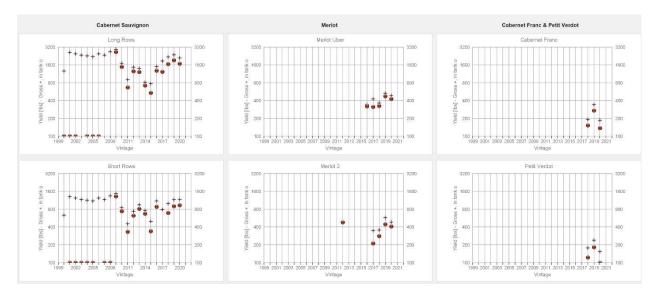
This page covers the harvesting of grape bunches in the field, sorting out bad bunches and debris, destemming the bunches, and then sorting out remaining waste among the grape berries. The result is clean grape berries in the fermentation tanks.

Picking the Grapes

A manual harvest involves organizing a large enough picking crew to harvest all the grapes during the morning hours before it gets too hot. Exposing picked grapes to sunshine and heat for more than 1-2 hours can severely reduce their quality. We usually organize a group of a dozen or so friends to show up in the morning, hand them picking bins and clippers and get the job done within a few hours. The bribe is a good lunch.

In 2013 we started to record the crop volume [lbs] by row. In 2014 we estimated the crop load for each vine and then recorded the crop volume for each vine at harvest (except for lowyielding vines, which we combined into groups of 2, 3, 4, or 5 plants). In 2015 we recorded crop loads for each vine but in 2016 returned to recordings per row.

These charts show the harvest volumes over the last 20 years. We show the gross yield in the field for each block and how much ended up in the fermentation tanks. The y-axis in the charts is on a logarithmic scale to highlight the relative changes over time.



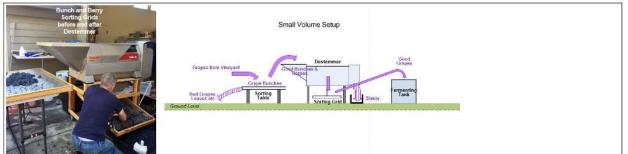
Three points of note:

- 1. We only started making wine in 2009, before we sold all our grapes.
- 2. The yield in the Cabernet Sauvignon blocks dropped significantly after 2009 because we battled a self-inflicted Eutypa infection of the vines. It took us almost ten years to recover from that mistake.
- 3. In 2016 the 4 blocks in the upper vineyard started producing Merlot, Cabernet Franc, and Petit Verdot.

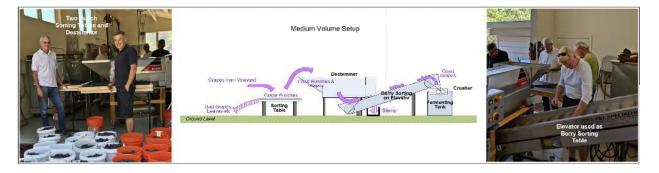
Sorting, Destemming & Crush

Bunch sorting is a labor-intensive manual process taking as long as picking. We pour picking bins of grape bunches one by one on a table, and helpers sitting around the table sort out by hand all the irregular, infected or damaged bunches, and berries. Good bunches and grapes are passed on to destemming. Bad material is discarded. The percentage of the discarded material varies between 2% in a good year (e.g., 2014) and >25% in a bad year (e.g., 2011, 2015, 2017). We use three different setups for sorting and destemming, depending on volume:

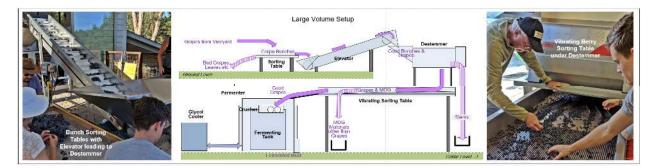
 For small harvest volumes below 300 lbs, we use a single Bunch Sorting table from which we throw clean bunches into a Destemmer. The destemmer detaches the berries from the stems. The grape berries fall on a Berry Sorting grid from which we scoop the clean berries into a small fermentation tank. This is a two-person operation. We use a Delta E1 Destemmer from Bucher Vaslin (http://bvnorthamerica.com/wpcontent/uploads/2013/07/Delta_E1_ang_avril_2007.p°F), which can efficiently process 1 ton of grapes per hour.



 For medium-size harvests (300 – 1200 lbs), we add another bunch sorting table and a Grape Elevator, which we use as a platform for berry sorting. We may use a Crusher, which crushes the berries before they fall into the Fermentation Tank. The grape elevator was manufactured by P&L Specialties, Santa Rosa, CA (pnlspecialties.com). The Crusher is a modified electric grape crusher from Williams Brewing, San Leandro, CA (williamsbrewing.com). This is a 5-8 person operation.



3. We add another bunch sorting table for larger harvests, and we mount the destemmer on top of a TRV15 Vibration Table from Bucher Vaslin (<u>http://bvnorthamerica.com/wpcontent/uploads/2013/07/TRV20-35-50 ANG 2006-11.p°F</u>) on which we sort out bad berries and MOG (Material Other than Grapes). Under the sorting table, a pan collects juice from damaged grapes and MOG. That juice can be filtered and poured into the fermentation tank, or it can be counted as part of the "Saignee" and used elsewhere or discarded. At the end of the sorting table, a Grape Crusher can be inserted to break the grape skins before the gapes fall into the Fermentation Tank. This is an 8-12 person operation.



Data Management

We use the HarvestActions table is to record the weight of bunches collected with picking bins for each row or vine and the estimated percentage of weight left on the vine or dropped in the vineyard for each row. This screenshot shows how the weights were recorded by row for the 2018 harvest of the lower field (in 2018 we used 5-gallon buckets to collect grape bunches)

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Next, we use the HarvestActions table record the sorting losses (bunch sorting, destemming, berry sorting, unused saignee from the vibration table) and how the net yield is allocated to different fermentation tanks. This screenshot shows the losses and allocations for the same harvest

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This layout also summarises the grape quality as recorded in the berry tests. It provides an opportunity to record commentaries on the quality of each block and the harvest overall. It shows the labor input (in total manhours) accumulated to date for the must in each fermentation tank.

Tracking Results

The following screenshot provides details on the 2020 Harvests across all vineyard blocks, and all the way on the right margin, it summarizes volume-weighted average data across all blocks.



Note the following:

- The estimated Anthocyanin levels averaged 1858 ppm, slightly below our target minimum of 2000 ppm. Thus the juice is expected to be somewhat weak in color and phenolic content.
- The sugar levels measured in the field just before harvest averaged 22 Brix, significantly underestimating the average sugar levels measured in the tank: 23.58 Brix, slightly higher than our target of 23 Brix. We could have harvested a bit earlier.
- The pH levels measured in the field averaged 3.44, close to our target of 3.5, but significantly underestimated the final pH in the tank averaging 3.79. We lost too much acidity in the grapes during the last weeks of maturation and should have harvested a week earlier on average.

The following two screenshots compare the 2020 harvest with all previous vintages. Note

- The comparison of berry maturation across vintages confirms the observations above.
- Net yields were high (total ~3700 lbs) despite relatively low average berry weights of less than 720 mg. We harvested more but smaller berries in 2020.
- We lost more acidity in 2020 than in any other year. The average pH in the tanks, at 3.79, was higher than ever before.

Clearly an average harvest at best.

C	OMPARE: Vintages				driven	by VintageSur	mmarie	i for VS			
Summary	Summary for website Weather Vineyard Berry Maturation	Harves	a Ferm	entation	Elevage /	ksemplage / Bott	tie Dz	TABASE STRUCTURE			
High R	Rating for: Harvest before day 285, high Potential Anthocynins, pH below 3.5. Brix in 22.5 - 23.5 range, Berry Weight below							CSL	R CSSR PetV CabF	Me2 Me1	
	Below 3.5, Brix in ZZ,5 - 23.5 range, Berry Weight below 800mg	2	Budbre		Flowering Ver			Pot. Antos (ppm)	pH in Tank	Brix in Tank	Berry Weight (mg)
Commo	entary	6 3	10 43 60	80 100 1	20 140 160 180 2	00 226 240 250 2	90 300	1000 1400 1500 2200	3 30 3 42 3 54 3 66 3 78 3 90	21 22 23 25 26 27	0.200 800 1000 1403
21											
20	Mixed Large berries, few blemistres but very poor anthocyanns	284			60	75 60	1	838 	3.79	23.6	717
20	Poor Low Potential Anthocyanins, very high pH, Brix in target range, small berries	284	1	2.6	60	75 60	9	68	3.72	23.8	892
019 3	Good: Poer potential Anthocyanins, very high pH Brix on target except upper field, large berries	285		93	*	70 6	2	194	3.66	23.6	797
18	Excellent: Excellent Polential Anthoyanins, pH too high, Brix on largel except upper field, OK Berry weight	279		92		76 59		180	3 73	23.8	787
17	Poor: Vey low Potential Anthocyanins, small, shrivelled berries du to significant mildew. Dropped >50% of thuil	287	71			80 63	s 2	951	3.70	25.5	663
3	Good: Excellent level of potential Anthoxyanins in CSLR but not in CSSR. Very low net volume	289	66			90 55	2	060	3.65	24.0	791
3	Good: First year of berry testing before harvest, Excellent Potential Anthocyanins, pH too high, Brix a bit high	284	67	48		88 7:	s	0	3 45	25.0	0
13 5	Excellent: Exceptionally high Potential Anthocyanins (info from fermentation): good pH, Brix too high	271	7	4	1	6 65					
112	Good: good pH, Brix on target	281		35		93 63			3.46	23.0	0
2	Poor: Fruit did not fully develop due to weather. Poor volume	308	- 10 in		at si na ar		30	0	3.40	22.9	0
10	Poor: Fruit did not develop fully due to weather. Poor Brix	293				2	293	0	3.60	22.0	0
09	Excellent: Excellent volume and on-farget Brix & pH	283	in the		- بالحمار - التحمار	283	3	0	3.50	24.0	0

mmary Summary for website Weather Vineyard	Berry Maturation Harvost	Fermentation Elevage		SE STRUCTURE				
1		Volume	CSLR	CSSR Pety CabF Mez Phenolics	Met	jar	A	cidity
	Berry Weight (mg) 0.200 600 1000 1400	Net Yield (Ibs) 0 1000 2500 4000	Net % Gross Yield 50 60 70 80 60 100	Pot. Antos (ppm) 1000 1400 1800 2200	Brix in Field	Brix in Tank 21 22 23 26 26 27	pH in Field 3 10 3 22 3 34 3 46 3 58 3 7	pH in Tank 0 3.30 3.42 3.54 3.66 3.78 3.90
Good: Clean grapes, poor anthocyanins., high Brix, Fair amount of shrivel	717	185	80	1838	22	24	3.44	3.79
Very Good, particularly in looks (minimal amount dropped in vineyard) but pH way loo high	892	158	81	1768	22	24	3.37	3.72
Good: Clean berries, limited bird damage, good anthocyanins, some dehydration, low acdity	797	29	76	2194	22	24	3 30	3.66
Excellent: Fair amount of sorting out,great Anthos, ok acidity	787	161	52	1680	21	24	3.31	3.73
Very Poor: Mildew; large sorting losses, low Anthocyanins in CS	663	0.08	69	2061	24	28	3.28	3.70
Very Poor. Despite strong anthos, miserable harvest due to mildew and shrivelling	791	190	89	2060	25	24	3.53	3.65
Excellent: Very high Anthocyanins		31	88	0	0	25	0.00	3.45
Excellent: Best color ever								
Good	0 1.	174	85	0	0	23	0.00	3.46
Very Poor: Weak anthocyanins	0	198	74	0	0	23	0.00	3.40
Good: Smaller crop due to Eutypa, low brix	0 2,	126	87	0	0	22	0.00	3.60
Excellent: Big crop, very little sorting losses, good acidity	0 3.	080	90	0	0	24	0.00	3.50

Previous page: Winery Overview Top of page: Go Next Page: Steps 3-11: Upfront Wine Making Decisions Last updated: November 27, 2021

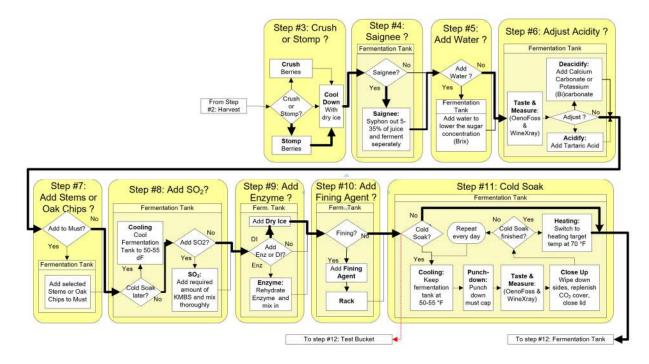
Steps 3-11: Upfront Wine Making Decisions

Nine decisions have to be taken when the clean berries are ready to drop from the berry sorting table into the fermentation tank. We decide depending on the quality of the berries and the intended style of wine.

- Step #3: Crush or Stomp? We decide whether we want to break the skins of the grapes with motorized rollers (crush) or with our feet or punchdown tool (stomp), or not at all (resulting in Full Berry Fermentation)
- **Step #4: Saignée?** We decide whether to increase the concentration of flavors by syphoning off a percentage of the liquids. This increases the "skins & seeds"-to- "liquids" ratio. The juice that is syphoned off can be used to produce rosé wine or discarded.
- Step #5: Lower Brix? We decide whether we need to lower the sugar level (Brix) by adding water.
- Step #6: Adjust Acidity? We decide whether we need to adjust the pH up (add carbonates) or down (add tartaric acid) now. This can be done now or later, anytime before bottling.
- Step #7: Add Stems or Oak Chips? We decide whether we want to add back some of the stems into the must to adjust flavor profile or add Oak Chips to adjust the phenolic extraction
- Step #8: SO₂ or native Fermentation? We decide whether to ferment with yeasts native in the vineyard and winery or with cultured yeasts purchased from external providers. If we decide to use cultured yeasts, we need to add SO₂ now to prevent spoilage of the fruit and to kill off any indigenous yeasts
- Step #9: Add Enzymes or Dry Ice? We decide whether we want to increase the extraction of desirable components in the skin artificially, pulp and seeds into the juice by adding enzymes that break down cell walls. Adding dry ice also breaks down cell walls where berries touch the ice; it is less effective but has the added benefit of initiating a cold soak.
- **Step #10: Add Fining Agents?** We decide whether we want to add fining agents to bind and precipitate spoilage bacteria (important for musts with low acidity, when SO2 is not as effective in controlling microbes).
- **Step #11: Cold Soak?** We decide whether we want to extract desirable skin components and pulp into the grape juice before fermentation is converting the juice into

alcohol. Again the idea is to get more aromas and flavours. Soaking needs to be done at a low temperature of around 50-55 °F to prevent spoilage.

This chart shows the detail process and the choices made in 2020



Natural style winemakers tend to stay away from using cultured yeasts, enzymes, oak chips, acidity adjustments, and fining agents; interventionist winemakers tend to use all available tools in the box. The following paragraphs describe the choices and actions in detail

Step #3: Crush, Stomp, or Full Berry Fermentation?

At this juncture, the pulp and juice in the grapes have the color of white wine. However, it turns red during cold soak and fermentation as phenolic compounds from the skin and seeds dissolve into the juice. This transfer can be accelerated by breaking the skins of the grapes before they are dropped into the fermentation tank, a process called crushing or stomping the grapes:

Crushing is usually accomplished by passing the berries between two rollers spaced at a

slightly smaller distance than the berries' diameter. Care must be taken not to crush the seeds inside the berries because that would release unwanted chemicals into the juice.

We built our Crusher to sit on top of a fermentation tank in 2016 based on components salvaged from hobby-winery crushers sold by Williams Brewing.com. An electric motor drives two rollers over a set of external gears. A funnel guides the grapes to be crushed to fall between the rollers, and the crushed berries drop into the fermentation tank. The picture shows the Crusher over a fermentation tank and fed by buckets.



Stomping is accomplished by a person stepping into the fermentation tank and on the grapes. This is old-fashioned, and the job is usually reserved for virgin maidens when available [increasingly challenging to find given the weight required!]. The alternatives are grown-ups (possibly in wet-suits) or stainless steel robots. Stomping is considered somewhat gentler on the grapes than breaking the cell walls with rollers.

If the grapes are very ripe, they tend to break open during destemming and crushing, or stomping may not be necessary at all.

If the grapes are left whole, then, during subsequent fermentation, the yeast will need to enter the berry through the small hole created when the berry stem was removed. This takes longer and is called **Full Berry Fermentation**.

Step #4: Saignée?

Saignée (from French, meaning "bleeding") is one method for producing rosé wine. It started, though, with the intent to remove liquid from the grape must before the juice gets exposed to skins. The idea is to increase the "skin-to-liquids" ratio by removing liquids upfront so that the remaining liquids get more exposure to the color and tannins that are extractable from the skins and seeds. The purpose is to increase the flavor and color density of the wine. Saignee is often

used in a bad-weather-year when the grapes did not get enough warmth and sunshine to fully mature. The juice is either separated as fallout from the vibration table or siphoned off within 1-2 hours after destemming. The slightly pink juice is either discarded or fermented separately to produce rosé wine.

Using a vibrating berry sorting table, as we do, automatically diverts some juice before the berries reach the fermentation tank. If sifted to eliminate MOG (Materials Other than Grapes), this juice can be poured back into the fermentation tank, discarded, or used elsewhere.

Step #5: Add Water?

We pick the grapes when they are ripe. Simplistically ripeness is measured by the amount of sugars accumulated in the berries. A good guideline is: berries are ripe when sugars reach 23-25 Brix (i.e., grams of sucrose per 100 grams of juice). A better way to evaluate ripeness is to taste the juice, skins, and seeds or measure accumulating Anthocyanins.

Particularly in a year with heatwaves, Brix levels at harvest may reach 26-27. If left to ferment, this amount of sugar will lead to alcohol levels close to or over 16%, negatively affecting the taste of the wine. Therefore it is advisable to reduce the sugar concentration before fermentation or reduce the alcohol level later with reverse osmosis. The easiest way to reduce sugar concentration is to add distilled water – the rule of thumb is: a 10% reduction in Brix or projected alcohol is accomplished by adding 10% of water. In most countries, the law prohibits commercial wineries from adding significant amounts of water to must; but we can do what we like since we do not sell our wine.

Step #6: Adjust Acidity?

Acidity affects the wine in many ways: microbial activity, protein tartrate stability, malolactic fermentation, color, flavor, and aging potential. Therefore, adjusting the acidity is an integral part of the winemaking process. Adjustment is advisable when the must has a pH below 3.2 or above 3.7 or a Titratable Acidity (TA) above 7.5 or below 5.0.

Also see: http://winemaking.jackkeller.net/acid.asp

www.chateauhetsakais.com

Increasing acidity: The addition of acid to grape juice, must, or wine decreases the pH and increases the TA of the wine. The low pH will make SO₂ more effective against oxidation and bacterial infections. Reduced use of SO₂ preserves color intensity and increases the aging potential of the wine. The amount of acid needed to correct the acidity deficiency depends on the total acidity, the pH, and the buffer capacity of the juice, must, or wine. The choice is between adding tartaric, malic, or citric acids as they will affect the pH, TA, and taste of the wine differently. The general guidelines are

- One g/L addition of Tartaric acid will increase the TA by about 1.0 g/L and decrease the pH by 0.1 pH units.
- One g/L addition of Malic acid will increase the TA by about 1.12 g/L and decrease the pH by 0.08 pH units.
- One g/L addition of Citric acid will increase the TA by about 1.17 g/L and decrease the pH by 0.08 pH units.

Adding acid can result in some precipitation of potassium tartrate (KHT), affecting both pH and TA. Therefore, it is highly advisable to make acid additions in small steps or do a bench test with the must at hand before making any additions.

Decreasing acidity: Red wine is usually put through a "malolactic fermentation" (see Step #17) after the fermentation of sugars into alcohol. In that step, malic acid is converted to lactic acid, increasing the pH by around 0.2, decreasing the TA by around 2, and softening the acid's mouthfeel. If that projected reduction is not substantial enough, deacidification with precipitation agents may be necessary at this juncture. The deacidification agents precipitate some tartaric acid in the form of insoluble salts.

- Calcium Carbonate CaCO₃ forms carbon dioxide and precipitates calcium tartrate (CaT).
 However, this introduces a risk of calcium tartrate instability.
- Potassium Bicarbonate (KHCO₃) and Potassium Carbonate (KH₂CO₃) deacidify grape juice, must, or wine, possibly improving quality or rounding off-flavors. They both form carbon dioxide and precipitate potassium bitartrate.

With the double salt method, we can reduce tartaric and malic acid. Double salt deacidification is a technique in which we take up to 20% of the volume to be treated and add all the CaCO3 calculated needed for the total volume. The goal is to precipitate tartaric and malic acid in roughly equal parts. The high pH over 4.5 produced in this fraction is to facilitate this.

A bench trial should be performed before any intervention.

Step #7: Add Stems or Oak Chips?

Do we want to add some of the stems (removed in the destemmer) back into the must? This is often done with Pinot grapes that are low in phenolics but less with other varietals. The goal would be to add more tannins to the wine. We have not added any stems back to date.

If desired, a small amount of specially treated oak chips can be added to the must to improve the projected flavor profile of the wine. Purveyors of these oak chips claim they can enhance the binding of anthocyanins and round out the mouthfeel; others can mask green flavors. Some argue oak chips are a substitute for soaking and fermenting in oak barrels. The jury is still out on the effectiveness of oak additions.

Step # 8: Add SO₂

Sulfur dioxide (SO₂) is the oldest and arguably one of the most important additives used in winemaking. When present in sufficient concentration, SO₂ has five major effects in wine/musts: (1) SO₂ is a strong antimicrobial agent and provides a protection against a wide array of detrimental microorganisms; (2) it is an effective antioxidant that consumes oxidants such as hydrogen peroxide or quinones formed during the course of wine/must oxidation; (3) it can inhibit polyphenol oxidase enzymes present in grapes; (4) it reversibly binds and bleaches wine pigments, particularly monomeric anthocyanins; and (5) it reversibly binds aldehydes and ketones produced by oxidation or during fermentation, rendering them non-odorous (Waterhouse et al. 2016)

There are four different instances when SO₂ is added to must and wine:

- After grape sorting and before cold soak, fermentation will be done with commercial yeasts (i.e., step #8). The purpose here is to kill off all native non-saccharomyces yeasts and bacteria upfront and protect the wine from accidental spoilage
- 2. After the malolactic fermentation has finished, to protect the wine during cellaring
- 3. During cellaring whenever we top up or rack a barrel (every 1-2 months).
- 4. Just before bottling to protect the wine in the bottle

SO₂ is added to most wine made today', but there is a clear tendency to reduce the amount used – particularly for the very high-end and artisan wines. The less SO₂ is used, the higher the risk of spoilage. Thus very clean grapes and winery/cellar equipment become even more critical. Details on how to measure SO₂ concentrations and how much to add are provided in the Laboratory section.

The first opportunity to reduce the use of SO_2 is right up front: before fermentation.

- SO₂ kills off bacteria and spoilage material carried into the winery from the vineyard with the grapes or have over-wintered in the winery. At this juncture, SO₂ also kills off any native non-saccharomyces yeasts. This is desirable in high-volume operations when laboratory-grown yeasts of known origin and characteristics are used to ensure consistent fermentations and wine quality. These cultured yeast are derived from samples collected in the most prestigious highest quality vineyards in the world. Since different yeasts applied to the same grapes produce wines with varying taste profiles, yeast selection is a key decision for the winemaker.
- On the other hand, native yeasts that arrive with the grapes provide "terroir" or individuality/uniqueness to the wine produced, making native fermentations attractive to artisanal winemakers. Their use, however, increases the risks of stuck fermentations, a significant production headache. One way around this conundrum is to extract yeast cultures in the vineyard and grow selected strains in the laboratory, then clean the grapes when they come in with SO₂ and subsequently inoculate with the in-house grown cultures, thus preserving the "terroir." This, however, is only economically viable for very high-end wineries.

So, if the intention is to do a native fermentation, it is better not to add any SO2 at this juncture or limit the addition to less than 20 ppm (parts per million, or grams per metric ton).

Step #9: Add Enzymes?

Enzymes are catalysts for biological reactions. Enartis Vinquiry (<u>www.enartisvinquiry.com</u>) and Laffort (<u>www.laffort.com</u>) are the leading developers and producers of enzymes for the wine industry. Some enzymes are used before and during fermentations to accelerate the break-down of grape cell walls so that preferred tannins from cell walls (compared to less preferred tannins from the seeds) are more readily released into the juice. The result is improved color stability of the wine and softer tannins.

Step #10: Add Fining Agents?

SO2 does not work effectively to control bacterial infections when the acidity of the must is low (i.e., pH above 3.7). In this case, we may decide whether to add a fining agent to bind and precipitate spoilage bacteria. For an example and more detail, see the Enartis video http://www.enartis.com/us/focus-on/webinars/high-ph-red-winemaking_5744.htm.

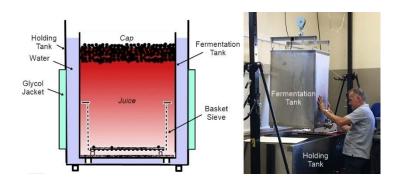
Step #11: Cold Soak?

A further technique to increase the release of color (and to a lesser extent tannins) from the grape walls into the juice is to let the crushed or stomped grapes soak in their juice at around 50° F for a few days before fermentation starts. The low temperature prevents spoilage and an accidental onset of fermentation. During cold soak, the must has to be covered with a blanket of Argon or CO₂ to avoid oxidation, and the grapes need to be agitated and punched down daily. There are two ways to achieve this: either by adding a daily dose of dry ice (which reduces the temperature and releases CO₂) or cooling down the fermentation tank with glycol. Using dry ice has the added benefit of breaking down cell walls (effectively flash freezing at the contact points). In 2013 we switched to an insulated fermentation tank with a cooling jacket fed with glycol from a refrigeration unit. The fermentation tank was built by Santa Rosa Stainless Steel (www.srss.com) on specification; the refrigeration unit is a Kreyer Chilly Max (www.kreyer.com) bought from MoreWinePro (www.morewinepro.com).

As the skins separate from the juice, they start forming a cap because skins are less dense than the liquid. This cap dries out unless the juice is pumped over or the cap is punched down into the juice regularly. We prefer to punch down as it does not involve pumps.

In 2016 we introduced four new smaller fermentation tanks designed to sit inside the glycol-

cooled larger tank in a water bath. The first purpose was to allow fermentations in smaller batches. The second purpose was to allow early removal of skins and seeds before the fermentation is finished by



introducing a basket sieve at the bottom of each tank. The third purpose was to allow for better temperature management during cold soak and fermentation. The tanks were custom-built again by Santa Rosa Stainless Steel.

The twice-daily cold soak/punch-down process is:

Lift the tank cover

Punch down the must to the extent possible.

Take out samples to taste and analyze.

Squeegee and wipe down the inside walls of the tank with disinfectant (weak KMBS solution on a paper towel), cover the must with a new blanket of Argon or CO2, and lower the tank cover.

We take two 2 ml samples and centrifuge them for 4 minutes at 13,500 rpm to measure the chemical properties. Then we use one sample for the OenoFoss instrument to measure Brix, Density, pH, VA, TA, Tartaric Acids, Gluconic Acids, Malic Acids, Alpha Amino Acids, and Ammonia. We use the second sample to measure phenolics: we measure the transparency at various wavelengths in the ultraviolet-to-visible spectrum and transmit the spectral data to wineXray.com, which instantly returns the phenolic results (Free and Total Anthocyanins, Anthocyanins Bound to Tannins, Protein-Precipitable Tannins and Total Iron-Reactive Phenolics). For a more detailed description of the process and the meaning of these measures, read the Laboratory section.

Data Management

We record data at least daily for all fermentations running simultaneously for a given harvest date with the "INPUT: Fermentation Actions by Harvest" layout. It can accommodate up to 8 simultaneous fermentation batches. This layout has five tabs: the first to input actions, the second to input measurements of chemical properties, the third to set the boundaries for the "MUF" (Must under Fermentation) calibration, and the fourth and fifth to review results graphically.

This screenshot shows the "Actions" tab of the input layout on October 14, 2017, at 6 pm, when we re-allocated the saignee on the vibration/berry sorting table from fermentation tanks 1, 2 & 3 to fermentation tank 4.

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This screenshot shows the "Juice Analysis" tab at the same time

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Note, we only have "Must" readings in the chemical analysis because the fermentation had not started yet.

The other three tabs are irrelevant at this juncture.

Tracking Results 2020

As indicated in the process-flow graphic at the beginning of this page, we made the following choices in 2020:

- We stomped all four fermentation batches (CS, CF-PV, Me1 & Me2).
- We discarded the juice falling off the berry sorting tables effectively a 7% saignee.
- We made no additions of any sort (no water, acidity adjustment, stems or chips, SO2, Enzymes, or Fining Agents)
- We used dry ice to cool down the berries as they fell into the respective fermentation tank, equivalent to a 1-day cold soak.

Over the years we have learned to minimize adjustments and interventions, by managing fruit characteristics in the vineyard and timing the harvest correctly. We now shy away from adding water or sugar, from adjusting acidity or using enzymes and SO2.

Previous page: Step #2: Harvest Top of page: Go Next Page: Step #7: Primary Fermentation Phase 1 Last updated: November 28, 2021

Step 12: Primary Fermentation Phase 1

Fermenting grape juice into wine is about transforming sugar into alcohol with yeast. This happens in a complex web of chemical reactions which are not yet fully understood. The level of Brix measured in grape juice translates linearly into the percentage of alcohol the wine will have: 24 Brix in must yields around 13.5% alcohol in wine.

Fermentations consist of two successive phases:

- Phase 1: Lag & Exponential growth phase. First, the yeast microbes need to adjust to the environment (temperature, pH, etc.). As soon as the adjustment is complete, the yeast cells divide and grow in number exponentially while at the same time converting sugar. This takes a few days, during which significant energy is dissipated in heat, and rising temperatures and oxygen is consumed. Next, berries start to disintegrate, and skins begin to float up to create a cap that needs to be broken up and submerged with regular punch-downs.
- Phase 2: Stable & Exponential Decline Phase. This is when the yeast cells systematically convert sugar into alcohol. CO₂ is generated, and temperatures tend to fall because the fermentation's energy dissipates. The cap of skins needs to be punched down regularly. The yeast cells start to die off when the sugar and other nutrition get scarce when the alcohol level gets too high, or the temperature falls too low.

A fermentation is called successful when all the sugar is consumed by the time the yeasts have died. The opposite is a stuck fermentation when sugars are still present after the yeasts die and new yeasts need to be added to restart the fermentation. This is cumbersome and can be prevented by managing temperatures and yeast nutrients and selecting the appropriate yeast strains for the grape variety at hand and winemaking style.

Choice of Yeasts

Different yeast strains produce different tasting wines even when applied to the same grapes. There are thousands of different yeast strains, many naturally available concurrently in the environment. So the challenge for the winemaker is to choose among three alternatives:

- Fermentation with Indigenous Yeasts: We rely on the mix of yeast strains that happen to be attached to the berry skins brought in or survived in the winery from previous fermentations. This choice creates wines that genuinely reflect the local terroir, but there is a risk that the fermentation may not complete successfully.
- Fermentation with Industrial Yeasts: We kill the indigenous yeasts with SO₂ in Step #8 above and inoculate the must with a known, commercially available yeast or yeast derived from the own vineyard and propagated. This choice reduces the risks of stuck fermentations but adds uniformity to the wine produced.
- 3. Fermentations with both: We start with Indigenous Yeasts but then, in phase 2, introduce Industrial Yeasts to make sure the fermentation finishes without a hitch.

For our first vintage (2009) decided to go with a native fermentation to establish a benchmark for what happens without interventions. In the subsequent six years, 2010-15, we used commercially propagated yeasts to reduce the risks of stuck fermentations and record which yeasts were doing the fermentation. Then, as we gained more confidence in our ability to control the fermentation process, we returned to native fermentations in 2016.

Yeast Nutrient

The essential yeast nutrient is Nitrogen which is metabolized by yeast to synthesize proteins. Nitrogen stimulates yeast multiplication, keeps yeast metabolism active, prevents H₂S and mercaptan formation, and stimulates aroma production. Nitrogen is provided as Yeast Assimilable Nitrogen (YAN). YAN is composed of ammonium ions and amino acids. Ammonium ions are the favorite 'food' of yeast. Easy and fast to use, ammonia impacts mainly yeast growth and population. Amino acids are harder to be assimilated. They impact yeast growth, health, and efficiency through fermentation as much as aroma production.

Berries contain YAN naturally. The optimal concentration for a healthy fermentation is between 150 and 350 mg per liter of must, depending on its sugar content. The rules of thumb are:

- For good population growth of yeast, we need at least 150 mg/L of YAN
- For converting sugars to alcohol, we need 10 mg/L/Brix of YAN (e.g., for must with a sugar concentration of 25 Brix, we need 250 mg/L of YAN)
- Too much YAN (>350 mg/L) produces off-flavors and increases stress conditions, possibly leading to stuck fermentations.

Artisan winemakers prefer to minimalize the use of additives of any sort, including nutrients. We used no nutrients in 2009, then used them 2010 through 2015 as suggested by commercial yeast manufacturers. In 2016 and 2017, we used nutrients sparingly, only when fermentations showed signs of stalling. In 2018 through 2020, we added significant amounts of nutrients because the level of YAN in the must was very low, below 100 for the Cabernet Sauvignon blocks. In the future, our goal is to manage the vineyard to get the YAN to 150-200 mg/L, so we can minimize additions.

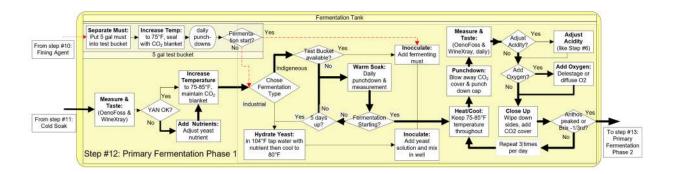
Process Steps for Primary Fermentation Phase 1

When we use commercial yeast and nutrients, we need to hydrate the yeast in a nutrient solution. Here are the steps we go through:

- We make sure the must has an adequate concentration of nitrogen food for the yeast.
 We measure YAN (Yeast Assimilable Nitrogen) and adjust yeast nutrients in the next step as required.
- We hydrate the required amount of additional yeast nutrient in 2 liters of 104°F tap water as specified by the supplier.
- We carefully hydrate the yeast in the solution; this process is essential to ensure that the yeast cells assimilate to the environment: We add the yeast, stir gently, and let the suspension stand for 20 minutes. Then we mix in 2 liters of grape juice and let the solution stand until it cools down to the temperature of the must in the fermentation tank + 15°F
- We pour the acclimated solution into the fermentation tank and start the punchdowns.

When we go for native fermentation, we may set a bucket or two of crushed grapes aside a week earlier, punch it down daily, and watch for the fermentation to start indigenously. The bucket is ready to be used to inoculate the main fermentation tanks when the fermentation is active (i.e., producing enough CO2 to form a 1-2 inch cap in the bucket). The alternative is to wait until the fermentation starts on its own; this creates a "Warm Soak" waiting period of 3-4 days.

Here is the process chart:



We may want to add nutrients at inoculation, mainly if the YAN level measured in Step #6 above is below 120 mg/L.

During fermentation, we need to repeatedly remix the skins and the juice a) to promote extraction of essential flavors from the skins into the juice and b) to add minute amounts of oxygen required by the yeast. This can be accomplished by punch downs (punching the skins down into the juice) or pump-overs (pumping the juice from the bottom of the tank and spraying it over the cap). We prefer punchdowns because we don't want to use pumps.

The punchdown process is:

- Three times a day, take the tank cover off and blow off the Argon or CO2 blanket with a fan
- Punch down the cap making sure not to crush seeds at the bottom of the tank (picture on the right). Decide whether to increase the oxygen supply in the must further. If yes, macro-oxygenate once a day during the first 3 days: Inject 10-20 ppm of pure oxygen through a diffusion stone into the must (equipment - the picture on the right). Note, we can only measure the amount of oxygen injected, but not the amount that bubbles up and is not



absorbed.We are currently exploring to monitor oxygen concentration in the must in real time by monitoring the Oxygen Reduction Potential (ORP) with a probe from Accuro Ltd, New Zealand (www.accuro.tech)

- An alternative to punchdown is delestage. Delestage is the french term for draining the fermentation tank into a holding vessel, leaving the remaining skins exposed to air for 20 to 100 minutes, and then pour the contents of the holding vessel back over the skins into the tank. Delestage should not be repeated more than three times and should be followed by a punchdown at least 16 hours later. (see this article for a good description https://winemakermag.com/237-delestage-fermentation-techniques). Note, we cannot measure the amount of oxygen supplied in the Delestage process.
- Take another tasting sample and comparison taste.
- Take two 2mL samples for chemical analysis once a day. Enter results into new records of the FermentationActions table.
- Squeegee and wipe down inside walls of the tank with disinfectant (KMBS solution on a paper towel), cover the must with a new blanket of Argon or CO2, if the fermentation is not yet producing enough CO2 itself, and put the tank cover back on
- Adjust heating or cooling to keep the temperature in 70-80 °F range

Around 3-4 days following inoculation, we expect to see a peak in the level of Free Anthocyanins (hopefully above 1,000) and sugar levels having dropped 1/3rd in Brix. At this point, we move on to Fermentation Phase 2.

Dealing with Fermentation Problems

A long lag phase or abrupt stop in the conversion of sugars to alcohol indicates a problem. An abrupt stop in fermentation activity can happen as a consequence of a severe temperature drop – no longer an issue for us since we can control the temperature in our fermentation tank. A problematic delay in the onset of fermentation activity is indicated when the lag phase is longer than five days. This can happen when:

- A native fermentation is attempted with indigenous yeasts. It may help to raise the temperature, but it is safer to switch to inoculation with industrial yeast instead.
- The yeast used for inoculation did not develop properly. This can be confirmed by counting the density of viable yeast cells under a microscope. It should have reached 10

to 100 million cells / mL - an analysis better left to a commercial lab (e.g., Enartis). The remedy is to re-inoculate

- There is a nutrient deficiency as indicated by low YAN levels relative to the Brix level of the must. The remedy is to add more yeast nutrition.
- There are toxins or spoilage microbes in the must. This can be confirmed by lab analysis
 of the must revealing excess SO2, pesticides, copper or iron residuals, or spoilage
 microbes. For example, if the analysis indicates Lactic Acid Bacteria as spoilage
 microbes, then the must should be treated with Lysozyme and SO2. If the analysis
 indicates non-microbial toxins, then fining is recommended with Bentonite, yeast hulls, or
 an industrial product like Enartis Cellferm.

When restarting a fermentation, it is advisable to use a special yeast that ferments vigorously and can adapt to high alcohol, high volatile acidity, and low nutrition needs.

Data Management

Data management is identical to what we described in Steps 3-11, with one exception. We measure the chemical properties twice, using both the "Must" and the "MUF" settings on the OenoFoss equipment. This is because the measurements for MUF (Must Under Fermentation) are not calibrated and need to be interpolated to calibrated Must-measurements. The following screenshot shows the "Juice Analysis" tab for October 19, 2017, at 10 am.

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Tracking Results for 2020

We made the following choices in 2020.

We had four fermentation batches, one for each of the Merlot batches, one large one for the Cabernet Sauvignon, and one for the mix of Cabernet Franc and Petit Verdot Petit. In all instances, we waited 2-4 days until the fermentation started on its own but had to add significant

amounts of nutrition 500 -1500 ppm) to compensate for the low YAN levels (85 – 175 ppm). We used Microessentials from Gusmer. We reached one-third of sugar depletion in 2-3 days before the Anthocyanins peaked. We infused between 8-11 ppm of pure oxygen. We had a problem with the Cabernet Sauvignon fermentation: it overheated probably because excessive injection of oxygen accelerated the growth of yeast cells. The picture illustrates the overflowing tank.



We will review the results at the end of Step 17.

Previous page: Steps #2-11: Upfront Winemaking Decisions Top of page: Go Next Page: Step #13: Primary Fermentation Phase 2 Last updated: November 27, 2021

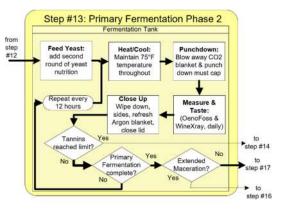
Step 13: Primary Fermentation Phase 2

Phase 2 of the Primary Fermentation represents the steady-state and the rapid decline in the yeast population. We may need to add more nutrient supplements. We reduce the number of daily punch-downs to two. When the temperature drops, we switch to heating to keep the temperature between 75 and 85 °F. Now we watch Tannins and Bound Anthocyanins rise: The target for the Tannins is 110% of the Anthocyanin peak, the target for the Bound Anthocyanins is 20% of the Anthocyanin peak.

Here is the detailed process graphic

The phase 2 punch-down process is:

- Take the tank cover off and blow off the accumulated CO2 with a fan
- Twice a day, punch down the must while making sure not to crush seeds at the bottom of the tank.



- Take tasting samples and measure chemical properties and temperature once a day.
- Squeegee the inside walls of the tank and wipe with a paper towel sprayed with KMBS solution. If sugar depletion is above 90%, cover the must with a new Argon blanket because CO2 production has diminished.

Press before Fermentation is Finished?

The critical decision for the winemaker in this phase is whether to remove the skins & seeds before the fermentation is finished. Early pressing is advised when the tannin levels get too high for the desired style of wine. So we watch out for Tannin levels to rise above 110% of the previous Anthocyanin peaks. If this happens before fermentation is complete, we consider to

- either scoop out the bulk of the skins, press them separately, pour the extracted juice back into the fermentation tank, and let the fermentation finish in the fermentation tank,
- alternatively, press the entire must before the fermentation is finished and then finish the fermentation in the settling tank without further skin and seed contact.

If Tannin levels stay below 110% of the previous Anthocyanin peak, we continue the punchdowns until fermentation is complete, i.e., Brix at -2. At that point, we will decide whether to look for further tannin extraction by extending the maceration or to go to pressing.

Dealing with Fermentation Problems

A sluggish fermentation is indicated when the daily reduction in the sugar level slows down before reaching 8 Brix or when the sugar reduction stalls entirely before reaching -2 Brix within three weeks of inoculation. The causes of a sluggish fermentation are the same as discussed on the previous page covering Phase 1: lack of nutrients due to the exhaustion of available supplies, toxins, volatile acidity, or spoilage microbes. For these causes, the remedies are the same: adding nutrients, fining with Bentonite, or adding Lysozyme. Alternatively, a fermentation can turn sluggish in phase 2 if the fructose/glucose ratio of the remaining sugars is out of balance; in this case, reinoculation with a special yeast capable of handling fructose is recommended.

Data Management

Data Management is identical to the process in Step 12, with one exception. We measure the chemical properties twice, using both the "MUF" and the "FinW" settings on the OenoFoss equipment. The following screenshot shows the "Juice Analysis" tab for October 24, 2017, at 9 am

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Density		0.5563	0.9939			0.9954	0.9964			0.9995	0.5575			0.9954	0.9933													
Glucose		0.4	0.4			0.2	0.2			0.7	0.7			0.0	0.0													
Fructose		0.0	0.0			0.0	0.0			3.7	3.7			1.2	1.2													
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Tracking Results for 2018

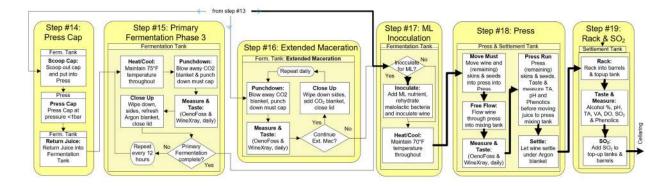
In 2018 we made the following choices: We did not apply a second batch of nutrients at the beginning of Phase 2 because we had used Microessentials which has a delayed availability. All fermentations completed except the Petit Verdot batch which stalled at -1 Brix, despite heating the musts to keep temperatures in the high 70's. Tannin extractions never exceeded the Anthocyanin peaks, so there was no need for pressing early. We decided to delay any addition of Tartaric Acid despite the low acidity levels (pH remained over 3.6 in all 4 fermentations)

We will review the results at the end of Step 18

Previous page: Step #12: Primary Fermentation Phase 1 Next Page: Steps #14 - 19: Extended Maceration to Press Last updated: November 27, 2021

Steps 14-19: Extended Maceration to Press

Here is the detailed process chart; the thick lines indicate the path taken in 2020:



Step #16: Extended Maceration

On completion of Primary Fermentation, we can consider extending the maceration to extract more Tannins and increase the level of Bound Anthocyanins. Because the alcohol level is now high, Extended Maceration will extract relatively more seed tannins which can be beneficial if seeds were very ripe and if the addition of nutty/almondy taste is desired. We keep the temperature at 70 °F and continue with one punch-down per day for up to ten days (depending on taste).

The Extended Maceration punch-down process is:

- Take the tank cover off.
- Punch down the must while making sure not to crush seeds at the bottom of the tank.
- Take two 2mL samples for chemical analysis.
- Taste sample and decide whether to continue or end extended maceration.
- Wipe down the walls of the tank with disinfectant (KMBS solution), cover the must with a new blanket of Argon or CO2, and put the tank cover back on

Step #17: Inoculating for Malolactic Fermentation\

In Malolactic Fermentation, bacteria transform malic acids into lactic acids. This reduces the young red wine's acidity and harsh fruitiness and helps create a rounder mouthfeel. These

bacteria occur naturally in the vineyard on the grape skins and find their way into the must during crush. If an earlier SO₂ addition killed the bacteria, they may be purchased from specialized laboratories/providers and added back. If the Primary Fermentation was done naturally (i.e., no SO₂ was added at crush), then the Malolactic Fermentation is often also left to occur on its own.

Malolactic Fermentation, particularly when induced by naturally occurring bacteria, can take months to complete and is often only successful if the temperature of the wine remains around 70 dF for an extended period. It helps to add specialized nutrition to support the malolactic bacteria and accelerate the conversion. Thus we have three choices:

- Leave it to chance: rely on the naturally occurring bacteria, assuming they were not killed off at crush
- Middle road: Support the naturally occurring bacteria with specialized nutrition to accelerate the conversion
- A safer bet for rapid conversion: Inoculate the young wine with commercial bacteria and matching nutrition.

We regularly measure malic and lactic acids (as part of the OenoFoss protocol) and monitor progress. Here is a more detailed discussion of the process and potential pitfalls from MoreWine.com: https://morewinemaking.com/articles/5 steps to mlf

Up to 2018, we used to inoculate with malolactic bacteria only after pressing, when the young wine was already racked into barrels, and we kept the barrels above 60 dF. Given our mixed success, we changed the timing in 2018 and started malolactic fermentation when the fermentation finished, before extended maceration, if any, and before pressing.

Steps #14,15 & 18: Pressing Decisions

We initiate pressing when

- Primary Fermentation (step #13) was incomplete when Tannin levels reached 2000 or 110% on previous Anthocyanin peak, or
- Primary Fermentation (step #13) completed in the fermentation tank, and tannin levels were high enough to skip Extended Maceration, or
- Extended Maceration finished.

If we press before Primary Fermentation is complete, we press the cap only. We scoop the cap out of the fermentation tank into the press, press and return the pressed juice to the fermentation tank, and complete the primary fermentation.

Suppose the fermentation was not completed before pressing due to high tannin extraction during Phase 2 of the Primary Fermentation. In that case, the fermentation now needs to be completed in the fermentation tank. The process for this Step #15 is:

- Take test samples, stir, and then recover with Argon blanket
- Taste and measure (OenoFoss & WineXray)
- Keep the temperature at 70 °F and continue the daily process until Brix reaches -1.5.

The side-by-side pictures show the two alternatives of pressing. On the left: When we press all the must (after the primary fermentation is completed), we first drain the juice into the press and then move the must over a steel channel into the press. On the right: When we press the cap only, we scoop out the cap in 5-gallon buckets, empty the buckets into the press, press and return the pressed juice to the fermentation tank by buckets.



We use a 1.5-ton bladder press: Bucher Vaslin XPro 5 (<u>http://www.buchervaslin.com/en-bucher-France-bucher-pneumatic-presses-16-22-26.html</u>), which, we now realize, is overkill for our requirements. We extract the additionally required juice at very low pressure (0.2 to 0.3 bar only) from the must in multiple rounds. This is called the Press-Run. The remaining pressed

must (now called pomace) is scooped out and distributed in the vineyard as fertilizer for the next season.

For small fermentation batches, we don't use the big bladder press. Instead, we use a small manual press which saves in setup and cleaning efforts. There are two types. In modern manual bladder presses, water pressure fills a bladder which presses the must outside against a stainless steel sieve. In old-fashioned screw presses, a wood lid is pressed down by a big screw, and the juice escapes laterally through a vertical wood lattice. We have used both types for the small lots from the upper vineyard. The picture on the right shows the two types.



Step #19: Mixing, Racking & SO2 Protection

We usually mix the free-run and press-run juice from different Fermentation Batches into what will become Cellar Batches in separate Settling Tanks. Because the fermentations are staggered time-wise, the mixing and holding of the young wine in the Settling Tanks can extend from a few days to a few weeks. During this time, dead yeast cells and other solid material sink to the bottom as sediment. To keep the malolactic fermentation progressing, we maintain a temperature of around 70 dF. We protect the young wine in the settlement tanks with an Argon gas cover to prevent oxidation and growth of microbes on the surface.

When all the fermentation batches are mixed as desired, and the dead yeast and other materials have settled at the bottom of the Settlement Tanks, we decide how much SO2 to add for protection and then siphon the young wine into Cellar Batch containers (barrels and top-up tanks). Until 2019, we regularly added the standard requirement of 30ppm free SO2 equivalent (see Step #8) at this juncture. Since then, we limited SO2 additions, if any, partly because the elevated pH of the 2019 and 2020 vintages made SO2 ineffective and we managed to keep infections at bay with more aggressive sanitation protocols (e.e. regular steaming of barrels)

Data Management

Data Management for Steps 14 to 16 is identical to Step 13.

Tracking Results 2018

In 2018 we made the following decisions:

- We did not press any of the fermentations early, nor did we extend the maceration periods after the fermentations were complete. The tannin and anthocyanin levels were adequate without.
- We pressed the two Merlot Cabernet Franc ferments in the old-fashioned manual screw press and combined the juice for settlement into a single stainless steel barrel.
- We pressed the Cabernet Sauvignon ferment in the large bladder press and settled the juice in the large Settling Tank
- We free-flowed the Petit Verdot ferment into two glass carboys for settlement.
- Finally, we mixed, at varying ratios, the different settlement tanks into 3 French barrels (one new, two neutral) and five topup tanks. The goal was to get one barrel of 100% Cabernet Sauvignon, two barrels of different Bordeaux-style mixes and separate topup tanks which reflect these mixes.

The following spreadsheet shows the allocations to barrels (green) and topup tanks (white):

ellar Batch Name		18	cs	18CS	Та	180	STb	18CSMe	CFPV1	18CSMeC	PV1T	18CSMe0	FPV2	18CSMeC	FPV2T	18CSMeCI	FPV3T
			-						-				_				
FINAL COMPOSITION	CS	60	100%	5	100%	5	100%	48.60	81%	4.05	81%	29.34	49%	2.61	52%	4.25	32%
	CSLR		71%		71%		71%		57%		57%		34%		37%		23
	CSSR		29%		29%		29%		24%		24%		14%		15%		9
	Me1		0%		0%		0%	4.81	8%	0.40	8%	12.98	22%	1.01	20%	3.76	28
	Me2		0%		0%		0%	3.60	6%	0.30	6%	9.71	16%	0.76	15%	2.81	21
	CabF		0%		0%		0%	2.02	3%	0.17	3%	5.44	9%	0.42	8%	1.57	12
	PV		0%		0%		0%	1.00	2%	0.08	2%	2.52	4%	0.19	4%	0.87	7%
		60.00	_	5.00		5.00		60.02		5.00		60.00		5.00		13.26	
FINAL IMPLIED COMPONENTS	CS	60.00	100%	5.00	100%	5.00	100%	48.60	81%	4.05	81%	29.34	49%	2.61	52%	4.25	32
	Me1Cab	F 0.00	0%	0.00	0%	0.00	0%	5.26	9%	0.44	9%	14.20	24%	1.11	22%	4.11	31
	Me2Cab	F 0.00	0%	0.00	0%	0.00	0%	5.16	9%	0.43	9%	13.93	23%	1.09	22%	4.03	30
	PV	0.00	0%	0.00	0%	0.00	0%	1.00	2%	0.08	2%	2.52	4%	0.19	4%	0.87	79
		60.00		5.00		5.00		60.02		5.00		60.00		5.00		13.26	

Previous page: Step #13: Primary Fermentation Phase 2 Top of Page: Go Next Page: Fermentation Batch Review (Steps 3-19) Last updated: November 27, 2021

Fermentation Batch Review (Steps 3-19)

Data Management

To review each Fermentation Batch, we designed a layout that pulls all berry tests and fermentation actions data together. The goal is to provide a context to explain the actions taken and the results achieved in a uniform format across all fermentations all vintages. The "REVIEW: Fermentation Batch" layout has seven tabs:

- MUF Calibration: is used to review the calibration and adjustments made to the OenoFoss "Must-Under-Fermentation" measurements
- Phenolics: is used to correct the results from WineXRay's phenolic component estimates, which tend to show aberrations due to sampling errors in the spectral analysis
- Acidity: is used to review the different measurements of acidity and comment on the effect of acidity adjustments
- Actions: This is used to review and comment on all actions taken during fermentation
- Fermentation: This is used to review and comment on the progress of the fermentation
- Source Detail: This is used to review and comment on the quality of harvest blocks which make up a fermentation batch
- Overview: sums up all the commentaries and data in the previous six tabs.

In the following paragraphs, we show the screenshots for each tab using the actual data for the 2017CSLR1 fermentation batch

MUF Calibration tab

/ Source De	teit Fermenta	tion Action	e Addity	Phenois	s MJ	= Calibration																
i i	Glucose + F	Final Final MUF Firm	Density Initial Must	??calo FinW		Bits	Alc Initial MUF Mus	ohol (15) Fir t MUF		initia MUF Must	H Final MUE FinW	initia MUE fa		LI Final UF FinW	Int MJ [#]		Final GUE FinW	16	tia)	cids (g/L =j- MUF	21	
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58 Complet	Measurer MUE Fla		Measurem Nust In		Meseur Must	ement FinW used		urement FinW o	sed	Weasuren Must MUF			irement	W used		MUF	d nW used		asurem MUF	ent FinW	used	
4 4 4 4 76	8.829 6.16 St	1.008-2 1.008-2	1.2007 1.2007 1.2000	19.0284 19.0284	22.70 22.30 23.00	132.101 132.101	5.5		1	5.90 4.18 5.90 4.19	1 3,445 1 3,445 1 3,940	101015		8.24 (9.15	1 24 1		1 2.2	0.7 1.8 1.4			131 521	1.00
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212	97.7	945.2	1.5488	1.5977	1270	122-56	7.8	T).	<u>я</u>	3.84 3.15	- (3-05)	0.9) Bda	67	6)	7.4	<u><u></u> <u></u></u>	2,2		201	
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¥9	A2 4	2.7	0.96	31 0.2951		0 24 .1.27	12.8	118 1	8.6	3.70	2.62 3.00		.cr ² 02	v an	·	9.7	1 7.6		3.3	1.4	1.8	—
áių:	2.6 2.	4.0	0.99	eo 0.93%		5.87 1.88	12.5	12.0 1	1.2	3.40	2.41 3.42] 10_04	2 4.82		84	8.7 . 8.9		3.3	चत्र [1.2	
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This tab shows the OenoFoss measurements of the chemical properties and the adjusted values. An adjustment has to be made to the raw "MUF / MustUnderFermentation"measurement because OenoFoss only provides calibrated measurements for "Must" and for "Finished Wine." Note, we need to input the boundary conditions in this table for the adjustments to happen. An explanation of how the adjustment is calculated can be found in the Laboratory section.

Phenolics tab

																	Pesks	s or Finals			PhenolikaComme	eler.	
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1,83	22.4	335		3405	137		13/	1,068		1,068	1,111		1.011	4.015		4,313				T			1
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The Phenolics tab reviews the phenolic results provided by WineXray based on the measured spectrum of each sample. Impurities occasionally distort the measured spectra in the sample. As a consequence, the phenolic results are distorted. We use this layout to make manual adjustments to the phenolic results by inspecting the graphs and eliminating outliers. Again, we input the yellow fields during the review to summarise the results.

Acidity tab

warvisw	Gource	Dotal Fer	mentation Actions	Acidity	Phenolics	MUF Calls	noten						
Days ance			start end	3.81 3.47	5.40 g/L 8.42 g/L	0.24 g/L 0.34 g/L			1.30 g/L 1.31 g/L	Tenaric Acid	AckieCommentary	Tartaric Acid addition (+2.8 g/L) effective	
Harvest	Complet	Temp.F	FermStep	μH	TÀ	VA	Tert Add	Gue Acies	Malic Acids	Addition			
0.42		70.0 dF	Upfront Decisions				7.40 g1_	0.40 g/L			<u>^</u>		
1.42	0 %	730 dF	Warm Soak	3.81	5.40 g/L	0.24 gL	8.90 gl_	0.60 g/L	1.30 gL				
2.17	0%	74.0 dF	Warm Soak	3.90	2.20 g/L	0.18 g/L		0.60 g/L	1.20 gt			pH	Tartaric Acids [g/L]
2.63		77.0 dF	Warm Soak										863
3.17	-1 %	77.0 dF	Warm Soek	3.96	2.21 g/L	0.15 g/L		1 00 g/L	1.30 gt.			3.78 ** 3.7	20 20
3.59		79.0 dF	Prim.Ferm.P1	12.00	(22)-21)	2227745	122202	122-27	10053007			0.72 0. 0.65 0 ⁹ 0.1	15 6 15
4.09	13 %	83.0 dF 85.0 dF	Prim.Ferm.P1 Prim.Ferm.P1	3.61	6.73 g·L	0.21 cl	8.10 g/_	0.60 g/L	1.34 oL			4.56 4.5	10 10
4.59		85.0 dF	Prim.Ferm.P1									3.51	Sen O
5.09	33 %	89.0 dF	Prim.Ferm.P1	3.67	7.37 t/L	0.43 g/L	12.10 gL	0.00 g/L	1.73 gL			3.51 3.1 3.44 9 6 ⁶⁶⁹ 3./ 3.37 3.1	6 °
5.34	35.4	84.0 dF	Prim.Ferm.P1	3.60	nor gru	0.45 Gr.	12.10 912	o co gre	1.79.95	180 g 1.3 g/L		3.37 3.30 3.1	C
5.59		82.0 dF	Prim.Form.P1							leog 1.age		C 5 10 15	0 5 10 15
6.13	52 %	87.0 dF	Prim Ferm P2	3.46	7.82 o/L	0.23 g/L	14,90 gt_	0.00 g/L	1.14 ol.			Days after Harvest	Days after Harvest
5.42		52.0 dF	Prim.Ferm.P2		1.00 2.0	6.400 Sec.	1.1.1.1.1. Same	111.2.4	1.1.5 2.4				
6.63		85 0 dF	Prim.Ferm.P2									Total Acidity TA [g/L]	Gluconic Acids [g/L]
7.09	74 %	85.0 dF		3.54	7.84 g/L	0.24 g/L			0.73 g/L			10 10	13
7.34		85.0 dF	Prim.Ferm.P2		100000	1.000.000			2000 C - 1000			40a	1.0
7.63		85.0 dF	Prim Ferm P2									_0 ⁰⁰⁰⁰	1.0 0 1.0
8.09	99 %	84.0 eF	Prim.Form.P2	3.62	7.74 g/L	0.28 g/L			0.95 pL			5 🔍 5	1.0
8.34		86.0 dF	Prim, Ferm P2		1000 C	0.1020.0904			· · · · · · ·				0.5 0 0 0.1
8.63		53.0 dF	Prim.Ferm P2									00	0.0 Q
9.05	97.%	84.0 dF	Prim.Ferm.P2	3.65	7.63 piL	0.30 pl			1.31.01			a	0.0
9.34		86.0 dF	Prim.Ferm.P2							200 g 15 gt_		0 5 10 15	0 5 10 15
9,63		84.0 dF	Prim, Ferm, P2									Days after Harvest	Days after Harvest
10.05	99 %	82.0 dF	Prim.Ferm.P2	3.42	8.92 g/L	0.23 g·L			1.21 g/L				
10.59		83.0 dF	Ext.Maceration									Volatile Acidity VA [g/L]	Malic Acids [g/L]
11.09	99 %	52.0 cF	Ext.Maceration	3.45	8.72 g/L	0.31 g/L			1.81 g/L			0.6 0.4	3 3
11.63		82.0 dF	Ext.Maceration										
12.09	99 %	79.0 dF	Press	3.47	8.42. <u>0</u> 1.	0.34 g·L			1.31 g/L			0.4 0 0) 0.2 0 _{0.6} 6 06 ⁰⁶⁰ 6 ⁰ 0)	2 1 0000 000 0 1
												0.0 0 5 10 15 Days after Harvest	0 5 10 15 Days after Harvest

The Acidity tab shows the evolution of the OenoFoss-based measurements of pH, TA, VA, Tartaric Acid, Gluconic Acid, and Malic Acid, and the timing of the Tartaric Acid additions, if any. Note, the table shows the adjusted values described in the MUF-Calibration tab. We complete the yellow fields during the review to summarise the results.

Actions tab

EVIE	W: F	erm	entati	on Batch	20	1708	SLR1									Vinlage	Dates 2' and	and inking to "F "BettyTestAction	FBComp L	FLRM	let.	niret s
arview	Sourc	e Oetali	Famianta	tion Actions	Acidity	Phenolic	s VUF Calibration															
ltaA striamino	aty g F	ronestar		to compensate for s test. 2.8 g/L Tarts no press			Enzyme used			KMBS or Yeast & Nu Canulative Yeast KMBS Add used			Contraction Manual		Cumu.	Cumulative	Cumulative			Dorre	a oter Lo	
			Weight.	Total Seignee %	Total Add	Water d %	1360	Yeast A	valable Nutrition Initial	Kales Acc		1111+	Natiferr For		Macro	Tertaric Acid Add	Potessium Carb. Add	Oak Chips Psceiter	Cap Remova		r Freeflow	
Days since	Si.	Initial 362 los	Title 150 los	-15.9 %	0	6 %		Alpha Amino	115 ppm	SO2 ecui	1			84 ppm	1.0 cuf MacroDx	Lo Ce.c	Pot. Carb	150 g	Cap	Press	154 lbs Amnl	15%
farveat	Complet	before	atter	Sagnee	: Water A	kedilien	Mecenation Enzyme	Acida	Amonia YAN		Yeast		Yeest Nubili	lon .	Amount	Addition	Addition	Oak Chice	Renod	Pressure	e Ramvd	Lo
.42 .42 .35 .35	83. 58.	223Ba	:05.34	60 lbs 16.9 %				142.531	26 ann 26 ann 1 627, 14760 27 jaco 180 262										ł.			ŀ
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an R	28 N .	2204-125 2570-125 2595 f.s.	500 74		,			Nate	Népiro, Gérané	· · ·	-		Sublemater, A	7 8 30	(i i i i i i i i i i i i i i i i i i i	÷			1.—			-
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			1460.8			1	i i i i i i i i i i i i i i i i i i i								1—1					1	1 182.9	1

The Actions tab reviews the actions taken during winemaking. The steps include saignee, additions of water, enzymes, yeasts, nutrition, sulfur, oxygen, tartaric acid oak chips, and the removal of skins and seeds in pressing. This tab allows reconciling the batch weights throughout all steps. Again, we enter summary data in the yellow fields during the review process.

Fermentations tab

3-3-362	- 195 (19 a - 14	R	erterbater	Section - the	iy - Marak		=									
ino-to-	දියක් සිං ක්ෂාභාවේන		Pinto i Rim Mariak					Pert Tar	20	Plant Salt	4			Possible		Asymptotical pairs EAN of 118 pper with 494 ppen furthiban (upiteral & nivburge mass mean
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23,00			THAT		<u> </u>		- incord by	ুমনত		-1.3	23248	36	30	32	12.0%	1874.99

The Fermentations tab reviews the progress of the fermentation in terms of fermentation step and conversion of sugars to alcohol as measured by completion %, Brix, density, glucose, fructose, and alcohol. This tab also lists all the action comments. Again, we enter summary data in the yellow fields during the review process.

Source Detail tab

REVIEW:	Fermentation	Batch 2017CS	LR1			Driven by: 'FermBata ''Vintage l	nDefinitions" , and linking to Dates 2" and "BerryTestActio	"FermActions 7", "HarvesAction on FBComp LFLRMe1"
Overview St	ource Detail Fermentation	Actions Addity Phenois	s MUF Calibration					
			Berry Composition [mg/Berry]	Acid Composition [94]	Brix [g Suc (100mL]	рН	Potential Anthos [ppm Mil]	YAN (ppm)
	Berry Test Commentaries	Harvest Commentaries	Super Weter Skins &	Chuennie Malie Tartarie			Skins & Junce	Alpha Amino Amonto-
CSLR 362 lbs 100 %	Dropped 50% due to militiew, heat waves stavaed i stagaad maturation. Small berries; poor potential Anthos without clear peak.	Dropped 25% in field bunch sorling due to milday Induced shrivel	2:05 .210 .210 .210 .210 .210 .210 .210 .210	27 25 25 10 10 10 10 10 10 10 10	20 20 20 20 20 20 20 20 20 20 20 20 20 2	91 92 92 92 93 92 93 94 95 95 95 95 95 95 95 95 95 95	1000 2000 2000 2000 2000 2000 2000 2000	200 200 100 100 100 100 100 100 100 100

This tab shows the berry test results of the components making up the fermentation batch. In this instance, the 2017CSLR1 batch consisted of only one component, grapes from the CSLR block. In other instances, we would see multiple rows of graphs in this layout – one for each component.

Overview tab

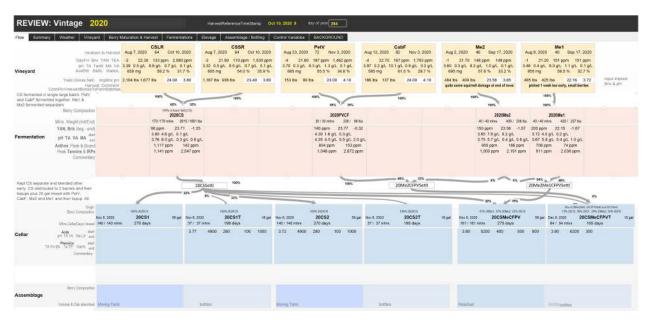
indicateour lindicateour tear	graptic representing i					21 (eeess) (C. 201	PRIMITIAN CR	14 南維第464	SAR 366 1	BO (%)	SEALER PLAYER MEN INC		ster ester
ecsectedian Canthogenlesy consected part YAR of the permitted national Cartescon independent fames portra 22 CP sectorarised sec	ten forsenation le - t par Nation policit	3 days, Added 680 pr 6.5 Brb., 1544 Biosholi Acture Georgian 1794 Commist r. 2544	on nabriála and 0 ki ka tere Na kolocan artes: 2.0-	a given poor VAN of 1	(6 21n, 19 2:54 cl 1916 1919	Visitable gran vzvy posr polonitisk by Priovakier Geschehen as 5650 etc. Bizeler boar zitranistat, Praetiswed Auster Serringersziv Turkenskok sutien (ro Rightin 2 in Status Active Statem (ro Rightin 2 in Status Active Statem) (ro Rightin 2 in Statem Active Statem Active Statem Active Statem Statem Active Statem Active Statem Active Statem Active Statem (robust) (robust) (robu	nptalion itsa li Iolget 130 (56	ide exists on tentine. 1ot Massioc	n af 3046 cloth listiner m 1941 - Tanar vita vidas (Tr.C	27 08 19	Yinki Tor Vadago LP 1.233 ba UR 1.233 ba KR 0 ba CP	Wightused In Päetch Ölbs DSZ lös Ölbs	15 81 55 6 RB305 - 911569 0.95 - 0.9 130 15 - 59 9 0.95 - 1
	YAN 118 ppm ek Temp 87 dF Ina Brix -1.60 Akahol Sugar	Water upfrent KMBS Nacro Dx	17 0 % 0.6 % 1.8 cuf 2.80 gt	Cap Removal Press Pressure Removed 154 lbs	43 N	Acidity start and pr- 3.81 3.47 TA (pt.) 5.40 3.42 VA (pt.) 0.24 0.34 Values (st.) 1.30 1.31	change -0.34 3.02 0.10 0.01	Phenalic Extraction Pasts or Finals Pat. Antros 1.453 ppm Total Antros 1.211 ppm Bound Antros 1.211 ppm PeakTinnins 1.167 ppm PeakTiRPs 2.655 ppm	Potential TAnthos	, k	PD Naci Mai	362 lbs Composition 100% CSLR	100 %
Brix	Temp	erature [dF]		pН		Total Acidity TA [g/L]		Anthocyanins	Tannins & T	ot Phen	ols Bound	I Anthos / Tan	1nins (%)
2013	24 1. 12			~	2420	117 1			az=1		7200 -22		201
75.5	38.W (#E)	2	1.111	0	用件	10 1		382*	302		72100 (12		18
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		54	11.58			61 6	T V81	-433	/ /		778		

The Overview tab pulls together all the information added in the yellow fields in the previously discussed tabs. The goal of the fermentation batch review is the write a Batch Commentary that summarises all the information collected.

Tracking Results for 2020

Currently, the "REVIEW: Vintage" layout provides the best overview of what we did with the 2020 vintage. We described it already on the Winery Overview page. Note, in 2020, we defined separate Settlement Batches to mix different fermentations and let them settle. The following three screenshots show

- the flows from harvest blocks through fermentations to settlement
- more detail on the berry maturation and harvest conditions
- comparative data on the different ferments





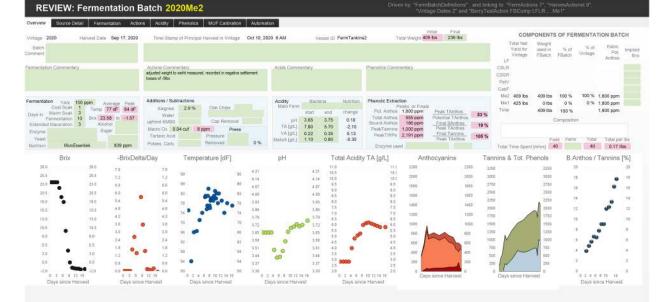
cessive heat in CS	ation Contributing OK: Fermentations completed, fermentation temp	OK: Fermentations completed, fermentation temp in CS out of control. Poor Anthocyanin extraction										
mentation	1000	82.0	84.0 82.5									
Tamp (dF)	77.8 77.8	74.8	70.5 V 76.2									
Manhours Weight Unit End	10% of lower leaf (13) 2629CS 2015 / 1661 ba	2020/PVCF 35/30/mms 238/ 88 bs	202034e2 202034e1 40 / 40 mites 409 / 228 bs 40 / 40 mites 425 / 227 bs									
Saignee or Water Add Days Cold, Warm, Farm, Est Erzymo VAN Yeast & Nathton Essent forcook Are & PeachTemp TartAcid PotCarb Add	1 3 10 2 90 ppm Wick@u4016 ppm 11 ppm 77.8 dP 99.0 dP	3 1 9 140 ppm Mt Phrs. 1165 ppm 74.8.d* 42.0 dP	2.2.% 64.% 1 3 10 3 1 3 10 3 100 ppm 200 ppm Microlifective 359 ppm 8.ppm 16.8.4/ 64.0.4/ 8.ppm 16.2.4/ 82.5.4/									
Brite (begin to and) pH TA VA MA ^{start} Anthos: Proc. 8 licard Post Termins 8. IRPs Commentary errotes	22.71 - 1.55 380.46.96,L.107,0.09,L 3.70.0.09,L.0.39,L.0.09,L 1.1197 ppm 1.40 ppm 1.141 ppm 2,547 ppm	2377 4032 430 10gt 634 436 45gt 05gt 53gt 856 ppm 103 ppm 1,048 ppm 2,672 ppm	2.549 -167 22.15 -167 367 361 20 31 372 40 50 10 20 10 379 8 7 git. 34 9 10 30 11, 367 8 8 git. 349 11 39 11 98 56 pm 16 66 ppm 17 80 ppm 14 50 pm 1.000 ppm 2,191 ppm 911 ppm 2,039 ppm									
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mantary Pating 2000 m2xeral 3 2000 C Formentations 12 2000 poleted.	2.547	2.672	2,191 2,008									
mentation temp in the tree to the temp in temp in the temp in temp	1.141											

The following screenshots show the Overview tab of the "REVIEW: Fermentation Batch" layout for each of the 4 fermentations, all indigenous. Note

- the temperature peak in the CS fermentation
- the similarity of the two Merlot fermentations, and
- the very high pH in the CFPV ferment







	Source Detail	Fermen	tation Actio	ins Acidity	Phenalics	MUF Calibration	Autor	nation						vital Final			10000200	1021123			2011/10/202	
ntage 20 Batch nment	020 Hai	rvest Date	Nov 3, 2020	Time Stamp	o of Princip	al Harvest in Vintage	Oct 10,	2020 8 AM	V	essel ID I	FermTankins	sa Ti	Total Weight 236 lbs 66 lbs					Veight sett in	% of FBatch	S of Vintage	Esten Pot Anthos	Implied
ementation Commentary				Actions Comm	Actions Commentary				ntan)			Phenolics Comm			CBLR CSSR Pety 99 bs CabF 137 bs		99 lbs 137 lbs	42 % 58 %		1,700 ppm 1,800 ppm	23.01 24.00	
aya in 1 Fa	n yan 140 p Cold Boek 3 Nerm Sosk 1 ementation 9 Maceration	Temp 7		Additions / Bub Baignee Water uptront KMBS Macro Ox	tractions	Cak Chos Cap Removal Press		TA [g/L]	start 4.30 1.60	and 4.35 4.50	Nutrition change 0.05 2.90	Pot: Anthos Total Anthos Bound Anthos PeakTannins	1,758 ppm 854 ppm 153 ppm 1,048 ppm	Peak TArthos Potential TAnthos Final BAnthos Peak TAnthos	49 % 18 %	Me1 Total		236 lbs C	100 % Composition		1,758 ppm	
Yeast	ME Pome, Complete		1,166 ppm	Tartanic Acid Potass. Carb		Pressure Removed	0%	VA [91] MwicA [91]	0.26	0.45 2.00	0.19 0.40	PeakTiRPs Enzyme.use	d	Peak TApthos	123 %	Total Time		nrs} 3		Total 30	Total per 0.35 /8	bs
28.0	Brix	38.0	-BrixDel	100 March 100 Ma	lem	erature [dF]		pH		10	tal Acidity	y TA [g/L]	2200 Anti	hocyanins 2000		nins & T	ot. Pher		B.A1	nthos /	Tannins	20
25.0		25.5	7.8	7.8	90	90	4.25		4.21	10.0		101			325			3250				
	· *.	15.0	7.2	7.2	80	DI.	4.14	0	4.14	0.0		10.0	5000	2000				3000 2750	18			18
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15.5		13,0	4.2	. 42	74	• 74	3.79		3.75	7.0		7.0	1200	1200	175	1		1750	ip		-	10
		10.5	5.8	3.6	TO	• 10	8.72		9.72	5 0.D		0.0	1000	1000	150	1		1500				
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13.0 10.5 8.0 8.5		3.0	2.0		54	54	3.57		2.31	25		2.5										

In each of these layouts, the commentaries have not yet been written

On completion of all fermentations, we settled the CS in one large tank, and we combined the Me1, Me2, and CFPV fermentations in two separate settlement tanks. From there, we created three cellar batches, two CS and once CS-Me-CF-PV mix, each consisting of a full barrel and dedicated topup tank.

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