

Supplemental Information:

Supplemental Table S1. Total anthocyanin concentrations (mg/L) during fermentation via Wine X-ray analysis for wines in 2016 and 2017 (n=3).

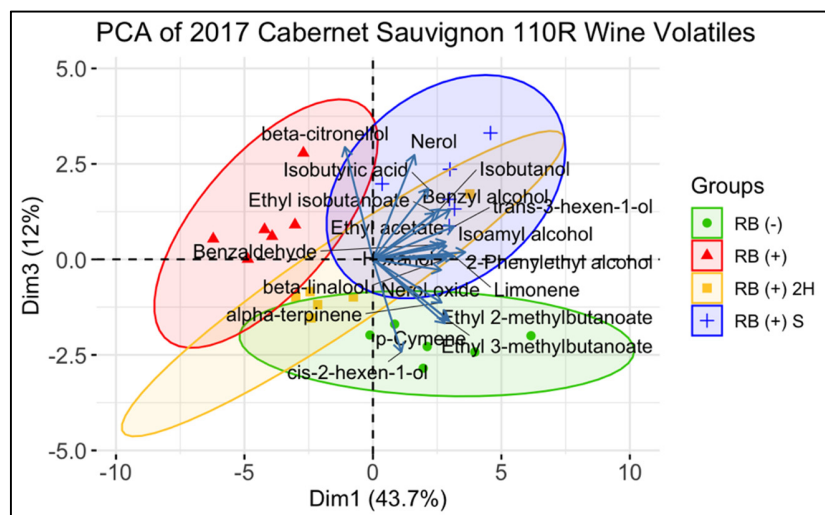
Total Anthocyanins	2016							
Day of Fermentation	CS110 RB (-)	CS110 RB (+)	CS110 RB (+) 2H	CS420 RB (-)	CS420 RB (+)	CS420 RB (+) 2H		
0	--	--	--	--	--	--		
1	295.33 ± 28.15 b	251.00 ± 28.58 b	359.00 ± 12.53 a	263.33 ± 19.66 b	242.00 ± 18.38 b	327.67 ± 28.01 a		
2	512.67 ± 24.66 a	447.67 ± 67.02 a	512.33 ± 18.50 a	498.67 ± 20.60 ab	417.67 ± 48.60 b	524.00 ± 47.03 a		
3	750.67 ± 34.85 a	568.67 ± 19.40 b	693.33 ± 22.48 a	755.33 ± 17.01 a	642.00 ± 40.00 b	677.67 ± 64.63 ab		
4	968.67 ± 37.5 a	673.67 ± 31.66 c	842.00 ± 17.06 b	925.33 ± 29.26 a	772.00 ± 17.35 b	844.67 ± 49.24 ab		
5	1084.00 ± 33.42 a	744.00 ± 29.51 c	884.33 ± 14.01 b	1018.00 ± 7.00 a	837.33 ± 13.05 b	858.00 ± 41.58 b		
6	1100.67 ± 27.74 a	752.33 ± 16.65 c	927.33 ± 11.72 b	1017.67 ± 16.01 a	851.00 ± 19.52 b	914.33 ± 39.27 b		
7	1117.00 ± 28.35 a	753.33 ± 18.23 c	963.33 ± 2.08 b	1023.67 ± 13.32 a	857.00 ± 7.55 c	932.00 ± 30.79 b		
8	1097.33 ± 22.14 a	755.00 ± 14.11 c	970.00 ± 20.78 b	1017.00 ± 16.46 a	851.00 ± 11.27 c	938.67 ± 11.37 b		
Total Anthocyanins	2017							
Day of Fermentation	CS110R RB (-)	CS110R RB (+)	CS110R RB (+) S	CS110R RB (+) 2H	CS420A RB (-)	CS420A RB (+)	CS420A RB (+) S	CS420A RB (+) 2H
0	304.00 ± 8.54 a	261.00 ± 25.54 a	291.00 ± 25.06 a	282.33 ± 10.12 a	255.00 ± 6.56 a	221.00 ± 11.79 b	232.00 ± 6.24 b	215.67 ± 3.21 b
1	590.00 ± 27.73 a	391.67 ± 29.02 b	388.00 ± 6.00 b	358.67 ± 23.18 b	362.67 ± 26.27 a	302.33 ± 25.38a	328.67 ± 25.72 a	358.33 ± 20.84 a
2	743.00 ± 22.91a	478.00 ± 41.94 b	450.00 ± 21.00 b	486.67 ± 29.09 b	564.33 ± 9.61 a	431.00 ± 30.05 b	452.00 ± 15.62 b	528.33 ± 26.63 a
3	851.67 ± 16.26 a	576.00 ± 27.22 c	526.67 ± 19.30 c	642.67 ± 11.68 b	762.00 ± 16.37 a	598.33 ± 19.66 b	557.67 ± 74.54 b	659.67 ± 23.18 ab
4	900.33 ± 13.43 a	629.33 ± 28.02 c	573.33 ± 7.23 d	702.67 ± 6.81 b	855.00 ± 19.97 a	674.00 ± 13.08 bc	611.33 ± 85.24 c	745.33 ± 13.20 ab
5	950.33 ± 11.93 a	671.00 ± 25.51 c	613.00 ± 8.19 d	780.67 ± 5.13 b	931.00 ± 20.52 a	724.67 ± 14.47 bc	666.33 ± 55.08 c	791.33 ± 10.97 b
6	992.00 ± 9.54 a	702.67 ± 20.84 c	650.67 ± 3.21 d	808.67 ± 2.08 b	973.33 ± 15.57 a	751.33 ± 22.01 c	702.33 ± 30.62 c	812.00 ± 6.93 b
7	1000.33 ± 11.59 a	711.33 ± 16.80 c	673.00 ± 7.00 d	828.33 ± 13.65 b	1006.00 ± 14.73 a	769.00 ± 20.95 c	734.00 ± 14.73 c	815.33 ± 5.86 b
8	996.33 ± 10.97 a	711.67 ± 15.28 c	685.67 ± 8.14 c	792.33 ± 23.76 b	991.67 ± 14.29 a	757.67 ± 23.03 c	737.00 ± 13.45 c	812.67 ± 3.06 b
9	1000.00 ± 40.15 a	682.00 ± 13.45 c	661.33 ± 12.66 c	812.00 ± 22.52 b	--	--	--	--

Difference in letters indicates a significant difference between treatments for each rootstock after applying Tuckey's HSD test ($p < 0.05$). CS110= Cabernet Sauvignon 110R, CS420= Cabernet Sauvignon 420A, RB=red blotch, (-)=negative, and (+)=positive, 2H= second harvest, NS= no sugar, S= chaptalization, ME=malvidin-3-glucoside equivalents, and CE=catechin equivalents.

Supplemental Table S2. Total tannin concentrations during fermentation by Wine X-ray analysis for wines in 2016 and 2017 (n=3).

Total Tannins	2016							
Day of Fermentation	CS110 RB (-)	CS110 RB (+)	CS110 RB (+) 2H	CS420 RB (-)	CS420 RB (+)	CS420 RB (+) 2H		
0	--	--	--	--	--	--		
1	24.00 ± 0.00 a	24.00 ± 0.00 a	24.00 ± 0.00 a	24.00 ± 0.00 a	24.00 ± 0.00 a	24.00 ± 0.00 a		
2	24.00 ± 0.00 a	24.00 ± 0.00 a	24.00 ± 0.00 a	24.00 ± 0.00 a	24.00 ± 0.00 a	24.00 ± 0.00 a		
3	24.00 ± 0.00 b	24.00 ± 0.00 b	109.00 ± 28.35 a	87.00 ± 19.67 b	153.00 ± 53.08 ab	240.00 ± 75.48 a		
4	229.67 ± 28.29 a	83.00 ± 35.16 b	301.67 ± 24.01 a	333.67 ± 45.37 b	380.33 ± 15.37 ab	469.33 ± 65.59 a		
5	377.67 ± 21.22 a	212.33 ± 35.70 b	395.00 ± 19.29 a	458.67 ± 42.15 a	504.33 ± 13.01 a	525.33 ± 56.32 a		
6	422.33 ± 15.70 b	235.67 ± 18.58 c	485.33 ± 15.31a	476.67 ± 58.23 a	539.67 ± 21.73 a	601.00 ± 99.80 a		
7	499.00 ± 17.32 a	278.33 ± 38.80 b	527.67 ± 4.51a	524.00 ± 55.57 b	582.33 ± 2.52 ab	657.00 ± 35.93 a		
8	598.67 ± 19.66 a	363.67 ± 22.50 b	599.00 ± 29.51a	623.67 ± 92.51 a	674.33 ± 17.62 a	733.00 ± 7.00 a		
Total Tannins	2017							
Day of Fermentation	CS110R RB (-)	CS110R RB (+)	CS110R RB (+) S	CS110R RB (+) 2H	CS420A RB (-)	CS420A RB (+)	CS420A RB (+) S	CS420A RB (+) 2H
0	24.00 ± 0.00 a	24.00 ± 0.00 a	24.00 ± 0.00 a	24.00 ± 0.00 a	24.00 ± 0.00 a	24.00 ± 0.00 a	24.00 ± 0.00 a	24.00 ± 0.00 a
1	24.00 ± 0.00 a	24.00 ± 0.00 a	24.00 ± 0.00 a	24.00 ± 0.00 a	24.00 ± 0.00 a	24.00 ± 0.00 a	24.00 ± 0.00 a	24.00 ± 0.00 a
2	115.00 ± 20.30 a	31.67 ± 13.28 b	24.00 ± 0.00 b	24.00 ± 0.00 b	24.00 ± 0.00 a	24.00 ± 0.00 a	24.00 ± 0.00 a	51.67 ± 22.50 a
3	293.67 ± 10.02 a	172.00 ± 38.97 b	77.33 ± 31.72 c	146.00 ± 27.18 bc	259.33 ± 10.41 a	235.00 ± 33.60 a	177.33 ± 129.25 a	246.67 ± 19.09 a
4	404.00 ± 3.00 a	286.00 ± 44.40 b	193.67 ± 17.67 c	274.67 ± 7.51 b	408.33 ± 13.65 a	387.67 ± 37.07 a	299.00 ± 169.58 a	435.67 ± 18.18 a
5	517.67 ± 8.14 a	391.00 ± 48.87 b	309.33 ± 11.93 c	428.67 ± 4.04 b	563.00 ± 13.45 a	507.67 ± 27.32 a	438.67 ± 126.62 a	540.00 ± 19.47 a
6	568.00 ± 8.00 a	444.67 ± 45.21 b	371.00 ± 10.00 c	519.33 ± 13.50 a	677.67 ± 9.07 a	594.00 ± 21.00 a	551.33 ± 93.60 a	581.67 ± 14.84 a
7	625.33 ± 4.04 a	505.67 ± 45.08 b	444.00 ± 13.89 b	606.33 ± 15.57 a	749.33 ± 8.08 a	656.67 ± 10.02 b	638.33 ± 62.40 b	636.67 ± 8.50 b
8	669.00 ± 7.81 a	554.67 ± 44.60 b	534.00 ± 20.30 b	592.00 ± 24.58 b	771.67 ± 7.37 a	676.00 ± 4.36 b	679.33 ± 57.55 b	675.33 ± 12.66 b
9	813.33 ± 22.14 a	629.00 ± 33.81 b	611.33 ± 15.14 b	667.00 ± 32.45 b	--	--	--	--

Difference in letters indicates a significant difference between treatments after applying Tuckey's HSD test ($p < 0.05$). CS110= Cabernet Sauvignon 110R, CS420= Cabernet Sauvignon 420A, RB=red blotch, (-)=negative, and (+)=positive, 2H= second harvest, NS= no sugar, S= chaptalization, ME=malvidin-3-glucoside equivalents, and CE=catechin equivalents.

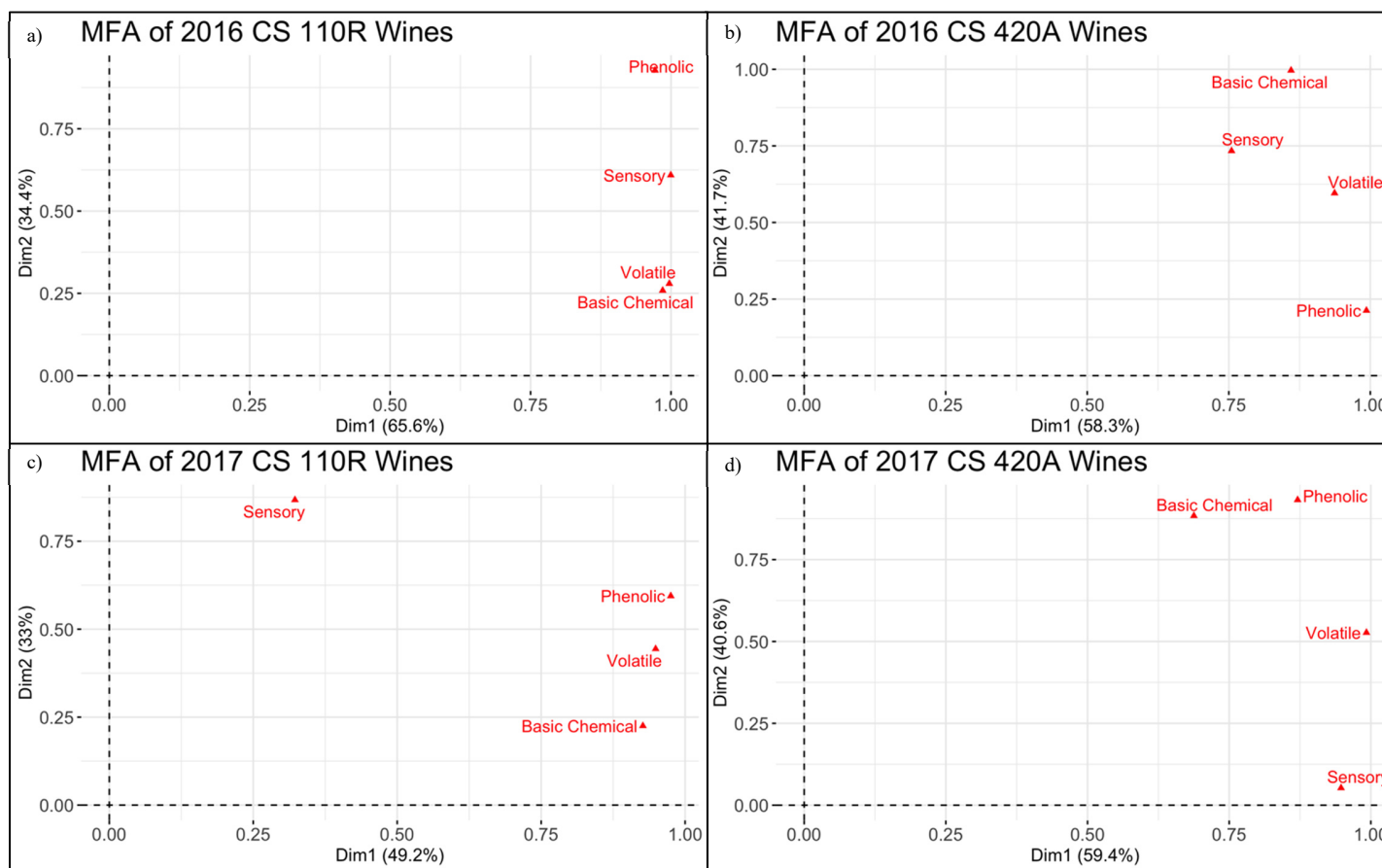


Supplemental Figure S1. Principal component analysis of the first and third dimension for volatile compounds in CS 110R wines made in 2017. Ellipses are drawn to 95% confidence with an n=6 for two bottle replicates for each fermentor replicate. Only the highest 20 significant volatile compounds that contribute to the variance are plotted. CS110= Cabernet Sauvignon 110R, RB=red blotch, (-)=negative, and (+)=positive, 2H= second harvest, S=chaptalization.

Supplemental Table S3. Significantly different sensory attributes of wines made in 2016 and 2017 as determined through descriptive analysis.

	2016							
Sensory Attribute	CS110R				Sensory Attribute	CS420A		
	RB (-)	RB (+)	RB (+) 2H			RB (-)	RB (+)	RB (+) 2H
Sour	1.88 ± 0.38 b	2.35 ± 0.43 a	2.27 ± 0.17 ab		Alcohol	2.75 ± 0.32 a	2.32 ± 0.28 b	2.84 ± 0.34 a
Hot	2.29 ± 0.23 a	1.48 ± 0.22 c	1.74 ± 0.17 b		Sweet	1.93 ± 0.37 ab	1.57 ± 0.39 b	2.03 ± 0.34 a
Dry	1.86 ± 0.30 b	1.65 ± 0.19 b	2.15 ± 0.22 a		Viscous	2.17 ± 0.34 b	2.24 ± 0.41 ab	2.58 ± 0.24 a
Viscous	2.58 ± 0.27 a	2.21 ± 0.46 a	2.22 ± 0.35 a					
Color	23.19 ± 0.97 a	18.36 ± 1.64 b	22.11 ± 1.35 a					
	2017							
Sensory Attribute	CS110R				Sensory Attribute	CS420A		
	RB (-)	RB (+)	RB (+) S	RB (+) 2H		RB (-)	RB (+)	RB (+) S
Dark Fruit	3.59 ± 0.31 a	2.27 ± 0.55 c	2.37 ± 0.80 bc	3.20 ± 0.51 ab	Hot	4.60 ± 0.58 a	3.28 ± 0.54 b	4.23 ± 0.45 a
Red Cherry	2.59 ± 0.44 a	1.61 ± 0.77 b	1.22 ± 0.43 b	2.93 ± 0.63 a				
Vanilla	1.51 ± 0.22 a	1.26 ± 0.30 ab	0.90 ± 0.49 b	1.84 ± 0.42 a				
Black Pepper	1.20 ± 0.47 ab	1.45 ± 0.47 a	1.79 ± 0.50 a	0.63 ± 0.31 b				
Barnyard	1.79 ± 0.74 b	2.74 ± 0.53 a	2.80 ± 0.52 a	1.69 ± 0.51 b				
Soil	0.71 ± 0.37 a	0.92 ± 0.44 a	1.16 ± 0.50 a	0.55 ± 0.31 a				
Savory	1.56 ± 0.68 bc	2.59 ± 0.82 ab	3.08 ± 0.80 a	1.40 ± 0.51 c				
Astringency	3.62 ± 0.75 ab	3.97 ± 0.41 a	4.54 ± 0.89 a	2.55 ± 0.71 b				
Hot	4.15 ± 1.21 ab	2.98 ± 0.67 b	4.27 ± 0.51 a	3.56 ± 0.55 ab				

CS110R= Cabernet Sauvignon 110R, CS420A= Cabernet Sauvignon 420A, RB=red blotch, (-)=negative, and (+)=positive, 2H= second harvest, S=chaptalization. Difference in lettering indicates a significant difference between RB(-) and RB(+) after applying Tuckey's HSD test (p<0.05).



Supplemental Figure S2. Multifactor analysis of the groups of variables that were used to analyze the wines: sensory profile volatile profile, phenolic profile, and basic chemical parameters at bottling. a) CS 110R wines made in 2016, b) CS 420A wines made in 2016, c) CS 110R wines made in 2017, and d) CS 420A wines made in 2017. CS110= Cabernet Sauvignon 110R, and CS420= Cabernet Sauvignon 420A.

Supplemental Table S4. RV coefficients to compare each data set in the multifactor analysis of each rootstock and season. Significant RV coefficients are indicated in bold lettering.

Comparison	RV Coefficient			
	CS 110R 2016	CS 420A 2016	CS 110R 2017	CS 420A 2017
Sensory vs. Phenolic	0.28	0.43	0.81	0.09
Sensory vs. Volatile	0.80	0.47	0.28	0.51
Sensory vs. Basic Chemical	0.76	0.51	0.18	0.68
Phenolic vs. Volatile	0.80	0.22	0.24	0.19
Phenolic vs. Basic Chemical	0.10	0.33	0.16	0.04
Volatile vs. Basic Chemical	0.91	0.86	0.56	0.82

CS= Cabernet Sauvignon, phenolic= phenolic profile of wines, volatile= volatile profile of wines, basic chemical= chemical data from bottling

Supplemental Table S5. List of sensory attributes that were used in 2016 and the recipes to make each sensory standard.

Aroma		Recipe
1	dark fruit	three thawed crushed blackberry plus 1 frozen dark cherry
2	strawberry	2 small pieces of frozen strawberry + 10 ml wine
3	banana -fresh	1 x 1cm circle of fresh banana, no peel
4	pear	20 mL R.W. Knudsen Pear juice + 10 grams of fresh pear
5	apple	15 g sliced fresh Grannysmith green apple, 20 mL base wine
6	citrus	0.15 g fresh tangerine peel + 0.1 g fresh lemon peel + 0.1 g fresh grapefruit peel
7	fresh veg	10 g McCains Frozen Sliced Green Beans + 10 g McCains Frozen Green Peas + 1 g bell pepper NO WINE
8	vegetation	0.1 g "birdsfoot trefoil green" +0.1 g "assorted green leaves"
9	floral	1/2 tspn Rose water (Monin) + Few Dry petals + 1/2 tspn Violet water
10	spice	1/2 tsp all spice
11	leather	20 mL base wine plus 2 leather show lace strips, 3 inches brown, 3 inches tan
12	vanilla	2ml McCormick Pure Vanilla extract + 25 ml wine
13	earthy	0.3 g dried mushroom 1 tps potting soil + 2 drops of water
14	oak	1 Am Oak cube M+ with 1 French Oak Cube Light + 1 Fench Oak Cube M in 20 mL wine
15	alcohol	20 mL Everclear 30 mL base wine
16	yeasty	1/8 teaspoon active dry yeast + 10 mL demineralized water
17	mineral	1 tbsp gravel in 5 mL mineral water (investigate other rocks and decarbonated sparkling water)
18	black pepper	two turns of black pepper mill
Taste		Recipe
1	sour	3.5 g/L tartaric acid
2	bitter	1.25 g/L caffeine
3	sweet	20 g/L sucrose
Mouthfeel		Recipe
1	hot	Alcohol Hotness (300 mL/L seagrams vodka)
2	dry	Dry (1.3 g/L alum)
3	viscous	Viscous (3 g/L CMC)
4	grippy	Drawing or tightening sensation felt in the mouth, lips and/or cheeks, lack of slip between mouth surfaces resulting in the inability to easily move mouth surfaces across each other
5	puckery	white vinegar (200 mL/L)
6	effervescent	sparkling mineral water

Supplemental Table S6. List of sensory attributes used in 2017 and the recipes to make each sensory standard.

Aroma		Recipe
1	dark fruit	3 thawed crushed blackberries + 1 thawed dark cherry + 5ml of black currant juice+1 teaspoon of black currant jam+10ml of base wine
2	strawberry	1 small, cut, thawed strawberry
3	red cherry	3 crushed, fresh cherries + 1/2 tablespoon of black cherry jam +10 ml of black cherry juice
4	dried fruit	2g of raisins + 2g of dates + 2g of appricots all crushed
5	green	5 g Frozen Sliced Green Beans + 4 blades of grass + 5 g bell pepper
6	chocolate	10g of dark chocolate (baking chocolate)
7	soil/earthy	1 teaspoon of potting soil + 2.5g of fresh chopped mushroom + 10ml of mineral water
8	musty	1g of ripped cardboard + 5mL of tap water
9	wood cedar	1 piece of ceddar + 10ml of base wine
10	black pepper	2 pinches of black peppper
11	mulling spice +vanilla	1/8 teaspoon cinnamon + 1/8 teaspoon whole all spice + 1/8 teaspoon ground cloves + 1 drop of vanilla + 40ml of base wine
12	barnyard	1/8 teaspoon white pepper + 20ml base wine
13	floral	(3 drops) of rose water+ 3 drops of orange blossom+20ml of base wine
14	flint/mineral	5 rocks + 10mL of tap water
15	savory	1 drop of liquid smoke+ 50ml of base wine
16	alcohol	20 mL Everclear Vodka + 30 mL base wine
Taste		Recipe
1	Sour	3 g/L tartaric acid
2	Bitter	1.5 g/L Caffein
3	Sweet	15g/L sucrose
4	Salty	2 g/L table salt
Mouthfeel		Recipe
1	Hot/Burning	350ml/L of Vodka in water; 150ml/L of Vodka; 50ml/L of Vodka
2	Viscous	3g/L of CMC in water; 1.5g/L of CMC; pure water
3	Astringent	3g/L of Alum in water; 1.5g/L of Alum; 0.5/L Alum