

**Comparison of Reverse Osmosis to Chaptalization in Free Run Chardonnay (2017)**  
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**Summary and Introduction**

The purpose of this study is to compare reverse osmosis treatments of juice to reverse osmosis treatments on wine, traditional chaptalization techniques, and no treatments at all. These techniques are commonly used in the wake of heavy rainfall events forcing winemakers to pick early. Chardonnay grapes were harvested and pressed into tank. This free run juice was allowed to settle overnight, and then was split into three separate lots: 1) Control, 2) Chaptalized, and 3) Reverse Osmosis Before (ROB) Fermentation. The ROB juice was concentrated 15%. After fermentation and malolactic conversion, the control lot was split into two separate barrels, and one of these received another treatment: 4) Reverse Osmosis After (ROA) Fermentation and malolactic conversion, to concentrate 15%. The juice chaptalization treatment was increased by 0.5 Brix in order to produce a potential alcohol which would mimic the ROA alcohol concentration, as opposed to the ROB alcohol concentration. Wines were bottled for the WRE right after the ROA treatment in early January. All other treatments between lots were equal. The ROB wine had higher alcohol content than the other wines. Lactic acid was slightly higher in the ROA wine, which also had a higher TA. The sensory results suggest that reverse osmosis can increase the perception of alcohol in wine, as well as increase acidity and other descriptive parameters. Reverse osmosis wines were generally preferred over the chaptalized wine, but this may have been due to reduction being present in the chaptalized treatment. More studies are needed to better elucidate the impact of RO on the aromatic and mouthfeel qualities of wine.

**Results and Discussion**

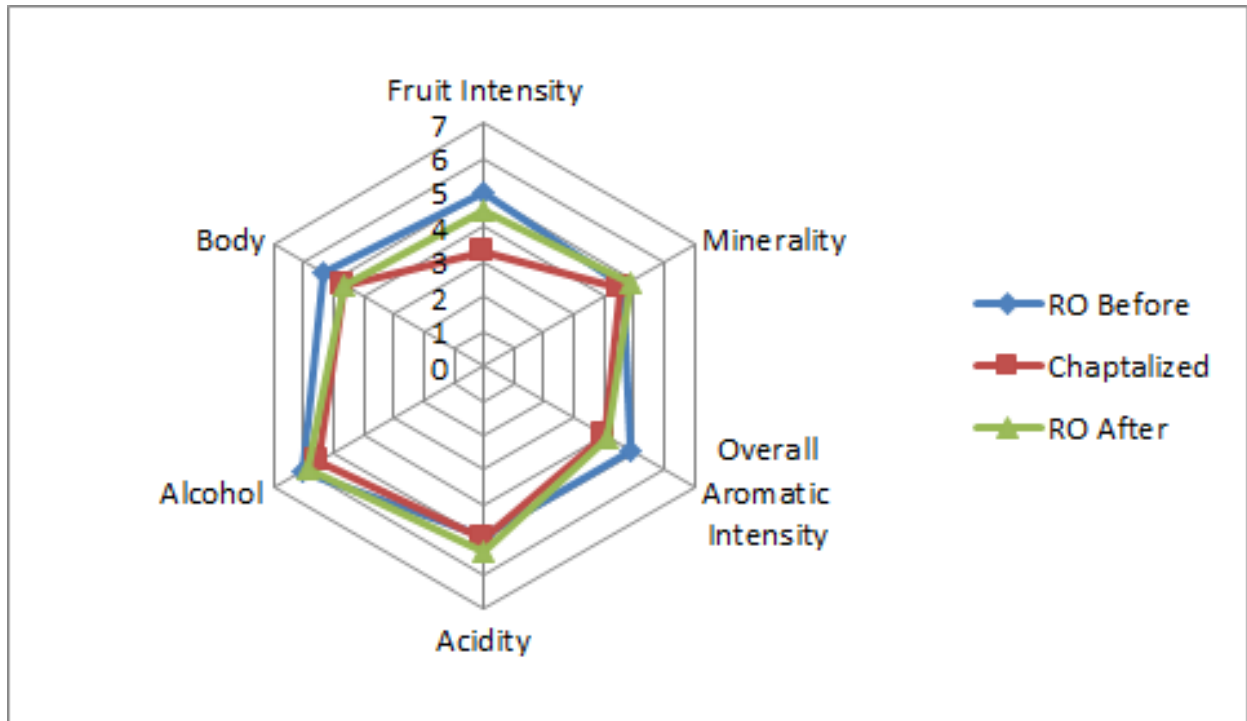
The ROB wine had higher alcohol content than the other wines. Lactic acid was slightly higher in the ROA wine, which also had a higher TA.

Juice Chemistry				
	Brix	pH	TA (g/L)	YAN (mg N/L)
Juice Chemistry	21.2	3.31	8.80	114

Wine Chemistry										
	Ethanol (%vol/vol)	Residual Sugar (g/L)	pH	TA (g/L)	Volatile Acidity (g/L)	Malic Acid (g/L)	Lactic Acid (g/L)	Total SO2 (ppm)	Free SO2 (ppm)	Molecular SO2 (ppm)
Control	12.48	<1	3.32	5.80	0.43	<0.15	1.97	90	34	1.43
Chaptalized	12.59	<1	3.30	6.00	0.33	0.25	1.79	95	27	1.19
RO Before Fermentation	14.16	<1	3.36	6.02	0.55	0.16	2.04	102	32	1.32
RO After Fermentation	12.59	<1	3.29	6.73	0.40	<0.15	2.22	89	23	1.04
% Change Chaptalized	1%		-1%	3%	-23%		-9%	6%	-21%	-17%
% Change RO Before	13%		1%	4%	28%		4%	13%	-6%	-8%
% Change RO After	1%		-1%	16%	-7%		13%	-1%	-32%	-27%

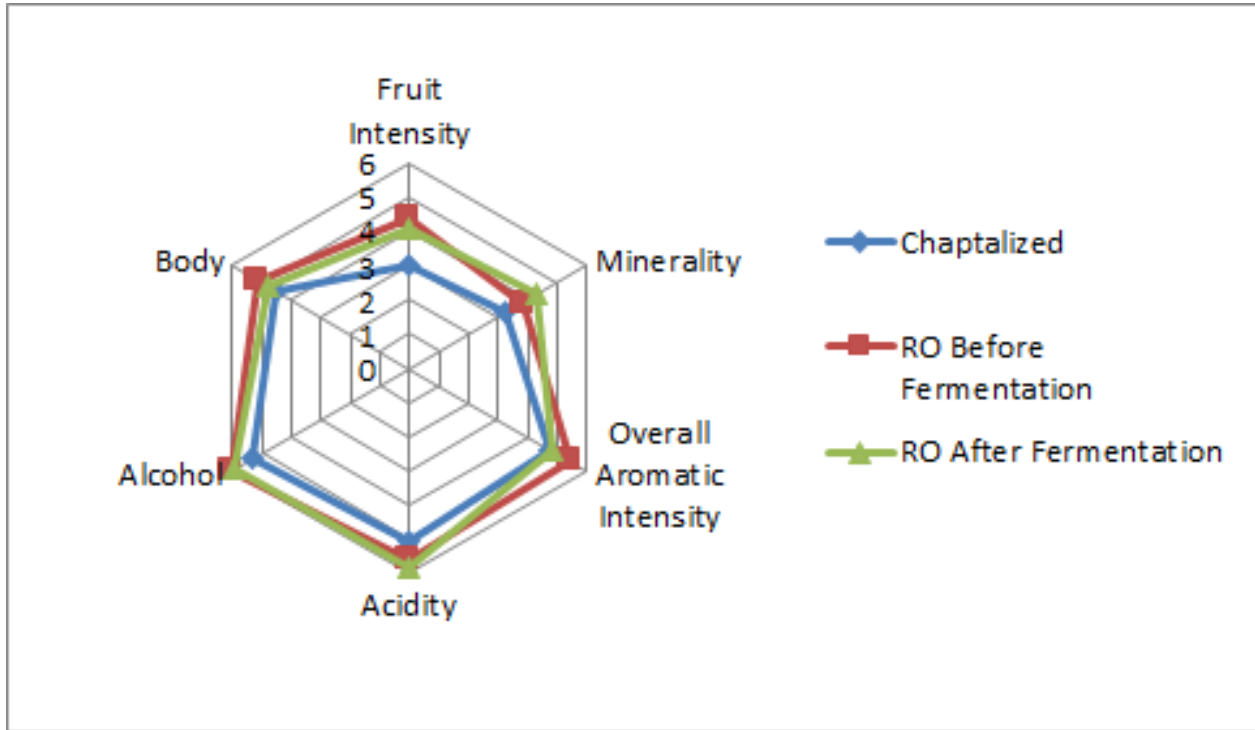
Results from ICV in Mid January

No strong trends were found between wines at the January 31 sensory session. There was a slight tendency for reverse osmosis to increase fruit intensity, and RO Before Fermentation had a slight tendency for increase Body and Overall Aromatic Intensity. Acidity had a slight tendency to be increased in RO After Fermentation. Ignoring the control wine (due to it being aged in new oak compared to the other wines), the RO wines tended to be most preferred, with RO Before being more so than RO After. Some judges felt that the Chaptalized wine was reductive, which may have impacted the preference results.



	Control	Chaptalized	RO Before	RO After	Total Votes
Most Preferred	30%	7%	37%	27%	30
Second Most Preferred	26%	26%	33%	15%	27
Third Most Preferred	23%	31%	15%	31%	26
Least Preferred	20%	37%	17%	27%	30

For the descriptive analysis on February 7, there was a strong tendency for Alcohol to be higher in the RO treatments compared to the Chaptalized wine (LSD=0.56). There was a slight tendency for RO to increase all descriptive parameters. The Chaptalized wine was least preferred. However, the Chaptalized wine was reduced, which may have impacted these results. The other wines may have been a little reductive as well.



	Chaptalized	RO Before	RO After	Total Votes
Most Preferred	13%	42%	46%	24
Second Most Preferred	26%	42%	32%	19
Least Preferred	57%	24%	19%	21

These results suggest that reverse osmosis can increase the perception of alcohol in wine, as well as increase acidity and other descriptive parameters. Reverse osmosis wines were generally preferred over the chaptalized wine, but this may have been due to reduction being present in the chaptalized treatment. More studies are needed to better elucidate the impact of RO on the aromatic and mouthfeel qualities of wine.

### Methods

Chardonnay grapes from the Middle Hill block (0.76 acre block on limestone rich penn silt loam, south facing, planted in 1988 on the area with the most rock formation and limestone on the Hill Block, 100% cane pruned VSP) were harvested and pressed on September 12, 2017. The yield was 4.27 tons per acre, 1.59 pounds per linear foot cane, and about 0.453 pounds per square foot of canopy (heavier yield than normal). Harvested grapes were chilled overnight, and then destemmed and crushed into the press. Only free run was used for this study. The juice was cold settled overnight with CinnFree. At racking the juice was split into three lots:

1. Control
2. Chaptalized
3. Reverse Osmosis prior to fermentation

The juice which underwent reverse osmosis prior to fermentation was concentrated 15%. The chaptalization was minimal (only 0.5 Brix increase) to mimic the expected potential alcohol of the 4th treatment: reverse osmosis wine after fermentation. YAN was corrected to 175ppm using 25g/hL Fermaid and the remainder

DAP over a course of two days for all lots other than the reverse osmosis prior to fermentation treatment, which was corrected to 200ppm YAN due to the higher sugar content.

Fermentation and aging occurred in the same barrel without racking. The barrels were topped after fermentation with a control barrel of Chardonnay from this block. The barrels were all Cadus Equilibre 2013 (5th fill). Malolactic conversion was complete and all barrels were sulfured by December 7. Barrels received batonage by-weekly, except for the fourth treatment:

#### 4. Reverse Osmosis after fermentation and malolactic conversion

This treatment occurred in January and was immediately bottled for the WRE, on the same day as all other treatments. It was concentrated 15%. The remaining wine was returned to the same barrel without cleaning it to keep the lees and keep the project still intact as best as possible for aging. However, due to a sampling error for the Control wine, this wine was accidentally from a new oak barrel for the tastings, and thus its sensory results will be ignored.

These wines were tasted on January 31 and February 7, 2018. In order to balance the data set to perform statistical analysis for descriptive analysis on the January 31 tasting, any judge who had not fully completed the descriptive analysis ratings were removed. In order to then make the number of judges between groups equivalent, one judge from group 2 was transferred to group 3, and another judge from group 1 and 2 were eliminated. This resulted in a final data set of 3 groups, each with 7 judges (considered as replications within groups, and groups were considered as assessors). Data was analyzed using Panel Check V1.4.2. Because this is not a truly statistical set-up, any results which are found to be statistically significant ( $p < 0.05$ ) will be denoted as a “strong trend” or a “strong tendency,” as opposed to general trends or tendencies. The statistical significance here will ignore any other significant effects or interactions which may confound the results (such as a statistically significant interaction of Judge x Wine confounding a significant result from Wine alone). The descriptors used in this study were Fruit Intensity, Minerality, Overall Aromatic Intensity, Acidity, Alcohol, and Body.

The same procedures for data analysis were used on the February 7 tasting, except that the Control was not tasted due to it having a strong new oak presence. For the descriptive analysis in this tasting, one judge was eliminated from group 2 so that each group had 7 judges, for a total of 21 judges.