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Winemaker's Trial
Examining the Profile Change from O_2 During Fermentation in Cabernet Sauvignon

Wanting to create a richer, more opulent style of Cabernet Sauvignon, Alpha Omega winemaker, Henrik Poulsen, experimented with increased levels of oxygen during primary fermentation to see how that would affect tannin polymerization and yeast performance.

ALPHA OMEGA WINEMAKER Henrik Poulsen's career took him from the Old World of winemaking to the New World of Napa Valley where, since 2000, he has handcrafted ultra-premium wines. A member of Alpha Omega's founding winemaking team, his first seven years of crafting wine at Alpha Omega helped put the winery on the map. He reunited with his Alpha Omega family in 2019 to oversee all aspects of winemaking.

TRIAL OBJECTIVE: The objective of this trial was to examine how higher amounts of oxygen during fermentation would impact the profile of the tannins and the performance of the yeast.

TRIAL DESCRIPTION: About 2.4 tons of 2019 St. Helena Cabernet Sauvignon were crushed into two sets of four open-top barrels for barrel fermentation. Each lot included two new barrels and two used or neutral barrels. After a three-day cold soak, both were inoculated. After the Brix dropped below 20° on the trial lot, Pulsairs were replaced with bubbling pure oxygen via a sparging stone. Oxygen was monitored with a DO meter, and each barrel was held at 5 ppm DO for five minutes when the treatment was performed. It took four days for the fermentation to reach 10° Brix after dropping below 20° Brix. After this point, all oxygen treatments were halted, and all procedures mimicked control.

LOT 1: 2019 St. Helena Cabernet Sauvignon—Control
LOT 2: 2019 St. Helena Cabernet Sauvignon—O_2 Treatment

TRIAL CONCLUSION: Tests did not demonstrate an increase in polymerized anthocyanin or a decrease in tannin. However, the producing winery believes the texture of the tannin was significantly altered by the oxygen treatment. We believe the wines show more of a ripe, voluptuous character, both aromatically and on the palate, as opposed to a leaner, fresher character.

ANALYSIS NAME	LOT 1	LOT 2	UNITS
free sulfur dioxide	<2	<2	mg/L
molecular sulfur dioxide	<0.10	<0.10	mg/L
total sulfur dioxide	12	14	mg/L
titratable acidity	6.2	6.7	g/L
pH	3.73	3.67	
volatile acidity (acetic)	0.67	0.64	g/L
L-malic acid	0.1	0.75	g/L
glucose + fructose	0.4	0.3	g/L
ethanol at 20C	15.42	15.3	% vol
ethanol at 60F	15.37	15.25	% vol
catechin	6	6	mg/L
tannin	1507	1488	mg/L
polymeric anthocyanins	120	117	mg/L
total anthocyanins	574	616	mg/L
catechin/tannin index	<0.010	<0.010	
polymeric anthocyanins/tannin index	0.08	0.079	

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Winemaker's Post-Mortem

Why are you specifically interested in modifying tannins earlier in the fermentation process?

Poulsen: Generally speaking, the earlier we can impact the tannin profile, the better, and this would give us an opportunity to modify them as they extract. The other factor is the yeast in solution. Going in, we knew that the oxygen would be absorbed rather quickly, and that proved to be true, but we did not know if that absorption would be by yeast, tannin or simply oxygen being pushed out of solution by generation of CO_2. After the trial was complete, it was clear that both the tannins and the yeast had been impacted. We were originally hoping for more polymerization via the

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creation of acetyl-bridges by the O_2; but because we did not see a significant jump in polymerization, we don't think that was the biggest impact the O_2 had on the wine. We did, however, see a dramatic change in the aroma of the wine, making the wine jammier and fruitier, leading us to believe the yeast had a bigger role in absorbing the O_2. We also saw a slightly jammier texture on the palate. Overall, this technique seemed to lend itself toward a more opulent style of wine.

Describe how you set up the trial.

Poulsen: We split the Clone 337 block of our Partridge Vineyard Cabernet Sauvignon into two open-top barrel fermentation lots. We ended up with four barrels of control and four barrels of trial. The control was fermented in the traditional manner of our barrel fermentation, and the trial lot followed the same procedure across the board. At 20° Brix, we began sparging with O_2. We used a device involving a plastic shell and holes that we call the "torpedo" to create an all-liquid environment for the O_2 stone and DO probe to sparge and measure. The O_2 stone was linked to pure oxygen and was sparged in slowly until the DO probe read 5 ppm. We then slowed down O_2 incursion until the DO held steady. We did this for five minutes per barrel. The first day of sparging, we were at 20° Brix; the second day, we reached 17.5° Brix; and by the third day, we were down to 12.5° Brix. On the fourth day, we decided not to sparge since Brix measured 6.6°. We did see an acceleration of fermentation during the sparging.

Sparging stones were used to create pure oxygen bubbling in the wine. How often did you conduct this procedure and for how long?

Poulsen: We performed this for five minutes once a day. We only performed it for three days during the fermentation, when it was between 20° and 10° Brix. This ended up being the fifth, sixth and seventh days of fermentation.

Can you describe some of your observations during the course of the experiment?

Poulsen: The biggest observations during fermentation were, first, that the O_2 increased fermentation speed by 1° to 2° Brix and, second, that the fermentation's ability to absorb oxygen was pretty impressive. After the O_2 sparging, it took roughly 90 seconds for the DO to return to zero.

Did you encounter any complications during the course of the trial?

Poulsen: There were a lot of skeptical looks from our French harvest interns. This didn't slow us down at all, though.

Your conclusion states that lab tests did not show any change in tannins, but you and your team believe that the texture has, in fact, been altered. On what basis did you make that conclusion?

Poulsen: It was purely organoleptic. In our tasting, we think of the wines as being more aggressive on the palate and aromatics. That being said, a big unknown for us is how the oxygen absorbed by the yeast affected the palate. We would love to see data on whether polysaccharide or glycerol production was affected in any way. We would also be curious about mean degree of polymerization.

Based on the conclusion of this trial, would you repeat this experiment?

Poulsen: We felt the data points were a little sparse to properly validate our organoleptic findings, so we will repeat this experiment with 2020 Cabernet Sauvignon.

Based on the conclusion of this trial, do you think the Alpha Omega winemaking team will alter any of their winemaking protocols?

Poulsen: While we naturally are curious to see the effects of our research, at this point we have no intentions of letting this single trial affect the overall winemaking strategies.

What are some of the lessons or main takeaways you learned from this trial?

Poulsen: We feel fairly confident this technique is an effective way to create a richer, more opulent style of Cabernet Sauvignon. **WBM**