



# Wine Grenade trials at Sacred Hill Winery

This document lays out the goals of the commercial trials, outlines the trial setup and monitoring approach, and summarises the results.

## Goals and setup

### Wine Grenade Objectives

- Compare the Wine Grenade product to an existing competitor and a control
- Validate that correct oxygen rates can be delivered with the Wine Grenade to mature wine according to the Winemaker's taste
- Validate the efficacy of micro-oxygenation through permeation compared to traditional bubble plume diffusion methods
- Test the performance and durability of the product design
- Confirm that the innovative "Active Float System" performed as designed
- Honestly capture the winemaker's experience using the product during the trial including the usability of the device
- Uncover any limitations in designs of the Wine Grenade and competing systems

### Trial Background

The Wine Grenade team conducted a 10 week in-situ trial at Sacred Hill Winery to test the suitability and performance of the newly developed Wine Grenade device. The Trial was designed to assess and compare the Wine Grenade unit against an existing market leader's micro-oxygenation system used by Sacred Hill Winery as well as a control across a 6 tanks and two wine varieties.

Care was taken to replicate environmental factors as well as time spent in the act of winemaking (e.g. all tanks were exposed to external oxygen for the same amount of time). Wines were actively monitored throughout the Trial with the resulting wine assessed by an independent laboratory at regular intervals throughout the Trial.

### Tank setup

Six tanks were included in the trial, each tank was the following dimensions:

- Height: 2.5m
- Diameter: 2.35m
- Capacity: 11,000

<b>Tank</b>	<b>Wine type</b>	<b>Treatment</b>	<b>O2 rate</b>
1	Pinot Noir	Wine Grenade	2 months @ 1mg
2	Pinot Noir	Competitor	2 months @ 1mg
3	Pinot Noir	Control	2 months @ 0mg
4	Merlot	Wine Grenade	1 month @ 2mg 1 month @ 1mg
5	Merlot	Competitor	1 month @ 2mg 1 month @ 1mg
6	Merlot	Control	2 months @ 0mg

Table 1 - Tank setup

### **Winemaker objectives**

Sacred Hill Chief Winemaker Tony Bish and Red Wine maker Jenny Dobson determined objectives and characteristics of each wine prior to the commencement of the trials.

- The Pinot Noir needed “to build body and soften tannins to give more depth and fullness to the wine”
- The Merlot needed to ‘refine and soften tannins to bring depth across palate and less dryness on the finish”.

These development objectives determined the oxygen flow rates required for each variety as shown in Table 1.

### **Monitoring the trial**

#### **Blind tastings**

To assess the progress against the development goals, Jenny and Tony conducted systematic blind tastings of each wine at fortnightly intervals. Each sample was assessed on its taste and development, noting its individual attributes and comparing those to the other blind samples within its variety.

#### **Independent laboratory analysis**

Samples of each of the wines were taken and sent to an independent laboratory specialising in wine analysis where a Basic wine panel was conducted pre and post trial across each sample. This panel analysis consisted of measuring the pH, Titratable acidity (TA), Free and Total SO<sub>2</sub>, Alcohol, Acetic acid, Glucose/Fructose, Malic acid of the wine. Fortnightly testing and analysis was also conducted by the laboratory across the range of samples. In addition

to this, Sacred Hill also conducted their own chemical analysis of the wines, assessing the changes in pH, Free and Total SO<sub>2</sub>, TA, volatile acidity as well as measuring the temperature, dissolved oxygen, hue, density and turbidity across the course of the trial.

### Real time remote monitoring

Through the addition of new functionality to the Wine Grenade device, the team was able to undertake real time monitoring of each of the unit's performance, as well as remote adjustments to flow rates. This provided valuable feedback with respect to flow rate, pressure, float oscillations, oxygen levels and temperature, all reported automatically every 5 minutes throughout the ten week trial providing a robust data set.

## Trial Outcomes

### Tasting panel

At the conclusion of the trials, Sacred Hill hosted a wine tasting panel, inviting local Hawke's Bay wine makers to take part in blind taste testing to assess whether the different treatments were easily distinguishable from each other and to assess the individual attributes of each wine. The panel were provided with blind samples with the objective of establishing the taste profile across the 6 tanks, ranking how the Wine Grenade performed in relation to the leading competitor and the control.

Figure 1 – Pinot Noir aggregate attribute ranking

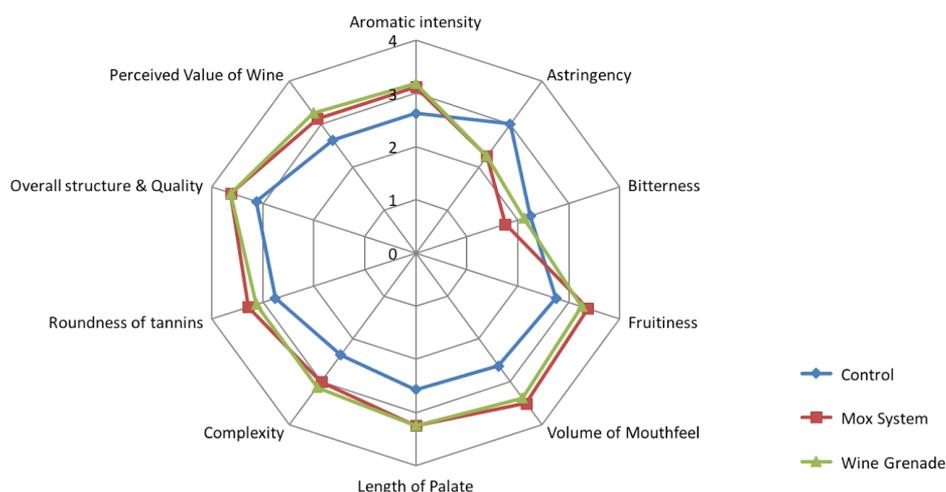
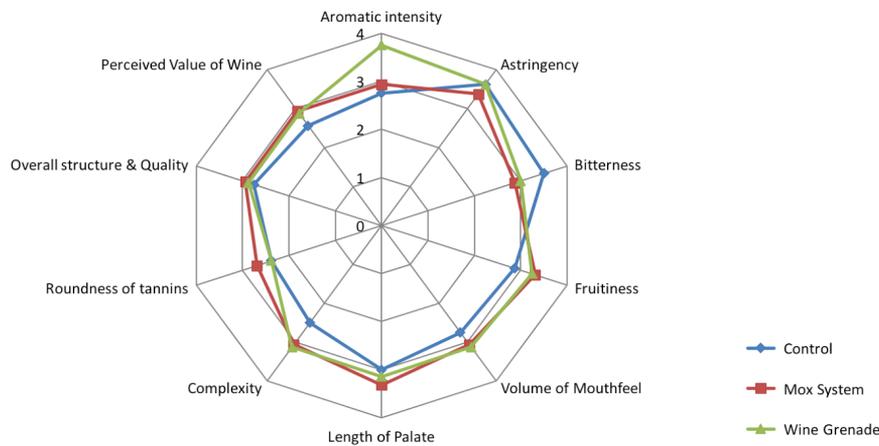


Figure 2 – Merlot aggregate attribute ranking



As can be seen in Table 2 and 3, the aggregated tasting panel attribute ranking showed that Wine Grenade ranked equally or above the competitor and control across each of the 10 different attributes.

### Winemaker feedback

Winemaker feedback was overwhelmingly positive. The Wine Grenade outperformed the competitor and control tanks across both varieties showing a better end result.

*“We’re very happy with the results; we’d like to use it again. I think it has great potential adaptation to a variety of winemaking styles and intended outcomes. Its portability, flexibility and low capital cost and the ability to work in any shape and size tank are distinct advantages over existing technologies”*

– Tony Bish, Chief Winemaker, Sacred Hill

### Tasting notes

The tasting notes taken throughout the trial also showed that the Wine Grenade samples proved to be the most favourable sample within each wine variety at each sample point.

*“Complex nose with red fruits and savoury highlights. More depth on palate than D (Control) and more complexity than E (Competitor). Structure slightly more integrated into overall flow of wine than E (Competitor).”*

*“Sweet blackberry aromas with some spicy lift. Richness and depth on entry, good complexity, leads to grainy tannins and low astringency. The most supple and balanced of these three wines.”*

*“Most lifted of the three glasses with sweet dark baked fruits with a complexing savoury note. Good depth on the attack which is well sustained through plate despite chewy structural tannins. No bitterness on the finish. Overall good balance to depth and structure.”*

## Remote data analysis

The robust data set generated by the Wine Grenade also showed that the oxygen rates delivered by both units stayed within Sacred Hill’s targets, delivering 13.04 and 6.66 grams per month for Units 1 (Merlot) and 3 (Pinot Noir) respectively. The data, when graphed, show a uniform and consistent flow of oxygen. This is consistent with the feedback received from the Sacred Hill winemakers who tracked the development of the wine as the oxygen was introduced. Also encouraging to see was the reliable performance of the active float which oscillated every 5 minutes throughout the wine vat for the entire trial.

Figure 3 - Unit 1 trial monitoring data

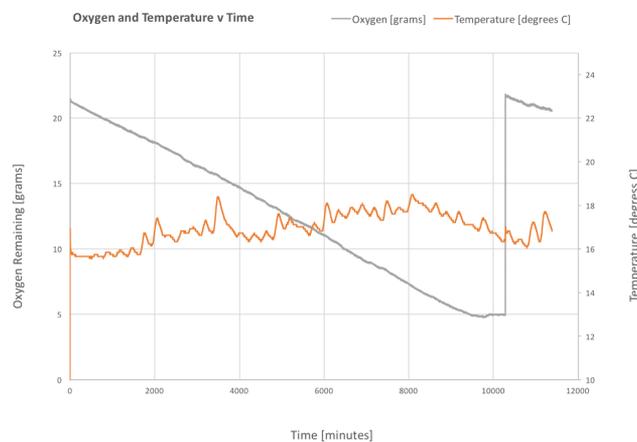
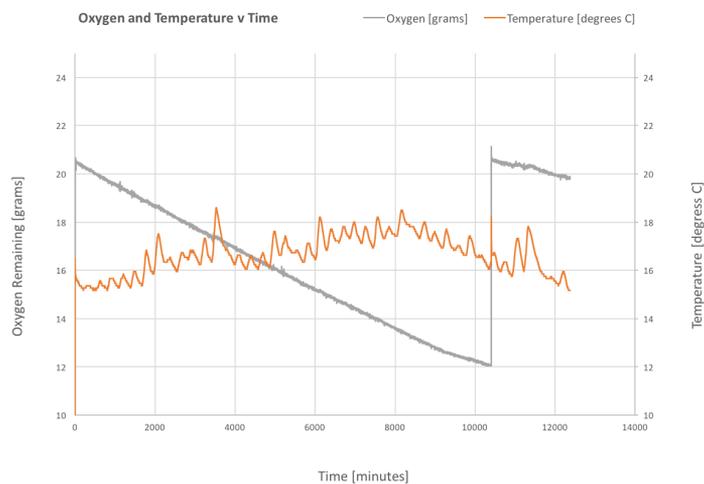


Figure 4 - Unit 3 trial monitoring data



## Independent laboratory analysis

An independent Basic Panel test was conducted at Hill Laboratory. Analysis results show no noticeable variances between the three samples of each variety from a chemical analysis perspective. This demonstrates that the Wine Grenade is effectively improving the wine without having any chemical impact on the wine.

Basic Wine Panel - Pre vs Post Trial							
		Pinot Noir			Merlot		
		Control	Mox	WG	Control	Mox	WG
<b>Actual Alcoholic Strength</b> (% v/v)	Pre Trial	13.3	13.3	13.3	13.9	13.9	13.9
	Post Trial	13.4	13.4	13.4	13.9	13.9	13.9
<b>Total Acidity</b> (g/L as Tartaric Acid)	Pre trial	5.4	5.4	5.4	5.7	5.7	5.8
	Post Trial	5.4	5.4	5.4	5.7	5.7	5.7
<b>Volatile Acidity</b> (g/L as Acetic Acid)	Pre Trial	0.57	0.58	0.57	0.46	0.45	0.46
	Post Trial	0.56	0.56	0.57	0.48	0.48	0.49
<b>L-Malic Acid*</b> (g/L)	Pre Trial	0.04	0.04	0.03	0.03	0.03	0.02
	Post Trial	0.03	0.03	0.03	0.03	0.03	0.03
<b>Total Sugars</b> (g/L)	Pre Trial	0.46	0.46	0.46	0.24	0.24	0.24
	Post Trial	0.53	0.53	0.53	0.26	0.27	0.27
<b>pH</b> (pH Units)	Pre Trial	3.72	3.72	3.73	3.66	3.66	3.67
	Post trial	3.74	3.75	3.75	3.69	3.69	3.69
<b>Total Sulphur Dioxide</b> (mg/L)	Pre Trial	29	30	29	35	36	36
	Post Trial	24	25	24	24	21	21
<b>Free Sulphur Dioxide</b> (mg/L)	Pre Trial	19	19	18	16	19	18
	Post Trial	15	15	13	7	8	8

Table 2 - Pre and Post Trial Hill Laboratory analysis