

Oak maturation trial results show cost savings

This article is based on a presentation at the 2013 Winery Engineers Conference in McLaren Vale, South Australia, in June.

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FOR THE PAST 25 years, Ausvat has been developing an alternative wine storage and oak maturation system to that of conventional oak barrels. The original 'Stakvat' vessel concept was of a 225L volume design and the first commercial prototype was supported and launched by the late Dr Bryce Rankine at a McLaren Vale winemakers' forum held at Middlebrook winery on 23 August 1988.

Current research and development

The last four years has seen rapid advances in the development of engineering products for controlled wine maturation.

These advances have been assisted by the previous R&D involving the Australian wine industry and teaching Institutions, and by utilising today's engineering materials combined with advancements in maturation vessel design. The vessel is still known as "Stakvat" today, but is now in a very different form to its predecessors.

In lieu of oak doors used in previous designs, the latest door design has two doors (one each side) with a simple guide system that captures and holds in place two food-grade exchangeable maturation membranes (one in each door). The membrane exchange is done by simply opening the maturation doors and sliding the membranes in or out using the guide system integral with the door.

These membranes can be of different food-grade and or air-permeable materials such as polyethylene (PE) or non-permeable material such as stainless steel for an inert environment or finished wines. Recent successful wine maturation trials have shown by application of different thicknesses of membranes, the wine maturation times for the 900L volume are directly proportional to the maturation membrane thickness. That is, the thinner the membrane the faster the maturation time. Conversely, the thicker the membrane, the slower the maturation time.

Engineering material requirements

We found through initial research that natural polyethylene (PE) materials in sheet form are suitable for the Stakvat doors because in its natural form it is food safe, and has oxygen permeability values in the desired range for wine maturation. Polyethylene is already used in the wine industry.

Another benefit of PE is that due to the size of the spaces between its chain molecules, water molecules cannot escape through the material and hence there are no wine losses through evaporation as with oak casks. High density polyethylene (HDPE) has a water evaporation rate of less than 0.05%

Wine losses during oak barrel maturation can be up to 5% of the volume of wine contained in oak casks per annum. This is caused by the evaporation of liquids through the oak in each cask. Then there is also the very costly wine-topping work required to keep the oak vessels off ullage.

Wine maturation field trial and results (a case study):

Trial prerequisites

Prior to commencing the wine maturation trials, a trial protocol design process was carried out with meetings and discussions held between the trial participants. Using our previous R&D experience and findings, we needed to define what we were actually looking for in terms of wine maturation and control, and this to be combined with the utilisation of current engineering materials.



The Stakvat allows for controlled wine maturation.

Further, how could we directly translate the anticipated trial results to current industry practices and needs for the maturation and storage of quality wines, but most importantly, cost effectively.

Early on in our considerations, it was decided to engage a professional consultant and design engineer familiar with our needs and the needs of the Australian wine industry. We chose a locally based consultant who had previously worked on various projects associated with the University of Adelaide.

Blind tasting observations and results

The tasting panel consisted of 11 tasters all experienced in sensory evaluation of wines. Only three of the tasters were aware of the trial protocols.

Importantly, it can be seen in the final average scores there are no spikes in the final average scores.

Highest average score was Stakvat replicate Vat 4 (16.5 points) This Vat was set up with 2 x 1.5mm high density polyethylene membranes. (HDPE)

Second highest average score was Stakvat replicate Vat 6 (16.1 points) This vat was set up with 2 x 4.0mm HDPE.

Lowest average score was Stakvat replicate Vat 2 (15.5 points) This vat was set up with non-oxygen permeable stainless steel membranes and was the control.

New oak barrel and old oak barrel replicates average scores out of 20 were (15.7 points) and (16.0 points) respectively.

Table 1. Trial protocol (Stakvat replicates including new and old barrel replicates). The trial settings:

Target applications:	Required air permeation into a 900 litre volume per month
1 MOX setting as specified (by the producer)	equivalent for 900 litres = 4500–13500 mLpm
2 New barrel maturation	equivalent for 900 litres = 1125–2520 mLpm
3 Old barrel maturation	equivalent for 900 litres = 500–600 mLpm

Note: A single sheet of 3.0mm thick HDPE door combined with a 1.5mm thick stainless steel door (non-permeable) could have been added to the trial protocols as another option here due to the simplicity of only requiring one oxygen-permeable door compared to 2 x 6.0mm thick HDPE doors.

Winemakers comments:

The senior winemaker and project leader was impressed with the result and had this to say: "Looking at my scores across the 12 months, I reckon that the 1.5mm sheets (HDPE membranes) hit an earlier peak back in July and continued to mature slowly during the preceding months to best in October, whereas the 4.0mm sheets (HDPE Membranes) peaked in November, but continued to improve to January and then stabilised. This is closer to the 12 month format I'm looking for to replicate oak barrel equivalent".

The senior winemaker then went on to say, "I still believe the thinner 1.5mm membranes will have great use in some applications and should be offered as a shorter term maturation option".

The use of the 1.5mm membranes could eliminate the need for artificially introduced oxygen (micro-oxygenation or MOX) and the complexities that go with MOX and wine.

Notes:

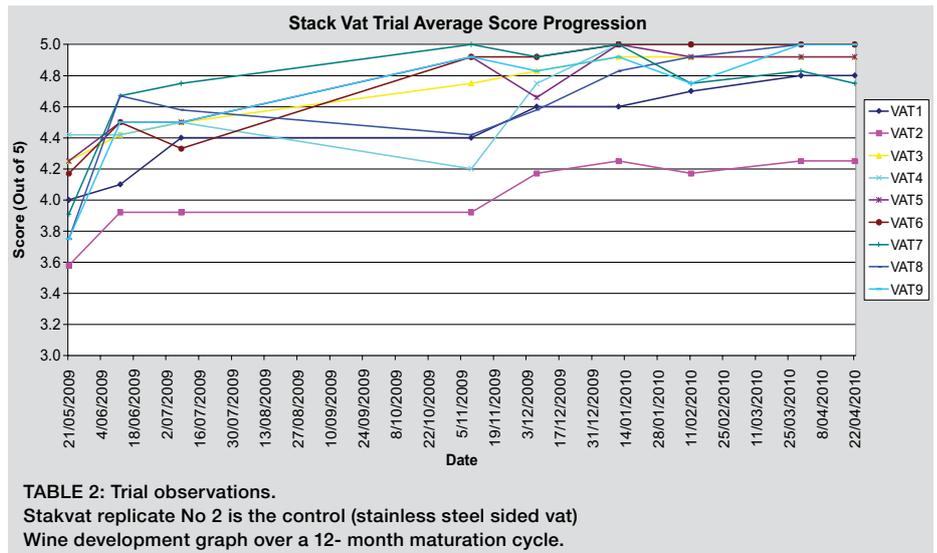
Cost analysis is over nine years and allows for two barrel replacements in that period

Each hogshead is worth approximately \$60 towards barrel reclaim (-\$18K in first two lines)

The Stakvat/barrel reclaim wine maturation method is 37% cheaper than new American oak barrel maturation and 63% cheaper than new French oak barrel maturation.

From 25 years experience the life expectancy of a Stakvat is 25 years and beyond.

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2010 STACK VAT TRIAL TASTING

Code	Longbottom PAD CAS 2009	Vint	Var	No.	Longbottom Padthway Cabernet Sauvignon 2009 - Comments	SCR	NB	ND	HS	JM	SB	MRe	AB	MPo	MRO	PW	NH	Av
TX01809	VAT 1 - Oak Sided Vat/ No Mox	2009	CAS	10			15.0	17.0	16.0	17.0	15.0	15.5	16.0	16.5	15.0	16.0	15.0	15.8
TX01809	VAT 2 - Control Tank/ 2g/L FO Chips/ No Mox	2009	CAS	1			15.0	15.0	15.0	15.0	16.0	16.5	16.0	16.0	16.0	15.0	15.0	15.5
TX01809	VAT 3 - 2g/L FO Chips/ 3-4 Months MOX	2009	CAS	7			15.5	16.5	14.0	16.0	16.5	15.0	17.5	16.5	15.0	16.0	17.0	16.0
TX01809	VAT 4 - 2g/L FO Chips/ LD PDE 1.5mm	2009	CAS	5			15.5	16.5	16.0	16.0	15.5	15.5	16.5	16.0	17.0	15.0	14.5	15.8
TX01809	VAT 5 - 2g/L FO Chips/ HD PDE 1.5mm	2009	CAS	9			16.0	15.5	16.0	16.0	16.5	17.0	18.0	17.5	16.0	16.0	17.5	16.5
TX01809	VAT 6 - 2g/L FO Chips/ HD PDE 4.0mm	2009	CAS	2			16.5	17.0	15.0	16.0	17.0	16.0	17.0	16.5	15.0	15.0	16.0	16.1
TX01809	VAT 7 - 2g/L FO Chips/ LD PDE 4.0mm	2009	CAS	11			16.0	16.0	15.0	16.0	16.0	15.5	17.5	16.5	16.0	16.0	16.0	16.0
TX01809	VAT 8 - 2g/L FO Chips/ HD PDE 5.0mm	2009	CAS	6			16.0	15.5	15.5	15.5	16.0	16.5	16.0	16.0	15.0	17.0	16.0	15.9
TX01809	VAT 9 - 2g/L FO Chips/ HD PDE 6.0mm	2009	CAS	3			15.5	16.0	14.5	17.0	17.0	15.5	16.5	16.5	15.0	15.0	16.0	15.9
TX11709	Stack 090225 - New Oak 09WCFR2	2009	CAS	4			15.0	17.5	14.0	15.0	15.0	15.5	17.5	17.5	16.0	15.0	15.0	15.7
TX11709	Stack 090225 - Old Oak 04CFIA21	2009	CAS	8			15.0	17.0	17.5	16.5	15.5	15.0	17.0	16.5	15.0	15.0	16.0	16.0

Table 3: Blind tasting results - Wine: Vintage 2009 Padthway Cabernet Sauvignon. Scores out of 20 points evaluating: green or undesirable fruit flavours, colour retention/changes across time, tannin balance, oak integration, oak flavour and quality, hydrogen sulphide levels, oxidative characters

	No.	Cost	Amt	Yr 1	2	3	4	5	6	7	8	9	Total cost	Total litres	Cents/ litre
American Oak	300	900	270,000	270,000	0	0	297,000	-18,000	0	326,700	-18,000	0	857,700	810,000	\$1.06
French Oak	300	1,500	450,000	450,000	0	0	495,000	-18,000	0	544,500	-18,000	0	1,453,500	810,000	\$1.79
Ivat (Stakvat)	100	3,600	360,000	360,000	0	0	0	0	0	0	0	0	360,000		
Barrel Reclaim	100	105	10,500	10,500	10,850	11,200	11,550	11,900	12,250	12,600	12,950	13,300	107,100		
Total Ivat & BR	100	3,705	370,500	370,500	10,850	11,200	11,550	11,900	12,250	12,600	12,950	13,300	467,100	810,000	\$0.58

Table 4. Oak maturation cost comparison & analysis.
(Stakvat/Barrel Reclaimed oak maturation costs versus oak barrel maturation costs.)

Comparison criteria:

- 1 Comparison volume is 90,000 litres of wine matured per year
- 2 Barrel type is assumed Hogshead ie. 300 litres
- 3 Barrel turnover is assumed 3 years
- 4 Barrel costs are average prices sourced from the market
- 5 Assume CPI cost increase 3% PA
- 6 It takes 30 battens of oak per Ivat to oak the equivalent of 3 barriques
- 7 Each Hogshead produces 60 battens of barrel reclaim
- 8 Each Hogshead is worth approximately \$60 towards barrel reclaim
- 9 The Ivat price of \$3,600 is for refurbished vats only. If new vats are required to be built, the price per vat is \$4,300 plus GST

Notes:

- 1 The barrel oak content diminishes each year where Ivat remains fully oaked
- 2 The Ivat/BR is 46% cheaper than American oak Hogshead and 68% cheaper than French oak Hogshead per litre over 9 years
- 3 The annual cost for Ivat is per the Barrel Reclaim line ie. \$10,500 in year 1
- 4 Life expectancy for the Ivat is 20+ years. Regular maintenance of seals and poly eth sides will maximise the savings.

