Chardonnay Lees Management with Extralyse (ARC)

Blenheim Vineyards
Submitted by Kirsty Harmon

Summary

This study examined the impact of lees stirring and batonnage enzyme addition during Chardonnay aging on the chemical and sensory qualities of the wine. It is a companion study to Blenheim's Chardonnay Lees Management (2016), which compared the effects of not stirring Chardonnay to stirring Chardonnay. Chardonnay juice was fermented in barrels, and afterwards two different treatments were imposed: stirred, and stirred with Extralyse (Laffort). Stirring occurred once per week for 8 weeks. No major chemical differences could be observed between the finished wines. Wine tended to become more cold stable over time. Additionally, increased bentonite additions to become heat stable were necessary after aging. In general, people often could not distinguish between stirring and stirring with Extralyse. When people could distinguish, there appeared to be a slight preference for wine made with Extralyse. The descriptors used generally did not help elucidate which qualities in wine were affected by stirring. There may be a small tendency for Extralyse to enhance Fruit Intensity and Depth of Flavor, but these tendencies were weak. However, the stirring regime for this study was relatively short (8 weeks). In the future, more realistic stirring regimes should be implemented to see whether differences tend to increase over time.

Introduction

Marchal et al. (2011) provide an excellent brief review of yeast autolysis in their introduction. Lees are mainly composed of yeast, bacteria, tartaric acid, polysaccharides, and protein-tannin complexes (Zoecklein 2013). Heavy lees generally refers to lees which precipitate 24 hours after fermentation (generally grape particles and large complexes of other lees particulates), and can often lead to off-aromas in wine. Light lees precipitate later and are generally beneficial to wine quality, and have less grape particulates and less heavily complexed yeasts and other lees particulates (Zoecklein 2005; Zoecklein 2013). Lees aging can decrease vanilla flavors from oak, and increase toasted flavors (Chatonnet et al. 1992; Tominaga et al. 2000). Others have observed that lees stirring increases yeast character in the wine, decreases fruit and oak character. In some cases, this reduction in oak character can increase the perception of fruit (relative to very oaky control wines) (Zoecklein 2005).

Lees aging also increases the polysaccharide content of wines, particularly mannoproteins, which may enhance wine protein and tartrate stability (Llaubères et al. 1987; Ledoux et al. 1992; Moine-Ledoux et al. 1997; Feuillat 2003; Zoecklein 2005; Zoecklein 2013). Sur lies aging releases mannoproteins and other cell wall polysaccharides which can enhance the colloidal structure, stability, and aromatic quality of red wines while reducing their astringency, making sur lie aging of red wines important (Zoecklein 2005). Although yeast-derived proteins can increase during lees aging, these proteins are not involved in protein instability (Zoecklein 1991).

Lees may also act to preserve fruity and varietal characteristics by preventing oxidation and producing a reducing environment (Marchal et al. 2011; Zoecklein 2013). The release of thiols into the wine from yeast has been attributed to lowering reductive characteristics by being able to oxidize methanethiol and ethanethiol into their non-volatile disulfide forms (Lavigne and Dubourdieu 1996); however, this greatly depends on other factors in the aging process, and could impart a more reductive character to the wine. Yeast glycoproteins from autolysis may also decrease astringency in wines through interaction with phenolic compounds (Escot et al. 2001). Lees autolysis can also impart sweetness to wine (Zoecklein 2005; Marchal et al. 2001), which may be in part due to sweet peptide fractions released during cell autolysis. One such fraction appears to be derived from heat shock proteins (Hsp12p) (Marchal et al. 2011), which is expressed from high temperature, ethanol, oxidative stress, and glycerol concentrations (Varela et al. 1995). All of these factors are present under winemaking conditions (Marchal et al. 2011). The breakdown of peptides can result in aromatic precursors in wines (Zoecklein 2005), but may also provide more nitrogen for spoilage organisms to consume. Many of these impacts of lees aging can be affected by winemaking practices, such as frequency of stirring, amount of lees present, amount of oxygen ingress, pectinase/glucosidase enzyme additions (such as Extralyse by Laffort), and perhaps even quality of lees. This study examines the impact of one such lees stirring regime on the chemical and sensory qualities of wine.

Results and Discussion

No major chemical differences could be observed between the finished wines. Wine tended to become more cold stable over time. Additionally, increased bentonite additions to become heat stable were necessary after aging.

Juice Chemistry

	Brix	pH	Ammonia (mg/L)	NOPA (mg N/L)	YAN (mg N/L)	Turbidity (NTU)
Juice Chemistry	20	3.62	32	223	255	215

Chemistry after Primary Fermentation

	Ethanol (%vol/vol)	Residual Sugar (g/L)	pH	Malic Acid (g/L)
Stirred Barrel	11.7	0.11	3.43	2.17
Stirred Plus Extralyse	11.7	0.11	3.46	2.17

Wine Chemistry

	Ethanol (%vol/vol)	Density (g/cm3)	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)
Stirred Barrel	12.1	0.9900	0	3.83	4.7	0.43	0.1	2.2	84.8	12.2
Stirred Plus Extralyse	12.0	0.9905	0	3.78	4.7	0.50	0.0	2.4	90.6	14.3

Lab Results from Enology Analytics from Early January, 2017

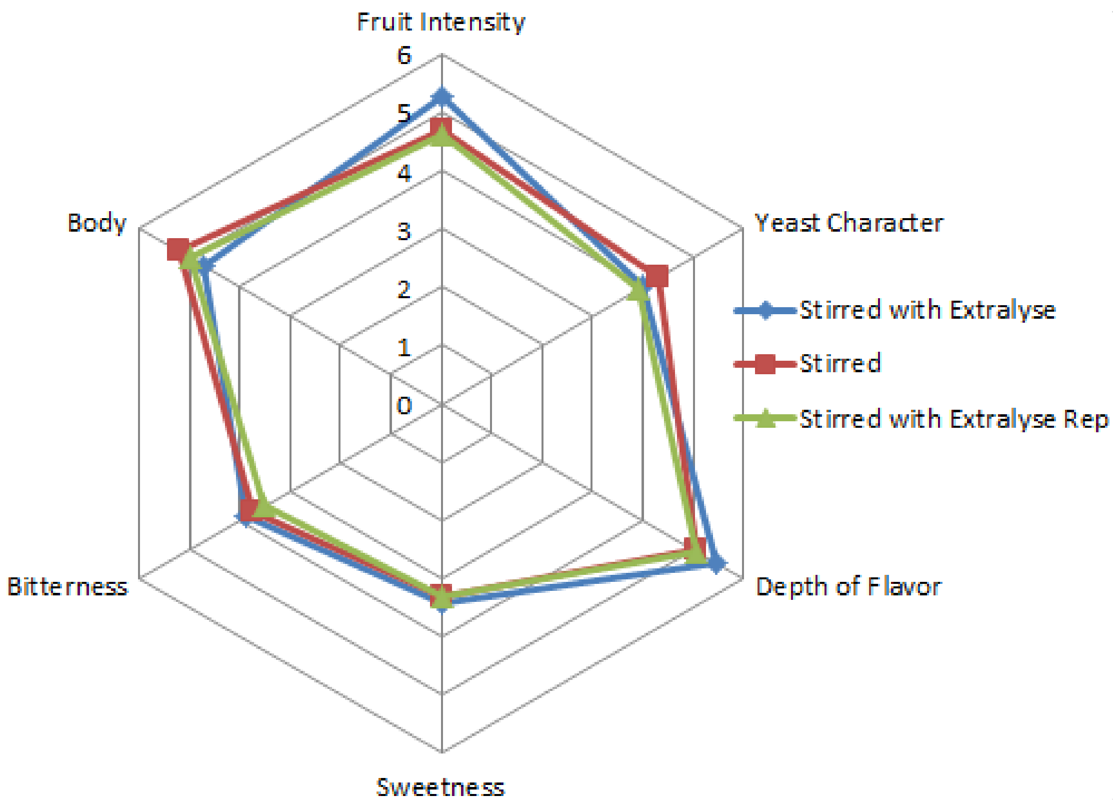
Stability before and after Stirring Regimes

	Cold Stability - DIT	Heat Stability - Bentonite Fining (pounds/1000 gallons)	Turbidity (NTU)
Before Stirring Regime	30.90%	1	2350
Stirred Barrel	12.80%	4	>5
Stirred Plus Extralyse	13.80%	4	>5

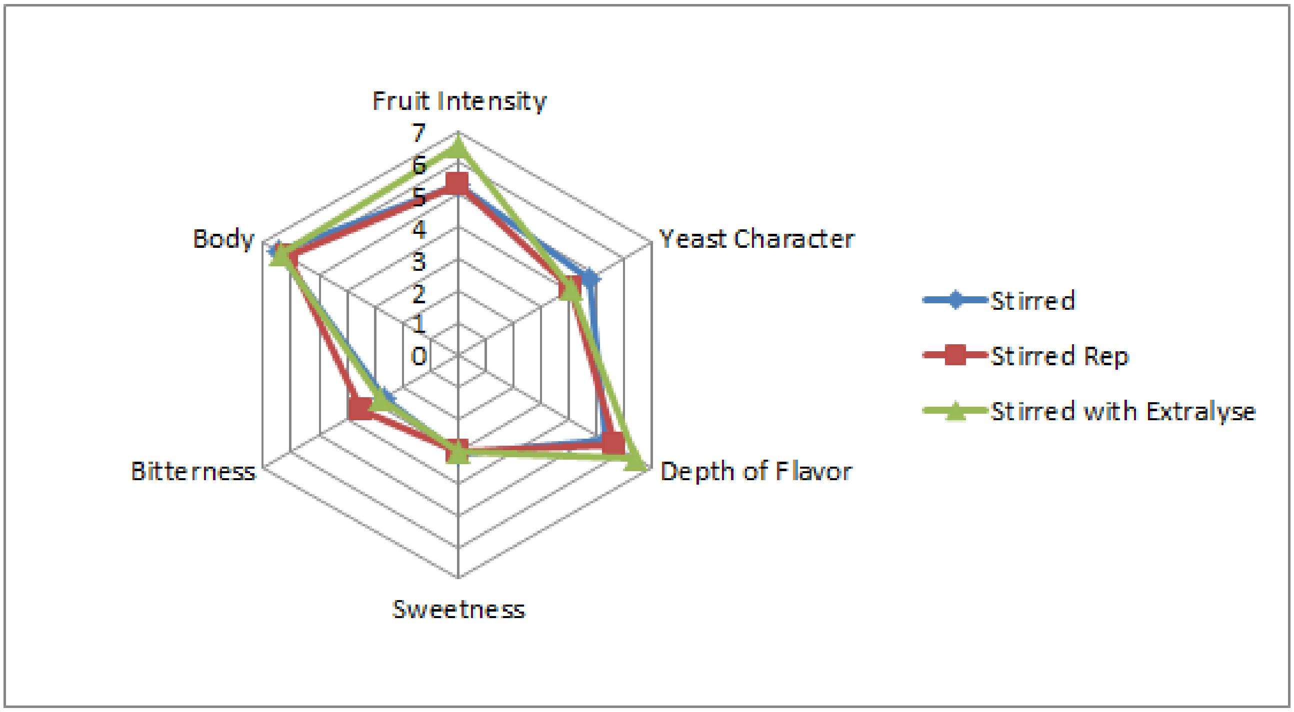
Lab Results from ETS and My Enologist from Early January, 2017

The wine was tasted at two different sensory sessions. In the January 25 session at Early Mountain Vineyards, of 37 people who answered, 13 people chose the correct wine (35%), and thus these wines were not significantly different. In general, there was a slight preference for the treatment with Extralyse by those who chose the correct wine. No strong trends were found between wines using the descriptors in this study.

	Stirred	Stirred with Extralyse	Total Votes
Most Preferred	40%	60%	10
Least Preferred	75%	25%	8



In the February 15 session at Williamsburg Winery, 7 out of 10 judges were able to correctly distinguish the stirred from the stirred wine with Extralyse, suggesting that these wines were significantly different ($p<0.05$). The wines were voted to have an average degree of difference of 3.1 (out of 10), suggesting that the difference between these wines was not great. Of those judges that correctly distinguished the wines, out of 6 votes 33% of judges preferred the stirred wine and 66% of judges preferred with stirred wine with Extralyse. However, this number of judges is very small. No strong trends were found between wines based on the descriptors used in this study. Stirring with Extralyse had a slight tendency to increase Fruit Intensity and Depth of Flavor.



In general, people often could not distinguish between stirring and stirring with Extralyse. When people could distinguish, there appeared to be a slight preference for wine made with Extralyse. The descriptors used generally did not help elucidate which qualities in wine were affected by stirring. There may be a small tendency for Extralyse to enhance Fruit Intensity and Depth of Flavor, but these were not significant in these studies. These results may have been enhanced if the stirring regime was allowed to continue for a longer period of time, or if panelists had been trained more rigorously in descriptors and had had more replications.

Methods

Approximately 1.83 tons of Chardonnay were sourced from the same vineyard on 8/24, refrigerated at 50°F, and were whole cluster pressed on 8/26 for approximately 1250L of juice. 50 mg/L of sulfur dioxide were added at processing. Bentonite (AEB Bentogran) was added at a rate of 30g/hL as the juice exited the press and was settled overnight at 35°F. Tartaric acid was added at a rate of 1g/L to bring pH into a range of 3.4-3.6. The morning after settling (8/27), the juice was racked off of sediment to another tank to ensure homogeneity. Juice was then racked into two identical barrels. Juice was allowed to warm to approximately 50°F and 15g/hL of EC1118 yeast was added to each barrel. Fermentation was monitored daily.

After alcoholic fermentation was complete (residual sugar as measured by enzymatic assay was 2g/L or less), samples were taken from each barrel for in-house post fermentation wine chemistry. Additionally, samples were taken for heat stability and cold stability analysis. Sulfur dioxide was added at a rate of 50mg/L. These samples were taken before Extralyse addition or initiation of the stirring regime. Extralyse was added at a dose of 8 g/hL to the second barrel and the stirring regime was started at 1 time per week for 45 seconds per barrel with a stainless steel barrel stirrer. Stirring was done by the same individual each time to ensure consistent and repeatable technique.

Post-Fermentation heat and cold stability were performed by ETS. All cold stability trials on finished wine was performed by My Enologist. All general wine chemistry on finished wine was performed by Enology Analytics. The rest of the results were gathered in-house. 8 weeks after Extralyse addition occurred (December 2016), samples were taken of all barrels for polysaccharide, protein heat stability, cold stability, basic chemistry, and sensory analysis.

For the triangle test and preference analysis for the January 25 tasting, anybody who did not answer the form were removed from consideration for both triangle, degree of difference, and preference. Additionally, anybody who answered the triangle test incorrectly were removed from consideration for degree of difference and preference. Additionally, any data points for preference which did not make sense (such as a person ranking a wine and its replicate at most and least preferred, when they correctly guessed the odd wine) were removed.

In order to balance the data set to perform statistical descriptive analysis on the January 25 tasting, any judge who had not fully completed the descriptive analysis ratings were removed. In order to then make the amount of judges between groups equivalent, two judges from group 2 were transferred to group 1, and then an extra judge was eliminated both from group 2 and group 3. This resulted in a final data set of 3 groups, each with 9 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, Yeast Character, Depth of Flavor, Sweetness, Bitterness, and Body.

The procedures for analyzing sensory analysis were the same for the February 15 tasting. In order to balance the data set for descriptive analysis, one judge was randomly moved from group 1 to group 3, to result in 3 groups each with 3 judges.

References

Chatonnet, P., Dubourdieu, D., and Boidron, J. N. 1992. Incidence des conditions de fermentation et d'èlevage des vins blancs secs en barriques sur leur composition en substances cèdèes par le bois de chêne. Sci. Aliments. 12:665–685.

Escot, S., Feuillat, M., Dulau, L., and Charpentier, C. 2001. Release of polysaccharides by yeasts and the influence of released polysaccharides on colour stability and wine astringency. Aust. J. Grape Wine Res. 7:153–159.

Feuillat, M. 2003. Yeast macromolecules: Origin, composition, and enological interest. Am. J. Enol. Vitic. 54:211-213.

Lavigne, V. and Dubourdieu, D. 1996. Demonstration and interpretation of the yeast lees ability to adsorb certain volatile thiols contained in wine. J. Int. Sci. Vigne Vin. 30:201–206.

Ledoux, V., Dulau, L., and Dubourdieu, D. 1992. Interprètation de l'amèlioration de la stabilitè protèique des vins au cours de l'èlevage sur lies. J. Int. Sci. Vigne Vin. 26:239–251

Llaubères, R.-M., Dubourdieu, D., and Villettaz, J.-C. 1987. Exocellular polysaccharides from *Saccharomyces* in Wine. J. Sci. Food Agric. 41:277–286.

Marchal, A., Marullo, P., Moine, V., and Dubourdieu, D. 2011. Influence of yeast macromolecules on sweetness in dry wines: role of the *Saccharomyces cerevisiae* protein Hsp12. Journal of Agricultural and Food Chemistry. 59:2004-2010.

Moine-Ledoux, V., Perrin, A., Paladin, I., and Dubourdieu, D. 1997. Premiers rèsultats de stabilisation tartrique des vins par addition de mannoprotèines purifièes (Mannostab). J. Int. Sci. Vigne Vin. 31:23–31.

Tominaga, T., Blanchard, L., Darriet, P., and Dubourdieu, D. 2000. A powerful aromatic volatile thiol, 2-furanmethanethiol, exhibiting roast coffee aroma in wines made from several *Vitis vinifera* grape varieties. J. Agric. Food Chem. 48:1799–1802.

Varela, J. C. S., Praekelt, U. M., Meacock, P. A., Planta, R. J., and Mager, W. H. 1995. The *Saccharomyces cerevisiae* HSP12 gene is activated by the high- osmolarity glycerol pathway and negatively regulated by protein kinase A. Mol. Cell. Biol. 15:6232–6245.

Zoecklein, B. 1991. Protein stability determination in juice and wine. Virginia Cooperative Extension. http://www.apps.fst.vt.edu/extension/enology/downloads/ProteinS.pdf.

Zoecklin, B. 2005. Lees Management. Enology Notes #106. http://www.apps.fst.vt.edu/extension/enology/EN/106.html.

Zoecklein, B. 2013. Nature of wine lees. Practical Winery and Vineyard. July. http://www.apps.fst.vt.edu/extension/enology/downloads/wm_issues/Nature%20of%20Wine%20Lees.pdf.