Color and Tannin Extraction and Stabilization in Red Winemaking (ARC)

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Summary

This study examines the impact of different tannin addition practices on the color and tannin profiles of Merlot wine. Merlot was harvested from the same block and split into three separate fermentation vessels. One vessel received no tannin or oak chip additions, a second vessel received 42g/hL VR Supra and 4.6g/100kg Lafase HE Grand Cru at processing and 32 g/hL VR Color during fermentation (ARC-Laffort Protocol), and a third treatment received 4.6g/100kg Lafase HE Grand Cru and 2g/L mini chips bois frais oak chips at processing. All other treatments between wines were equal. Wine chemistry between treatments were the same, except that the control tended to have slightly lower TA. Both treatments increased color intensity and tannin, with the Laffort-ARC protocol having the greatest impact. The treatments slightly increased catechin and gallic acid. The treatments tended to slightly lower anthocyanins, but increased polymeric pigment. No strong trends could be seen for the descriptors used in this study. There was a slight tendency for the control to have higher Fruit Intensity and lower Astringency. The Oak Chips + Grand Cru had a slight tendency to increase Body, Bitterness, and Overall Aromatic Intensity. However, these were weak trends. In general, the ARC-Laffort Protocol Treatment was the least preferred. Several judges described these wines as having slightly oxidized characteristics, and as such these sensory results may not be very representative. One judge had no preference.

Introduction

A significant quality parameter of red wines is the color and tannin content. Darker wines are perceived as higher quality and overall tannin concentration can impact mouthfeel, structure, stability, astringency and perception of overall quality of the wine. Numerous techniques have been shown to increase extraction of both color and tannins; however, stabilization of the extracted compounds can be elusive. Often oak chips, enological tannin, or even skins from other grapes are added to must prior to the onset of fermentation. It is thought that these additions may help prevent oxidation, enhance color stability, and enhance phenolic quality and mouthfeel. They may also ameliorate tannin problems from unripe or damaged fruit, increase the amount of tannin available to form polymeric pigment, and reduce vegetal aroma (Zoecklein 2005). Some authors have observed that exogenous tannin can both enhance the final concentration of anythocyanin in wine after 72 hours of fermentation (Giacosa et al. 2017). It is not clear from this study how stable this difference in wine is over time. These effects all depend on the source and kind of tannin (hydrolysable vs condensed tannin). All grape-derived tannin is condensed tannin, whereas hydrolysable tannin comes from oak wood or additives (Zoecklein 2005).

The timing of tannin addition will greatly impact the effect of these tannins, with earlier additions having less of an impact. Although pre-fermentation additions may help the exogenous tannin to integrate more fully with grape phenolics to form polymeric pigment, yeast cell walls will often bind tannin during precipitation, thus in effect “fining” tannin out of wine (Zoecklein 2000; Zoecklein 2005). Additionally, sometimes tannin addition can result in protein precipitation in must, causing a cascade of tannin precipitation which could actually result in lower tannin concentration in the finished wine (Steve Price, 2017, personal communication). In this trial the combination of a specific enzyme, Lafase HE Grand Cru, and joint application of two different fermentation tannin products, Laffort Tanin VR Supra (or

Elegance) and Tanin VR Color, were tested for the selective extraction and stabilization of both color and tannins in Merlot (ARC 2016). This will be compared to the winery's "house" protocol of oak chips and Lafase HE Grand Cru.

Results and Discussion

Wine chemistry between treatments were the same, except that the control tended to have slightly lower TA. Both treatments increased color intensity and tannin, with the Laffort-ARC protocol having the greatest impact. The treatments slightly increased catechin and gallic acid. The treatments tended to slightly lower anthocyanins, but increased polymeric pigment. No strong trends could be seen for the descriptors used in this study. There was a slight tendency for the control to have higher Fruit Intensity and lower Astringency. The Oak Chips + Grand Cru had a slight tendency to increase Body, Bitterness, and Overall Aromatic Intensity. However, these were weak trends. In general, the ARC-Laffort Protocol Treatment was the least preferred. Several judges described these wines as having slightly oxidized characteristics, and as such these sensory results may not be very representative. One judge had no preference.

Juice Chemistry

	Brix	pH	TA (g/L)	YAN (mg N/L)
Control	23.2	3.96	4.2	120
ARC Protocol	23.8	3.98	3.9	117
Oak Chip Treatment	23.1	3.90	4.0	113

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	13.10	<1	3.87	4.04	0.48	<0.15	0.88	37	15	0.20
ARC Protocol	13.29	<1	3.88	4.41	0.52	<0.15	0.94	33	15	0.19
Oak Chip Treatment	13.33	<1	3.79	4.62	0.49	<0.15	0.86	34	15	0.23

Lab Data from ICV in Late April

Color Profile

	A420	A520	A620	Hue (420/520)	Intensity (420 + 520)	Intensity (420 + 520 + 620)
Control	0.262	0.331	0.089	0.792	0.593	0.682
ARC Protocol	0.301	0.393	0.100	0.766	0.694	0.794
Oak Chip Treatment	0.283	0.391	0.092	0.724	0.674	0.766
% Change ARC Protocol	15%	19%	12%	-3%	17%	16%
% Change Oak Chip	8%	18%	3%	-9%	14%	12%

Lab Data from ETS in Early May

Phenolic Profile

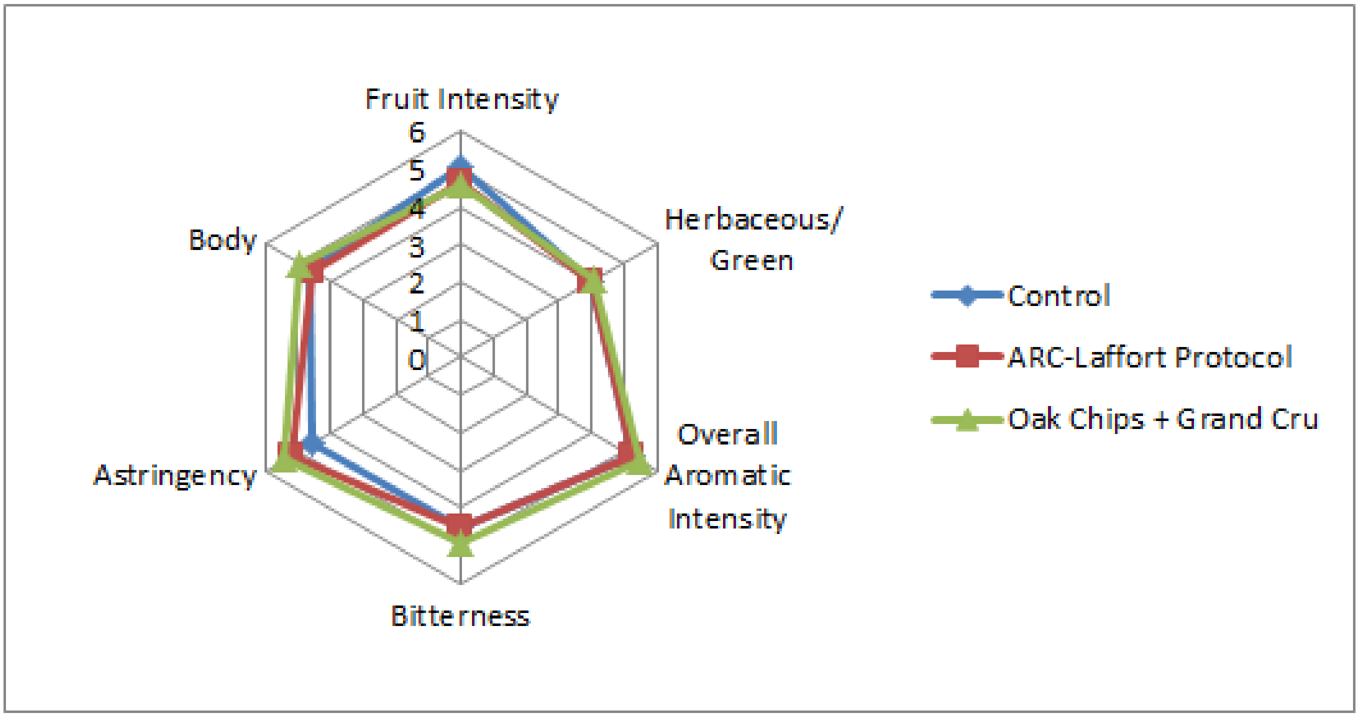
	Caffeic Acid (mg/L)	Caftaric Acid (mg/L)	Catechin (mg/L)	Epicatechin (mg/L)	Catechin:Tannin Ratio	Catechin:Epicatechin Ratio	Gallic Acid (mg/L)
Control	5	9	41	20	0.09	2.05	27
ARC Protocol	4	10	49	23	0.09	2.13	32
Oak Chip Treatment	4	10	46	19	0.09	2.42	30
% Change ARC Protocol	-20%	11%	20%	15%	0%	4%	19%
% Change Oak Chip	-20%	11%	12%	-5%	0%	18%	11%

Lab Data from ETS in Early May

Phenolic Profile

	Malvidin glucoside (mg/L)	Monomeric Anthocyanins (mg/L)	Polymeric Anthocyanins (mg/L)	Quercetin (mg/L)	Quercetin Glycosides (mg/L)	Tannin (mg/L)	Total Anthocyanins (mg/L)	Resveratrol (mg/L)
Control	129	224	24	<1	17	452	248	1.1
ARC Protocol	121	215	28	<1	21	567	243	1.0
Oak Chip Treatment	119	217	27	<1	21	494	244	1.0
% Change ARC Protocol	-6%	-4%	17%		24%	25%	-2%	-9%
% Change Oak Chip	-8%	-3%	13%		24%	9%	-2%	-9%

Lab Data from ETS in Early May



	Control	ARC-Laffort Protocol	Oak Chips + Grand Cru	Total Votes
Most Preferred	50%	8%	42%	12
Second Most Preferred	38%	38%	25%	8
Least Preferred	25%	50%	25%	8

Methods

Merlot was harvested on 9/26 and processed into 3 T Bins on 9/27. 5g/hL sulfur dioxide was added at processing, and the must was inoculated with FX10 at 5g/hL. On 9/28, 1.3g/L tartaric acid and 0.4g/L malic acid was added to the fermentation. On 10/2 10g/hL FX10 was added to the fermentations. 33g/hL of Fermoplus Permier Cru was added on both 10/4 and 10/6, and on 10/7 the fermentation was chaptalized with 9g/L sugar. The wines were pressed on 10/19, and on 11/1 the wines were stabilized with 6.6g/hL sulfur dioxide.

The wine with the ARC Color stability treatment was treated identically except for the following practices: 42g/hL VR Supra was added at processing, on 10/3 4.6g/100kg Lafase HE Grand Cru was added to the fermentation, and on 10/5 32g/hL VR Color was added.

The third treatment was a kind of "house protocol" that the winery follows, and was treated the exact same way as the control except that at processing (9/27) mini chips bois frais were added at 2g/L and on 10/3 Lafase HE Grand Cru was added at 4.6g/100kg.

In order to balance the data set to perform statistical analysis for descriptive analysis on the May 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 1 was transferred to group 3, and another judge from group 1 was eliminated. This resulted in a final data set of 3 groups, each with 4 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, Herbaceous/Green, Overall Aromatic Intensity, Bitterness, Astringency, and Body.

References

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