Whole Cluster Inclusion in Merlot Fermentations

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Summary

This study examines the impact of whole cluster inclusion on the sensory and chemical profile of Merlot. Merlot was harvested from the same vineyard block on the same day and processed identically except that one treatment was only 70% destemmed (not crushed) with the other 30% of fruit added as whole clusters. All other treatments were the same. Whole cluster inclusion did not affect wine chemistry, except for slightly increasing pH. Whole cluster inclusion lowered color intensity, anthocyanin content, quercetin, caftaric acid, and epicatechin. However, tannin and catechin content was slightly increased by whole cluster inclusion. Hue was also increased, due to the lower absorbance at 520. Judges found the wines to be significantly different ($p<0.01$), but no real preference trends could be seen between treatments. 30% whole cluster inclusion tended to score slightly higher in all attributes except for Fruit Intensity and Astringency, where it was the same as 0% whole cluster inclusion. However, the differences for these descriptors were very small, and more studies are needed to identify in what ways the wines can be described as different.

Introduction

The role of whole cluster and stem inclusion in winemaking is very controversial. Whole cluster fermentation is often used in Burgundian Pinot noir and is thought to add complexity to the wine (Weston 2000). Whole clusters are thought to round out and complement the low tannin in Pinot noir, and the flavors of Syrah can be complemented by stems (Meisner 2016). However, whole cluster inclusion also results in stems being added to the wine. Stems can enhance structure and wine quality sometimes, but also can add vegetal aromas (Ribèreau-Gayon et al. 2006). In certain cases, these vegetal aromas can also be perceived as spicy, and may act as a counterbalance to overly fruity qualities. Vegetal aromas and tannin additions may also balance out some carbonic maceration character which is found in whole cluster inclusion, which enhances ester aromatics, extends fermentation after pressing, and reduces the contribution of seed tannin. Stem inclusion is less common for Bordeaux varieties because of their already high levels of pyrazine (Meisner 2016). The reticence to use stems due to pyrazine characteristics in certain varieties is likely unfounded, due to cultural practices and climatic conditions which can greatly lower pyrazine character. Stems tend to lower alcohol content, decrease titratable acidity, and increase pH (due to high potassium levels). Stems can contribute a large amount of tannin to wine. Additionally, stems tend to decrease color intensity by adsorbing anthocyanins (Ribèreau-Gayon et al. 2006; Reshef et al. 2016). Finally, wines made with stem inclusion tend to have higher color stability over time (Ribèreau-Gayon et al. 2006). These results vary, however (Ribèreau-Gayon et al. 2006), and are dependent on many other factors, such as extraction kinetics, maceration practices, the level of crushing in the grapes, grape variety, and possibly stem maturity. Whole cluster and stem inclusion require much more thorough study before any hard conclusions can be drawn. This study examines the impact of whole cluster inclusion on Merlot wine.

Results and Discussion

Whole cluster inclusion did not affect wine chemistry, except for slightly increasing pH. Whole cluster inclusion lowered color intensity, anthocyanin content, quercetin, caftaric acid, and epicatechin.

However, tannin and catechin content was slightly increased by whole cluster inclusion. Hue was also increased, due to the lower absorbance at 520. These results generally conform to what is classically found with stem inclusion (Ribèreau-Gayon et al. 2006; Reshef et al. 2016).

Juice Chemistry

	Brix	pH	TA (g/L)
Juice	21.3	3.88	2.9

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)
0% Inclusion	12.9	1.4	3.62	4.7	0.43	0.2	0.9	37.3	16.9
30% Inclusion	13.2	1.2	3.67	4.8	0.46	0.2	0.8	39.8	14.7

Lab Results from Enology Analytics from Late January, 2017

Color Profile

	A420	A520	A620	Hue (420/520)	Intensity (420 + 520)	Intensity (420 + 520 + 620)
0% Inclusion	0.198	0.293	0.050	0.676	0.491	0.541
30% Inclusion	0.198	0.263	0.050	0.753	0.461	0.511
30% Inclusion % Change	0%	-10%	0%	11%	-6%	-6%

Lab Results from ETS from Late January, 2017

Phenolic Profile

	Caffeic Acid (mg/L)	Caftaric Acid (mg/L)	Catechin (mg/L)	Epicatechin (mg/L)	Catechin: Epicatechin Ratio	Catechin: Tannin Ratio	Gallic Acid (mg/L)
0% Inclusion	2	9	15	18	0.83	0.04	25
30% Inclusion	2	8	23	17	1.35	0.05	32
30% Inclusion % Change	0%	-11%	53%	-6%	63%	25%	28%

Lab Results from ETS from Late January, 2017

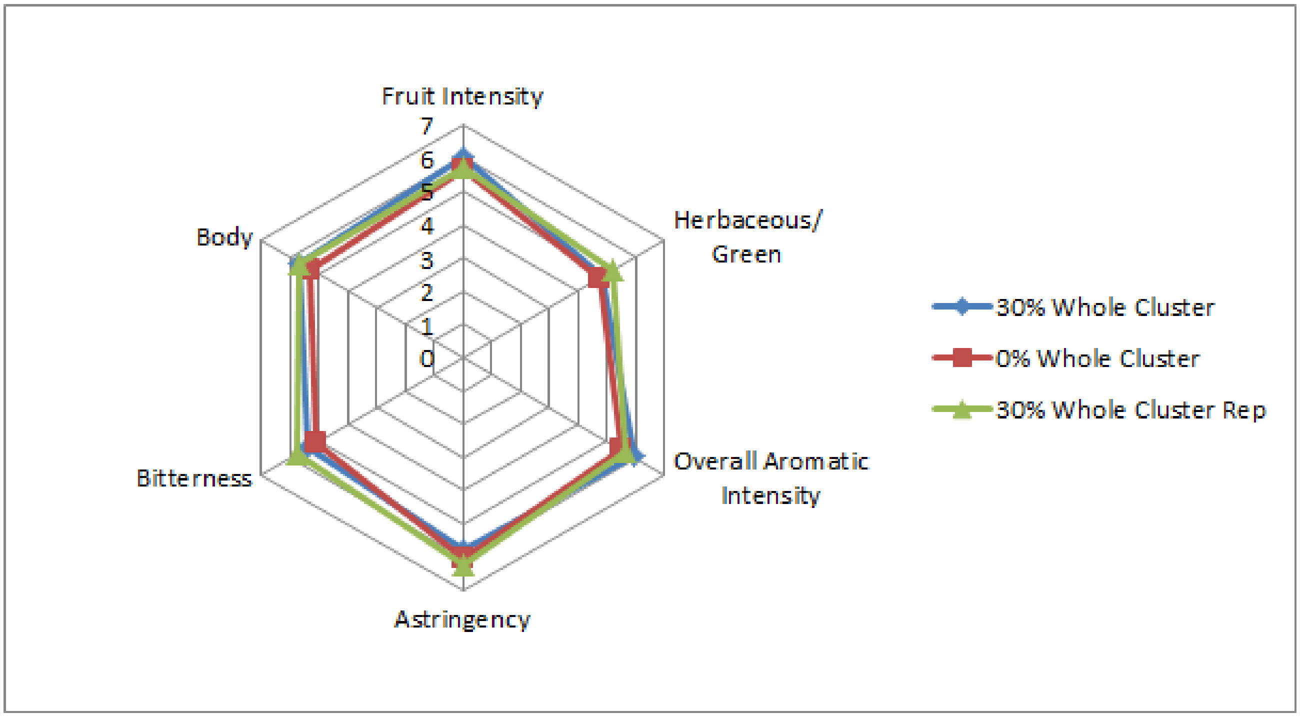
Phenolic Profile

	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)
0% Inclusion	97	156	22	<1	18	407	178	0.3
30% Inclusion	77	120	20	<1	14	433	140	0.3
30% Inclusion % Change	-21%	-23%	-9%		-22%	6%	-21%	0%

Lab Results from ETS from Late January, 2017

For the triangle test, of 30 people who answered, 18 people chose the correct wine (60%), showing a statistically significant difference between wines ($p<0.01$). These wines were voted to have an average degree difference of 4.5 (out of 10), suggesting that the wines were moderately different. In general, no real preference trends could be seen for those who answered correctly. No major trends could be seen with the descriptors used in this study. 30% whole cluster inclusion tended to score slightly higher in all attributes except for Fruit Intensity and Astringency, where it was the same as 0% whole cluster inclusion. However, the differences for these descriptors were very small, and more studies are needed to identify in what ways the wines can be described as different.

	0% Inclusion	30% Inclusion	No Preference	Total
Preferred	33%	44%	22%	18



Methods

4.33 tons of MT Merlot was harvested on 10/6/2016 and destemmed and crushed into 2 T-Bins in the following treatments:

1) T bin 1 - 100% of the fruit was de-stemmed but not crushed
2) T bin 2 - 70% of the fruit was de-stemmed but not crushed; 30% (by wt)added as whole clusters

Each treatment received 3g/hL sulfur dioxide during crush along with 0.25kg/ton mini chips bois frais. All three treatments were inoculated with Fermol Premier Cru. On 10/9, 1g/L tartaric acid and 0.22 g/L malic acid was added to each treatment. On 10/10, 6g/hL Lafase HE Grand Cru was added to each treatment. On 10/11, 17g/hL Fermaid K was added. On 10/13, 22g/L sugar was added to each treatment.

All treatments were pressed on 10/24 to ensure equal maceration times between treatments. These were then racked off lees into identical neutral barrel on the same day. On 11/16 the wines were stabilized with sulfur dioxide.

This project was tasted on March 15. For the triangle test and preference analysis, 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 analysis for descriptive analysis, 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, one judge from group 3 was eliminated. 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). A three way, pseudo-mixed analysis of these interactions was not used to further verify whether the wine result was truly significant. The descriptors used in this study were Fruit Intensity, Herbaceous/Green, Overall Aromatic Intensity, Astringency, Bitterness, and Body.

References

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