The Impact of Increased Ethanol Concentration through Chaptalization on the Chemical and Sensory Properties of Malbec (2019)

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Summary

Even in good years in Virginia (such as 2019), some varieties, such as Merlot and Malbec, stall in Brix accumulation but still present other markers of maturity (varietal character, ripe seeds and tannins). The purpose of this study was to examine the effect of chaptalization in Virginia Malbec. At the time of harvest, fruit was divided evenly and randomly between two chaptalization regimes (1) no chaptalization (2) chaptalization of 40 g/L (increase in alcohol of 2.2%). All other cellar operations were the same between treatments. Fruit was harvested with 20.5°Brix, a pH of 3.56 and TA of 6.2 g/L. Chaptalization led to an increase in 1.75% actual alcohol. This is less than the predicted 2.2% increase in potential alcohol (based on 18 g/L for 1% increase). There were no other large differences in chemistry, color, or phenolic compounds between treatments. Sensory impressions by the winemaker and research coordinator indicated that the chaptalization led to decreases in herbal/green character and increased body, aromatic and fruit intensity. Specifically, the chaptalized Malbec wine had a perception of riper, darker fruit, and better expression of varietal character.

Introduction

The 2018 growing season was fraught with consistent and sometimes heavy rainfall throughout the state of Virginia. Some localities reported more than 80 inches of rain in 2018, leading to the wettest year on record for many cities and counties[1]. Through diligent work in the vineyard, many wineries were still able to harvest a crop, however these grapes came in with notably lower sugar accumulation. Winemakers in Virginia began to wonder how much a low Brix wine can be chaptalized before becoming unbalanced. Anecdotally, several winemakers had been trained that the limit for chaptalization was two degrees of alcohol while others had been trained 1.5 degrees was the limit (perhaps reflecting their region of training). The 2018 vintage forced sugar additions up to 3 degrees of alcohol with surprisingly acceptable results, challenging the assumptions of many local winemakers.

Increasing alcohol through chaptalization has several effects on the finished wine. The concentration of alcohol affects the chemical stability of the wine (acting as an antimicrobial agent). The viscosity of alcohol adds weight to the palate[2], it volatilizes fruit aromas[2], augments the production of glycerol, succinic acid, and esters[3]. Previous work by Sherman et al[4] tested the effects of ethanol concentration on chemical and sensory properties of wines harvested at three levels of ripeness in Washington State Merlot. In an elegant experimental design, they

harvested the same block at three intervals: underripe, ripe, and overripe. For each harvest, they broke the grapes into three treatments and used either chaptalization (to raise the Brix) or saignée and watering back with acidulated water (to lower Brix) so that they could compare chemistry and sensory responses for wines of each harvest interval with each resulting alcohol concentration. They found that there were expected differences in chemistry between wines from different harvest dates, however, adjustments for ethanol "had a greater effect on wine sensory properties than fruit maturity" Specifically, "wines made from ripe (24° Brix) or overripe fruit adjusted to low ethanol concentrations were described similarly to wines made from unripe fruit" including green and sour, and "wines made from unripe or ripe fruit adjusted to high ethanol concentrations were described similarly to wines made from overripe fruit" including descriptors such as red fruit and flora. They conclude that "wine ethanol concentration is more important for the sensory profiles of wines than is fruit maturity at harvest."

Even in good years in Virginia (such as 2019), some varieties, such as Merlot and Malbec, stall in Brix accumulation but still present other markers of maturity (varietal character, ripe seeds and tannins). Malbec is not listed in the Wine Grape Production Guide[5] as a recommended variety for Virginia. This variety quickly deteriorates as it nears ripeness, often showing slip skins prior to adequate Brix accumulation. When harvested, these wine are often thin and sometimes vegetal or sharp. Despite this drawback, more than 50 acres are reportedly planted in the Virginia,[6] and the variety is often used in blending Meritage wines. The purpose of this study was to examine the effect of chaptalization in Virginia Malbec.

Methods

At the time of harvest, fruit was divided evenly and randomly between two chaptalization regimes (1) no chaptalization (2) chaptalization of 40 g/L (increase in alcohol of 2.2%). All other cellar operations were the same between treatments. Fruit was hand harvested (on 10/5) and refrigerated overnight prior to destemming and lightly crushed with addition of 45 ppm SO_2 and 20 g/hL Stab Micro M (Enartis). Fermentations were inoculated with the same well mixed vineyard starter culture. Chaptalization was done on the fourth day of fermentation. Each treatment bin was punched down twice per day. Brix and temperature were checked daily. Wine was pressed on 10/16, after 11 days of maceration. Wine was settled overnight then racked to barrels for malolactic fermentation with the addition of 0.75 g/L tartaric acid. The progress of malolactic fermentation was checked every week with paper chromatography and completion confirmed with enzymatic analysis. At the completion of malolactic fermentation, 0.5 g/L tartaric acid, 40 ppm SO_2 and and 3 g/hL chitosan (Stab Micro) were added to each barrel with no racking.

Results

Fruit was harvested with 20.5°Brix, a pH of 3.56 and TA of 6.2 g/L. Both treatment lots finished with <1.2 g/L glucose/fructose and <0.15 g/L malic acid and, at the time of analysis, free SO_2 levels were within 3 ppm (data not shown). Chaptalization led to an increase in 1.75% actual alcohol. This is less than the predicted 2.2% increase in potential alcohol (based on 18 g/L for 1% increase). There were no other large differences in chemistry, color, or phenolic compounds between treatments (Tables 1&2, Figure 1). Due to social distancing restrictions during COVID-19, this experiment did not undergo blind sensory analysis. Sensory impressions by the winemaker and research coordinator indicated that the chaptalization led to decreases in herbal/green character and increased body, aromatic and fruit intensity. Specifically, the chaptalized Malbec wine had a perception of riper, darker fruit, and better expression of varietal character. These observations are consistent with the findings of blind sensory analysis in a separate experiment of chaptalization in Merlot.

Table 1: Wine chemistry for two treatments of Malbec (ICV labs)

	Alcohol (%)	pH	Titratable Acidity (g/L)	Volatile Acidity (g/L)
Control	11.42	3.77	4.62	0.69
S40	13.16	3.71	4.84	0.77

Figure 1: Color intensity for two treatments of Malbec (ICV labs)

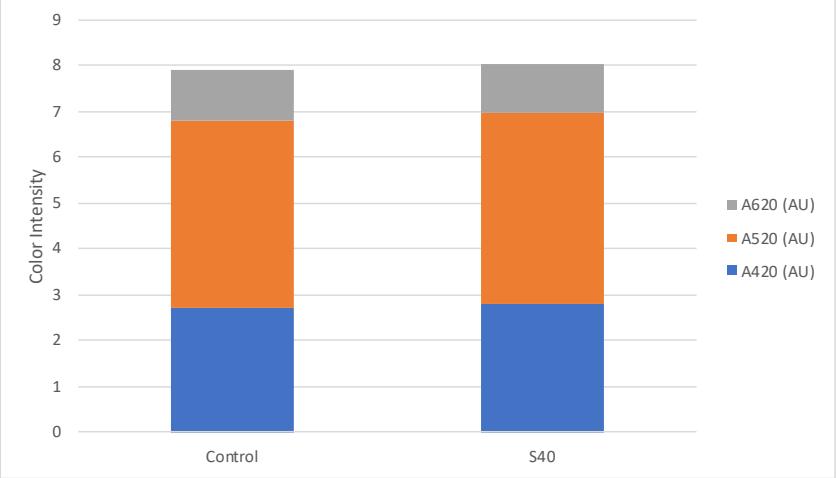

Table 2: Phenolic compounds for two treatments of Malbec (mg/L) (ETS labs)

	Polymeric Anthocyanins	Total Anthocyanins	Catechin	Tannin
Control	36	399	9	450
S40	40	359	8	499

References

(1) Wood, V.; Custer, S.; Watson, K.; Alper, D. Virginia 2018 Commercial Grape Report. 11.

(2) Sogg, D. Inside Wine: Chapitalization When Augmenting Alcohol, It's a Matter of Degree. *Wine Spectator*, 2003.

(3) Jackson, R. S. *Wine Science: Principles and Applications*, 4th edition.; Academic Press: Amsterdam, 2014.

(4) Sherman, E.; Greenwood, D. R.; Villas-Boâs, S. G.; Heymann, H.; Harbertson, J. F. Impact of Grape Maturity and Ethanol Concentration on Sensory Properties of Washington State Merlot Wines. *Am J Enol Vitic.* 2017, *68* (3), 344–356. https://doi.org/10.5344/ajev.2017.16076.

(5) Wolf, T. K. *Wine Grape Production Guide for Eastern North America*; Plant and Life Sciences Publishing: Ithaca, New York, 2008.

(6) SMS Research Advisors. 2019 Virginia Commercial Grape Report. 2020.