

Comparing fermentation techniques in Petit Manseng

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Summary

Virginia has the second largest acreage of Petit Manseng in the world². It is a good fit for Virginia due to its loose clusters, thick skins, and resistance to bunch rots¹. This variety exhibits high acidity even at harvest, along with rapid accumulation of sugar. The aim of this study was to explore skin fermentation as a means to achieve balance in a dry style Petit Manseng. The same lot of grapes was processed three ways: overnight skin contact with pressing prior to fermentation, fermentation on skins in a Tbin, and fermentation on skins in a cocchiopesto amphora. Fermentation on skins in both vessels was faster and hotter than the tank fermentation of pressed juice. Skin fermented wine had notably lower alcohol than tank fermented wine. Tbin and cocchiopesto wines finished fermentation with notably higher pH and A420 (browning). These wines had lower malic acid and higher lactic acid, indicating the activity of malic acid bacteria. Skin fermented wines also exhibited higher levels of volatile acidity and phenolics. Blind sensory analysis by wine producers indicated a preference for the tank fermented wine, with significantly higher scores for balance and varietal character in the tank wine. The skin fermented wines had significantly higher scores for bitterness and astringency. Skin fermentation, either in Tbin or cocchiopesto amphora shifts the balance of pH much higher and reduces alcohol, however, these wines also have unpleasant levels of volatile acidity, bitterness and astringency.

Introduction

Petit Manseng originates from the Jurançon region of Southwest France, where it is predominantly made in sweet and off-dry styles, often in blends with Gros Manseng and other varieties¹. The second largest acreage of Petit Manseng in the world is in Virginia², where it is favored for its loose clusters, thick skins, and resistance to bunch rots¹. This variety exhibits high acidity even at harvest, along with rapid accumulation of sugar. This chemical profile lends itself easily to desert style wines, however, many winemakers are seeking to make this wine in a style that is less sweet. The balance of acidity and alcohol from high Brix grapes leads to challenges in fermenting Petit Manseng to dryness, however this chemistry is seen has having potential to produce a full bodied, ageable dry white wine.

One approach for balancing the acidity of Petit Manseng has several hours of pre-fermentation skin contact of crushed and destemmed grapes.. The pH of the juice decreases as potassium from the skins complexes with tartaric acid to precipitate out of solution. Some phenolic extraction is also likely during this maceration. The juice fermented in tank in this experiment was subject to overnight skin contact prior to pressing.

Fermentation on white grape skins is traditional in regions such as Georgia, where white grapes are fermented in Qvevri, a form of amphora. These vessels are buried in the ground to moderate temperature, and the resulting wines are amber in color³. Diaz et al (2013) surveyed 15 European wine varieties made in both conventional and qvevri styles and compared the resulting chemistry. Qvevri wines had much higher pH, with ranges of 3.6-4.3 and a mean of 3.8 compared with 3.0-3.4 in conventionally made wines. Qvevri wines also had much lower tartaric acid (0-2.6 g/L) compared with 2.3-3.5 g/L in conventionally made wines. Many of these wines had undergone malolactic fermentation, as evidenced by very low levels of malic acid and higher levels of lactic acid. Qvevri wines also had higher phenolic content, presumably due to skin contact and high acetic acid (0.8 g/L on average). High acetic acid is attributed to longer maceration times as well as oxidative conditions during juice handling³.

The aim of this study was to explore the effects of skin fermentation on the style of dry Petit Manseng and to honor the tradition of amphora style winemaking. Three fermentation techniques were utilized: overnight skin contact prior to pressing then fermentation, skin fermentation in T Bin, skin fermentation in cocchiopesto amphora.

Methods

Grapes were harvested on September 20 and refrigerated overnight. Grapes were destemmed and crushed the next day with the addition of 40 ppm SO₂. Three treatments were pursued:

- (1) Tank: One third of the grapes were crushed to TBins, held overnight in a refrigerated trailer, then pressed to tank the following day. Juice was cold settled overnight then racked to a temperature controlled tank for fermentation. Fermentation was monitored daily. After completion of fermentation, 45ppm SO₂ was added and wine was racked to neutral barrels for storage.
- (2) Tbin: One third of the grapes were crushed to TBin then inoculated and allowed to ferment on skins in the TBin with one gentle punchdown per day. After completion of fermentation the TBin was gassed and sealed to prevent oxidation until pressing. The TBin was drained on December 6. Only free run juice was used for the experiment. After draining, 1 g/L tartaric acid and 45 ppm SO₂ were added.
- (3) Cocchiopesto: One third of grapes were crushed to a cocchiopesto amphora, inoculated and allowed to ferment on skins in the amphora. At the end of fermentation, the amphora was gassed and sealed until pressing on December 6. Only free run juice was used for this experiment. After draining, 1 g/L tartaric acid and 45 ppm SO₂ were added.

Each treatment was inoculated with 25 g/hL ICV D47 (Scottlabs, Lallemand) rehydrated in 6 g/hL Fermoplus Energy Glu (AEB) and received 30 g/hL Actimax Naturae nutrient (Agrovin) at ½ brix depletion.

Sensory analysis was completed by a panel of 29 wine producers. Wines were presented blind in randomly numbered glasses. Tasters were presented with three wines, one of each fermentation treatment, and asked to rank the wine by preference with 1=most preferred and 3=least preferred. There were three tasting groups with three different tasting orders for these wines. Tasters were then asked to score each wine on a scale of 0 to 10 for the perception of acidity, bitterness, astringency, Petit Manseng varietal character, and overall balance. They were also given open ended questions to describe the wines. Preference test was evaluated using a Friedman's Test. Descriptive scores were analyzed using repeated measures ANOVA.

Results

Juice chemistry for each fermentation vessel can be found in Table 1. Malic acid was measured on the pressed juice only. There was 4.92 g/L malic acid at the beginning of fermentation. The pH and TA of these vessels differed slightly, however these differences could be due to the fact that the juice in the tank fermentation had already undergone a pressing operation while the other 2 tanks had not yet been pressed, meaning these differences are inherent to the protocol being tested rather than differences in original fruit.

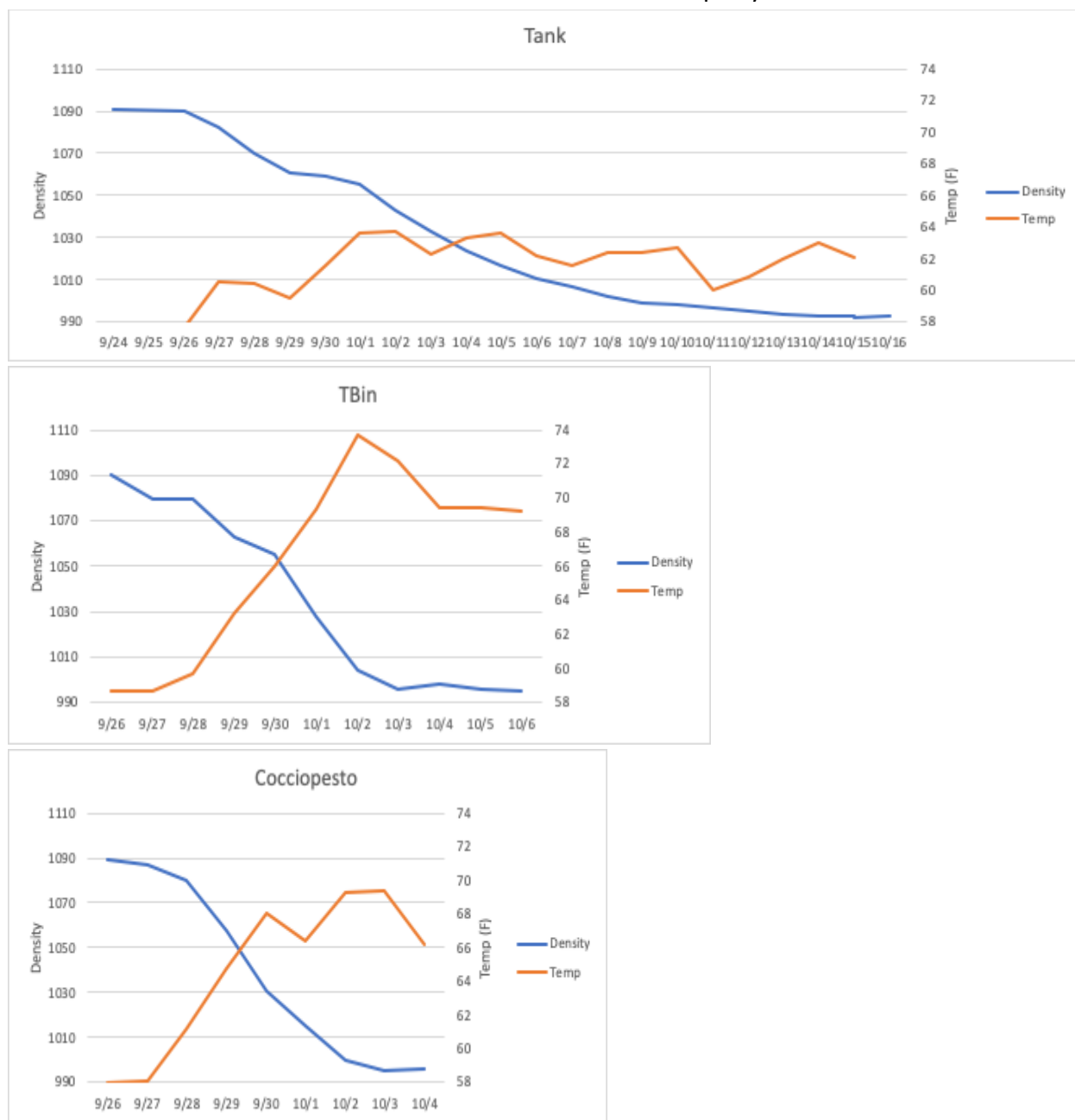
Table 1: Juice chemistry for three treatments of Petit Manseng (in-house data)

	Brix	pH	TA (g/L)	YAN (mg/L)
Tank	21.8	3.47	5.17	184
TBin	21.8	3.39	3.87	
Cocciopesto	21.3	3.39	3.87	185

Fermentation curves for the three treatments can be found in Figure 1. Fermentation proceeded more quickly in TBin and cocciopesto, finishing on October 3, when compared to tank, which finished on October 16. The TBin fermentation saw the highest fermentation temperature of 73.7°F. Maximum temperature in the cocciopesto was 69.4°F while the tank temperature was 63.7°F.

Finished wine chemistry for the three wines can be found in Table 2. Skin contact wines had higher pH after fermentation than tank fermentation. After pressing, TBin and cocciopesto wines received 1 g/L tartaric acid while wine fermented in tank did not need this addition. Skin fermented wines also had lower malic acid and higher lactic acid as well as higher acetic acid. Each of these trends is consistent with the results found by Diaz et al (2013). The skin fermented wines also had a full degree lower alcohol than the tank fermented wine. This may be in part due to the effect of higher temperature in the fermentations that occurred in the presence of skins.

Figure 1: Fermentation kinetics for three treatments of Petit Manseng. Figures are arranged so that time on the X axis is scaled equally.



Absorbance at 420 nm is a measure of browning in white wines. Wines fermented on skins had higher levels of browning, which was also visually apparent. This is likely due to higher amounts of phenolic extraction as well as oxidative conditions during fermentation and extended maceration. White wine phenolics (Table 3) show higher level of pulp phenolics (caftaric acid, Grape Reactive Product) in the tank fermented juice while seed phenolics were

much higher in the skin contacted wines. These levels are still below threshold for bitterness. For example, the threshold for bitterness from catechin is 200 mg/L and quercetin glycosides is 30 mg/L. Tannins are also elevated in the skin fermented wines. White wines have an average of 10 mg/L tannin while red wines have an average of 750 mg/L. These wines are in between these values.

Table 2: Finished wine chemistry for three treatments of Petit Manseng (ICV, Feb 2019)

	pH initial	pH final	TA (g/L)	RS (g/L)	Alc (%)	MA (g/L)	Lactic (g/L)	VA (g/L)	A420
Tank	3.61	n/a	5.54	<1	13.11	2.69	<0.15	0.26	0.19
TBin	4.2	3.82	5.49	<1	11.9	0.27	2.09	0.82	0.67
Cocciopesto	4.1	3.82	5.42	<1	12	0.51	1.94	0.75	0.55

Table 3: White wine phenolic panel for three treatments of Petit Manseng. All metrics are measured in mg/L (ETS, Feb 2019)

	Pulp and skins		Skins		Seeds		Tannin
	Cafftaric Acid	Grape Reactive Product	Quercetin Glycosides	Astilbin	Catechin	Gallic Acid	
Tank	43.5	9.5	<0.2	2.4	1.2	2	23.4
TBin	14.7	1.3	2	11	45.9	26.8	171.4
Cocciopesto	17.3	2.1	1.7	10.8	44.7	25.3	142

When 29 wine producers were presented with these wines and asked to rank them in order of preference, with 1 indicating most preferred and 3 indicating least preferred, the wine fermented in tank was significantly preferred over the Tbin and cocciopesto wines ($Q = 13.66$, $P = 0.001$) (Figure 2). There was no significant difference in preference between the TBin fermented wine and the wine fermented in the cocciopesto.

When asked to score these wines for specific descriptors, wine producers gave the Tbin and cocciopesto wines higher scores for bitterness and astringency and lower scores for Petit Manseng character and overall balance relative to tank fermented wines (Figure 3, Table 4). There were no significant differences in perception of acidity among the wines. In group discussion following sensory analysis, winemakers remarked that, in their experience, skin contact white wines needed time to age in order to soften the astringency and bitterness

common with this technique. However, with higher levels of volatile acidity and higher pH, longer aging time includes risk.

Figure 2: Mean Preference of wine producers were 1=most preferred and 3= least preferred

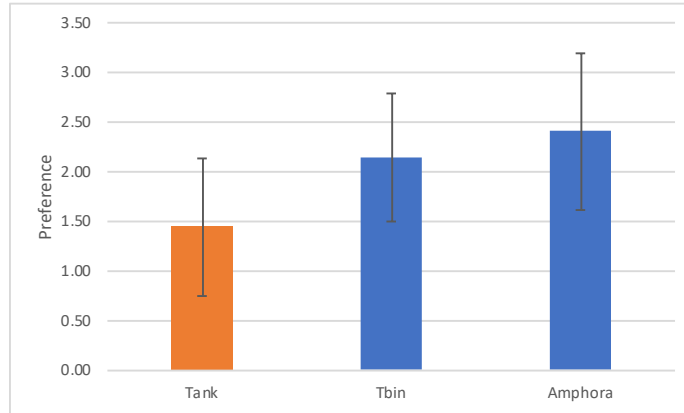


Figure 3: Mean scores for specific descriptors in blind tasting. Error bars represent standard deviation.

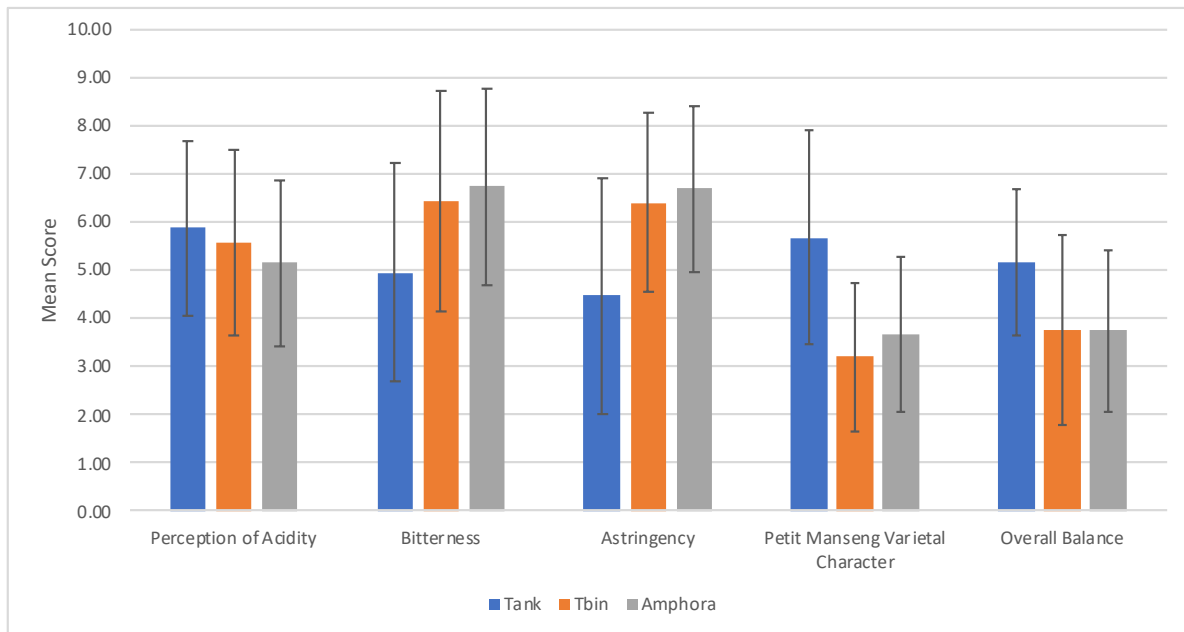


Table 4: Statistical analysis of sensory descriptors using repeated measures ANOVA

	F	P
Perception of Acidity	2.33333	0.10397
Bitterness	8.5094	0.0005
Astringency	14	< 0.0001
Petit Manseng Varietal Character	17	< 0.0001
Overall Balance	8.7038	0.0004

Conclusions

Skin fermentation of white wines is a traditional approach in some Eastern European wine growing regions. Skin fermentation was employed here to determine if this approach would be a desirable style for dry Petit Manseng. The appeal of this approach would be the expected moderation of acidity and alcohol. However, skin fermentation also led to unpleasantly high levels of volatile acidity, astringency and bitterness along with loss of aromas and flavors associated with Petit Manseng varietal character. It is possible that longer aging time will moderate the sensory effects of phenolics, reducing bitterness and astringency, however volatile acidity is likely to continue to rise with longer aging.

References

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- (3) Díaz, C.; Laurie, V. F.; Molina, A. M.; Bücking, M.; Fischer, R. Characterization of Selected Organic and Mineral Components of Qvevri Wines. *Am J Enol Vitic.* 2013, *64* (4), 532–537. <https://doi.org/10.5344/ajev.2013.13027>.