18-053 Using yeast to de-acidify Petit Manseng

Walsh Family Wine
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Abstract

Petit Manseng is a white fruited variety of *Vitis vinifera* that originated in the Pyrenees-Atlantiques of Southern France and has its largest plantings in the Jurançon (Tablas Creek a). Petit Manseng was introduced to Virginia by Dr. Tony Wolf in 1987 and has become popular among producers for its loose clusters, thick skins, and resistance to bunch rots (Wolf 2008). In Virginia, a growing number of winemakers are exploring dry Petit Manseng as a varietal table wine, however, the high sugar and high acidity characteristics of this grape variety can be a challenge for dry wines. In the present study a side by side comparison was done of wines produced by D47 yeast and Anchor Exotics SPH yeast. Product information indicated Anchor Exotics can consume malic acid during fermentation via the malo-ethanolic pathway. D47 yeast produced Petit Manseng wine with lower pH, higher acidity, and lower volatile acidity than Anchor Exotics SPH yeast. Anchor Exotics SPH yeast consumed 26% of the malic acid in the juice during primary fermentation. One of the two barrels inoculated with this yeast also showed signs of malolactic fermentation. In a triangle test, tasters were able to discriminate between the wines. Though descriptors for aromatic intensity, perception of acidity and overall balance were not significantly different, open ended questions revealed a difference in perception of acidity by some tasters. Discussion after the wines were identified indicated there is a difference in preference based on acidity. Some winemakers considered high acidity a desirable part of the varietal character of Petit Manseng while others felt the opposite.

Introduction

Petit Manseng is a white fruited variety of *Vitis vinifera* that originated in the Pyrenees-Atlantiques of Southern France and has its largest plantings in the Jurançon (Wolf 2008, Tablas Creek a). In its home region, it is most often made as an off dry or dessert wine, often blended with Gros Manseng. These wines are described as having unique fruity and spicy aromas such as pineapple, peach, melon, grapefruit, nutmeg, honey, wildflowers, box tree, and roasted coffee bean (Gardiner et al 2017). Notable levels of thiols (Tominaga et al 2000) and esters (Antalik et al 2014) have been measured in wines made from Petit manseng grapes and contribute to these descriptors.

Petit Manseng was introduced to Virginia by Dr. Tony Wolf in 1987 as part of vineyard variety trials and has become popular among grape growers for its loose clusters, thick skins, and resistance to bunch rots (Wolf 2008). In the last 30 years, popularity has grown such that Virginia now boasts the second largest planting of Petit Manseng in the world with more than 62 acres of Petit Manseng are planted around the state (Wood et al 2018).

In Virginia, a growing number of winemakers are exploring dry Petit Manseng as a varietal table wine, however, the high sugar and high acidity characteristic of this grape variety can be a challenge for dry wines. In a survey of past vintages, Tablas Creek surveyed brix and pH at harvest (Table 1). When

potential alcohol is calculated with a conservative conversion rate of 0.55 degree/degree Brix, it is evident the wines produced from these grapes, if fermented to dryness could be out of balance.

Table 1: Tablas Creek Petit Manseng chemistry at Harvest

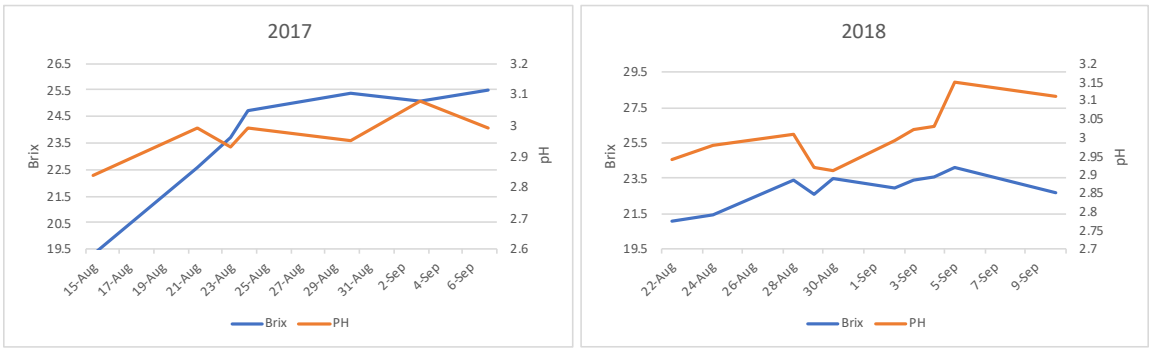
Year	Brix	pH	Potential Alcohol
2010	26.2	3.10	14.4
2011	25	3.26	13.75
2012	31	3.28	17
2013	27	2.976	14.9

Virginia has hot summers and occasional-to-frequent rain during the growing season, partially moderating the high alcohol and acidity of Petit Manseng. Early Mountain Vineyards provided Brix and pH measurement data from grape sampling for one block of Petit Manseng from 2017 (a relatively dry year) and 2018 (a wet year). In 2017 potential alcohol was substantial but did not exceed 15% while pH at harvest was near 3.1. The real appeal of the variety is seen in 2018, which demonstrates that this variety can accumulate high levels of sugar without steep increases in pH even with substantial rainfall (Figure 1).

Several winemaking strategies have been explored to find a balance of acid and alcohol in Petit Manseng when fermented dry. Some winemakers have experimented with earlier harvest dates to reduce alcohol level and tame some of the aggressive aromatics Petit Manseng can present, however this must be balanced with acidity that may be very high with an early harvest. Skin contact prior to fermentation releases potassium that can precipitate tartaric acid and lead to lower acid wines, however this must be balanced with the introduction of phenolics that can be texturally apparent and can lead to early browning. Some have attempted malolactic fermentation, however high alcohol and high acidity are a challenging environment for *O. oeni* and can lead to high levels of volatile acidity. Aging the wine on yeast lees for an extended period of time (18 months) can lead to release of polysaccharides from yeast hulls that add roundness to the wine but can come with the added risk of VA accumulation during long aging.

Another option for balancing the acidity of Petit Manseng is the careful selection of yeast strains that consume acid during fermentation. Yeast have a variety of metabolic pathways in addition to those that convert sugar to alcohol. Some species and strains synthesize malic acid under specific conditions (Volschenk et al 2003) while others have cellular machinery to de-acidify their environment by metabolizing malic acid to lactic acid (Jackson 2014). Still others use the malo-ethanolic pathway to convert malic acid to pyruvate, an intermediate in the pathway that leads to alcohol production (Saayman and Viljoen-Bloom, 2006). The ability to metabolize malic acid to ethanol varies by strain and species with *Saccharomyces cerevisiae*, *S. bayanus*, and *S. paradoxus* are able to utilize this pathway in the presence of glucose (Saayman and Viljoen-Bloom, 2006).

Figure 1: Ripening kinetics of Petit Manseng in a single block at Early Mountain Vineyards



The rate of malo-ethanolic conversion is limited due to cell transport and the location of the enzymes within the cell. *Saccharomyces* cells lack specific transport proteins for malic acid, so the rate of uptake from the juice is only as fast as diffusion will allow. The higher the malic acid concentration, the faster malic acid will be taken into the cell (Volschenk et al 2003). The enzymes responsible for converting malic acid to pyruvate (and ultimately to alcohol) are located in the mitochondria of the cell. Under fermentative conditions, few mitochondria are maintained. Those that are present are in a poorly developed state, leaving fewer enzymes available and slowing the conversion rate of malic acid (Volschenk et al 2003).

The ability of *Saccharomyces* to metabolize malic acid differs by species and strain. *S. paradoxus* has been shown to consume 28-38% of malic acid during fermentation while *S. cerevisciae* consumed 17% and *S. bayanus* consumed only 8% (Redzepovic et al 2003). These differences in rate were shown to be due to differences in gene expression. In *S. paradoxus* and *S. cerevisciae*, expression of these genes responsible for malic acid degradation increased toward end of fermentation while in *S. bayanus* gene expression decreased. In *S. paradoxus*, the rate of malic acid degradation increased as well, indicating this species can use malic acid as a secondary carbon source once glucose has been depleted. Within *S. cerevisciae*, strains will vary in ability to degrade malic acid; generally, wine producing strains are thought to be inefficient (Volschenk et al 2003).

In the present study, Petit manseng juice was inoculated with different yeast strains in a side by side comparison. Scottlabs product information indicates D47 is a *S. cerevisciae cerevisciae* strain isolated from Chardonnay barrel fermentations in the Cotes du Rhone. It is a high producer of glycerol and polysaccharides, leading to full mouthfeel. It is tolerant to 14% alcohol and brings out ripe stable fruit character and jam-like qualities in wine. This is the standard Petit Manseng yeast at Walsh Family. Anchor Exotics SPH (Scottlabs), now packaged as Exotics Mosaid, is a hybrid of *S cerevisciae* and *S. paradoxus* developed in South Africa. Several characteristics indicate this might be a good yeast choice for Petit Manseng. It is a malic consuming yeast, with the ability to break down up to 17% of the malic acid during fermentation. It is tolerant to 15.5% alcohol with moderate nutrient needs. In high grape-sugar musts it produces more glycerol and less alcohol than most strains, leading to a rounder mouthfeel and reduction in alcoholic heat. It is a moderate fermenter which helps keep barrel

fermentations in check. Sensory descriptors for this yeast strain include “exotic aromas and flavors”, guava, passion fruit, tropical and stone fruits, hinting at high thiol production. Petit Manseng has previously been shown to produce notable levels of thiol precursors, and this yeast has the metabolic machinery to convert these to thiols. Resulting chemical and sensory attributes were measured to determine if yeast strain selection can help achieve a more balanced dry Petit Manseng.

Procedure

After harvest, grapes were chilled overnight then whole cluster pressed. During the first press cycle, juice from the press pan was pumped back into the press to allow for skin contact for 60 minutes. After pressing, juice was cold settled in tank at 40°F for 24 hours with addition of 25 ppm SO_2, then racked off lees to tank. Turbidity was adjusted to 115 NTU, after which the juice was racked to neutral barrels for fermentation. Two barrels of comparable age, cooperage and dimension were used for each treatment. Two treatment conditions varied only by yeast strain: D47 and Anchor Exotics SPH.

Wine was inoculated with 15 g/hL yeast. Fermentations were monitored daily for brix and temperature. No nutrient additions were made. Upon completion of fermentation, 40 ppm SO_2 was added, with an additional 15ppm added 15 days later. The wines remained on the lees without stirring.

Sensory analysis was completed by a panel of 28 wine producers. Wines were presented blind in randomly numbered glasses. Panelists were presented with three wines, two of one type and one of another, and asked to identify which wine was different (a triangle test). There were three tasting groups with different tasting order and the unique wine in the triangle test balanced between groups. Panelists were then asked to score each wine on a scale of 0 to 10 for aromatic intensity, perception of acidity and overall balance. Panelists were also given open ended questions to describe the wines. Results for the triangle test were analyzed using a one-tailed Z test. Descriptive scores were analyzed using repeated measures ANOVA.

Results

Juice chemistry can be found in Table 1 while Figure 1 shows the fermentation kinetics for each treatment. D47 led to slower fermentation, with up to 4°Brix difference between the treatments at mid-fermentation. Temperature remained relatively similar between treatment groups.

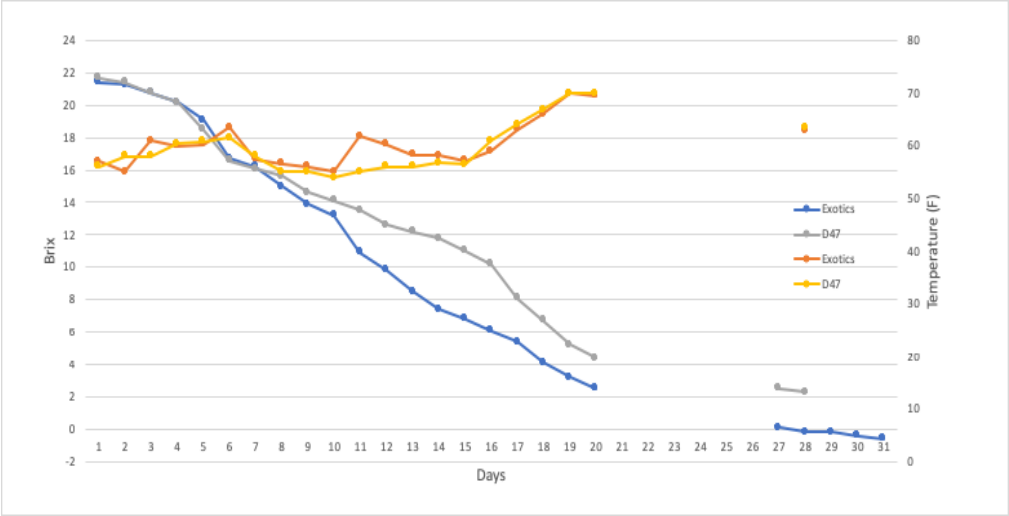
Table 1: Juice chemistry for Petit Manseng

Brix	pH	TA (g/L)	YAN (mg/L)	NTU	Pot Alc
21.9	3.157	7.94	109	115	12-13%

Anchor Exotics SPH yeast produced wine with higher pH and lower TA than D47 (Table 2). There was 38% less malic acid on average in wine produced by Anchor Exotics SPH, however there is a difference in lactic acid concentration between the two barrels fermented with SPH. Barrel 1 has less malic acid and 0.65 g/L lactic acid, indicating some activity of malolactic fermentation while barrel 2 does not. With no evidence of malolactic fermentation (lactic acid level was <0.15 g/L) the fermentation in Barrel 2 produced a wine with 26% less malic acid, indicating the yeast strain did de-acidify the wine. The putative spontaneous activity of malolactic bacteria in wine fermented by SPH presents a second

de-acidifying mechanism for malic acid consuming yeast. Malic acid bacteria are generally inhibited by high levels of malic acid like that typically found in Petit Manseng. Partial consumption of malic acid by yeast during primary fermentation may provide a more favorable environment for *Oenococcus oeni* to further de-acidify this wine.

Figure 1: Fermentation kinetics for Petit Manseng inoculated with D47 and Anchor Exotics



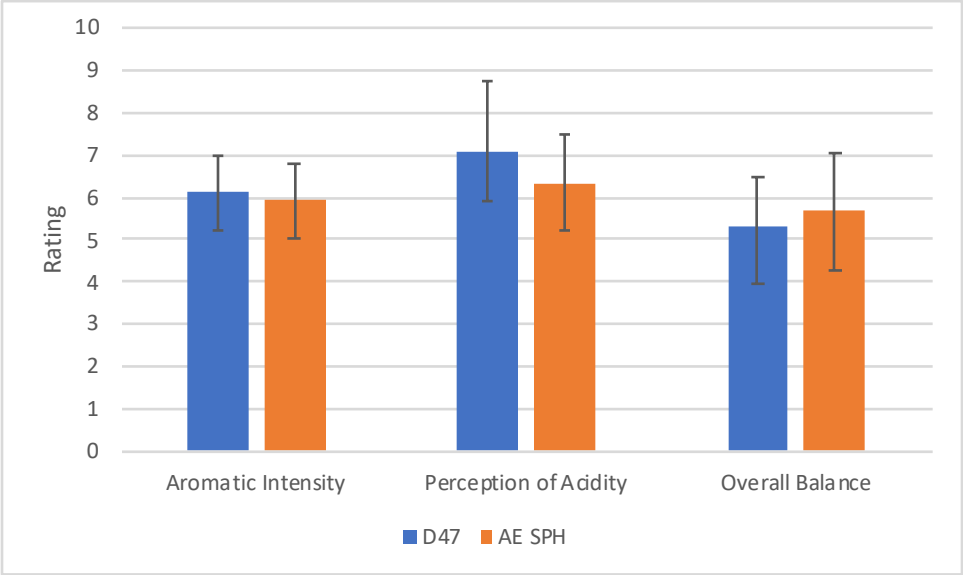
Another concern with choosing a yeast strain for Petit Manseng is alcohol tolerance and ability to finish fermentation in a challenging environment of alcohol and acid. Here, D47 and Anchor Exotics SPH produced wines with similar average residual sugar and alcohol percentage. However, there was enough variation in residual sugar between barrels to underscore this aspect of Petit Manseng winemaking. A notable difference between the two stains was the production of volatile acidity. D47 produced wines with 0.17 g/L less volatile acidity. Generally, the threshold of perception of VA on white wines is thought to be 0.6 – 0.7 g/L, though this varies significantly among wines. The wine produced by Anchor Exotics is nearing this threshold.

In a triangle test of wines produced from different yeast strains wines, 16 out of 28 respondents were able to distinguish which wine was different, indicating the wines were significantly different ($Z=2.47$, $p= 0.0068$). Scores for aromatic intensity, perception of acidity and overall balance are shown in Figure 2. None of these differences was significant, however, in open ended questions, there was a trend for respondents to list the perception of acidity as a reason they could distinguish the wines. In discussion following the tasting, respondents were asked to raise their hands to show a preference for one wine or the other. Preference was split relatively evenly among respondents and discussion revealed this preference was largely based on stylistic impact. Some felt high acidity was integral to Petit Manseng while others felt the wine needed moderation of its acidity to achieve balance.

Table 2: Finished wine chemistry of Petit Manseng inoculated with D47 and Anchor Exotics

Anchor Exotics							
	pH	**TA (g/L)**	**MA (g/L)**	**LA (g/L)**	**VA (g/L)**	**RS (g/L)**	**Alc (%)**
BBL1	3.14	7.1	1.87	0.65	0.58	5.2	12.56
BBL 2	3.1	7.58	2.87	<0.15	0.54	6.1	12.5
Average	**3.12**	**7.34**	**2.37**	**0.40**	**0.56**	**5.65**	**12.53**
D47							
	pH	**TA (g/L)**	**MA (g/L)**	**LA (g/L)**	**VA (g/L)**	**RS (g/L)**	**Alc (%)**
BBL1	3.07	8.08	3.79	<0.15	0.4	7.8	12.4
BBL 2	3.06	8.16	3.92	<0.15	0.38	4.1	12.58
Average	**3.07**	**8.12**	**3.86**	**<0.15**	**0.39**	**5.95**	**12.49**

Figure 2: Rating of descriptors for Petit Manseng wines produced with two different yeast strains



Conclusions

- D47 yeast produced Petit Manseng wine with lower pH, higher acidity, and lower volatile acidity than Anchor Exotics SPH yeast.
- Anchor Exotics SPH yeast consumed 26% of the malic acid in the juice during primary fermentation. One of the two barrels inoculated with this yeast also showed signs of malolactic fermentation.
- In a triangle test, tasters were able to discriminate between the wines. Though descriptors for aromatic intensity, perception of acidity and overall balance were not significantly different, open ended questions revealed a difference in perception of acidity by some tasters.
- Discussion after the wines were identified indicated there is a stylistic difference in preference for acidity in Petit Manseng. Some winemakers considered high acidity a desirable part of the varietal character of Petit Manseng while others felt the opposite.

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