

Fermentation Kinetics and Sensory of Microbially Impacted Red and White Wine

Jeremiah Loyd, Garrett Morales, Stephan Sommer, and Sonet Van Zyl*
 Department of Viticulture and Enology, California State University, Fresno

Introduction

Machine harvesting does not discriminate between healthy grapes and microbial infected (MI) grapes. Hiring contracted labor to remove spoiled fruit from the vineyard can be costly to a grower. Machine harvesting damages fruit, making it difficult to visually quantify spoilage. Incoming fruit quality can be quantified by assessing known spoilage indicators, such as volatile acidity (VA), gluconic acid and ethanol content. There is currently no objective method to tier microbial spoilage of grapes coming into a winery test stand. Truckloads are either accepted or rejected based on visual inspection.



Figure 1: A & B. Microbial spoilage in Chardonnay. C & D. Microbial spoilage in Zinfandel.

White Wine (vol/vol.)		
Dose Rates	Clean Juice	M.I. Juice
C1 - 0%	12 gal	0 gal
C2 - 0%	12 gal	0 gal
5%	11.4 gal	0.6 gal
10%	10.8 gal	1.2 gal
15%	10.2 gal	1.8 gal
20%	9.6 gal	2.4 gal

Table 1: White wine MI levels treated by volume.

Red Wine (wt./wt.)		
Dose Rates	Clean Must	M.I. Must
C1 - 0%	300 lbs.	0 lbs.
C2 - 0%	300 lbs.	0 lbs.
5%	285 lbs.	15 lbs.
10%	270 lbs.	30 lbs.
15%	255 lbs.	45 lbs.
20%	240 lbs.	60 lbs.

Table 2: Red wine MI levels treated by weight.

Wine	Vintage	0% to 0%	0% to 5%	5% to 10%	10% to 15%	15% to 20%
Riesling	2019	No	No	No	No	No
Chenin blanc	2019	No	Yes	No	No	No
Chardonnay	2019	No	Yes	No	No	No
Zinfandel 1	2019	No	No	Yes	No	No
Zinfandel 2	2019	Yes	No	No	No	No
Petite Sirah	2019	Yes	No	No	No	No
Chardonnay	2020	Yes	No	No	No	No
Zinfandel	2020	No	No	No	No	No

Table 4: Highlighted yellow areas are levels of 3-AFC sensory testing that contain significance of samples.

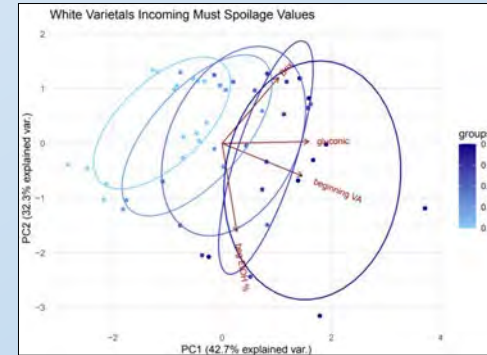


Figure 4: Compiled vintages of white varietal must indicator values by spoilage level.

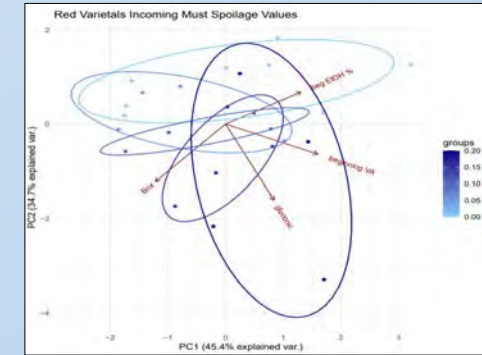


Figure 5: Compiled vintages of red varietal must indicator values by spoilage level.

Results and Discussion

Objective: To use FT-MIR Spectroscopy as an analytical testing tool for incoming grapes at a test stand to quantify different levels of microbial spoilage and determine fruit quality objectively.

Materials & Methods

Grapes were collected from commercial vineyards that had notable microbial infections. These grapes were to be mechanically harvested and sampled by a commercial test stand. Healthy and microbially impacted grapes were harvested respectively into separate bins, processed, and treated according to tables 1 and 2. Grapes were produced into heat/cold stable filtered wines to duplicate commercial winemaking practices. Grapes were harvested during the 2018, 2019 and 2020 vintages. Sensory testing was conducted with 16 panelists utilizing ranked preference and 3-Alternative Forced Choice (3-AFC).

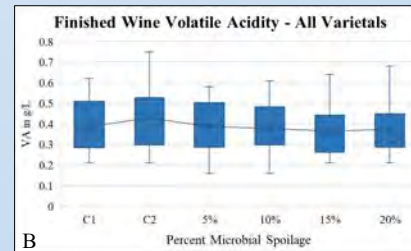
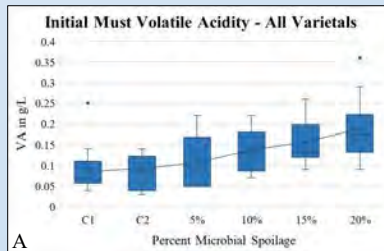


Figure 2: A. VA in incoming must. B. Initial VA levels of finished wine.

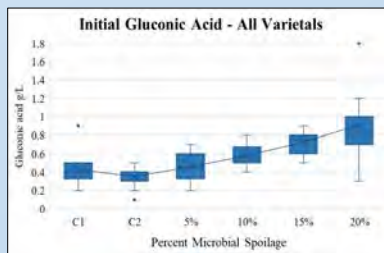


Figure 3: Initial must Gluconic acid levels.

Wine	Vintage	0%	10%	20%
Riesling	2019	37	31	28
Chenin blanc	2019	26	35	35
Chardonnay	2019	37	24	16
Zinfandel 1	2019	35	24	37
Zinfandel 2	2019	23	36	37
Petite Sirah	2019	41	26	29
Chardonnay	2020	37	24	16
Zinfandel	2020	25	32	39

Table 3: Highlighted yellow areas are levels of ranked preference sensory testing that contain significance.

- Initial VA levels increase as microbial spoilage levels increase. Higher initial VA levels did not correlate to higher levels of VA in a finished wine.
- Initial must gluconic acid levels increased as microbial spoilage levels increased.
- Sensory panelists preferred higher MI levels in both Chardonnay wines, lower MI levels in two of the three Zinfandel wines, and 10% MI in Petite Sirah.
- 3-AFC testing: Sensory panelists were unable to discriminate against higher levels of microbial spoilage. Lower levels, including controls, are discernable, while higher levels were not. Note: sample sets containing the control as significant, potentially had more prevalent microbial spoilage in vineyard.
- Incoming white must samples would be more discernable to be indicated by gluconic acid and VA as they are almost completely parallel to PC1.
- The red must PCA reads similar to the white must, though contains more overlap in the indicator values.

Acknowledgments

California Winegrape Inspection Advisory Board
 Agricultural Research Institute
 E&J Gallo Winery