Winemaker Trial

Using Engineered Yeast to Create Stylistically Different Chardonnay

Erosion Wine Co. winemaker Patrick Rue wanted to know—is it possible to customize the aroma and flavor profile on Chardonnay based on yeast choice alone? Here's what he found out.

PATRICK RUE is the "winemaker-in-training" and co-owner of Erosion Wine Co. His career in beer started at The Bruery, which he founded in 2008. He has developed hundreds of different beers and experimented with many ingredients, techniques and microorganisms to create unique and delicious flavor profiles. Along the way, he became a Master Cicerone in 2014 (the beer equivalent to MS or MW). Rue, along with his spouse and Erosion Wine Co. co-founder Rachel, and daughter Charlotte, moved to St. Helena in late 2018 to start Erosion Wine Co. He hopes to explore wine with a similar level of curiosity that he brought to making beer.

TRIAL OBJECTIVE: To determine the feasibility of creating multiple stylistically distinct wines from one juice source through the use of engineered yeast.

TRIAL DESCRIPTION: In collaboration with Berkeley Fermentation Science (BFS), Erosion Wine Co. fermented the same Chardonnay juice with three different Saccharomyces cerevisiae yeast strains. The Chardonnay fruit, from McKenzie Mueller in Napa's Los Carneros AVA, was grown to create a ripe, rich style. Harvested fruit was pressed on Oct. 3, 2019 at 25° Brix with a pH of 3.45 and 6.6 g/L TA. The yeast strain used for the control was Lamothe-Abiet Excellence TXL, which was selected for its low production of esters and phenols. It produced a wine with typical Chardonnay varietal aromas of ripe apple and mango. Strain 524, an experimental yeast developed by BFS, is designed to amplify the fruit-based terpenes by incorporating genes from edible plants, like mint and basil. In Chardonnay, strain 524 produces a bouquet of flavor compounds that accentuates the fruit-based terpene notes of pineapple, peach and banana skin. Strain 480, also developed by BFS, is designed to contribute thiol-based aromas and flavors, reminiscent of New Zealand Sauvignon Blanc. In Chardonnay, this strain exhibits strong aromas of crushed herbs, freshly cut grass, blackcurrant leaf and passionfruit.

Lot 1/Control: Chardonnay fermented with Excellence TXL
Lot 2: Chardonnay fermented with BFS Strain 524
Lot 3: Chardonnay fermented with BFS Strain 480

TRIAL CONCLUSION: The three wines are very different, both from an aromatic and flavor perspective—so much so that they exhibit uncommon varietal aromas and are unlikely to be selected as coming from the same varietal or juice source.

TRIAL ANALYSIS

Analysis Name	Lot 1	Lot 2	Lot 3	Units
free sulfur dioxide	<2	4	66	mg/L
molecular sulfur dioxide	<0.10	<0.10	0.92	mg/L
total sulfur dioxide	33	32	129	mg/L
titratable acidity	7	4	4.4	g/L
pH	3.23	3.68	3.66	
volatile acidity(acetic)	0.25	0.34	0.51	g/L
L-malic acid	1.96	<0.05	<0.05	g/L
glucose + fructose	0.2	1.6	0.8	g/L
ethanol at 20° C	12.84	13.94	13.96	% vol
ethanol at 60° F	12.8	13.9	13.92	% vol

SOURCE: ETS LABS

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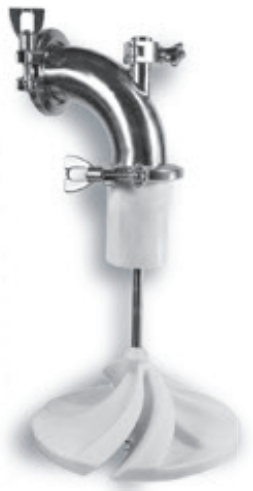

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Winemaker's Post-Mortem

Why were you interested in studying the effects of different yeast strains on the Chardonnay grape?

Rue: Most white wine varietals exhibit distinctive aromatic characteristics that we felt may clash with the distinctive aromatics the yeast produces. Chardonnay has a recognizable aroma, but it is fairly neutral in comparison to most other white grape varieties. Also, Chardonnay is the most widely planted winegrape in California, so it presents the greatest opportunity for diversifying its flavor perception based upon fermentation alone.

Can you describe the two engineered yeast strains and why you chose to use them?

Rue: Strain 524 is a fruit bomb. It offers ripe stone fruit (peach, apricot) and tropical "Juicyfruit" characteristics. It's tough to compare it with a certain varietal, but it offers a slight petrol flavor and banana skin in the finish, so it reminds me a little bit of Alsace Gewürztraminer but with the texture of a Chardonnay.

Strain 480 is very much reminiscent of a New Zealand Sauvignon Blanc with its green, grassy character mixed with ripe, tropical and citrus notes. To me, it's mind-blowing how different strain 480 is compared to the control.

How did you set up the trial?

Rue: Berkeley Fermentation Science provided the two yeast strains in a direct-pitch, quantity liquid form. We added one strain per 50 gallons of Chardonnay juice in 60-gallon stainless steel barrels. The ambient temperature was kept at a consistent 59° F, and the fermentation temperature did not exceed 60° F during the peak of fermentation. The control was 700 gallons of the same juice fermented with Lamothe-Abiet Excellence TXL yeast at a set temperature of 55° F.

Who else worked on this experiment with you and what were the hypotheses?

Rue: Enrique Hernandez, our cellar master, and Samuel Dearden, our tasting room manager, assisted with this trial internally. BFS engineered the yeast. I've used yeast from BFS previously for beer fermentations; those strains helped produce aromas and flavors that are similar to hop aromatics. Based on that experience, I had confidence that this trial would produce distinct aromatic differences from the control. I expected the results to be more subtle and was surprised by how much flavor was contributed from the yeast.

What were some of the impressions from some of those who tasted through your wines?

Rue: I expected the results to be more subtle and was surprised by how much flavor was contributed from the yeast. Strain 480 is a favorite of ours as it provides a flavor profile that we have not experienced in any California wine. Listening to the guests of Innovation + Quality was fascinating. I think people were excited and amazed by how big of a difference there was between wines. There were certainly some skeptics of using genetically engineered yeast, but many of the guests inquired about commercial availability, and I bet we'll see a number of wineries using BFS strains this coming season.

What were some of the winemaking lessons you learned through the course of this trial?

Rue: In today's world, I think most of the flavor in California wines is driven by growing different cultivars in different terroirs. Our major takeaway from this trial is that flavor can also be driven by the strain of yeast that the winemaker chooses.

Given the results of this trial, do you think Erosion Wine Co. will change any of its Chardonnay winemaking protocols?

Rue: Since we're a start-up and 2019 was our first harvest, we don't have any Chardonnay protocols. However, it does give us optimism to continue experimenting with yeast, particularly regarding Chardonnay.

Do you plan to conduct a follow-up trial?

Rue: Yes, we're planning on a follow-up trial. One of the issues with the trial was that the parent yeast strain of the engineered yeast was different from our control strain. In the next trial, we plan to use the same parent strain as the control strain. Additionally, we will ferment trial lots, using the same volume and tank size/geometry/temperature as the control. For this experiment, the control was fermented in a 900-gallon tank, and the two trial lots were fermented in 60-gallon tanks—this may have had some impact on the variances. We're also very interested in determining the consistency of these strains. Our instinct is that yeast-driven flavors will be more consistent between seasons as the fermentation can be more easily and precisely controlled than viticulture.

We will also trial other strains that BFS is working on and may apply those to varietals other than Chardonnay. We will experiment with Chardonnay from other regions around California as well. I am curious to see whether these yeast strains can increase the perception of quality for economical Chardonnay—or at least make it taste more interesting. **WBM**

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