

Native Fermentations May Hold the Key To Maintaining Wine Quality Amidst Changing Growing Conditions



Gillian Allen

While opinions on native fermentations in Napa differ, one thing most can agree on is that the best tool in a winemaker's arsenal is increased biodiversity.

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NATIVE FERMENTATIONS HAVE BEEN known to drive unique flavor profiles and deepen the complexity of a wine. With the amount of yeast options available on the market increasing every year, native fermentations can act as a tool to distinguish a particular winery's terroir and potentially create a flavor profile that no other winery has. Considering that many native fermentations are initiated by the vineyard microflora on the grapes, native ferments are, theoretically, a great way to connect the consumer to the wine, which may appeal to a population that, post-pandemic, is more curious than ever about the products they consume. In a perfect world, clean, intact and undamaged fruit arrives from the vineyard and is processed in sanitized equipment. However, the conditions of each harvest seem to stray further and further away from perfect. From wildfires to frost events and power outages, so much is already out of a winemaker's control, and leaving the fate of a very expensive fermentation up to chance can seem ludicrous. For a winemaker with a lot at stake, taking this risk may not be a feasible option.

of bacteria and a lot of yeast on the grapes; other years you have minimal. Some years, the cellar conditions just aren't quite right. You can end up with a stuck ferment, or you can end up with a reduced wine or a wine that's gone kind of stinky." In addition, it can be questionable as to whether or not the fermentation that occurred spontaneously is truly "native" in a facility that has historically used industrial yeast strains. In a custom crush facility, major yeast strains are in circulation, and many different styles and varieties of wine are made simultaneously, adding to the unpredictability. There may be cross-contamination of unsanitized equipment, and oftentimes a more robust and commercial *Saccharomyces cerevisiae* strain ultimately takes over. Mondavi understands these challenges, but that is not to say she would never choose to pursue a true native fermentation. "If I were ever to do native, it would be at a brand-new facility where I know there are very minimal yeast strains and [I would] be able to have the strain that I really want, isolate it and focus on that," Mondavi explained, adding, "which you can do. It's not easy, but it's been done."

Consistency is Key for Angelina Mondavi

Winemaker Angelina Mondavi understands that she has been tasked with creating a consistent and quality product for her clients, and her business thrives on dependability. Mondavi is founder and winemaker for A. Mondavi Consulting, LLC and spends much of her time at Brasswood Cellars' custom crush facility, making wine for Brasswood as well as her other clients. She worked with native fermentations, as an intern, in Australia but really cut her teeth on this style of winemaking as the assistant winemaker for Pine Ridge Vineyards in Napa. She appreciates the extra level of character and personality that a native fermentation can add to a wine as well as the patience it requires on behalf of the winemaker. Mondavi has dabbled in partial-native fermentations with her Dark Matter Zinfandel. She lets it start natively for about two days then inoculates with her preferred yeast because she knows that this wine won't finish fermenting otherwise. Given that Mondavi has lost a lot of sleep working with native fermentations in the past, she currently leans toward inoculation to protect her lots from an unfavorable native yeast taking hold and potentially imparting negative characteristics onto her wine. "Every year is completely different," she said. "Some years, you have a lot

Starting with a Clean Slate

This was exactly the case at Knights Bridge Winery. Prior to 2021, Knights Bridge made its wine at a custom crush facility in Napa. The winemaking team was interested in native fermentations, but the idea of having an in-house culture take over and transmit undesirable sensory characteristics was too risky. In 2021, their situation changed with the inaugural vintage of a brand-new facility in the Knights Valley AVA, nestled between Napa and Sonoma counties, and the possibility of pursuing native fermentations became a serious consideration.

Brand-new tanks, immaculate floors, drains and technology to eradicate any airborne microbes offered the perfect equation for the winemaking team to take their wines to the next level. They could now be sure that once they didn't inoculate a barrel, the resulting fermentation would truly be native.

"Up at the winery, we ended up going native on all of our red wines through primary and secondary fermentation. They went through, no problem," said Knights Bridge winemaker Derek Baljeu. "They didn't pause or have any slowing towards the end, which is really eye-opening. Once you go from 0 to



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100 percent native fermentation, seeing that sort of success broke down any doubts that I had prior to this vintage.”

Knights Bridge is a small-scale winery, and most of their fermentations are kept around 5 tons. This allows tanks to be well-mixed throughout the fermentation process, minimizing the potential for getting stuck. When it comes to native fermentations, patience is a virtue as is staying in-tune with each lot’s progress. Knights Bridge has automated pump-overs controlled by the team’s devices, but Baljeu stressed the importance of going to the top of each tank to assess the cap and check for off-aromas. The word “complexity” often comes up when a winemaker discusses the benefits of a native fermentation. For Baljeu, the complexity he sees in the Knights Bridge wines stems from the “biochemical warfare” taking place in the beginning stages of fermentation before the dominant strain finishes. Ben Montpetit, associate professor of yeast biology in the Department of Viticulture and Enology at UC Davis, elaborated on this concept further. His experience with native fermentations comes from years of research with a Napa Valley winery’s Pinot Noir program. Montpetit said native fermentations allow more time for interesting non-*Saccharomyces* organisms to become active, and that fight for survival among organisms can lead to interesting complexities in the wine. He pointed out that while the vast majority of spontaneous fermentations end with *Saccharomyces* on top, there are considerable advantages to allowing nature to run its course.

“Advantages of that could be sensory compounds that are created,” he explained. “It could be an actual consumption of some of the sugar that’s present in a way that doesn’t produce ethanol—so in a respiratory way—in which case your final wine is likely going to have a lower alcohol content as well.”

The competition of several strains that exist and thrive at different times can also translate to a certain *je ne sais quoi* on the palate.

“Native yeast end up building out this big texture and make the wine really rounded in the mid-palate, which I like,” said Baljeu. “You end up getting a horizontal wine versus vertical; instead of different shades of the same fruit, in native fermentations you get deeper expressions of fruit, chocolate, coffee. A wider variety of aromatic and flavor markers develops.”

A clean facility and knowledge of home cultures is only half the battle of a successful and healthy native fermentation. As any seasoned winemaker can attest, great wines start in the vineyard. Knights Bridge’s first line of defense in a healthy native ferment is their viticulture team. Sorting out damaged



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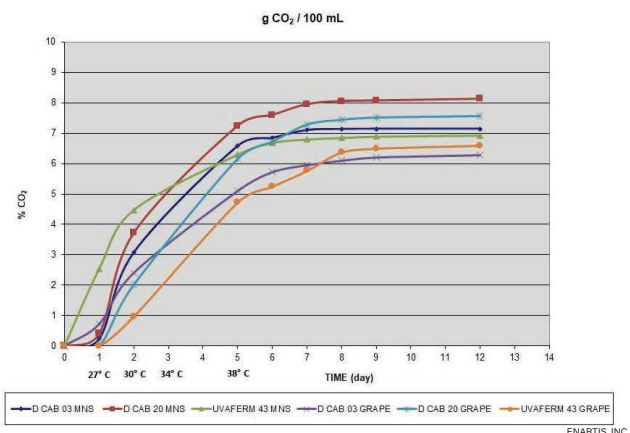
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D20 graph showing CO₂ production, courtesy of Italiana Biotechnologie study “Technological Characterization DAOU Strains Non-D20 July 2021”



Data courtesy of Italiana Biotechnologie’s 2021 experiment to identify other strains of technological interest among the isolates of the 2013 DAOU project. D20 performed best at high temperature (38°C)

or rotten fruit, during picking, is key; and according to Baljeu, it gives the indigenous yeast the first chance for success. Care and oversight in the vineyard gave him peace of mind this past harvest to experiment in the cellar and exercise the grape microflora’s ability to express Knights Bridge’s flavor. Baljeu likes the results from the native fermentation program and will continue with this stylistic choice as long as the winery continues to bring in consistent and clean fruit.

“The microbiology in our vineyard cannot be replicated, so that alone is going to make our wines more unique and true to place,” he commented. “I think it’s always good if the story is focused around terroir and the vineyard, which ours is. It speaks truly to that sense of place and site. I think anything that draws a product closer to where it comes from is always going to be received positively.”

A Study Isolating Native Yeast in the Vineyard

When it comes to native versus non-native fermentations, it doesn’t have to be an all or nothing situation. Labs now have the ability to isolate a winery’s native microflora and potentially mass-produce it as a freeze-dried and commercially available product. Winemakers could then “inoculate” with their own in-house culture, allowing for all the benefits of a native fermentation with significantly less risk. This hybrid, “controlled native” fermentation uses the biodiversity that already exists in the wine and is becoming a more popular choice among winemakers, said Enartis president and CEO José Santos.

In 2013, Enartis began a project with DAOU Family Estates in Paso Robles after Daniel Daou asked the lab to isolate the natural microflora from a Cabernet block in his vineyards. DAOU’s hope was to cultivate a “genetic patrimony” from their best blocks that they could use to retain their terroir, Santos explained. Enartis collected about 10 to 12 kilos of grapes in sterile bags just before harvest and sent them to their yeast lab in Italy. These grapes then began fermenting spontaneously in the lab under the conditions that Daou thought most suited his winemaking philosophy back in Paso, which were higher temperatures.

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Using temperature as a selection factor, 24 isolates in six different genetic groups of *Saccharomyces cerevisiae* were the result (the experiment only looked at *Saccharomyces* strains). Researchers then narrowed the study down to a winery-scale trial with liquid yeast that Enartis produced. The following year after doing lab characterization and winery trials, two isolates were chosen, D03 and D20. Ultimately, D20 was chosen as the most favorable isolate, and DAOU now uses this to inoculate many of its red wines. In addition, it is now a commercially available product in Enartis' yeast catalog, and other wineries can use it as well.

D20 has demonstrated its ability to thrive if winemakers wish to push the temperature up to promote color and phenolic extraction. In addition, it has been helpful in Spain, where wineries with limited temperature control have used it to avoid stuck fermentations. Enartis saw in trials with large wineries in Castilla-La Mancha that if fermentation temperatures climbed extremely high, say around 105°F, D20 was immediately able to restart fermentation when the temperature decreased. The yeast was inhibited but didn't die. Santos said this peculiar characteristic of D20 gives it great potential to be a high-end yeast for Cabernet Sauvignon and other Bordeaux varieties.

Using Native *Saccharomyces uvarum* to Fight the Effects of Climate Change

As temperatures in wine-growing regions increase, this affects the microflora in the vineyard every year and thus the predictability of a native fermentation. Inoculating allows for consistency from year to year, and certain large-scale wineries may not have the luxury of taking the risk to ferment spontaneously.

However, a cryophilic *Saccharomyces* strain called *Saccharomyces uvarum* has been isolated from spontaneous fermentations in Amarone della Valpolicella in Italy. Its properties may give winemakers a happy medium between the dependability of inoculating and the benefits of native fermentations. In Amarone, grapes are harvested and dried in the cellar, until late winter, when crush and fermentation occur. *S. uvarum* dominates in the early parts of these fermentations when the temperatures are quite cool; then *S. cerevisiae* takes over when ethanol and temperature increase.

"We have a lot of experience in using [*S. uvarum*] in blends," noted Santos. "You use the same amount of yeast, but you replace 20 or 30 percent of your *Saccharomyces cerevisiae* with *S. uvarum*. In that case, the feedback that we have is a big increase in terms of complexity because it will not only be one but two microorganisms, working in synergy during that fermentation. And the beauty of the *S. uvarum* is that it has a control switch ... you can allow the *S. uvarum* to dominate in cooler environments, which can be cold soak or the early part of a fermentation. Then just by increasing the temperature, you allow the *cerevisiae* to take over and finish the fermentation. This basically opens the door to controlled micro-diverse fermentations."

In addition to fostering a diverse microbiome to increase complexity, *S. uvarum*'s unique characteristics have proven to combat some of the adverse effects of climate change. Santos' colleague Jasha Karasek is the product manager for winemaking products at Enartis. At 2022's Enoforum USA, Karasek, in his presentation "New Technological Strain of *Saccharomyces Uvarum* for Addressing Climate Related Challenges in the Cellar," spoke about yeast that can metabolize glucose and produce other compounds besides just ethanol, and discussed how winemakers can harness this to maintain quality in their wines.

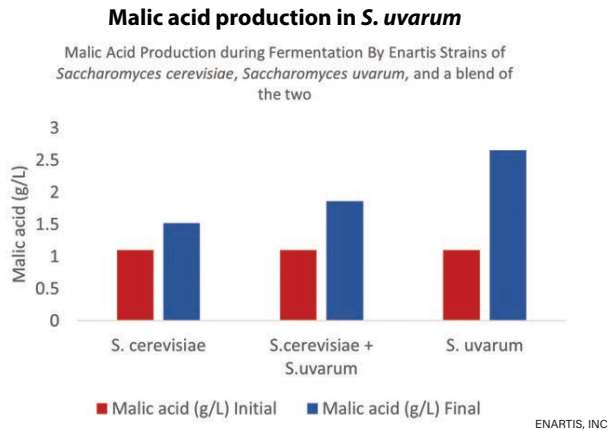
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“What we’ve found is that this particular strain is able to produce malic acid and succinic acid to a higher degree than *Saccharomyces cerevisiae*, and we think that could help off-set some of the situations we’re seeing with climate change,” said Karasek. “This particular strain of *uvarum* is producing wines with lower alcohol, which counteracts the higher Brix situation/higher malic acid, which helps counteract some of the situations we see with low organic acid and these really ripe grapes and then also lower pH for that reason as well.”

“Most of the organic acid used in winemaking for TA and pH adjustments is shipped from Europe,” said Karasek. “If we can harness the ability of organic acid production by *Saccharomyces uvarum*, we might have a natural way of lowering the demand for organic acid from Europe, which would decrease the carbon footprint associated with its transport. It might be a drop in the CO₂ bucket, but we need to think of how we can reduce CO₂ emissions from every angle possible.”

Understanding native yeasts gives winemakers more freedom to experiment in the cellar, and there is always the option to fall back on inoculating with a commercial yeast strain if things go sideways. To ferment natively or non-natively is ultimately a question of winemaker preference, but the beauty of continued research is that it gives winemakers more tools to achieve the best possible results and adapt to changing conditions in the vineyard.

“The quality of the grape material as well is going to change,” Montpetit said. “Is it going to be using different types of yeasts, different fermentation patterns to try to augment those changes? Microbiology may offer an avenue to combat that.” **WBM**



The above graph highlights the differences in organic acid production during fermentation, which is one of the challenges as temperatures increase in wine growing regions. Interestingly, Karasek pointed out that this yeast has the ability to create an even bigger positive impact than just producing more malic acid in wine.

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