

Preservation Programs Around the World Work to Save Old Vines

Plus:

Sustainable Lending Gains Foothold Across Industries

Sulfur Dioxide: Understanding its Past, Present and Potential Future

Old World Meets New at Winery in New Mexico





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Manfred Krankl

SINE QUA NON

* 22-time recipient of Wine Advocate's perfect 100 points



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Inside the May Issue

THE WINE INDUSTRY IS full of dreamers with vision and passion and sometimes those dreams take people in interesting directions. In the case of Vara, a new project profiled this month, Spanish wine meets California terroir in New Mexico. That's not hype. The partners and specialists behind the venture include an "A team" of industry veterans with a rather unique vision. They're not in it for the money, just the fun of making wonderful wine.

Oregon isn't really known for Sauvignon Blanc but a handful of producers there had the vision to work with it in small quantities years ago. Now, as highlighted in this issue, one Oregon producer is even making enough Sauvignon Blanc to gain national distribution.

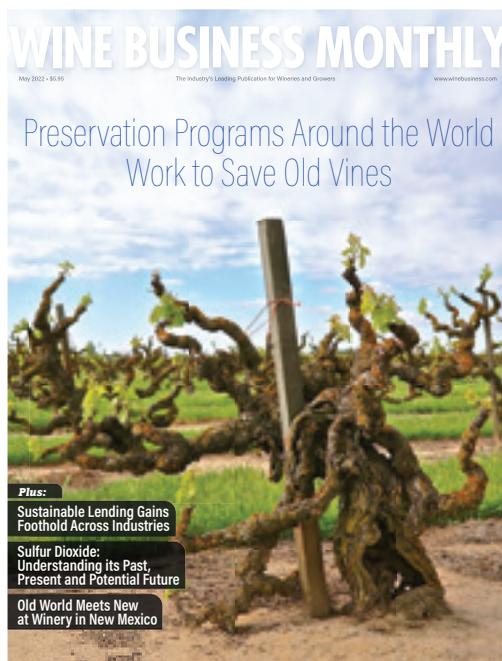
When Australia-based Treasury Wine Estates announced a few months ago that it was transitioning more than \$1 billion of financial loans into sustainability linked loans, the wine world took notice. Sustainability linked loans, which discount rates for a company's good "green" performance, have already started gaining traction in Europe. At the same time, the U.S. Securities and Exchange Commission has unveiled plans to require public companies to disclose greenhouse gas emissions. That's one reason we're seeing public companies hire chief sustainability officers, a rather new position for many. So far, no U.S.-based wineries we're aware of have secured sustainably-backed financing per se, but as we report this month, the practice could become more common in the future. The worlds of finance and sustainability are converging.

Managing SO₂ is a crucial aspect of wine quality, and understanding SO₂ management is one of the remaining frontiers of winemaking. This issue includes a summary of new research into how SO₂ works in wine. There's been quite a bit of new information over the past five years and the science continues to evolve. The most recent research has led to new ways to measure SO₂. This is required reading for winemakers.

As readers may have surmised from the cover, we take a look at old-vine preservation programs around the world. The best efforts to protect old vines for terroir-based winemaking come from efforts led by wine-makers with passion for the past and a vision to include it in the future.

The May winemaker trial compared remote sensing technologies, both local and satellite-based, to automate labor and water use with a focus on soil moisture and crop water use. Among the takeaways: Don't be too tempted to adopt a new technology that promises to save time until you test it. Also, be patient. Vision usually requires patience.

Cyril Penn – editor



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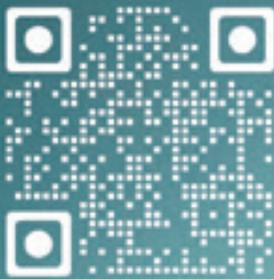
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winemaking

TECHNICAL REVIEW



A Collaborative Vision14

Lance Cutler



Oregon Sauvignon Blanc Enters the Flagship Fray . . .22

L.M. Archer

Sulfur Dioxide: Understanding its Past, Present and a View into the Future.32

Richard Carey

grape growing



Old Vines Begin to Capture the Wine World's Attention40

W. Blake Gray

VINEYARD SURVEY

Continued Labor Woes Push Growers Toward More Mechanization46

Latest Vineyard Survey Illustrates Acceleration of Trends

PRactical Winery & Vineyard

Mineral Nutrient Management Methods: A Comparison Considering Effectiveness and Efficiency 52

Stan Grant

GRAPEGROWER TRIAL

Optimizing Irrigation Efficiency with Satellite Technology58

Wilson Creek Winery of Temecula Valley evaluated satellite technology to achieve irrigation efficiency over current ground-based methods

Bryan Avila

sales & marketing



Glass Producers Pursue Sustainability Despite Persistent Headwinds64

Michael S. Lasky



PACK DESIGN SHOWCASE

Redesign Adds More Brand Details70

Andrew Adams

RETAIL SALES ANALYSIS

Retail Wine Sales Down 5 Percent in February72

Wines Vines Analytics

technology & business

Eco-Performance Based Loans, Investors, Retailers and New State Regulations Fuel Climate Progress . . .74

Pam Strayer

BUYER'S GUIDE

Select Vineyard Lenders78

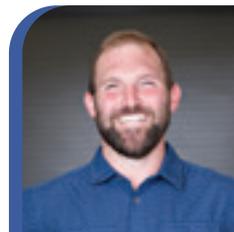


Private Labels Expected to Carve Bigger Slice of Market . . .82

Andrew Adams

Departments

MONTH IN REVIEW	4
NEWS	10
PEOPLE	86
ADVERTISER INDEX	88
JAKE LORENZO Of Dreams and Consequences	89



WINEMAKER OF THE MONTH 90

Spencer Spetnagel, winemaker, Durant Vineyards, Dundee Hills, Oregon



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Xavier Zamarripa

Co-founder and President, Vara Winery & Distillery, Albuquerque New Mexico, "VARA: A Collaborative Vision," page 16

"To have the highest expression of what you are going to make, you need to provide your artisans with the best tools and materials."

Brent Stone

COO and winemaker, King Estate, Eugene Oregon, "Oregon Sauvignon Blanc Enters the Flagship Fray," page 22

"You have a blank canvas because there aren't a lot of expectations for what an Oregon Sauvignon Blanc should or shouldn't be."

Tegan Passalacqua

winemaker, Turley Wine Cellars, Amador and Paso Robles California, "Old Vines Begin to Capture the Wine World's Attention," page 40

"The big wineries didn't want [the Historic Vineyard Society] to happen. They like paying not so much for old-vine grapes."

Amanda Barnes

author, *The South American Wine Guide*, "Old Vines Begin to Capture the Wine World's Attention," page 43

"Most of the producers in South America are paying at least double what they would for grapes from younger vines as a gesture and to try to retain these old vines."

Herve Duteil

chief sustainability officer for BNP Paribas Americas, parent company of Bank of the West, New York, NY, "Sustainability Meets Finance," page 76

"We moved from financing the green [leaders] to financing the greening of the economy. We moved from niche to universal."

Erica Landin-Löfving

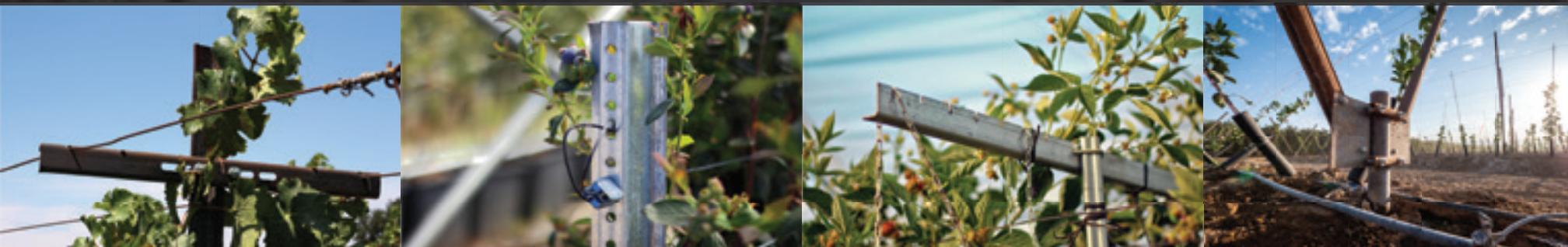
chief sustainability officer, Vintage Wine Estates, Santa Rosa, CA, "Sustainability Meets Finance," page 76

"Sustainability is moving from storytelling to data."

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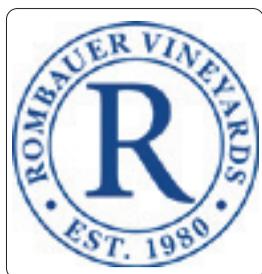


Federal Antitrust Complaint Filed Against Nation's Two Largest Wine and Spirits Distributors

A B2B e-commerce provider of alcoholic beverages has filed a complaint in Federal Court in Illinois against Southern Glazer's Wines and Spirits and Republic National Distributing Company, the two largest wine and spirits distributors in the United States.

The complaint, filed by Provi, alleges unlawful efforts by Southern and RNDC “designed to stifle competition and maintain or enhance their monopoly power” in the relevant markets for online alcohol marketplaces, search and display advertising on online alcohol marketplaces, and data analytics services in certain states. The complaint alleges Southern's and RNDC's violations of antitrust laws include blocking and rejecting orders for wine and spirits products that retailers choose to communicate through Provi; and boycotting Provi by forcing or coercing retailers not to use Provi is active in 35 states.

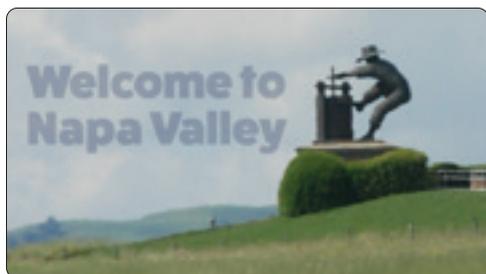
The complaint is the first of its kind following President Biden signing an Executive Order on Promoting Competition in the American Economy in July 2021, which included a directive for the Secretary of the Treasury—in coordination with the Federal Trade Commission and the Department of Justice—to produce a report assessing the “threats to competition and barriers to new entrants” in beer, wine and spirits.



Rombauer Announces Three Vineyard Acquisitions

Rombauer Vineyards acquired three premium vineyards, totaling 154 vine acres in the California appellations of Carneros-Sonoma, Sonoma Valley and Fiddletown. The acquisitions include the Haire Vineyard in Carneros-Sonoma, the Carriger Vineyard in Sonoma Valley, and an historic vineyard in the Fiddletown AVA of Amador County, bringing the family-owned winery's estate and leased vineyards to a total of 830 planted vine acres.

The 52-acre Haire Vineyard in Carneros was a source of Chardonnay for Rombauer for nearly two decades, after Koerner Rombauer shook hands with owner Jim Haire on a deal to acquire the fruit. The Carriger Vineyard sits in a small pocket on the southwestern reach of Sonoma Valley and has been a source for Rombauer's Sauvignon Blanc, with 45 acres planted to the variety. The Rombauer family has long been active in the Sierra Foothills and the Fiddletown AVA in Amador County where it owns a winery, tasting room and vineyards. The new acquisition there includes 90 acres with 13 acres planted to old vine Zinfandel.



Napa County Approves Micro Winery Ordinance

Napa Valley grape growers who want to build a “micro winery” to produce and sell wine at their family farms can do so at an affordable price under a new county law.

The micro winery ordinance enacted by the Napa County Board of Supervisors streamlines the permitting process. Under the new law, a micro winery cannot generate more than 10 round trips per day by staff and customers. No marketing events are allowed. The ordinance, to be re-evaluated in three years, was a victory for Save the Family Farms, a small group of growers who had sought to have a micro-winery law for five years. The group include 25 grape growers who produce wine at custom crush facilities.



The San Luis Obispo Coast Named By TTB As Wine's Newest AVA

The San Luis Obispo Coast is the newest American Viticultural Area, a designation awarded March 9, 2022 by the U.S. Alcohol and Tobacco Tax and Trade Bureau. The AVA establishes a long, narrow strip of land along California's Central Coast as a unique region. The new AVA spans about 60 miles from San Simeon in the north to Nipomo in the south, but is at most only 15 miles wide, bordered by the Pacific Ocean and the Santa Lucia Mountains. The San Luis Obispo Coast AVA's 78 vineyards have 3,942 acres planted to vines—most notably to Chardonnay and Pinot Noir. Over the past decade a more diverse list of grape varieties includes Albariño, Grüner Veltliner and Riesling as well as Grenache, Syrah, Tempranillo, Zinfandel and Lagrein. The SLO Coast Wine Collective, a group of 32 wineries making wine from grapes grown within the region, applied for the SLO Coast AVA in 2017.



ASEV Selects 2022 Best Enology and Viticulture Papers

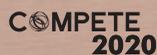
The American Society for Enology and Viticulture has selected the 2022 Best Paper Award winners, who will present their papers during the 2022 ASEV National Conference. Both papers are highlighted on [asev.org](https://www.asev.org) and are available free of charge. The 2022 Best Viticulture Paper is “Field Performance of Winegrape Rootstocks and Fumigation during Establishment of a Chardonnay Vineyard in Washington.” For the 2022 Best Enology Paper, ASEV selected “Whole Cluster and Dried Stem Additions' Effects on Chemical and Sensory Properties of Pinot noir Wines over Two Vintages.” **WBM**



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After a two-year hiatus, WiVi Central Coast returned to the Paso Robles Event Center on March 31, 2022, to deliver a full day of regionally focused educational sessions, trade show and networking opportunities and a tasting of the most unique wines being made in the area.

WiVi kicked off with a future-focused keynote session, featuring (top photo, left to right) Cathy Huyghe, A Balanced Glass; emcee Erin Kirschenmann, *Wine Business Monthly*; Amanda Wittstrom Higgins, Full Cup Solutions; Stasi Seay, Hope Family Wines; Maryam Ahmed, Maryam + Company; and Amy Butler, McBride Sisters Collection.



New tools and technology are available to grape growers looking to automate vineyard tasks. Moderated by Loni Lyttle of Advanced Viticulture and a writer for *Wine Business Monthly*, the viticulture session featured Greg Gonzalez, Foley Family Wines; Mark Battany, UC Cooperative Extension, and Dr. Mark Greenspan, Advanced Viticulture.



Microsoft's senior talent acquisition manager, Noël Burgess, led a session on hiring best practices. He walked attendees through new ways of finding candidates, improving job descriptions, and making the hiring process more efficient and effective.



ALL PHOTOS BY STEPHEN HERALDO



In "Exploring New Wine Styles on the Central Coast" six winemakers poured wines that were made using offbeat grape varieties, experimental winemaking methods, or even incorporate non-winegrape ingredients. Led by Trelio's Chris Shackelford, the session featured Joe Barton, Grey Wolf Cellars and Barton Family Wines; Daniel Callan, Thacher Winery & Vineyard; Ryan Pease, Paix Sur Terre; Karen Steinwachs, Buttonwood Winery; Brian Terrizzi, Giornata; and Alex Frost, Sextant Wines.



The tradeshow floor was in full swing, as both vendors and winery/vineyard reps welcomed the chance to reconnect and talk about the latest products. In 2022, a third tradeshow building was opened up to allow heavier and larger equipment to be on display.



Cal Poly's Federico Casassa presented research on phenolics, fermentation temperatures and the effects of whole cluster and stem additions to Pinot Noir.

Direct-to-consumer models have changed, and now more than ever it's important to make sure your brand stays relevant. (Left to right) Lindsey Jessup of Foley Family Wines, Thomas Reiss of Kraftwerk Design and Marianne McGarry Wolf of Cal Poly offered up ideas to help wineries modernize.



TECHNICAL REVIEW:

VARA: A Collaborative Vision

Lance Cutler



VARA
Djuna loading Chardonnay into the press

THE REASONS FOR STARTING a wine business are myriad. A grower may need a home for excess grapes. A millionaire may need a hobby. A person stuck in the rat race may decide to do something less stressful. Sometimes, you just have a dream and can't resist following it.

If the dream is strong enough, people will start planting grapes in some of the least likely places. It's hard enough to succeed in traditional places, like California, Oregon and Washington, but dreamers are having success in the snow of Finger Lakes, New York and the Leelanau Peninsula, Michigan. They are surviving heat waves in Arizona and Texas. Grapes have been planted and wineries have been started in every state in the continental United States.

This particular story is about some dreamers who have decided that New Mexico is the perfect place to bring their dreams to fruition. Xavier Zamarripa was a highly successful artist, having studied mosaic restoration at the Vatican, glass blowing in Murano, Italy then working as a consultant for Daltile and the Mexican luxury tile company, Kolorines. Married in Europe, Xavier returned to his wife's home state of New Mexico with their two daughters and was looking for a new project.

He met another dreamer, Doug Diefenthaler, co-founder of the legendary New Mexico Wine Patrol Distributing Company, and the two became friends. Regularly finding themselves at social events, the two of them would move to a quiet corner to drink wine while discussing life, art and philosophy. Years passed. The two of them attended a lot of events and emptied many a wine bottle.

In their discussions, they talked about the ways Europe influenced America. France had its time influencing architecture, food and wine. Then the focus shifted to under the Tuscan sun with its pasta, Italian villas and food-friendly wines. They both felt that the next big wave would come from Spain. While drinking their way through Albariños, Tempranillos and Garnacha, Doug discussed the Spanish connection to New Mexico wine. The very first *vinifera*, Listán Prieto (also known as the Mission grape), was brought by the Spaniards and had been grown and harvested along the Camino Real in the Rio Grande Valley without interruption since 1629— 140 years before grapes were planted in California.

Xavier got excited, "Why isn't anyone shouting this from the mountain tops? New Mexico was the birthplace of the American wine experience! New Mexico needs to know this! The world needs to know this!"

Xavier told Doug that they should start a company right there in Albuquerque: one that focused on Spanish varietals and Spanish drinking culture, including brandy and vermouth. Xavier envisioned it as a wonderful opportunity. He could use his artistic sensibilities and combine them with Doug's history and experience to assemble a team like no other, made up of incredibly talented people who fit their criteria, shared their work ethic and would be completely captivated by their vision. The project would be their coup de grâce, their last hurrah.

Doug responded, "Xavier, this would be a lot cheaper if we just opened our cellars and kept talking about it."

Eventually, Doug acquiesced. They started the company and named it Vara, the Spanish word for cane, referring to the canes of sovereignty given to pueblo governors by the King of Spain in 1620. The company was to be their collaborative vision, connecting to the past while focusing on the future. They would make wines from Spanish varietals, but they would not be handcuffed to a single place. They wanted to use high-quality fruit from special estates in Spain, California and New Mexico. Their goal was to get the best quality wine into the consumer's glass at reasonable prices.

"The model was to find the best of the best because we were building something unique and beautiful," explained Xavier. "The product is only as good as the raw material. That was the mindset behind it. To have the highest

expression of what you are going to make, you need to provide your artisans with the best tools and materials."

They wanted to put together an "A" team of partner/specialists who bought into the concept and had the talent to bring it to fruition. They first pitched Bob Lindquist and his wife Louisa Sawyer Lindquist. Named one of the world's 50 most influential winemakers by *Wine and Spirits* and honored by the Rhône Rangers with a Lifetime Achievement Award, Bob was the founder of Qupé Winery and had more than 45 years' winemaking experience. Louisa, who was dubbed the "First Lady of Albariño" by *Tasting Panel Magazine*, ran her own Verdad winery, one of the first California wineries to specialize in Spanish varietals. They both immediately embraced the project.

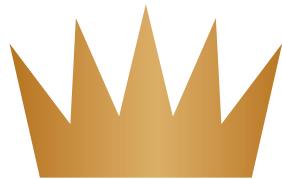
"What attracted us was how unique a project it was," said Bob. "First off, we love all things about Spanish wine, and we were intimately involved with those varietals in California, so there was that connection. Then there was the long friendship I had with Doug, all the way back to the New Mexico Wine Patrol days, and the new friendship we were developing with Xavier. I had just finished with my responsibilities to Qupé, so we were in the right place at the right time."



Xavier Zamarripa and Doug Diefenthaler in Montsant, Spain

Bob and Louisa officially came on board in 2014 as partner/winemakers. They were charged with finding special vineyards in California and making the wine, directing *élevage* of all the wines in Albuquerque and working out the blends. The logistics of making wine in two different countries and three separate places were a bit daunting. In Spain they worked with one estate in Campo de Borja near the town of Ainzón, one estate on the Alt Emporda, another in the Penedes and several estates in Montsant. As soon as the wines were stable post-fermentation, they were loaded into 1,000-liter totes and shipped to the Vara facility in New Mexico.

In California they focused on Central Coast vineyards located in the Edna Valley, Santa Maria Valley, Santa Barbara County and Paso Robles. Bob and Louisa made all the Central Coast wines in their winery at Bien Nacido. Once stable, those wines also got shipped to the Vara facility. (Future plans call for the grapes to be shipped in refrigerated trucks to the new Vara facility in Albuquerque so they can be vinified in New Mexico.)



VARA

WINERY & DISTILLERY



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Owners/Principals

Xavier Zamarripa, Douglas Diefenthaler

Winemakers

Table Wines:

Bob Lindquist & Louisa Sawyer-Lindquist

Sparkling Wines: Laurent Gruet

Distiller: Scott Feuille

Year Bonded 2017

Winery Case Production current: 10,000
(projected in new facility 100,000)

Average Bottle Price \$28

Direct-to-Consumer Sales 39%

VINEYARD INFORMATION

Vineyard Sourcing

- Viñedos de Santo Cristo, Campo de Borja, Spain
- Viñedos Masroig, Montsant DOP, Spain
- Viñedos Capçanes, Montsant, Spain
- Viñedos Espelt, Emporda DOP, Spain
- Ribera del Duero, Spain
- Alt Penedès, Spain
- Mission Ridge Vineyard, Mesilla Valley AVA, New Mexico, USA
- Martian Vineyard, Santa Barbara County AVA, Los Alamos, CA
- Ampelos Vineyard, Santa Rita Hills AVA, CA
- Schied Vineyard, Monterey AVA, CA
- Jack Ranch, San Luis Obispo, CA
- Santa Ynez Vineyard, Santa Ynez Valley AVA, CA
- Vogelang Vineyard, Santa Inez Valley AVA, CA
- Wild Rose Vineyard, Lodi-Woodbridge AVA, CA
- Morro View Vineyard, Edna Valley AVA, CA
- Green Gate Vineyard, Edna Valley AVA, CA
- J&J Shinn Ranch, Mule Plane Vineyard, Lodi AVA, CA
- Mora Vineyard, Los Olivos, CA
- Rancho de Ontiveros, Santa Maria, CA

BUILDING THE WINERY

Year Built Breaking Ground 2021

Size New facility: 80,000 sq. ft.

Architect Studio 151, LLC, Albuquerque, NM

WINERY

Cooperage

Barrels Tonnellerie, Boutes, Cadus, François Frères, Ermitage, Giraud, Baron, Mercury, Montguillard, "O", Tonelería Antonio Páez S.A.

Barrel Washing System Hotsy

Winery Equipment

Bottling Line Cork Mobile Bottling, Atascadero, CA

Hoses MoreWine: Continental Vintners Reserve Hoses, Assemblies, and Bungs

Pumps Cenoflex impeller; CPE systems centrifuge; Lenze AC Tech

Pumpover devices JME spray ball



Doug, Louisa and Bob Lindquist, Xavier

Presses 10 ton DeFranceschi

Tanks Letina (6,000L, 8,500L, 1,000L x 2, 600L x 9); Santa Rosa Stainless Steel (4,000 gal x 3, 4,500 gal x 2, 6,000 gal x 3); Transtore Custom Metal Craft 550 gal x 4; St. Patrick's of Texas: Letina tanks, cartridge filters, gaskets; Glacier Tanks: gaskets, triclamps, reducers

Tank heating/chilling system 2x Quantech Chillers and 2x Fluid Chillers

Crushpad Equipment

Bin Dumper Liftmaster (purchased from Malavac Inc.)

Winemaking

Analytical Equipment Anton Paar (Alcohol); Vinmetrica (SO₂ meter); ETS Labs, Napa CA - analysis

Filters Mori 40 x 40in plate and frame; Scott Labs: Seitz Filter Pads, Destainex, GUTH tank agitator; Ertel/Alsop: Filter and filter media; Mori 40 x 40 plate and frame TCW Equipment: Filter

Yeast, nutrients, enzymes Vintners Vault: Potassium Metabisulfite, Citric acid, tartaric acid, cream of tartar; Gusmer Enterprises: gelsol, bentonite, keislesol; Oenofrance USA: Selectys L'Elegante, Vivactiv Armoe, Performa, Malo, Bacteria Crescendo, Lysis, Vinificateur, Clar T Special Tirage, Colle de Poisson, Yeast SP 7, Phosphate Compose

Accounting software Quickbooks

Club Management Active Club

Tasting Room POS Activ8

Tasting Room/Tapas Bar Reservations Open Table

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Label Printing Stixon

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125-year-old Godello vineyard in Valdeorras, Spain

For now, both California and Spanish wines arrive at New Mexico in bulk. They are shipped young, and *élevage* occurs at the New Mexico facility. All wines are finished, blended and bottled at Vara in Albuquerque. Bob and Louisa go six times a year to direct the winemaking and determine the blending, which is carried out by Vara's Djuna Benjamin. Some Vara wines, like the Viura and Garnacha, carry Spanish appellations. Others, like the Monastrell and Albariño, are designated American. They have two Tempranillos: one from Spain and another from America. By law, to be designated American or Spanish, at least 75 percent of the wine used in the blend must be from the designated country.

Louisa pointed out, "It's a really unique vision: to blend the two cultures, the two histories and make the best wines possible. We've been importing interesting wines from Catalonia, Montsant and Campo de Borja. They are old vines with distinctive soils, and virtually all are farmed organically. The ultimate goal in our blending is to make the best wines possible. We don't always blend the Old World and New World wines together; but if it makes for a better wine, we can do that."

Bob summed it up this way, "We are shooting for a more traditional European style that has subtlety, balance and freshness. Our goal is to make wine that you can drink with food—a wine that two people can drink together—but when the bottle is empty, they wish they had another glass or two."

Added Louisa, "It is great to have these incredible components to work with on both sides of the world. It is a wonderful opportunity for us as wine-makers, and it is loads of fun."

In 2018, Vara opened a winemaking facility and tasting room, serving Spanish-influenced food prepared by their private chef. By 2019, Vara was operating on all cylinders. Wines were coming in from their special vineyards

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Laurent Gruet checks the density of freshly pressed Chardonnay.

in Spain. Other wines were getting made in California and then shipped to New Mexico. They were producing both still wines and cava sparkling wines. In keeping with their intent of trumpeting New Mexico's historical role in this country's wine history, they created a wine called Viña Cardinal, a Rosé aperitif wine produced from 100-percent New Mexico heirloom Listán Prieto grapes and fortified with grape spirit produced in Vara's own distillery.

"We envisioned Vara as an international family of Spanish and American wines, celebrating the American wine experience thanks to the historical connection of Spain and New Mexico," Doug explained. "For Vara's first 100-percent New Mexico wine, we used Listán Prieto, the original *Vitis vinifera* brought from Spain and planted here in New Mexico. We were able to create a unique, delicious wine. It was an opportunity we couldn't pass up."

In December 2020, an old friend joined the Vara team to head up their sparkling wine production. Doug and Laurent Gruet had teamed up many years before and together had made Gruet, the most successful winery in New Mexico's history. Robert Parker had deemed Laurent's Gruet Blanc de Noir the "best sparkling wine in the United States."

"We had worked together before," said Laurent, "and we were remarkably successful. It is like we wrote a book, but now we can write a second chapter. Experience really matters in the wine industry—and also people. I have

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Barrel room at Vara

known the partners at Vara for 30 years. They have a great plan, and they are wonderful people. I am thrilled to be a part of it.”

Vara will have two tiers of sparkling wine. The first, dubbed Silverhead, blends wine from two grapes in Spain into wine made in California. The wine in Spain was made according to Laurent’s instructions then shipped to New Mexico in bulk. The Silverhead sparkling wines are scheduled to spend 15 months en tirage and should have good acidity, balance and more fruit.

Laurent supervised production from 100 tons of California grapes in 2021. “I’ve worked with these grapes for Gruet for many years, so I am familiar with them.” Much of the California product will go into the new upper-tier Laurent Laurent sparkling wine, which will offer a Brut with 18 months en tirage and a Blanc de Noir with 24 months. Next year, Laurent is planning to harvest some Listán Prieto at 16 to 17° Brix to blend into Chardonnay and Pinot; he is excited to see what he comes up with.

Doug and Xavier recently purchased 30 acres in the beautiful north valley of Albuquerque near the original Camino Real to establish Vara estate vineyards. The land is currently being planted with rootstock for Listán Prieto, Macabeo, Xarel-lo, Pinot Muenier, Pinot Noir and Chardonnay. They also purchased Shady Lakes, a natural wonder located adjacent to their estate vineyards. Shady Oaks has been a community favorite for 55 years with beautiful ponds, teeming with fish and water lilies, huge cottonwood trees and picnic areas.

“The vision for the property is that we needed to create an agro-tourism destination that serves as a beacon to tell and commemorate the story of the first vines planted in New Mexico, which started the entire American wine

experience,” Xavier explained. “For the first time, we are creating a public and private partnership that benefits the New Mexico Wildlife Federation, the Albuquerque Sign Language Academy and a bunch of other non-profits, like Ducks Unlimited. Vara’s philanthropic mission is to preserve and protect the lakes and fishing areas on the property and provide programs for the kids to continue outdoor education and introduce them to the agro-world.”

There are plans for Vara to use holistic and Biodynamic® principles for the landscape and vineyard design. They hope to reduce reliance on ground-water and surface water withdrawal while recycling treated wastewater for irrigation. They are setting up a program to educate visitors and the public on water-efficient development strategies appropriate for arid climates, specifically the Middle Rio Grande watershed.

With all these projects moving forward, Vara’s new winery and distillery are already under construction, scheduled to open in 2023. By the time they are done, Doug and Xavier envision a vertically-integrated vineyard with winery, distillery, restaurants, lodging, retail space and an event venue that will serve as a mecca for tourists who are wishing to explore New Mexico’s historical influence on wine in America.

This small group of people in New Mexico has embarked upon an ambitious adventure. The sheer audacity of the project is reminiscent of Don Quixote’s escapade (which was written about the time Spaniards first planted Listán Prieto grapes in New Mexico). Xavier tells why he is attempting so grand a venture. “I view this company and project as the greatest art piece I will create in my lifetime. In the assembly, it is one giant mosaic to me. Every piece matters. Every little piece is crucial. In the blend, the grapes and spirits are all like colors to me. Each one matters. I want to provide the world with that unique, beautiful expression every time from these great artisans.”

The reasons for starting a wine business may be myriad, but only a few lucky people who build a business have the good fortune to live out their dream, be successful *and* reap substantial rewards. Then, some of them choose to start another version of that first wine dream. That was the impetus for this article. Each of the principals in this story created a business, found success, cashed out and had their money in the bank. What made them pony up their time, money and effort for another chance at the same brass ring?

Louisa: Working with these incredible wines from Spain has been a delight. It is invigorating to be exposed to new vineyards and ideas. Doug and Xavier bring an incredible energy and passion to this, which is infectious. It is just fun and interesting to create something, using grapes from quality vineyards. I am happy to do it, and it has been a joyful experience.

Bob: Vara was a project we were already part of tangentially, but then it became something real and interesting that breathed new life into our careers. It is a great thing to be part of.

Laurent: I love what I do. I just love it. The only thing I know how to do is make wine. It is not for the money: it’s for the pleasure. I don’t want to be bored, and making wine keeps me excited every hour of the day. At Vara we all understand each other. We speak the same language. We like good wine, good food and the good life.

Doug: If I was going to do something at this point in my life, I wanted it to be something worthwhile that allowed me to maintain my high standards, and I wanted to collaborate with people I respect. Vara is filling all those boxes.

Xavier: This is invigorating and allows me to keep learning. After all, what you want to do in life is keep learning. I’m like a sponge around Doug, Bob, Louisa and Laurent. My life has become richer than I had ever imagined.

All good reasons and, surely, reason enough. **WBM**

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Oregon Sauvignon Blanc Enters the Flagship Fray

L.M. Archer

DURANT VINEYARDS/ANDREA JOHNSON

MORE THAN 50 YEARS ago, Oregon winemakers established Pinot Noir as their flagship red variety. Today, the state still struggles to find a signature white wine equivalent.

Initially, pioneer David Lett championed Pinot Gris, a cool-climate Alsatian variety. Later, others touted Chardonnay, Burgundy's flagship white, as a natural contender. However, another white variety emerged as a surprising alternative—Sauvignon Blanc.

Playing at the Fringes

Many credit King Estate for putting Oregon Sauvignon Blanc on the map. “I think we were the first, and maybe the only, that have national distribution of Sauvignon Blanc, so I would think it's safe to say we're the largest producer,” said Brent Stone, King Estate COO and winemaker. North America's largest Biodynamic®-certified vineyard located south of Eugene, King Estate bottled its first vineyard-designate Sauvignon Blanc in 2013. Encouraged by the market response, they initiated national distribution in 2018.

But the history of Oregon Sauvignon Blanc predates King Estate's first forays. More than 20 years ago, a trio of Willamette Valley winemakers bottled a bit, dubbing themselves “The Oregon Sauvignon Blanc Cartel.” “It was a big joke because it was us, Jay Christopher and Andrew Rich,” recalled Jim Anderson of Patricia Green Cellars. “Three wineries that made any Sauvignon Blanc—certainly any appreciable amount of Sauvignon Blanc—in



“In our estimation, Sauvignon Blanc is a lot like Pinot Noir in that it shows where it was grown quite a bit in the finished wine.”

Brent Stone, COO and winemaker, King Estate

the state of Oregon.” Anderson and co-owner Patricia Green purchased their 52-acre property on Ribbon Ridge in 2000, which included a block of Sauvignon Blanc vines planted in 1990.

“When we got here, this place had Sauvignon Blanc growing,” Anderson said. “[We thought], well, we like Sancerre, we like Pouilly Fumé, maybe we can make something along those lines out of this property?” Soon their estate Sauvignon Blanc program attracted a cult following with sold-out sales, which led to implementing an equally popular non-estate program in 2004.

Fellow “cartel” member Andrew Rich of Andrew Rich Wines in Carlton happened upon Sauvignon Blanc in 1999 by chance when he attempted to source Pinot Noir from Croft Vineyards near Monmouth. “They didn't have any Pinot to sell, but they did have some Sauvignon Blanc—would I be interested?” noted Rich. “Figuring I needed to get my foot in the door, I tried it, and it was a hit. It's had a steady following ever since.”

Over time, other winemakers cottoned to the grape's success, including Paul Durant of Durant Vineyards in the Dundee Hills AVA. “It really started with Jim Anderson of Patricia Green Cellars,” acknowledged Durant, who grafted 2 acres of his estate vines onto Sauvignon Blanc in 2017 for Anderson's use. “We got the word from Jim.” In 2018, Durant started his own Sauvignon Blanc program and continues grafting over other varieties throughout his vineyards to the grape whenever possible. “It's a very popular wine, obviously, and very obscure in Oregon. It's always nice to play at the fringes. It keeps things interesting.”



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Increased Demand, Limited Supply

According to *Wine Business Monthly* 2020 statistics, Oregon currently lists 55 Sauvignon Blanc producers. Yet supply remains static. “When Patty and I started this winery, there were like 100 wineries in the state; now there’s like 800,” said Anderson. “So, appreciably no more Sauvignon Blanc 20 years later than there was 20 years ago.”

Due to its dearth, Sauvignon Blanc falls under the “other white wine-grapes” category in Oregon, making tracking elusive. “Unfortunately, for the past two years, we have not received enough data to develop estimates for production of Sauvignon Blanc grapes,” confirmed Robert Parker, director of strategy and technical solutions at the University of Oregon’s Institute for Policy Research and Engagement, who compiles the “Oregon Vineyard and Winery Annual Report” for the Oregon Wine Board.

Limited availability frustrates producers. “I think it’s hard to find,” said Durant. “Obviously, scarcity drives some demand. Why isn’t Oregon producing [larger] quantities? Wineries that have it: they’re sold out of it. We’re sold out. Our neighbors are sold out. It’s a hard grape to come by.”



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Fog settles over the vineyard at King Estate

ANDY NELSON

So why don't more Oregon vineyards grow Sauvignon Blanc? "I think some of it is maybe market-driven," offered Rich. "People start planting Pinot Gris, and then that's what everyone's planting, and that's what's selling, and that's what Willamette Valley becomes known for."

Others blame the grape's difficult ripening history in Oregon. "My belief is that most of what we have planted in the valley is based on what has worked in the past," said Kevin Green of La Randonnée Wines in Yamhill-Carlton. "And what would have worked in the past, I think probably would not have included Sauvignon Blanc."

Ironically, climate change has improved ripening conditions. "It's been about a decade now where Sauvignon Blanc has had the opportunity, given how hot it's been, to ripen reliably," observed Green. "Before that time, I just don't think that it would have been reliable enough, each vintage, that someone who was concerned with the plant would be willing to take that risk because historically, it would not have ripened adequately."

Other winemakers agree. "It's easy to get Sauvignon Blanc ripe here in Oregon," said Anderson. "So you know, it's not Sancerre, it's not California, it's not New Zealand. Oregon's got its own thing. People like bright, fresh, dramatic. Balanced, high-acid whites, like Sauvignon Blanc, are easily the best variety for that here in Oregon."

Oregon Style

Yet query a consumer about a definitive Oregon Sauvignon Blanc "style," and most draw a blank. "We've bounced this around quite a bit as a team," noted Stone. "We go all the way down to the Rogue and then all the way up to North Valley and Umpqua to build the 4,000-case program that we have." Ultimately, Stone finds Oregon Sauvignon Blanc combines the minerality and richness of Sancerre in France's Loire Valley with the acidity and green, grassy notes of New Zealand, plus tropical and white peach notes unique to southern Oregon. "The combination of all of those components and regions can make a fantastic Sauvignon Blanc," he said. "We feel it fits its own unique place, kind of in the middle of some of those other regions."

"I think that it's kind of just a little bit of the Chardonnay story, where it's a cooler climate; it's a longer growing season," added Durant about his niche. "So those grapes develop the phenolics that are unique to the northern Willamette Valley, and they retain their acid well. You get this beautiful, fruity balance of fruit-forward wines that still have a really bright, crisp acid component to them that I think makes it unique."

Vineyard Choices

Stylistic imprinting begins in the vineyard. Throughout Oregon, Sauvignon Blanc Clone 1, a tropical-noted Bordeaux clone sourced from California's Wente Vineyards, predominates. Other clones include tiny amounts of 20 (France), 27 and 906 (Bordeaux), 28 (Italy) and 530 (Loire). One notable exception: Ray Walsh of Capitello Wines sources a rare Sauvignon Gris mutation that looks like Pinot Gris but tastes like a floral-noted Sauvignon Blanc, from Elkhead Vineyard in Yoncalla, Oregon.

Sustainable farming proves the norm rather than the exception. "We're the largest Biodynamic vineyard in North America," said Stone. "So it's been a huge commitment from the family here at King Estate, sustainability. And so, you know, that's always going to spill over into your partnerships and what you look for in your grower partners."

"Most of the Sauvignon I work with has come from Croft Vineyard, which is in the vicinity of Dallas and Monmouth—in what one day may be the Mt. Pisgah AVA," stated Rich. "The soil is marine sedimentary (Bellpine), and the vineyard lies at about 400 feet in elevation. Croft has practiced organic viticulture forever and has been certified for something like 10 years. The vineyard is trellised to VSP, and leaves are generally pulled on the east side only. Harvesting is manual as it is for all our fruit."

Unlike Pinot Noir, Sauvignon Blanc does not ripen in a gentle, predictable upward fashion. "It just like all of a sudden—boom—there you go," said Anderson. "You have ripe Sauvignon Blanc and then go pick it." Thus, controlling acids, sugar levels and phenolics proves a challenge.



RAY WALSH

Capitello Croft Vineyard has certified organic Sauvignon Blanc planted.



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PATRICIA GREEN CELLARS/ANDREA JOHNSON

Estate fruit is hand-harvested at Patricia Green Cellars.

“The goal in the old days was always to have a lot of airflow because of moisture and getting the fruit ripe, and that’s not the issue anymore most years,” observed Rich. “Now the issue is how we keep the sugars in check and get ripeness without high sugar—and, of course, sunburn is a real problem now. So, we pull 75 percent of the leaves on the east side and create dappled sunlight. It’s cool in the morning, and it does help with airflow, but you don’t have the intense heat you do on the west side.”

Walsh, a native Kiwi, harvests Sauvignon Blanc in both New Zealand and Oregon. “In New Zealand, the majority of the Sauvignon Blanc comes out of the Marlborough region, the top of South Island, a valley full of old river beds,” he said. These rocky, salty soils drain quickly, requiring irrigation. Marlborough also features intense UV light, less air pollution and a thinner ozone layer. “We tend to keep a lot more of our canopy on leaves to help shade the grapes, which is also going to help with giving some of those greener, grassier tones and jalapeño-like high notes that we’re looking for.”

By contrast, Oregon enjoys rich, volcanic and marine sedimentary soils. “We’ve definitely got to tell these vines to stop growing, which is why we hedge,” he said. Hedging also helps maintain balance.

“As important as it is with Pinot Noir, I think it’s perhaps equally important with Sauvignon Blanc—that the vigor is in balance with the fruit production,” noted Green, who sources his Yamhill-Carlton fruit from Joel Myers, of Vinetenders. “If there’s a lot of green growth in the vineyard, a lot of vegetative growth, then the risk of more pyrazines, and hence that green kind of quality, is elevated.”

Leaf pulling also controls airflow and sun exposure, mitigating moisture and disease in the soggy Pacific Northwest. “We’re really careful about how we grow it,” said Durant. “We definitely put in the time and effort to make sure that we’re getting a lot of sunlight on the fruit so we can wash out those pyrazines. It’s really artisan-level production because we do a lot of hand work to really get the fruit into a spot to make wines that people want.”



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Cellar Practices

Cellar practices further impact style. Most winemakers employ whole-cluster pressing at low press cycles to retain freshness and avoid harsh phenolics. “I pretty much use the same program in New Zealand that I use here,” stated Eugene-based Walsh. “I use a yeast program that I think really brings out the [lovely] styles, and that’s definitely what we’re all looking for in Sauvignon Blanc.”

Many producers separate ferment lots. “When we first got into it, we wanted to be pretty mindful of keeping everything separate because we were sourcing all these new sites and trying to see how it did by region, by site,” recalled Stone. “In our estimation, Sauvignon Blanc is a lot like Pinot Noir in that it shows where it was grown quite a bit in the finished wine.”

A majority interviewed favor inoculated yeasts over natural ferments. “We have our own Biodynamic vineyard, and we do a lot of native fermentations there,” explained Stone. “But with Sauvignon Blanc, we have selected some commercial strains that we think pair well, based on what we’re going for aromatically.”

As for sulfur, a light touch prevails. “Because of our Biodynamic protocols, you’re kind of capped on what you can use,” said Stone. “So, we don’t make a big distinction when it comes to sulfur. It’s easier to roll everything into very similar protocols when it comes to those kinds of things in the winery.”

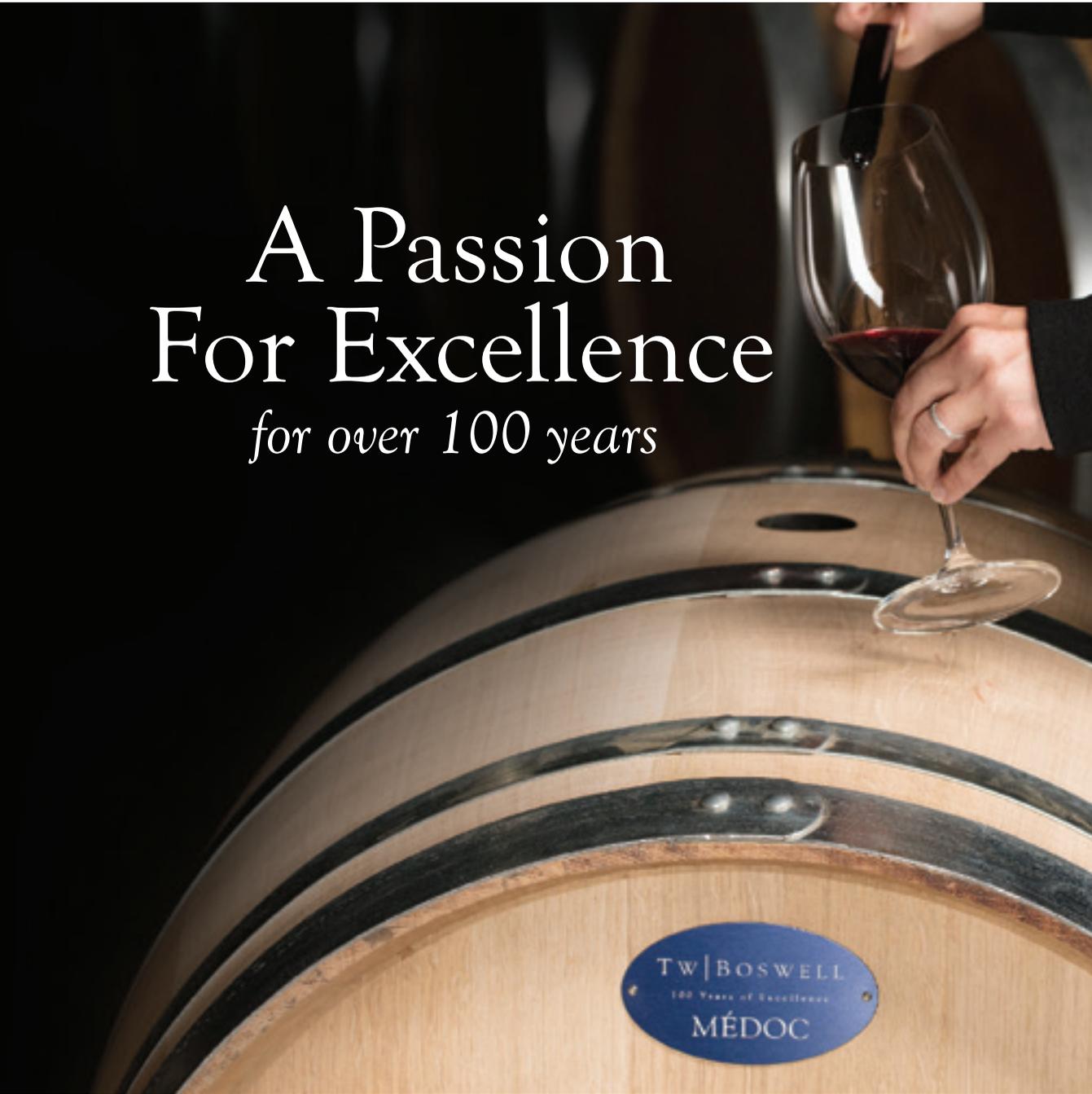
On the other hand, Green, who makes 50 to 100 cases annually—including a sparkling pét-nat Sauvignon Blanc—opts for natural yeasts, along with filtering and minimal sulfur application for his still wines. “This year I’m 100-percent native; last year I was 100-percent native,” he noted. “The majority of that juice winds up going to our still Sauvignon Blanc, whether it’s in bottle or keg, and that gets as little sulfur as I can manage. It also gets filtered again because of that risk-balance calculation. I don’t feel like my primary white product can afford not to be filtered.”

King Estate also filters “because we’re sold in the broad market,” explained Stone. “It’s just a more consistent, stable product.”

So does Walsh. “I fine the juice for any excess phenolics but not the wine (apart from Bentonite for protein stabilization.” He also uses cross-flow filters.

A few, like King Estate, apply bâtonnage to increase texture and richness. Others, like winemaker Leo Gabica of Sweet Cheeks Winery in Eugene, do not. “I like a nice, clean ferment,” he explained.

Fermentation vessels add a final fillip. “Here in Oregon, or Willamette Valley in particular, it really amazed me in the early stages of working with Sauvignon Blanc how, whether a cool year or a warm year, I still got these quite intensive, tropical flavor profiles,” said Walsh. “That led me to buying concrete eggs—I was the first to bring concrete eggs into Oregon and start doing my fermentations that way. I decided to do the Oregon Sauvignon Blanc fermentations in egg to give a rounder profile so that acidity matches the flavor, and mouthfeel matches the flavor profile.”



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Sweet Cheeks winemaker Leo Gabica

Stone warms his fermentations up a few degrees, uses a particular yeast to tamp down aromatics then ferments the wine in neutral oak, stainless steel and the concrete egg-shaped tank to impart minerality. For the New Zealand fruitiness, he'll do the opposite and ferment cool in stainless steel only, using a different strain of yeast to drive aromatic intensity.

Anderson selects stainless steel for his Sauvignon Blanc but settles for acacia puncheons to age his estate bottling. “I would say that acacia wood doesn't necessarily have a flavor profile unto its own, but it takes the very high acid of Sauvignon Blanc and mellows it down. It's almost like turning lemons into lemon meringue pie.”

He first discovered acacia through “cartel” member Jay Somers, former winemaker at J. Christopher. “Jay Somers, who was the owner and winemaker at the time, was making a reserve Sauvignon Blanc called ‘Uber,’ and he was doing it in acacia wood,” Anderson recalled. “I thought it was impressive. I knew that I had these older vines to work with and that they could, at the very least, stand up to the acacia wood.”

For the past five years, Andrew Rich has employed both stainless steel and wood, typically about 66 percent and 33 percent, respectively. Barrels are a mix of sizes, from 228L to 500L, and include some cigars. “Until 2020, only neutral barrels were used, but last year we tried a couple of light-toast Schneckleitner puncheons (Austrian oak) and really liked the results,” he said.



RAY WALSH

Capitello Wines uses concrete eggs for its Sauvignon Blanc.

However, Green favors the freshness of stainless steel. “What I hear from people is, ‘I love the fruit. I love the aromatics. It’s so aromatic. This just smells wonderful.’ I think that going to wood would muddy those waters a bit,” he noted. “I’d get something more complex, but I’d lose some of the pure fruit.”

Hot Category

Beyond bottling and release each spring, the clamor for Oregon Sauvignon Blanc continues. “We realized that in the price point that we’re at, it’s a pretty hot category,” said Stone. “It tends to do well across a range of consumers.”

“I think Sauvignon Blanc is the person that shows up and says, ‘I brought the fun,’” described Durant with a wry laugh. “I just think it is a very user-friendly wine that people enjoy drinking. I think Chardonnay can be a little bit more of a serious wine; I think Sauvignon Blanc is just a very pleasurable wine to drink.”

And more affordable, too. Unlike premium Pinot Noir, Sauvignon Blanc offers consumers an affordable entry point into Oregon wine, with most prices ranging between \$19 to \$35. “I think it’s a great opportunity for Oregon,” noted Green. “To sell Sauvignon Blanc in the Northwest is a great way to get more people to appreciate what we’re doing in Oregon or what we can do.”

Gabica reports a keen interest among Gen Xers, whom he said, appreciate “nice refreshing, more fruit-forward wine,” followed by equally interested Millennials and Boomers. “I think it will be the next variety coming up,” he said. “We can see demand just keeps growing.”

“You have a blank canvas because there aren’t a lot of expectations for what an Oregon Sauvignon Blanc should or shouldn’t be,” concluded Stone. “You’ve got the ability to really stretch your legs when it comes to the variety. It’s a neat, exciting thing for Oregon winemakers to work with Sauvignon Blanc, and I think you’ll see the category grow as we get more planted, as we get into more markets, and we get it in front of more customers. We’ve had a lot of fun with it.” **WBM**

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Sulfur Dioxide: Understanding its Past, Present and a View into the Future

Richard Carey

“**SULFUR DIOXIDE IS ONE** of the older amendments added to wine.” This was an opening statement by Dr. Andrew Waterhouse, professor of enology in the department of viticulture and enology at the University of California, Davis, in his address to the Unified Wine & Grape Symposium in 2020 for the best paper in enology. While listening to his talk, I knew that an article could provide readers with important new information about SO₂ discovered by Waterhouse and his lab, as well as contributions from the research of other scientists, in particular, Dr. Gavin Sacks, professor of food chemistry at Cornell University.

SO₂ is, in one sense, a simple material that has been used for more than 200 years to preserve wines. However, the chemistry of what happens when SO₂ is used is complex and intricate. Therefore, the goal of this article is to help readers understand the unique work presented at Unified and the results of other research advances in the complex reactions in wine that emanate from SO₂.

The sophisticated chemistry SO₂ in wine can be reduced to simpler terms. However, for those readers who have forgotten a lot of the chemistry definitions learned in college or high school, I have included a box with definitions of some terms that are not frequently used (see page 37). A term included in the box will be printed in **bold** the first time it is used in the article.

The Power of SO₂

The main purpose for the use of SO₂ has been for microbiological control of wine organisms and protection against wine oxidation. The classic graph illustrating the **dissociation** of SO₂ describes how this molecule exists in wine (**FIGURE 1**). This graph indicates that, depending on the pH of the wine, the three components of SO₂ when dissolved in wine will vary as the

pH changes. The active part of the SO₂ molecule in a wine solution is its molecular form, plus HSO₃⁻. In the pH range of wine, **molecular SO₂** exists at level of less than 5% of the total, HSO₃⁻ accounts for < 94.4% and SO₃²⁻ is in an even smaller percentage (< 0.1%). Most winemakers have heard about the other two forms of SO₂ in wine, the bound and free forms. The free form is comprised of molecular and HSO₃⁻, the only active form for microbial control and oxidative protection, and researchers over the last few years have concentrated their efforts on understanding how the SO₂ molecule works its chemical force on maintaining wine quality.

Conventional Measurements of Sulfur Dioxide

There are several interesting historical facts about the analysis of SO₂ in wine. Early analysis of SO₂ began in late 19th century, with investigations of the aldehyde-Schiff reactions with pararosaniline dyes. At that time, two sets of reactions based on the direct oxidation of SO₂ became available to the wine industry. In 1892, M. J. Ripper published a method of analysis for SO₂ in the *Journal Praktische Chemie* that was adopted by the industry to analyze, accurately for the time, the concentration of SO₂ in wine. Then, in 1900, Prud'homme showed that the reaction products of basic fuchsin with/and sodium bisulfite on acidification changed the dye color in direct concentration to the amount of SO₂ present. These two reactions formed the basis of SO₂ analysis for many decades, with the Ripper method adopted by many wineries and the fuchsin reaction used in spectroscopic test kits.

In 1970, Rankine *et al.* described the aeration oxidation (A-O) reaction in an article published in the *Australian Wine, Brewing and Spirit Review*. J. W. Buechsenstein and C. S. Ough validated their work in an article in the *ASEV Journal* in 1978 that brought notice of this analysis to the U.S. wine industry.

Additional contributions to SO₂ analysis follow two other technologies. The first uses a liquid or gas sampling media. Known as Fourier Transform Infrared spectroscopy (FTIR), it is represented primarily in the wine industry by the FOSS analyzer. The second analysis separates SO₂ from the sample using a membrane before determination of SO₂.

Consequently, there were then two groups of analytical processes. The first, composed of Ripper and Fuchsin reactions, are based on direct oxidation of SO₂ at the time of quantification (titration). The other reactions separate SO₂ from the reaction media and then perform the quantification, such as with A-O that uses vacuum aspiration to volatilize SO₂ and then titration. All these technologies follow a similar functional protocol of acidifying the sample prior to determination to drive the free SO₂ to its gaseous state.

In 2015 Coelho *et al.* added a significantly new understanding to SO₂ analysis by showing that all of these analytical procedures can overestimate the amount of free SO₂ in some wines, notably in young red wines.

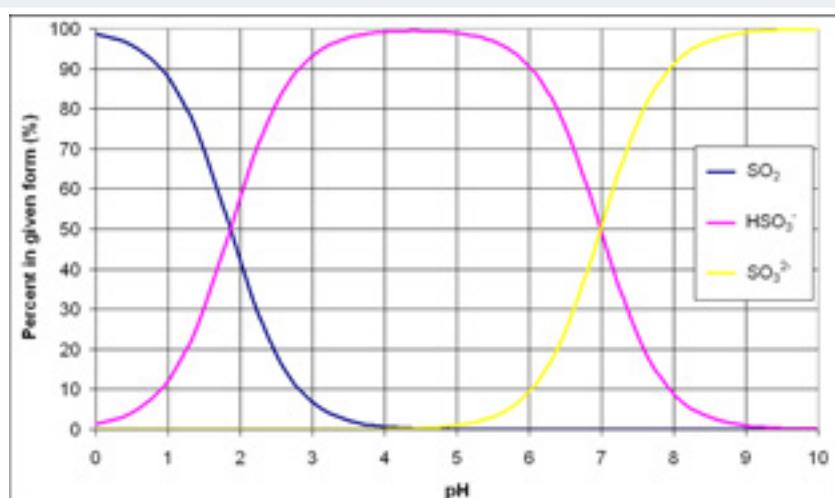
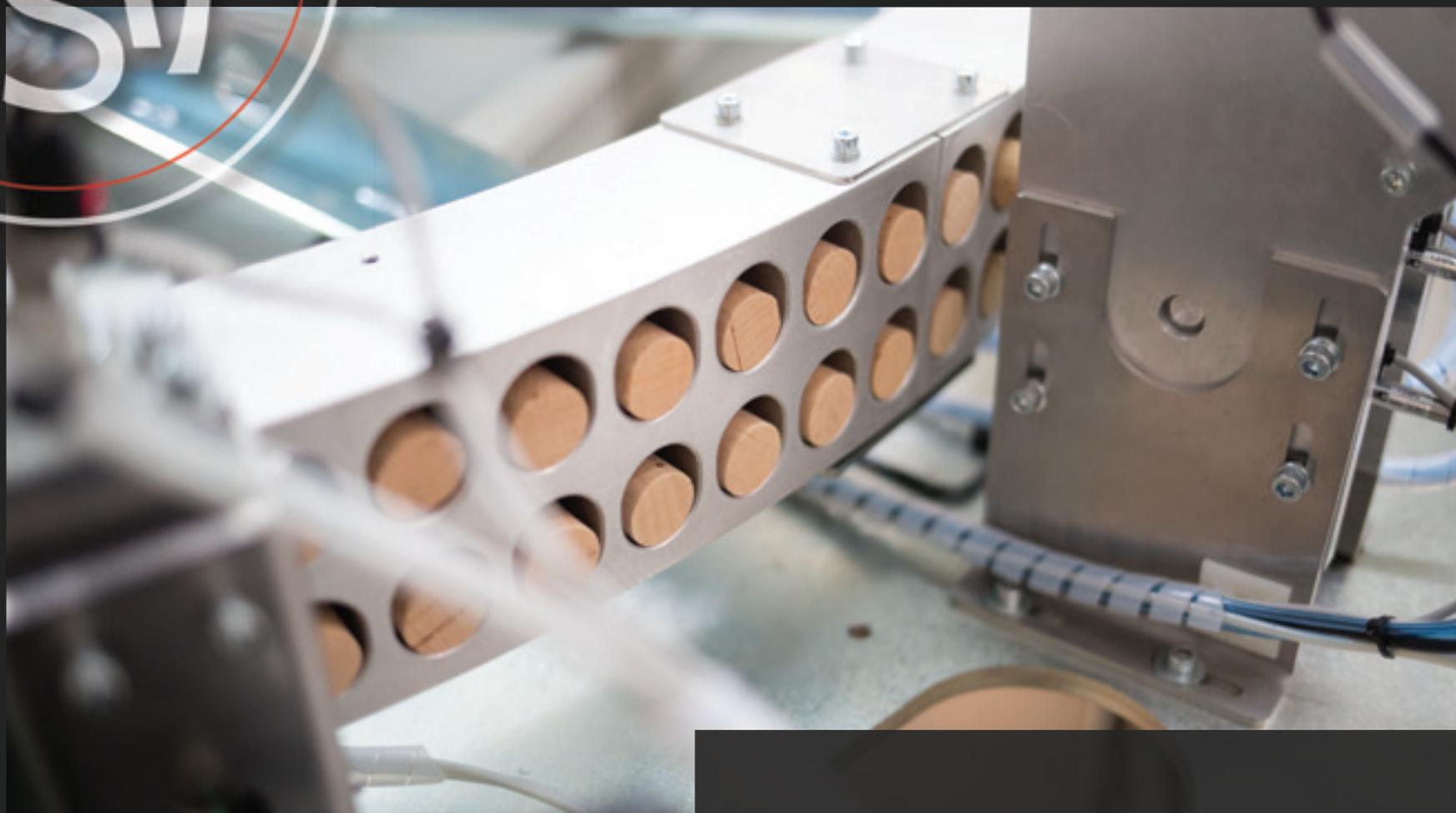


FIGURE 1 Dissociation graph of SO₂ showing the ionization species for SO₂ in wine as a function of pH in a dilute solution.



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This observation sparked interest in other researchers to understand what accounts for this overestimation and what are the implications of this condition. In this paper, they described a different analytical procedure identified as the Headspace Gas Detection Tube (HS-GDT) analysis (FIGURE 2).

The HS-GDT procedure repurposes a 60 ml plastic syringe into a headspace instrument. The user pulls in 10 ml of wine, leaving 50 ml of headspace. Attached to the end of the syringe is a stopcock that is connected to a tube with an SO₂ indicator (GASTEC 5LB, Sulphur Dioxide Tube, 0.05-10, Range (ppm)).

To execute the analysis, the technician shakes the syringe, lets it equilibrate and then opens the stopcock to push the headspace into the tube above. The gas reacts with the indicator that changes color in a linear response to the volume pushed. From this point, the work of Coelho *et al.* created a protocol and formula to determine the quantity of SO₂ required to change a fixed length of the colored tube. The results of that work reinforced the results of research done by Burroughs *et al.* in 1975 that showed the quantity of free SO₂ measured by a conventional method (A-O) in some wines varied significantly from what was determined by the new method. When young red wines are analyzed by a conventional analysis, they appear to have a significantly higher free SO₂ levels than what is expressed when analyzed by the HS-GDT analysis.

In a 2018 paper, Howe *et al.* investigated the known overestimating of sulfur dioxide analysis by conventional methods including aeration oxidation, iodometric and flow injection means of determining SO₂ in wines. Red wine in particular is known to cause most of this overestimation because of the interaction of HSO₃⁻ forming a **adduct dissociation equilibrium constant** with free anthocyanins. The anthocyanin HSO₃⁻ complex is the favored state of molecular association. This condition is known as the flavylium salt of an anthocyanin. Even though the complex is the favored state, the binding of HSO₃⁻ to an anthocyanin is easily and quickly broken (<1 minute) when acidification of the sample happens during conventional methods of SO₂ analysis. This acidic



FIGURE 2 The headspace gas detection tube apparatus prior to (left) and after (right) headspace expulsion through the gas detection tube.

perturbation of the sample increases the free SO₂ levels by each of these analytical methods above what is the true state of the wine in proportion to free anthocyanin concentration or other similar weakly binding compounds.

The authors understood the two components of what we call free SO₂ to be bisulfite and molecular SO₂ as shown in the dissociation curve in FIGURE 1. The conventional free SO₂ analyses drive all free SO₂ to its gaseous state and then, knowing the pH of the medium, one can calculate the molecular SO₂ level. This is what the conventional methods of SO₂ analysis are based on (A-O, iodometric, etc.) and is what the authors have called **Molecular SO₂**. The second type of free SO₂ analysis by HS-GDT is defined as **molecular SO₂** which identifies the analyzed free SO₂ concentration in its “True” state by not perturbing the weak binding of SO₂. Thus, the conventional methods of analysis should now identify SO₂ as “Apparent SO₂”.

The question now becomes, if this SO₂ is not functionally present in the wine, to what degree is a wine not protected from either microbial infection or changes in antioxidant levels? Experiments were conducted to evaluate the preservative effects of SO₂ on yeast in red and white wines. Two model wines that differed only in one respect, one wine (white) with no anthocyanins and the same white wine with anthocyanins (red), were challenged with live yeast cultures being added to the wines and then viewed over time (FIGURE 3). Both challenged wines were analyzed by conventional and the HS-GDT methods.

The left graph shows inhibition to yeast growth for both red and white wines. In this case, the free SO₂ levels were analyzed by HS-GDT and the red wine adjusted to be equal to the **molecular SO₂** level of the white wine. When presented with the same conditions above, but without the red wine being adjusted to the same molecular SO₂ level as the white wine, and then analyzed with the conventional testing method, the **Molecular SO₂** analysis was found to be at the same apparent free SO₂ level. In this case, only the white wine appears to be protected. This suggests that the perturbed release of SO₂ in the case on the graph on the right, in fact releases the SO₂ only in time for the analysis, but the SO₂ weakly bound to the red wine anthocyanins cannot provide antimicrobial protection to the wine.

Although not explicitly stated in this paper, it is reasonable to assume more work needs to be investigated to determine if the antioxidant properties of SO₂ change in times where apparent SO₂ is in excess. Howe has stated this apparent excess SO₂ may be a reservoir for future protection of wine.

Part of the HSO₃⁻ in wine is weakly bound to anthocyanins and other wine constituents. This portion of HSO₃⁻ is added to the molecular SO₂ and provides the total of free SO₂ concentration in the wine. The balance of SO₂

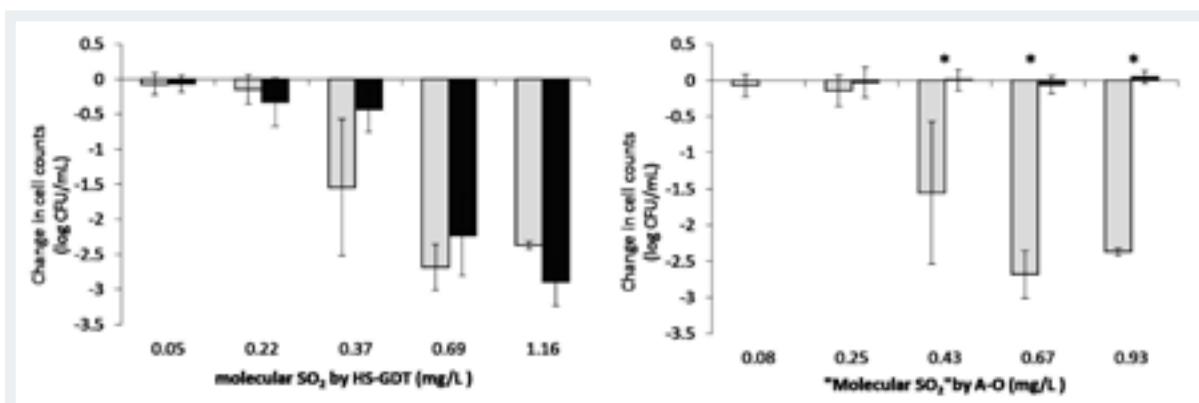


FIGURE 3 Experiment A. Change in cell counts (log cfu/mL) relative to SO₂-free control for pairs of white wines (light bars) and “red” wines (dark bars). The treatment pairs were matched for either molecular SO₂ (left) or “Molecular SO₂” (right), as described in Table 3. Cell counts were calculated as the average of the time points T6 to T9; error bars represent standard deviations of these measurements. *: significant difference in cell count change between “red” and white wines at a given SO₂ level (p < 0.05). HS-GDT, headspace gas detection tubes; A-O, aeration-oxidation.



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constituents forms covalently bound **nucleophiles**, such as acetaldehyde. The sum of these two parts equals the total SO₂ in the wine.

The next challenge experiment on red and white wine found that for red wine, the efficacy of SO₂ is lower in red wine than in white wines for the same total SO₂ addition. A-O analysis could not explain this difference, since **Molecular SO₂** was not different between white and red wines with the same total SO₂. HS-GDT analysis showed that **molecular SO₂** was significantly lower in red wine than white.

Another factor in understanding SO₂ in wine is the effect of oxygen (O₂) on SO₂ changes in wine. In “Free, Bound, and Total Sulfur Dioxide (SO₂) during Oxidation of Wines,” Dr. Gavin Sacks *et al.* described the changes in SO₂ in Bag in Box (BIB) wines over time and the **oxidizing** effects on the wines. Previous work by Danilewicz shows that the main pathway for oxygen consumption in wines is through reaction with phenols and metal catalysts to generate an oxidized phenol (quinone) and hydrogen peroxide. If SO₂ is sufficiently high, it will consume both the quinone and the peroxide at a ratio of 4 mg total SO₂ to 1 mg O₂. In addition, there was surprise to see that bound SO₂ can hydrolyze to replenish free SO₂. For this reason, total SO₂ declines as O₂ is consumed. Thus, winemakers should note that their wine is protected by the amount of total SO₂, not just free. However, when the total approaches ~10 mg/L (the actual amount varies by wine), oxidized aromas will start to appear from aldehydes that are no longer bound to SO₂.

The BIB study examined SO₂ and O₂ reactions as a model study since this packaging form has a significantly greater rate of O₂ ingress and helped gather important data that can be applied to bottled wines. The oxygen transmission rate (OTR) for bottled wine is <0.015 mL O₂/day per package (equivalent to <0.03 mg O₂/L per day) and can range up to 0.17 mg O₂/L per day for BIB.

SO ₂ binder	Typical concentration in mg/L (range) ^a		K _a (M) ^b
	Red	White	
Acetaldehyde	25 (nd-211)	40 (7-240)	1.5 × 10 ⁻⁶
Pyruvate	14 (nd-113)	25 (5-92)	1.4 × 10 ⁻⁴
α-Ketoglutarate	74 (7-208)	31 (6-202)	4.9 × 10 ⁻⁴
Methional	0.045 (0.017-0.064)	0.033 (0.010-0.052)	2 × 10 ⁻⁵

TABLE 1 ^aValues from Jackowitz and Mira de Orduna (2013), except methional (from Bueno et al. 2016).

^bValues from Burroughs and Sparks (1973a) at pH 3, except methional (estimated value from Bueno et al. 2014).

The ingress rate of O₂ into packaging would be slower than the rate the wine can consume O₂, and therefore O₂ will be consumed by SO₂ without building up measurable O₂. The study examined the ratio of total SO₂ loss in a package to free SO₂ loss in a package.

As indicated in **TABLE 1**, **adducts** of SO₂ have a range of affinity for SO₂. Acetaldehyde has one of the strongest **adduct dissociation equilibrium constants** and holds very tightly onto any SO₂. Other adducts in this list will release SO₂ back into the wine more easily than acetaldehyde. In this study, both total and free SO₂ fell, but at different rates. From Danilewicz’s previous work, the main pathway for free SO₂ loss was through consumption of peroxide and quinone formed via wine oxidation. As free SO₂ is consumed, equilibrium is re-established, and some bound SO₂ becomes free. Total SO₂ decreases at a faster rate than free SO₂. In **FIGURE 4**, the three wines investigated show significant drops in total SO₂ over the time and it was also

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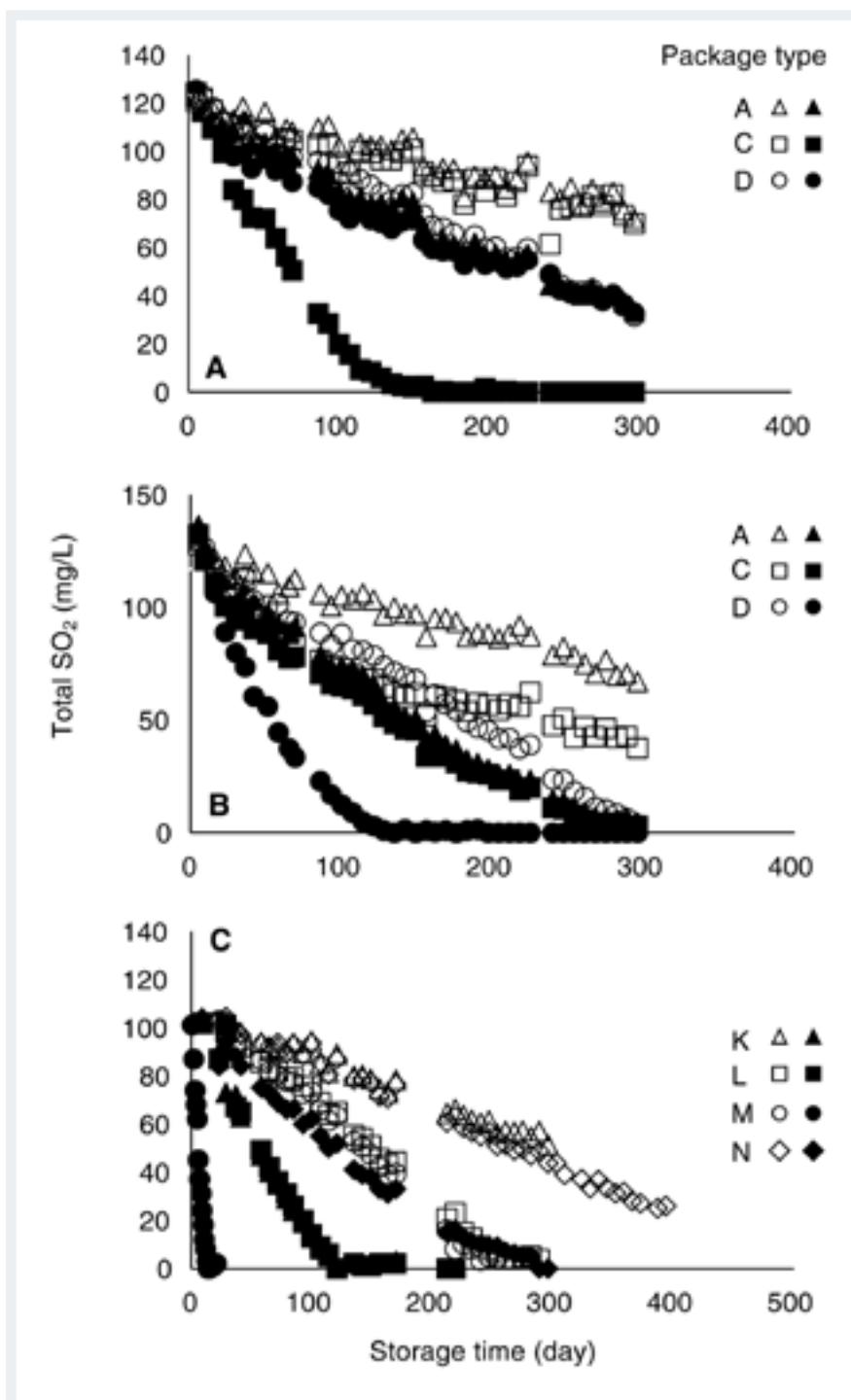


FIGURE 4 Total SO₂ versus storage time for Chardonnay (A), Merlot (B), and Cabernet Sauvignon (C) in bag-in-box packaging at different storage temperatures (31°C – closed marker, 19°C – open marker). The different marker shapes represent different packaging types, as described in the Materials and Methods. Data points represent averages of replicate bags (n = 2 or 3). Average standard deviations were <2 mg/L for total SO₂.

significantly accelerated by the storage temperature. Next, they compared the drop in free SO₂ as compared to total SO₂ (FIGURE 5). It is very clear that the rates fall in general synchronization, and that eventually all SO₂ is gone. The rates of SO₂ loss varied widely, influenced by packaging materials and temperature.

BIB packaging had OTR rates up to 22 times that of bottled wines, which is not as surprising as what happens to the total SO₂, as O₂ permeates the packaging. Much of this was thought to be due to package specific issues such as the tap. Free SO₂ fell more rapidly than total SO₂. Sacks et al. found that even after free SO₂ had become undetectable, total SO₂ continued to fall at the same rate as it had for the same package type and was generally falling across package types.

Therefore, OTR appears to be the driving force for SO₂ consumption. As soon as free SO₂ is consumed, the equilibrium is disturbed, and SO₂ is

Definition Box

Dissociation Constants K

K is the symbol for constants. Here we are referencing dissociation constants of acids or bases. A preceding character of **p** stands for proton, or **e** for electron

A following subscript refers to the type of constant **a** for acid, **b** for base, **d** for dissociation **eq** for equilibrium

pKa is the **negative log base ten of the Ka value (acid dissociation constant)**. It measures the strength of an acid – how tightly a proton is held by a Bronsted acid. The lower the value of pKa, the stronger the acid and the greater its ability to donate its protons. In the case of wine, this value is changed modified by alcohol concentration, temperature and ionic strength

K_d adduct dissociation equilibrium constant is used to identify the dissociation of molecular species governed by parameter such as temperature solubility and other factors effecting the degree of dissociation of the molecular elements

What is the relation between pKa and pH?

pKa: is the proton equilibrium constant dependent on the concentration of acid, conjugate base and H⁺. pH: pH depends on the H⁺ concentration. Conclusion. Both pKa and pH are very important parameters in laboratory practices. The main difference between pKa and pH is that pKa indicates the dissociation of an acid whereas pH indicates the acidity or alkalinity of a system. References: 1."PH."

What does a value of Keq greater than 1 mean?

A value of K_{eq} greater than 1 means that products are favored over reactants; **a value of K_{eq} less than 1 means** that reactants are favored over products. equilibrium position. relative concentrations of the reactants and products at equilibrium of a reaction, it indicates whether the reactants or products are favored in a reversible reaction...

Molecular SO₂ in wine is defined as the quantity of the neutral molecule in ppm of SO₂ that is undissociated in wine at a given pH.

Free SO₂ is the sum of the molecular form and the HSO₃⁻ form. A portion of HSO₃⁻ will also exist in forms with wine nucleophiles such as acetaldehydes.

Reductive agent: a substance that tends to bring about reduction by being oxidized and losing electrons.

Oxidizing agent: a substance that tends to bring about oxidation by being reduced and gaining electrons.

Nucleophile: a molecule or substance that has a tendency to donate electrons or react at electron-poor sites such as protons.

"nucleophiles are produced in the formation of acids and bases"

Adduct (from the Latin adductus, "drawn toward") is a product of a direct addition of two or more distinct molecules, resulting in a single reaction product containing all atoms of all components. The resultant is considered a distinct molecular species.

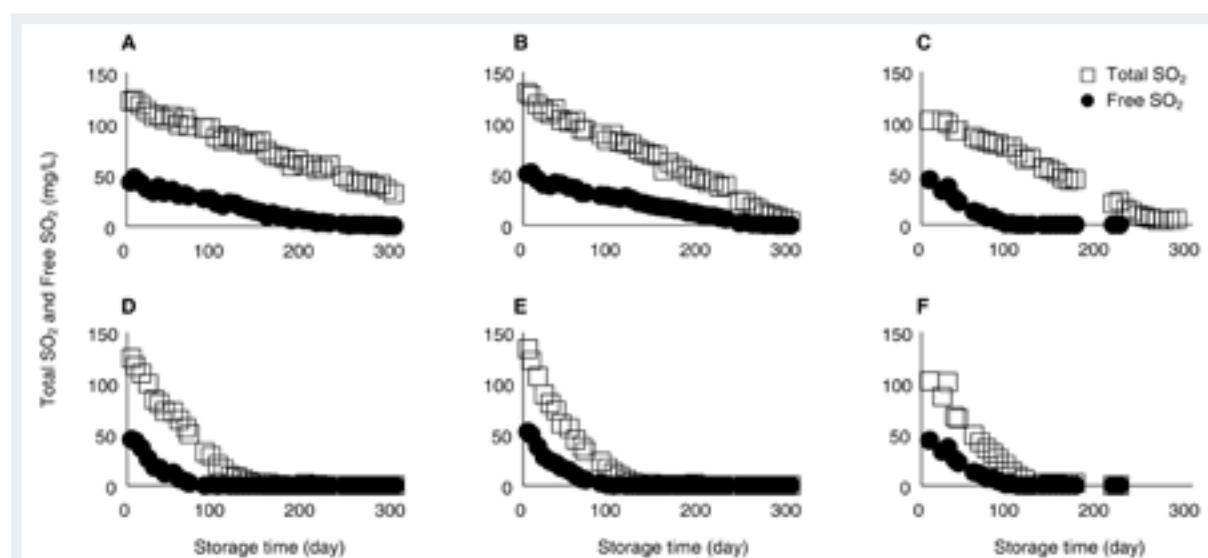


FIGURE 5 Representative data showing total and free SO₂ versus storage time for selected packaging materials: Chardonnay in Package C (left row, A and D), Merlot in Package C (middle rows, B and E), and Cabernet Sauvignon in Package L (right row, C and F). The storage temperature was 19°C for the top plots (A to C) and 31°C for the bottom plots (D to F).

released first from easily accessed free forms and then from the bound forms when the free is lowered to a sufficiently low level. Total SO₂ will continue to fall at the same rate until it also reaches an undetectable level. It was Godden at AWRI who reported that after free SO₂ fell to less than 10 ppm, aldehydic aromas were detected. If these are compounds that don't become apparent until this late state, it would appear that the winemakers need to assure that aldehydes are kept at their lowest levels possible in wines in order to protect against them showing up in aged, long-held wines.

Achieving Better SO₂ Determination

Jenkins *et al.*, 2020 and Waterhouse, ASEV, 2021 presented an improved way to analyze accurately the “True SO₂” and identify differences between the conventional analytical procedures. This method was based on the chemistry of the HS-GDT protocol. The Jenkins research extended the work of Coelho by adopting the same headspace technique into a more rapid and automated analysis. This protocol took advantage of the same property of SO₂, that it is volatile. When in an enclosed space at equilibrium, the solution/headspace equalizes the concentration of SO₂ in both volumes. The analytical instrument chosen was a gas chromatograph with a specialized detector for sulfur. It is important to note that while both A-O and the FOSS analyzer take advantage of SO₂ volatility, the HS-GC analytical method is significantly more sensitive than either of those two methods.

The analytical result is entered into a set of equations that transform the headspace result into an accurate measure of the free SO₂ found in the solution and is not perturbed by the anthocyanin bisulfite complex. The method is identified as the Headspace Gas Chromatography (HS-GC) method. This procedure is very quick (8 minutes).

To validate this new method, comparisons were made over many different wines from a wide variety of sources. In **TABLE 2**, this series of wines were analyzed by all four of the analytical procedures to provide the data from which analysis could be extracted in order to assure that the new system was valid. In this table, the two legacy procedures Ripper and A-O are identified as “Apparently” Free SO₂, and the two new procedures are identified as “Truly” Free SO₂. The data from this table is reflective of the normal range of deviation found throughout the industry for the Ripper and A-O methods. With respect to the two new methods, it is certainly obvious that the HS-GC method has a much better coefficient of variance or % RSD. However, wine-makers will undoubtedly take into account that the HS-GC method requires

an expensive instrument that most wineries cannot afford. In comparison, the HS-GDT can be roughly assembled for just a few dollars for the permanent equipment and a recurring consumable charge of about \$7.00 per tube. It is not out of the question that many wineries can afford a bit of impression to determine if they can benefit from this technique.

In the course of this work, the researchers validated the current conventional methods of Ripper and A-O (**FIGURE 6**). Here they show there is a better than has been recognized correlation between these two legacy methods than was thought to exist. In earlier studies, some results indicated that the % RSD from Ripper were greater than those of A-O. Reagents and more refinements of technique and instrumentation show that the

Results of free SO₂ in the test wines using aeration-oxidation (A-O), Ripper, headspace gas chromatography (HS-GC), and headspace gas detection tube (HS-GDT) methods. ^a

Sample ID	Wine type	“Apparent” free SO ₂ (mg/L)		“Truly” free SO ₂ (mg/L)	
		A-O	Ripper	HS-GC	HS-GDT
RED	Red	35.6 (1.0)	44.6 (1.0)	14.9 (0.2)	14.3 (1.6)
ZIN 1	Red	22.7 (1.0)	22.7 (1.0)	3.5 (0.0)	7.1 (0.9)
PIN 1	Red	30.6 (1.0)	36.7 (0.7)	14.9 (0.8)	15.1 (0.0)
BLAU	Red	13.3 (0.9)	16.3 (0.7)	1.2 (0.1)	1.9 (0.0)
CAB	Red	15.4 (0.0)	19.8 (1.5)	3.6 (0.2)	2.4 (0.0)
ZIN 2	Red	11.9 (0.5)	15.2 (0.4)	1.8 (0.1)	4.4 (2.2)
MER 1	Red	10.0 (2.0)	15.5 (0.8)	<LD	<LD
SAB 1	White	16.2 (1.0)	17.5 (0.8)	22.7 (0.2)	14.6 (0.0)
MER 2	Red	17.8 (0.5)	23.0 (0.4)	10.7 (0.4)	10.1 (1.2)
PIN 2	Red	22.8 (0.5)	30.4 (0.4)	16.3 (1.5)	11.3 (2.4)
MER 3	Red	11.7 (0.5)	15.9 (0.6)	5.3 (0.6)	<LD
ROSE	Rose	21.1 (1.0)	24.6 (1.0)	14.8 (0.1)	18.8 (2.3)
MOSC 1	White	8.8 (0.0)	9.5 (0.0)	2.5 (0.0)	3.4 (0.0)
PIN 3	Red	22.2 (1.0)	8.4 (1.5)	16.2 (0.1)	15.0 (2.0)
ZIN 3	Red	8.0 (0.0)	10.6 (0.4)	2.5 (0.1)	<LD
CHA 1	White	20.9 (0.0)	25.7 (0.4)	15.5 (0.5)	18.2 (2.5)
CHA 2	White	30.1 (0.5)	31.8 (0.4)	11.2 (0.2)	29.1 (1.4)
BRUT	White	27.1 (2.0)	25.7 (1.4)	25.3 (0.9)	25.9 (1.3)
CHA 1	White	17.2 (1.6)	18.1 (0.0)	16.0 (0.6)	15.3 (2.2)
WHITE	White	14.3 (1.6)	14.3 (0.7)	13.7 (0.5)	13.6 (0.9)
MOSC 2	White	17.1 (1.0)	17.3 (0.8)	16.5 (0.7)	13.2 (2.4)
MOSC 3	White	7.4 (1.0)	10.5 (0.8)	6.8 (0.5)	7.3 (1.5)
VIO 1	White	19.5 (0.9)	23.1 (0.9)	19.4 (0.2)	21.8 (2.7)
PORT	Red	<LD	6.4 (0.8)	<LD	<LD
SAB 2	White	23.3 (0.9)	24.8 (0.4)	23.5 (1.2)	23.1 (7.1)
VIO 2	White	15.2 (1.0)	17.3 (0.8)	15.8 (0.4)	11.5 (1.2)
CHA 3	White	32.7 (0.5)	34.5 (0.8)	34.6 (0.7)	34.3 (0.8)
Average Std. Dev. (mg/L)		0.8	0.7	0.4	1.4
Average % RSD ^b		4.60%	3.79%	3.72%	11.83%

^a Standard deviation is shown in brackets. LD: limit of detection.

^b RSD: Relative standard deviation.

TABLE 2

two analyses have a very similar % RSD (less than 5% across 27 wines). It is also not unexpected that the comparison of the HS-GC to the HS-GDT has a greater % RSD (FIGURE 7). It is also worth noting that the % RSD between legacy analysis and HS-GC is quite good (FIGURE 8).

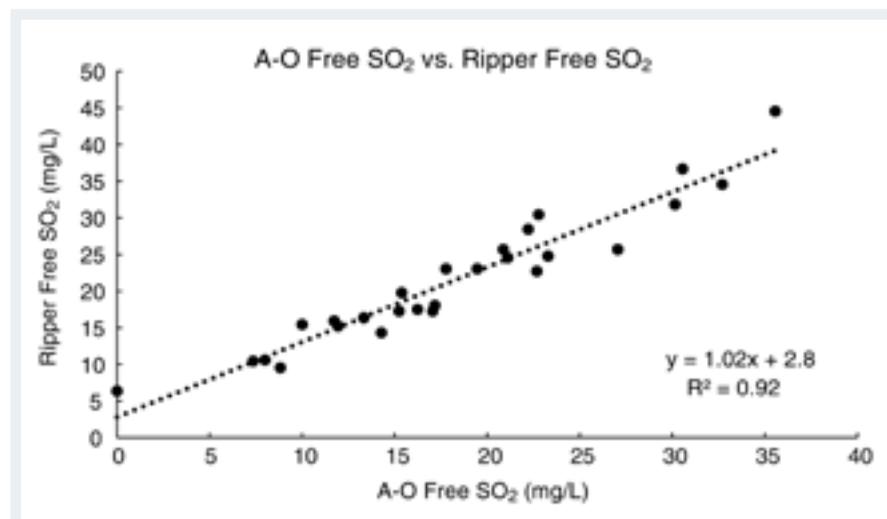


FIGURE 6 Correlation of free SO₂ values measured by aeration-oxidation (A-O) and Ripper methods.

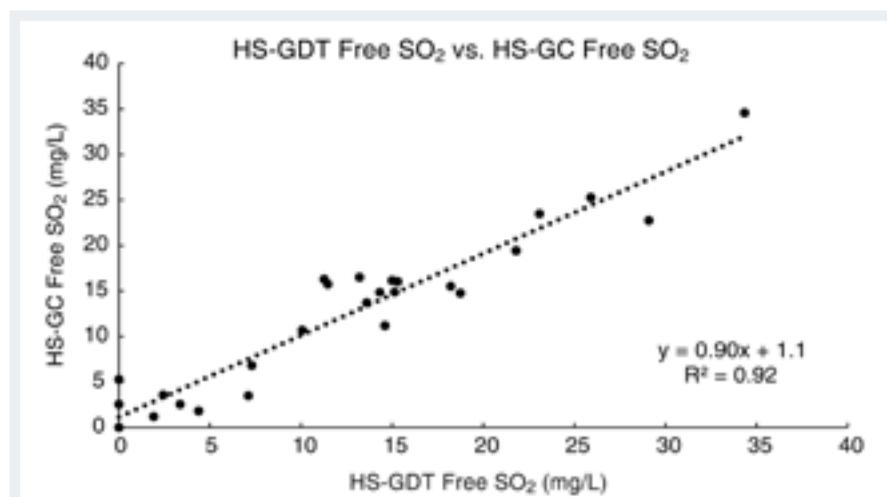


FIGURE 7 Correlation of free SO₂ values measured by the headspace gas detection tube (HS-GDT) and headspace gas chromatography (HSGC) methods.

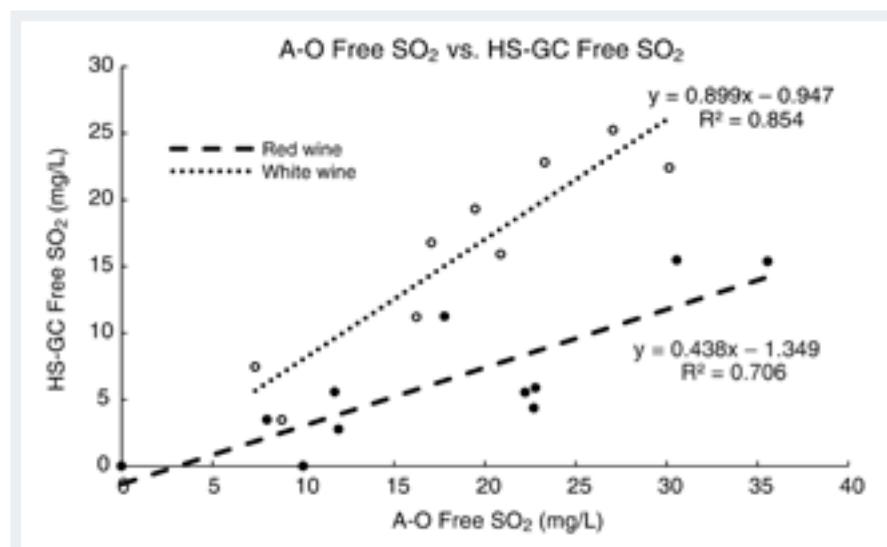


FIGURE 8 Correlations between aeration-oxidation (A-O) and headspace gas chromatography (HS-GC) methods for red and white wines.

Conclusion

The more researchers learn about how SO₂ works in wine, the better predictions winemakers can make about how to improve their wines. Knowing that there are two different types of free SO₂ (Apparent free SO₂ and Truly free SO₂), winemakers should have a wakeup call that they need to conduct a more careful evaluation of primarily red wines, and also on some white wines. These differences in free SO₂ analysis probably will not cause much concern for its antioxidant properties, but likely will be a concern for its antimicrobial properties. It is also a marker for past events as to why certain lots of wine did not turn out as well as the winemaker would have liked, when they “thought” they had maintained the wine in its best condition. It is even more important to realize just a small downturn of SO₂ in red wines could tragically create a possibility for a failure of a lot or vintage.

Acknowledgements

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Old Vines Begin to Capture the Wine World's Attention

W. Blake Gray



RANDY CAPAROSO

Vertical cordon block, Lodi

IN 2004, THE MOVIE “Sideways” excited the wine world, leading to a dramatic upswing in Pinot Noir sales and some unintended consequences. Suddenly the Russian River Valley, site of some of the oldest Zinfandel vines, had the potential for greater profit. Pietro’s Ranch, planted in 1905 by two Tuscan immigrants, was torn out and replaced with “more fashionable” varieties.

In the 2006 vintage, Pietro’s Ranch Zinfandel (which was actually a blended wine with interplanted Alicante Bouschet, Grand Noir, Carignan, Petite Sirah, Syrah and Grenache) was a single-vineyard wine made by Carlisle Winery that sold for \$43. Now, though, I wish I could tell you what happened to those grapes: there is no evidence online that they appear on any wine labels, which means the owners are likely selling them to be blended into some winery’s Pinot Noir program.

From special to anonymous: this is often the fate of vineyards when old vines are torn out. Yet given how small the yields are from 100-year-old field blends and the fact that Russian River Pinot Noir sells for more than Zinfandel, the decision might have made more money for the owners.

The fate of older vineyards, like Pietro’s Ranch, weighed on the mind of Jancis Robinson in 2010 when she started a worldwide Old Vine Register on her site.

Still today, a dozen years later, the best efforts to protect old vines come from initiatives led not by trade associations or government organizations, but by winemakers, journalists and even consumers. There is now an international Old Vine Conference in the United Kingdom. California has the Historic Vineyard Society. But these are efforts led by volunteers. While government organizations sometimes offer funding for viticulture under the general rubric of agriculture, support for old vines is rare.

“The big wineries didn’t want [the Historic Vineyard Society] to happen,” said Tegan Passalacqua, winemaker at Turley Wine Cellars and an old-vine advocate. “They like paying not so much for old-vine grapes.”

Wine Business Monthly decided to look at old-vine preservation programs around the world.

Australia

Australia has some of the world's oldest own-rooted vines because, although phylloxera has been in the country since 1877, it has never spread west from Victoria and into important regions, like the Barossa Valley and McLaren Vale.

Wine Australia has put together an impressive 28-page consumer guide to old vines, complete with maps, photos, explanations of the country's wine history and, most important, detailed descriptions of the country's old vines, often including the name of the person who originally planted them.

The Barossa Valley is extremely well-organized by way of the Old Vine Charter, a register of old vines separated by age. There are separate categories for Old Vine (equal or greater than 35 years of age), Survivor Vine (70 years), Centenarian Vine (100 years) and Ancestor Vine (125 years). That last category lists 10 examples, including some famous vineyards: Henschke Hill of Grace Shiraz and Penfolds Block 42 Cabernet Sauvignon. The website is worth a look for organizations that are considering how to pitch old vines to consumers: Barossawine.com/vineyards/old-vine-charter/.

"The Barossa Old Vine Charter was initially created by Yalumba Family Winemakers in 2008 and then later gifted to the Barossa community to use," stated Amanda Longworth, head of brand and destination marketing for Barossa. "I love this story as it speaks to the collaborative and communal spirit that the founding wine community shared, and that continues today."

Longworth said that old-vine seminars are a key part of Barossa Wine School's educational events for both trade and consumers. McLaren Vale also has an old-vine register, though not as slickly produced.



Chile

Here is my experience with old Chilean vines: On my first visit to the country as a journalist, about a decade ago, I visited some of the País vineyards in Maule that are believed to be more than 150 years old. I wrote a story about the efforts to revitalize them for a publication I won't name (you'll see why). In it, I wrote that the biggest challenge in keeping these vines alive was that growers couldn't make a living on them because producers paid only U.S. \$0.10 per ton for the grapes.

The editor took that information out because he couldn't believe the price was that low. But it was.

Prices are better now, but U.S. grapegrowers will still find them shockingly low. In 2010, a group of wineries got together to create VIGNO, which is devoted to old-vine Carignan. As with País, Chile has many pockets of dry-farmed Carignan vines that date to the 1800s or even earlier. The 16 members of VIGNO include wineries both large and small.

"One of the main objectives of VIGNO is to promote these wines that are coming from older vines and the care and the need for the transcendence of Carignan through some rules, such as the purchase of grapes at a fair price," explained Eduardo Jordan, chief winemaker for Miguel Torres winery. "It is a cause-effect relationship. If there is a demand for these wines, it will help to increase the prices and, consequently, to pay a better price for the grapes."

After more than a decade, Jordan said that VIGNO's efforts have raised the price of dry-farmed old-vine Carignan to ... about U.S. \$1.55 per ton.



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Carignan in Chile

VIGNO

Imagine a U.S. winery buying 60 tons of grapes from a 150-year-old vineyard and getting change from a \$100 bill—but to be fair, that's more than a ten-fold increase. A new organization, formed last year called Almaule, hopes to do the same for País, but it is in its early stages.

Bouchon Winery has been at the forefront of preserving País; it wasn't the first winery to produce varietal País for export, but it is one of the larger wineries to do so. Winery executive director Julio Bouchon said it took about 10 years just to revitalize the País vines on their own property and learn to make good wine from them.

"For us, it was a challenge to adapt our Bordeaux winemaking style into the traditional winemaking: Low intervention, no selected yeast, use of amphora and foudres," Bouchon observed. "Then we started working with small growers. For years they left the vines abandoned because the price that they received was not enough to cultivate properly. We convinced them to work again—like they used to in the past—using no pesticides and herbicides, and only horses to plow. The result is amazing: now we get excellent grapes, and they are happy working again in the farm.

"Now we are in the third step, which is planting new vines," Bouchon continued. "Because País is very old, 100-plus-years-old, we never had the opportunity to know them when they were young. So now we are planting them because we want to leave old vines for coming generations and planting now is the key. There is also a commercial side that is very important. In Chile there are around 10,000 hectares of País planted, and the way to preserve them is to make a sustainable business. We need wine bottled 'País' and branded 'País.' Then if you are able to sell these bottles and make a nice volume, finally you will need to buy more grapes from these producers, and then the circle is done."

Pedro Parra has built his winemaking reputation on Chile's old vines.

"I won't say that old vineyards need to be safe. They are safe and there for 100 to 500 years," Parra told *Wine Business Monthly*. "So me, as a saver, is not really the case. I will say me and others: we add value to the old vines. Old vines are only planted on granite and dry-farmed in Chile. They are 'different' vineyards, so people had problems understanding and loving these vineyards. So, for 50 years, they were totally out, not considered by almost anyone. In the last 15 years things started to change, and people like me and others really found unique value here. It was not easy. You need to get confidence with local old growers, and this takes time and work. Of course, if you buy grapes, you need to pay well and fast. People also can see if you love the vines, so they are happy selling to guys that care.

"It is very clear that the new Chile is really the old Chile," Parra added. "More and more people now buy grapes and produce wine and pay the grapes well. The abuse done by big companies, paying prices that are stupid, is little by little gone, but we are not yet there."

The UK

The UK has very few old vines of its own, yet it is a center of old-vine preservation, not just in Europe but across the globe.

The genesis of the efforts is British author and critic Jancis Robinson, who has been writing about old vines since 2004. In 2010 she published a column on her site titled "World heritage in the vineyard." A discussion among readers in the site's forum led to a suggestion that someone create a worldwide register of old vines. Robinson decided to become that someone.

"In my long career, I feel as though I have always been aware of the special attributes of well-managed old vines," Robinson told *Wine Business Monthly*. "Take the fact that, for example, Château Latour won't put the produce of any vine younger than 12 into the grand vin, and you see all those 'Vieilles Vignes' on labels."

The register now lists 1,484 vineyards in 20 countries. It is, apparently, the only old-vine register for many of those countries, including Spain (846 vineyards, more than half of the total), France (97 vineyards) and Germany (18 vineyards). The relatively small numbers for those last two countries seem to indicate that many old vineyards may not be listed; consider that the USA, which has a wine industry nowhere near as large or as old as that of France, has 244 vineyards registered, the second-most of any country. (Australia is third with 185.)

Robinson came first, and now there's a nonprofit company: The Old Vine Conference. The company's stated goal is "to build a credible category for Old Vine wines." It held three online symposia in 2021 with well-known speakers, including Tim Atkin, Jamie Goode and Jane Anson, as well as winemakers and winery principals from 10 countries. The company also has eight regional ambassadors for different countries.

The OVC keeps a record of its press coverage. It has garnered 51 articles in publications, including the *Financial Times* and the *Daily Telegraph*. For 2022, the OVC plans an expanded conference in October, as well as smaller tastings in the UK throughout the year.

Europe

The OIV (International Organization of Vine and Wine), which is influential in shaping European Union wine policy, has a working group on "Genetic Resources and Vine Selection" that is studying ways to change EU policy, which currently often rewards growers for tearing up old vineyards.

In October 2021, the working group adopted a definition of "old vineyards" as those over 35 years old. The group also released a group of recommendations to member states to study and analyze various aspects of old vineyards. It's early days on this issue for the OIV, but its potential influence should not be underestimated.

Portugal

Portugal has a national program, PORVID, that is intended to help preserve the genetic diversity of the more than 250 grape varieties in the country. A conservation center in Pegões, 40 km east of Lisbon, has collected specimens of more than 30,000 genotypes.

"The source of this plant material is always old vineyards because they were planted before clonal selection started in Portugal, later than most other western European countries," said António Graça, head of R&D for Sogrape, Portugal's largest wine company. "PORVID has also provided assistance to producers, wishing to keep the varietal mix in their old vineyards when these require renewal. PORVID itself is an association of private companies, universities, grapevine technical



organizations, cooperatives, consultants, the local mayor's office and two public institutes under the Portuguese Ministry of Agriculture.

"Based on the work developed since the 1970s, Portugal proposed and obtained unanimous support from 47 countries for an OIV resolution on the use of polyclonal selection as a means to conserve diversity from ancestral varieties, an important tool to stop the rampant genetic erosion caused by modern industrialized clonal selection," Graça explained. "As a consequence, Portugal became last September the first country in the world to officially certify grapevine polyclonal selections."

South America

Despite the size of their wine industries, neither Chile nor Argentina has an organization that compiles lists of old vines. So British wine writer Amanda Barnes, author of the *South American Wine Guide*, has compiled such a list on her website. She has listed 52 vineyards in Chile, seven in Argentina and one in Bolivia. The youngest was planted in 1965; some go back to the 1700s.

"I fell in love with the beauty of old vines on my early trips into vineyards since moving to South America in 2009 but have increasingly become more interested in old vines' ability to survive tough climate situations, drought especially," Barnes told *Wine Business Monthly*. "In the case of South American old vines, they are often Criolla vines (grape varieties brought from Spain during the 1500s), which I think also offer an authentic and unique expression of South American wine. Today you can spend less than \$20 on a delicious bottle of wine made from old-vine País, Carignan or Semillon. That's a huge bargain for the consumer, but I would happily pay an extra couple of dollars to give a higher rate for the grower."

"Most of the producers in South America are paying at least double what they would for grapes from younger vines as a gesture and to try to retain these old vines, but I think, from the consumer and media end, we could push for a special premium we pay on the bottle price (e.g., an extra \$0.50 or dollar), which could go directly to the grower," she added. "I would love to be part of a think tank to do this. In South America, at least, many of the growers are in very humble living conditions and need the extra income to warrant the extra work old vines require."

South Africa

The Old Vine Project (OVP) in South Africa has developed a Certified Heritage Vineyards seal that the project's 112 winery members can put on wine bottles. The project defines old vines as 35 years or older, but the website says that there are 10 vineyards in South Africa that are more than 100 years old.

In 2020 the OVP helped identify old-vine clones of Chenin Blanc that had become extinct in France. InterLoire took samples of the plant material back to France to increase the genetic diversity there.

The OVP Certified Heritage Vineyard label seal became available in 2018. By 2019, the influential *Platter's Wine Guide* included a Certified Heritage Vineyards category.

"The Old Vine Project in South Africa has been integral in highlighting the value of many high-quality older vineyards that were in danger of being replanted, either with new vines or with different fruits entirely, such as orchards or blueberries," said Jim Clarke, marketing manager for Wines of South Africa USA. "Previously, the grapes from many of these sites were being lost in large blends, and the farmers were being paid by weight, with



quality providing no extra dividend for vineyards that due to their age, were yielding fewer but higher-quality grapes. By highlighting these vineyards, providing guidance on how best to farm old vines and connecting wine-makers willing to pay for quality with the farmers of these old vineyards, a crucial part of South Africa's vinous heritage is now thriving.

"South Africa enjoys several advantages in putting together such a program; most importantly, since 1918, the [South African wine producer] KWV and subsequent industry organizations kept meticulous records of vine plantings, taking the guesswork out of the old-vine designation," Clarke said. "Nowadays, study of these old vines is also providing information on how best to plant for the future so that future vineyards can survive heat, drought and other aspects of climate change."



RANDY CAPAROSO

Gobelet and vertical cordon trained vines in the Mokelumne River-Lodi AVA

USA

The anecdote at the beginning about Pietro's Ranch reverberated around the world, Carlisle's winemaker, Mike Officer, told Robinson, and it was part of her story that led to her old-vine registry.

In 2010, an enophile named Mike Dildine published a partial list of California old vines on the Wine Berserkers website. The following year, Dildine got together with Officer and some other winemakers to start the non-profit Historic Vineyard Society. Members include Bob Biale of Biale Vineyards, David Gates of Ridge Vineyards, Morgan Twain-Peterson of Bedrock Wine Company and Tegan Passalacqua of Turley Wine Cellars.

"Morgan Twain Peterson, Mike Officer and I, we had all lost vineyards within a year or so of each other," Passalacqua told *Wine Business Monthly*. "Andy Beckstoffer bought part of the Hayne Vineyard and ripped it up. Mike Officer lost a vineyard out in the Russian River Valley that was ripped up and planted to Pinot Noir. We said we should protect these things, but we don't know how. We started meeting up and asking, 'What can we do?' The first thing is to ask what's out there. We realized that nobody had really identified the old vineyards. The Lodi Winegrape Commission put it in its newsletter. 'Do you have a vineyard that's over 50 years old? Do you want it registered?' Clearly part of the story is that the wine has to be good and warrant keeping these wines in the ground."



Old Vines Begin to Capture the Wine World's Attention



RANDY CAPAROSO

Lizzy James Vineyard remains planted to old vines.

The Historic Vineyard Society does not have a seal for the label as the South Africans do. But it has found a way—at least pre-pandemic—to get the message out to consumers: Lunches in vineyards and tasting events, especially in wine-loving San Francisco.

“We had a big tasting in San Francisco a few years back where we invited producers from around the state who make wine from old-vine vineyards. That sold out in no time,” Passalacqua said. “It’s really helped some of the fringe areas, like Contra Costa and San Benito. People have never even heard of those areas outside the Bay Area wine scene. Those need protection more than other places.”

The 152 vineyards registered on the site stretch across the state, from Amador to Temecula. The Society defines old vineyards as those planted at least 50 years ago, with at least one-third of the producing vines able to be traced back to the original date. Vineyards must be nominated for inclusion, and the project team reviews them, requesting documents in case of disputes.

The 50-year border is an interesting one.

“We’re hitting that time where vineyards from the ‘70s are hitting 50 years old. We’re starting to see Pinot and Chardonnay vineyards,” Passalacqua noted. “Right now, it’s not completely a Zinfandel story, but Zinfandel, Carignan and Mataro have dominated. Now that we’re getting into vineyards from the ‘70s, we’ll get more varieties.”

Randy Caparoso, a wine journalist who lives in Lodi, says that trellising, or more precisely the absence of it, has been an important factor in determining which vineyards are most likely to last for 50 years.

“There are a few remaining blocks as old as over 100 years, and these are head-trained vines, primarily Zinfandel,” Caparoso told *Wine Business Monthly*. “Zinfandel has always been trained this way because the canopy created by gobelet architecture gives vines the umbrella-like, dappled sunlight favorable to Zinfandel quality. Throughout the world, it is free-standing vines, whether trained as a gobelet or as vertical cordons, that are most likely to retain fruit quality and sufficient yields to warrant vines staying in the ground for 50 years or longer. It is nearly impossible for trellised vines to do so although there are exceptions. There are rare, odd vineyards, like the original Woodside Cabernet Sauvignon blocks in the Santa Cruz Mountains or the Dutton-Goldfield Rued Ranch Chardonnay in Russian River Valley, that are quite old, most likely because they are actually head-trained vines to which modified trellised wires have been added to support canes.”

Lodi is home to Bechthold Vineyard, which was planted in 1886 with what was assumed to be Black Malvoisie; the grapes were sold cheaply to home winemakers until they were identified by UC Davis in 2004 as Cinsaut.

“We’ve been saying that Bechthold is easily the oldest Cinsaut planting in the world. That’s because we know of no Cinsaut block in, say, Southern France that is nearly as old, and there are certainly none in the U.S.,” Caparoso said. “The reason they don’t exist in Southern France is because Cinsaut is



RANDY CAPAROSO

Ancient Zinfandel vine

used for Rosé production, and therefore there is no economical reason to keep Cinsaut vines in the ground as ‘old vines,’ let alone as a labor-intensive, head-trained vine. Why would you maintain a low yielding vine when all you want is big production?

“Which brings up the labor factor: The obvious drawback of head or vertical cordon-trained vines is that they do not allow for much mechanization,” Caparoso explained. “Anything with no wires has to be cultivated and picked by hand, and labor is one of the biggest issues facing all the world’s wine regions. Therefore, aside from vineyard owners willing to do the work themselves, new plantings of free-standing vines will only become more of a rare phenomenon. The remaining plantings, as they get older, will become ‘historical.’ Generally speaking, though, it is daft for the wine industry to deliberately plant a vineyard like that, which is why there is now so much concern about keeping the old vines that we have going by creating more demand.”

In fact, there is a small movement in Paso Robles today to plant head-trained vines: these may become our great-grandchildren’s old vines.

“I’ve been experimenting with head-trained grapevines,” said Matt Trevisan, proprietor and winemaker of Linne Calodo. “In 2005, I planted Grenache on 1103P with 10’ x 10’ spacing. Originally, this block had irrigation, but it was removed nine years ago. It’s a small experimental block, and yields average around 0.8 tons per acre. The fruit is loaded with fresh acid and shows a focused expression of Willow Creek Grenache. In 2013 I planted Grenache, Carignan, Tempranillo and Mourvèdre on spacings of 9’

x 6’ and 10’ x 6’. The increase in vines per row was for three reasons. First, we are farming single direction, up/down. Second, when spraying the vines, the efficiency is increased. Third, the competitive growth between each vine creates a perfect-sized vine, and zero irrigation is needed. I regulate growth by timing my thinning of both shoots and clusters, and then I come back if needed and trim the canopy. The method of farming is very deliberate, and every move is in anticipation of having zero water to work with.

“The cost of planting a head-trained vineyard is substantially less without all the trellis hardware,” Trevisan observed. “I think the initial development still requires water for establishment of young vines, but the ultimate goal needs to be a sustainable system that doesn’t tax society of a resource for a luxury product. With the yields decreased, the value of the liquid goes up, simply because it creates a long-term value by treading lightly on nature.

“I by no means am a saint,” Trevisan continued. “I have followed what I was taught and only in time have I come to realize that many of the things I’ve done are not great for the long term. While everyone is after production and the heavy use of irrigation, I see that as a slippery slope that is not long-term sustainable as we forecast the next 30 to 100 years. We need to work with nature and not against it. We are not going to beat nature at its own game by adding resources that do not balance with the incoming supply of rain.”

This brings us back to the old vineyards. By definition, they are survivors: they have made it through cycles of drought, heat, frost, etc. It does seem a shame to replace them for more fashionable varieties. **WBM**

VINEYARD SURVEY:

Continued Labor Woes Push Growers Toward More Mechanization

Latest Vineyard Survey Illustrates Acceleration of Trends

SMALL AND LARGE VINEYARD operations are feeling the pressure to mechanize more tasks, as the 2022 Wine Business Monthly Vineyard Survey shows, as labor costs continue to rise and finding available hands becomes more difficult.

This is, of course, nothing new. Every year, we ask growers and vineyard managers to name their top three concerns for the coming year and “Labor shortage and costs” is usually one of the top choices. In 2022, finding qualified (or even unqualified) help is a concern that isn’t limited to just the vineyard—every sector of the wine business has been affected, including tasting room and operations.

Mechanization can help, however, and the results of the 2022 survey show that many are making the move wherever the economics make sense.

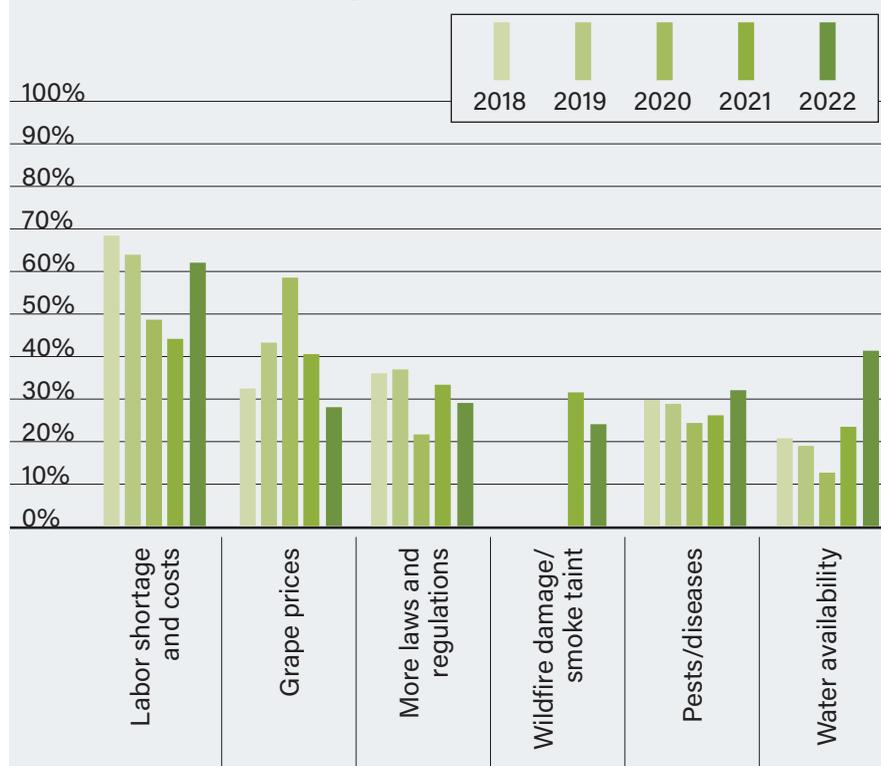
Top Grower Concerns

After a steady decline in the number of growers worried about labor shortages and costs, the trend reversed in 2022. While an increasing shortage of qualified labor has been a challenge for many years, the difference today is a lack of unqualified labor, and challenges bringing in international applicants owing to COVID-19 restrictions.

What are your top concerns for 2022?

Labor shortage & costs	62%
Water availability	46%
Supply chain disruptions & input costs	38%
Pests/diseases (Pierce’s Disease, leafroll, Red Blotch, etc.)	32%
More laws and regulations	29%
Grape prices	28%
Wildfire damage/Smoke taint	24%
Grape supply	15%
Reducing carbon footprint	13%
Changing consumer preferences	5%
Succession planning	5%
Winery consolidation	2%

FIGURE 1 *What are your top concerns?* By Year



Reflecting the worsening drought conditions, growers across the West Coast cited water availability as a key concern. This was much less an issue in prior years as other factors, like the grape oversupply, took precedence.

For the first time, we included “Supply chain disruptions and input costs” as a potential answer and Vineyard Survey results show that vineyard managers are not immune to shipping delays, inflation and decreasing availability of materials.

As always, grape prices, pests/diseases, laws and regulations and wildfire/smoke taint concerns rated highly.

Despite Concerns, Grower Finances Remain Stable

Amid the turmoil that has plagued the global economy over the last two years, most growers reported that revenues remained stable or increased—only 15 percent saw a decline in 2021—and only 19 percent saw a decline in profits.

With those additional profits/revenue, 79 percent of all growers will invest in the increased cost of labor, 48 percent will use the funds to replant and 44 percent will purchase tractors or other necessary tools to continue growing premium winegrapes. Responses were the same across all vineyard and wine production segments, further illustrating the effects of national and global trends on all facets of the wine business.

Perhaps surprisingly, few of the respondents (16 percent) will invest in water storage despite ongoing drought concerns across the West Coast, and vineyard acquisition took a backseat this year, with just 10 percent (typically those supplying wine for 5,000 to 49,999 case wineries) responding that this will be a priority in the next three years.

FIGURE 2 *How were your profits and revenues in 2021 compared with 2020?* By Winery Size

< 1,000 cases/year	Revenues	Profit
Higher by more than 20%	33%	16%
+15%	11%	5%
+10%	7%	9%
+5%	7%	7%
+1-2%		5%
No change	27%	40%
-5%		5%
-10%	2%	7%
Lower by more than 20%	13%	7%
1,000 - 4,999	Revenues	Profit
Higher by more than 20%	19%	16%
+15%	9%	5%
+10%	23%	24%
+5%	9%	16%
+1-2%	12%	8%
No change	14%	13%
-1-2%	2%	5%
-5%	2%	5%
Lower by more than 20%	9%	8%



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VINEYARD SURVEY:

Continued Labor Woes Push Growers Toward More Mechanization

5,000 - 49,999	Revenues	Profit
Higher by more than 20%	24%	21%
+15%	11%	
+10%	15%	12%
+5%	16%	26%
+1-2%	9%	4%
No change	13%	21%
-1-2%		2%
-5%	4%	7%
-10%	4%	2%
Lower by more than 20%	5%	5%
50,000 - 499,999	Revenues	Profit
Higher by more than 20%	13%	13%
+15%	13%	7%
+10%	27%	13%
+5%		20%
+1-2%		7%
No change	13%	13%
-5%	13%	13%
-10%	13%	7%
Lower by more than 20%	7%	7%
500,000+	Revenues	Profit
Higher by more than 20%	14%	
+10%	29%	29%
+5%		14%
No change	29%	29%
-10%	14%	
Lower by more than 20%	14%	29%

2022 WBM VINEYARD SURVEY

Mechanization Reaches More Vineyards

As growers invest in human capital, so too are they looking to technology, automation and mechanization to lend a helping hand. Of course, mechanization does not come easy, and the recent supply chain woes have the potential to exacerbate the problem as the cost of materials increases and delays mean the tools growers need become more costly and scarce.

For all its benefits, nearly half of the respondents (44 percent) said that no vineyard tasks are mechanized, a much more common answer for those growing grapes for wineries that produce less than 5,000 cases.

Above that, however, in-row, under-vine cultivation is the most typically mechanized, with pre-pruning and leafing a close second—again, not surprising. What is interesting, however, is that just 28 percent of respondents have mechanized harvest, and the reason many haven't isn't necessarily down to capital.

When asked for the main reason why they don't use mechanical harvesters, just 4 percent said it was because they couldn't get financing. Rather, 46 percent said “My operation is too small for it to be economical”, 19 percent cited inappropriate row spacing or vineyard configurations, 19 percent said that they believe it reduces the quality of the product and another 13 percent said, “Hand-picking allows me to charge a premium/is an important part of my brand's identity.” Here, marketing was a bigger factor than financing.

Sauvignon Blanc Takes Center Stage

In 2022, 64 percent of all growers surveyed will be replanting or redeveloping their vineyards, and while the majority of those replanting are doing so because vines have aged out or suffered from pest/disease presence, nearly one-third of them are changing varieties.

The survey did not ask which varieties they are replanting to, but the majority of respondents see demand for Sauvignon Blanc increasing in 2022. What are they pulling out? It would appear that Pinot Grigio/Gris sees the least potential for growth.

FIGURE 3 *For each of the varieties listed below, how will demand for grapes in 2022 compare with 2021?* All Responses

	Increase	Stay the Same	Decrease
Cabernet Sauvignon	45%	49%	6%
Merlot	34%	57%	9%
Pinot Noir	35%	54%	11%
Syrah	34%	60%	6%
Red wine blenders	48%	50%	2%
Chardonnay	50%	41%	9%
Pinot Grigio/Pinot Gris	22%	64%	15%
Sauvignon Blanc	64%	33%	3%

2022 WBM VINEYARD SURVEY

Are you replanting or re-developing your vineyard(s) this year? If so, why? By Winery Size

< 1,000 cases/year

Not replanting	56%
Replanting	44%
Planning to harvest and/or prune mechanically	5%
Changing grape varieties	26%
It's time/tired vines	19%
Better rootstock	7%
Reconfiguring vine orientation/spacing	2%
Disease/pests (Red Blotch, mealybugs, leafroll virus, etc.)	14%
Unable to secure grape market contracts	2%
Other (please specify)	7%

1,000 - 4,999

Not replanting	51%
Replanting	49%
Planning to harvest and/or prune mechanically	2%
Changing grape varieties	17%
It's time/tired vines	15%
Better rootstock	12%
Reconfiguring vine orientation/spacing	5%
Disease/pests (Red Blotch, mealybugs, leafroll virus, etc.)	22%
Unable to secure grape market contracts	2%
Other	5%

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5,000 - 49,999

Not replanting	39%
Replanting	61%
Planning to harvest and/or prune mechanically	2%
Changing grape varieties	23%
It's time/tired vines	29%
Better rootstock	9%
Reconfiguring vine orientation/spacing	13%
Disease/pests (Red Blotch, mealybugs, leafroll virus, etc.)	25%
Other	5%

50,000 - 499,999

Not replanting	33%
Replanting	67%
Planning to harvest and/or prune mechanically	44%
Changing grape varieties	67%
It's time/tired vines	78%
Better rootstock	11%
Reconfiguring vine orientation/spacing	11%
Disease/pests (Red Blotch, mealybugs, leafroll virus, etc.)	78%

500,000+

Not replanting	20%
Replanting	80%
Planning to harvest and/or prune mechanically	20%
Changing grape varieties	30%
It's time/tired vines	60%
Reconfiguring vine orientation/spacing	10%
Disease/pests (Red Blotch, mealybugs, leafroll virus, etc.)	30%
Other	20%

2022 WBM VINEYARD SURVEY

FIGURE 4 *If you will buy crop insurance in 2022, why?* All Responses

Flood	1%
Rain, hail, snow	40%
Fires/smoke	76%
Mildew or rot	26%
Sunburn/shrivel	39%
Other	30%

2022 WBM VINEYARD SURVEY

Wildfire Risk Pushes Many to Purchase Crop Insurance

Since 2017, wildfires have become a far more common occurrence in many winegrowing regions; they've always existed but the size and damage has only grown. In response to the potential threat of smoke taint, and loss of crop, 52 percent of survey respondents said that they purchased crop insurance for the 2022 vintage. Seventy-six of all those who did purchase cited this as a top reason. Other reasons not included in the answers were drought and frost. **WBM**

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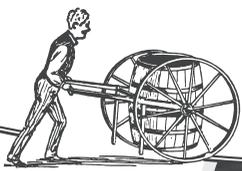
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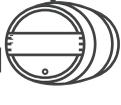
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Mineral Nutrient Management Methods: A Comparison Considering Effectiveness and Efficiency

Stan Grant

Stan Grant, a viticulturist and vineyard consultant, has worked with California winegrape growers for 34 years. He now resides in the Treasure Valley of Idaho and is seeking viticultural opportunities in the Pacific Northwest. For more information, please visit www.progressivevit.com.

GRAPEVINES REQUIRE at least 13 mineral nutrients for normal growth and development.^{23,24} The macronutrients are those mineral nutrients required in comparatively large quantities. They include nitrogen, phosphorus, sulfur, potassium, magnesium, and calcium. The micronutrients, which are required in relatively small quantities, include iron, manganese, copper, zinc, boron, and molybdenum.

With exception of potassium, the macronutrients serve mainly structural roles in macromolecules and tissues.^{23,24} In contrast, potassium is an ionic free agent, affecting solute movement within vines and maintaining tissue turgor and electrical neutrality. The micronutrients are primarily involved in the regulation of metabolism.

A shortage of any mineral nutrient is detrimental to grapevine growth and development, including fruit yield development and ripening.^{1,4,12,18,23,24,29,33} In spite of their importance, mineral nutrients are numerically minor constituents of grapevines compared to elements taken from air and water (**TABLE 1**).

Mineral Nutrition Facts

Grapevines rely on the supply of mineral nutrients vineyard soils to satisfy their needs, although small quantities of sulfur and chloride may be available in the atmosphere.²⁴ Unfortunately, mineral nutrients available in vineyard soils are seldom in balance with vine needs. Rather, one or more nutrient is likely deficient at any given time.

In addition, available soil moisture, which varies in time and space within soils, affects the movement of mineral nutrients to roots and their uptake.^{11,22,23} These affects are greater for some mineral nutrients than others. For instance, calcium tends to readily move into and through grapevines as their leaves transpire water. In contrast, potassium slowly moves through soils primarily by random motion within the thin films of water adhering to soil particle surfaces and potassium uptake by roots is largely an energy consuming process. These factors can challenge potassium acquisition, especially in soils low in potassium when potassium demand in developing berries is high.¹

Furthermore, the capacity of grapevine root systems to take up nutrients varies during the growing season.^{19,24} Early in the growing season, cool and sometimes excessively wet soil limits root activities, including mineral nutrient uptake. Later, after soils warm and roots are growing, vines have access to mineral nutrients in the greater vineyard root zone. Then, after water stored from winter rains is depleted, root activity is limited to the small volumes of wetted soils under drip irrigation emitters.²²

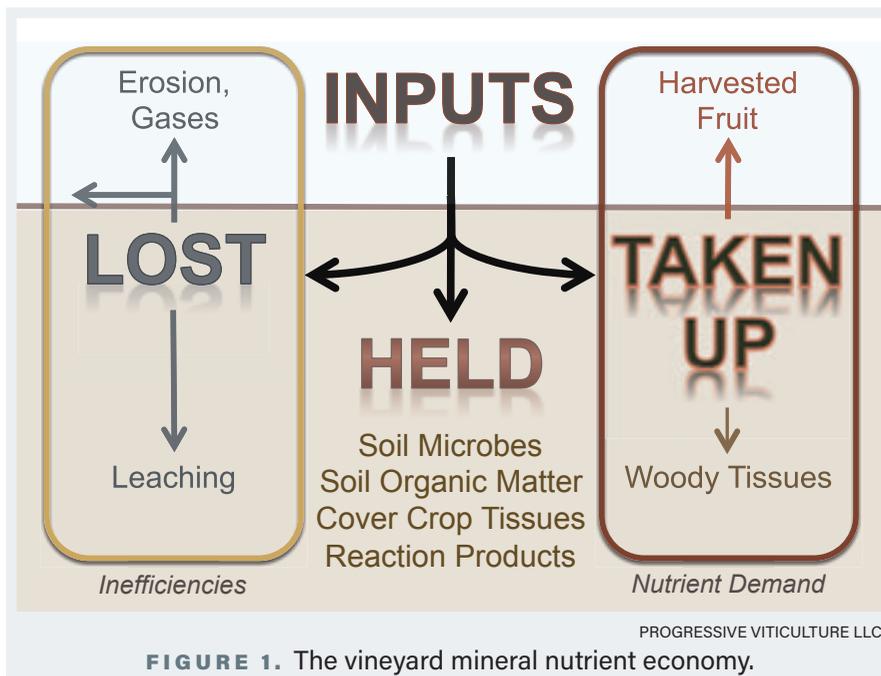
Actually, anything that limits root system size and root health will limit nutrient acquisition. This includes biotic factors, like Phylloxera, plant parasitic nematodes, and root diseases, and abiotic factors, like root zone shallowness, topsoil compaction, and environmental stresses. These factors, too, may vary in intensity across a vineyard.

Finally, the demand for mineral nutrients in vines varies over the course of the growing season depending on stage of growth and development (phenology).^{5,6,19,35,37} The main factors discussed here—supply, demand, and access—are fundamentals of a vineyard's mineral nutrient economy.

Nutrient Class	Element	Atom Content Relative to Mo	Atomic Percentage
Micronutrients	Mo	1	0.000001%
	Cu	100	0.000079%
	Zn	300	0.000237%
	Mn	1,000	0.000790%
	B	2,000	0.001580%
	Fe	2,000	0.001580%
	Cl	3,000	0.002371%
Subtotal			0.006638%
Macronutrients	S	30,000	0.024%
	P	60,000	0.047%
	Mg	80,000	0.063%
	Ca	125,000	0.099%
	K	250,000	0.198%
	N	1,000,000	0.790%
Subtotal			
Organic	O	30,000,000	23.7%
	C	35,000,000	27.7%
	H	60,000,000	47.4%
Subtotal			98.8%

SOURCE: STOUT, PR. PROC. 9TH ANN. CALIF. FERT. CONF. PP. 21-23. 1961.

TABLE 1. Essential elements in plant tissues and their relative quantities.



Mineral Nutrient Management Realities

Vineyard mineral nutrient economies are complex and dynamic (**FIGURE 1**). Additionally, our understanding of them is incomplete. At the same time, our ability to monitor them is limited to visual observations and laboratory analysis snapshots of the supply in the soil and leaf tissue nutrient status. We are still learning how to best use the array of available fertilization technologies, which have significantly advanced in recent years, to meet seasonal grapevine needs.^{2,7,8,9,12,13,14,15,16,26,36,38} Given these realities, how can we best manage mineral nutrients in winegrape vineyards?

As-Needed Mineral Nutrient Management Method

The simplest way to manage mineral nutrients is to apply them when there is a perceived need. The need may be apparent as visual foliar deficiency symptoms or tissue analysis results indicating deficiency (**FIGURE 2**).



FIGURE 2. Post bloom fruit and leaf symptoms of boron deficiency in Zinfandel.

A grower may also suspect a mineral nutrient shortage is contributing to declining grapevine growth and fruit production capacity, and apply fertilizer accordingly. Such an approach to managing grapevine mineral nutrition is an as-needed method.

As-needed mineral nutrient management has a noteworthy advantage. It is rational because nutrients are applied only when there is an apparent need.

At the same time, as-needed mineral nutrient management has some serious disadvantages. Most importantly, mineral nutrient applications are reactive; happening after a problem has developed. By the time a mineral nutrient problem is recognized and remedial actions taken, significant harm has occurred.

Additionally, opportunities to enhance nutrition for critical stages in seasonal vine development have been missed, including fruit initiation, fruit set, the onset of fruit coloration, and post-harvest storage of nutrients in woody vine tissues. Further, the as-needed method addresses only one of the 13 essential mineral nutrients at a time.

Due to these disadvantages, the efficiency of as-needed mineral nutrient management is low. Inefficiency can be expensive in terms of vine health, fruit yield, ripening, grape quality, and winter hardiness of woody vine tissues.

Proactive Mineral Nutrient Management

In the last few decades, the appreciation for proactive in-season resource management in agriculture has deepened. The water budget method for scheduling irrigations based on vineyard evapotranspiration (ET) is a well-known example.³² Such proactive methods avoid problems, improve efficiencies and lessen risk. Nutrient management programs were the first attempts at proactive mineral nutrient management.

Mineral Nutrient Management Programs

Mineral nutrient management programs involve planned fertilizer applications determined before the onset of the growing season. The program focus is mineral nutrients expected to be in short supply. In other words, their goal is mineral nutrient deficiency avoidance.

The basis for scheduling program fertilizer applications is usually the calendar of vineyard management activities, but sometimes it may involve seasonal grapevine developmental stages. Mineral nutrient programs often use tissue analysis results to monitor their effects. Familiar examples of mineral nutrient programs include boron applications with autumn preemergent herbicide applications and early bloom foliar fertilizer applications to promote fruit set.⁴

Mineral nutrient programs commonly avoid deficiencies, which of course, is their goal. Moreover, nutrient management programs are more likely to advance fruit maturation and enhance yields than as-needed fertilization. As a result, programs are frequently more effective than as-needed management. They work well for foliar fertilization where expectations for effects are specific and short term, and for soil fertility maintenance.

A failure to broadly consider the vineyard mineral nutrient economy, that is supply, demand and access, is among the failings of mineral nutrient programs. They also wrongly assume that applied nutrients will always elicit a positive vine response regardless of current mineral nutrient availability in the root zone and the current vine mineral nutrient status. As a result, some mineral nutrients are under applied or over applied. For this reason, mineral nutrient management programs seldom achieve balanced grapevine nutrition and optimum fertilization efficiency.

Mineral Nutrient Budgets

Mineral nutrient budgets are similar to financial budgets.²⁵ They work like this: Before the beginning of the growing season, mineral nutrients are allocated to meet forecasted grapevine demand. During the growing season, budgeted nutrient amounts may be adjusted to meet perceived changes in vine need. At the end of the growing season, applied and recovered nutrients are reconciled with budgeted amounts. In principle, mineral nutrient budgets assume some understanding of vineyard mineral nutrient economies.

The nitrogen-use metric, issued by the Stewardship Index for Specialty Crops (SISC), is an example of a mineral nutrient budget. The formula for the metric is as follows: Nitrogen use is equal to the nitrogen removed in the harvested crop in pounds divided by the nitrogen applied in pounds. (<https://bit.ly/3JF1zhm>). The state of California adopted this same formula for its waste discharge requirement (WDR) regulations.

Actually, these are partial budgets.²⁸ They include only the nutrient economy components routinely measured. They function more like crude estimates of fertilization efficiency. Partial factor productivity (PFP) is another agronomic term for them.^{3,21,30} In reality, complete mineral nutrient budgets are not feasible due to technical and cost limitations.

Additional factors further limit the viticultural value of these “mineral nutrient budgets.” They mistakenly assume mineral nutrients from all applied sources are equally available, which is not the case. For example, the nitrogen in highly soluble liquid calcium nitrate is readily available, with vines commonly responding within 24 hours of application. In contrast, the nitrogen in compost must go through decomposition and mineralization processes that, depending on environmental conditions, may take weeks to complete.

Such mineral nutrient budgets are seasonal summary accounting systems that do not include nutrient application schedules. Therefore, budgets seldom achieve optimum mineral nutrient resource allocation, use efficiency and balanced grapevine nutrition.

These budgets also assume winegrape growers apply mineral nutrients solely to fill the fruit. While some growers may be cognizant of fruit nutrient demand, many apply mineral nutrients for other reasons. As stated above, some growers apply mineral nutrients reactively after problems are perceived and others apply them according to a program. Still others apply fertilizers to elicit specific grapevine responses. These may include promoting root activity, enhancing shoot growth and canopy development, fostering fruit set, advancing fruit coloration, encouraging ripening and cane cold hardiness, and contributing to mineral nutrient storage in woody vine tissues.

While it may be appealing to think mineral nutrient budgets are essentially the same as water budgets, they are distinctly different. By and large, the factors affecting water availability and movement into and through vineyard soils and vines are physical, and to a significant degree, they are predictable, relatively easy to monitor, and manageable.³² Thus, the water budget method of irrigation scheduling is broadly applicable across vineyards.

The factors influencing mineral nutrient availability and movement in soils and into vines, on the other hand, are physical, chemical and biological.^{24,36} To a large extent, they are soil-specific, difficult to predict, hard to monitor, and in many instances, challenging to manage. Consequently, true mineral nutrient budgets are not feasible.

In spite of their limitations, mineral nutrient budgets provide a conceptual benefit. They get us to consider mineral nutrients within vineyards as economies.

Mineral Nutrient Management Plans

Mineral nutrient management plans are another proactive method for managing mineral nutrients in vineyards. To supply readily available mineral nutrients, as they are needed over the course of the growing season to satisfy grapevine mineral nutrient demand is the chief goal of mineral nutrient management plans. In addition, mineral nutrient management plans strive to harmonize mineral nutrient applications with root zone conditions and root activity. In so doing, mineral nutrient plans ought to foster balanced vine nutrition, enhance soil fertility and tilth, and promote mineral nutrient use efficiency.

Three developments are the basis for mineral nutrient management plans. They are research findings allowing us to anticipate the time course demand for nutrients in vines, modern fertilizer technologies enabling us to make mineral nutrients available as needed, and a deeper understanding of mineral nutrient effects on vine health, fruit yield and grape quality. These elements were part of a mineral nutrient management plan concept published about twenty years ago.¹² Since that time, plans have served as the basis for mineral nutrient management in hundreds of vineyards.

Mineral nutrient management plans are similar to business plans in that they serve as systematic management guides. They involve plan document development, plan execution, and afterwards, plan performance evaluation and perhaps, revision for improvement. The mineral nutrient management plan document includes the elements presented in **TABLE 2**.

Mineral nutrient management plans may include all fertilizer application methods, but commonly focus on fertigation for lengthy periods of seasonal grapevine development (prebloom, post bloom, ripening and post-harvest) and foliar fertilization for the short transitional periods (bloom and veraison).¹⁰ Like business plans, mineral nutrient management plans are subject to change during execution depending on changing environmental conditions and management goals.

Element	Examples
Setting specific nutrient management goals	To profitably produce optimum quality wine grapes
Listing nutritional challenges	Extremes in soil pH, very low levels of certain nutrients in the soil, deficit irrigation
Inventory of mineral nutrient sources	Available nutrients in soil, amendments, fertilizers
Outline of chronological list of actions	What and when to monitor, when to apply nutrients, how much nutrient to apply
List of nutrient management contingencies	Wet or dry year, large or small crop, damaged leaves
Designating measures of plan performance	Timely ripening, positive winery feedback, achieving targeted yields

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TABLE 2. Elements of mineral nutrient management plans.

Summary of Mineral Nutrient Management Methods

There are at least four methods for managing mineral nutrients in vineyards. They are the traditional or as-needed method and three proactive methods—programs, budgets and plans. The traditional, as-needed approach is inefficient and therefore, incompatible with modern grape growing. Proactive methods, to varying degrees, promote nutrient use efficiency, lessen risk and diminish problems.

The three proactive mineral nutrient management methods considered in this article differ in their goals. The goal of management programs is avoiding mineral nutrient deficiency. The goal of management budgets is nutrient accounting. The goals of management plans are satisfying mineral nutrient demand and promoting balanced grapevine nutrition.

Additionally, the proactive management methods differ in the scheduling of mineral nutrient applications. Programs primarily use the calendar of vineyard management activities, budgets commonly do not specify a schedule, and plans use grapevine phenology and uptake capacity.

Actually, management plans include the essence of the other two proactive mineral nutrient management methods. They include scheduled nutrient applications like programs and they include targeted nutrient allocations to satisfy vine nutrient demand like budgets. However, in comparison to programs and budgets, plans are more comprehensive and flexible.

Developing Mineral Nutrient Management Plan in Eight Steps

Step 1: Assess Resources

Begin by evaluating the background mineral nutrient supply in the vineyard root zone using soil analysis results, looking for those nutrients in short supply. Next, consider non-fertilizer inputs, including soil amendments such as green manure cover crop residues. For the discussion that follows, we assume low soil fertility and minimum applied soil amendments, and a high dependence on in-season fertilization.

Step 2: Determine the Seasonal Applied Nitrogen Target

The quantity of nitrogen applied over one growing season depends mainly on crop removal, which is also known as the crop nitrogen demand. It is typically about three pounds nitrogen per ton of fruit. The nitrogen in harvested fruit comes from nitrogen reserves stored in woody vine tissues and the soil, and the amount of fertilizer applied to meet the crop nitrogen demand commonly satisfies the replenishment nitrogen demand for these sources.

For a low-growth capacity vineyard on low fertility soil, the nitrogen need is likely greater and conversely, for a high-growth capacity vineyard with access to ample nitrogen in the soil, the nitrogen need will be less than the typical three pounds of nitrogen per acre.

Step 3: Allocate Applied Nitrogen Across the Growing Season

Allocate nitrogen applications over the course of the growing season as follows to satisfy changes in nitrogen demand associated with extended phenological periods. Early in the growing, where stored reserves in woody vine tissues are well-stocked from fertilization applications during the previous growing season and some residual nitrogen is present in the soil, little or no applied nitrogen is needed.

If, on the other hand, the vineyard was not well-resourced with nitrogen and struggled in the past, apply about 20 percent of the seasonal nitrogen requirement prior to bloom. Between bloom and veraison, apply about 20 to 35 percent, and following harvest apply about 15 to 25 percent of the seasonal nitrogen requirement.

Step 4: Determine Other Macronutrient Targets

The seasonal application targets for the other macronutrients are about 0.6 pounds of phosphorus per ton of fruit, 1 pound of sulfur per ton, 5 pounds of potassium per ton, 1 pound of calcium per ton, and 0.1 pound magnesium per ton of fruit. As with nitrogen, any of these mineral nutrients may be omitted from planned application as fertilizer if they are abundant in the soil.

Step 5: Allocate Other Macronutrients Across the Growing Season

Unlike other macronutrients, there is a large demand for phosphorus early in the growing season, in part to support roots (**TABLE 3**).³⁵ The seasonal course of sulfur demand in grapevines has yet to be determined, but it likely resembles that of nitrogen due to the similarities of their functions in grapevines. The seasonal demand for potassium, too, is similar to that of nitrogen. There is significant demand for all four of these macronutrients, nitrogen, phosphorus, sulfur and potassium, after harvest. In contrast, calcium and magnesium are required mostly before veraison.

Mineral Nutrient	Macronutrient Allocations by Developmental Stage			
	Prebloom	Post Bloom	Ripening	Post Harvest
N	0 to 20%	25 to 35%	0 to 20%	15 to 25%
P	15 to 35%	0 to 30%	0 to 10%	15 to 35%
K	0 to 10%	25 to 35%	0 to 20%	25 to 35%
Mg	0 to 30%	0 to 50%	0 to 10%	0 to 10%
Ca	0 to 30%	0 to 50%	0 to 10%	0 to 10%

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TABLE 3. Grapevine fruit mineral nutrient content.

Step 6: Select Fertilizer Formulations

Chose an N-P-K (nitrogen-phosphorus-potassium) blend low in nitrogen, but with ample potassium and if needed, phosphorus. Supply additional nitrogen as liquid calcium nitrate (CN-9). There are several options for additional potassium in readily available form, including KTS (potassium thiosulfate) and 0-0-30 (potassium carbonate). There are also thiosulfate and other fertilizers containing readily available forms of calcium and magnesium. **TABLE 4** is an example of the fertigation component of a mineral nutrient management plan developed using the steps presented here.

Fertigation Dates	Fertilizer Formulation	Fertilizer/Acre		organic	N	P	S	Cl	K	Mg	Ca
		gal	lb	C	lb/ac	lb/ac	lb/ac	lb/ac	lb/ac	lb/ac	lb/ac
Shoot Emergence	Foundation Pro	4.5	--	0.0	3.4	4.5	0.0	0.0	0.4	0.0	0.0
	CN 9	0	--	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	MVAS Liq. OM/OA	0	--	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Subtotal		4.5	0	0.0	3.4	4.5	0.0	0.0	0.4	0.0	0.0
Post Bloom	KTS	5	--	0.0	0.0	0.0	10.4	0.0	12.7	0.0	0.0
	Magnesium Sulfate	--	15	0.0	0.0	0.0	1.5	0.0	0.0	2.0	0.0
	CN 9	5	--	0.0	5.5	0.0	0.0	0.0	0.0	0.0	6.7
	MVAS Liq. OM/OA	8	--	2.8	0.3	0.0	0.0	0.0	0.0	0.0	0.0
Subtotal		18	15	2.8	5.8	0.0	11.9	0.0	12.7	2.0	6.7
Veraison	KTS	5	--	0.0	0.0	0.0	10.4	0.0	12.7	0.0	0.0
	CN 9	0	--	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	MVAS Liq. OM/OA	8	--	2.8	0.3	0.0	0.0	0.0	0.0	0.0	0.0
Subtotal		13	0	2.8	0.3	0.0	10.4	0.0	12.7	0.0	0.0
Ripening	KTS	3	--	0.0	0.0	0.0	6.2	0.0	7.6	0.0	0.0
	CN 9	3	--	0.0	3.3	0.0	0.0	0.0	0.0	0.0	4.0
	MVAS Liq. OM/OA	8	--	2.8	0.3	0.0	0.0	0.0	0.0	0.0	0.0
Subtotal		14	0	2.8	3.6	0.0	6.2	0.0	7.6	0.0	4.0
Post Harvest	3-12-14-4(S)	15	--	0.0	5.0	8.7	6.8	9.3	19.3	0.0	0.0
	MVAS Liq. OM/OA	8	--	2.8	0.3	0.0	0.0	0.0	0.0	0.0	0.0
Subtotal		23	0	2.8	5.3	8.7	6.8	9.3	19.3	0.0	0.0
SEASONAL TOTAL		73	15	11.2	18.4	13.2	35.2	9.3	52.6	2.0	10.7

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TABLE 4. Example of fertigation component of a mineral nutrient management plan.

Step 7: Accommodate Challenges

In mineral nutrient plans, emphasizing mineral nutrients, particularly in short supply in the vineyard soil, is of paramount importance. In many cases, this simply means higher than usual fertigation applications rates. In more challenging circumstances, high rate applications of dry fertilizer in or adjacent to the vine row may be appropriate.

If the vineyard root zone pH is high (alkaline, pH greater than or equal to 7.5), emphasize ammonium over nitrate as a nitrogen source because its acidifying characteristics will help neutralize alkalinity. Conversely, if the root zone pH is low (acid, pH lower than or equal to 5.5), avoid ammonium-nitrogen and emphasize nitrate-nitrogen, which is slightly basic and will help neutralize acidity.^{20,31} Thiosulfates can also be somewhat acidifying and correspondingly, their use ought to be limited for acid soils.

For root zones containing excessive soluble minerals (salts), use high analysis (low salt index) fertilizers and apply them more frequently at lower rates as not to exacerbate salinity following application.²⁷ Frequent, low rate applications also work best for vineyards with limited root systems and during periods of regulated deficit irrigation.

Step 8: Consider Contingencies

As mentioned above, mineral nutrient management plans are guides that are subject to change depending upon changing conditions and management objectives. The following are some examples of nutrient management contingencies.

During an unusually wet year, delay fertigations until the onset of the irrigation season to minimize fertilization inefficiencies. Application rates may have to increase to accommodate the delay and to replace mineral nutrients leached below the root zone with downward percolating rainwater. Under the opposite circumstances of a dry year, begin fertigations (and irrigations) early. Again, application rates may need adjustment proportionately.

Small crops require fewer mineral nutrients and applications rates may be decreased accordingly. Predictably, large crops require more mineral nutrients and especially more potassium.

A low rate of calcium nitrate will enhance the activities of pest- or stress-damaged leaves, while increased pre-bloom and post-bloom calcium nitrate can increase yeast assimilable nitrogen (YAN) in berries.¹⁷ Alternatively, foliar applications of low biuret urea between fruit set and veraison can increase fruit YAN. **WBM**

This article is dedicated to a friend, and extraordinary viticulturist, Pete Christensen.

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GRAPEGROWER TRIAL:

Optimizing Irrigation Efficiency with Satellite Technology

Wilson Creek Winery of Temecula Valley evaluated satellite technology to achieve irrigation efficiency over current ground-based methods

Bryan Avila

Bryan Avila is a formally trained enologist, seasoned commercial winemaker and wine production educator. He teaches best practices to the industry workforce and advises on advanced winemaking subjects to vintners via his company, Avila Wine. He is the trials liaison for *WBM's* Winemaker Trials section and would love to hear what you are doing in your vineyard and winery to overcome challenges, grow better grapes and make better wine. Contact: bryan@avila.wine.



Trial Partner: Greg Pennyroyal, vineyard manager, Wilson Creek Winery

Greg Pennyroyal is the vineyard manager at Wilson Creek Winery and Vineyards and professor of viticulture at Mt. San Jacinto College in Temecula, California. He has 25 years of experience in a wide range of fields, including agricultural production, medicinal plant production and genomics in traditional medicine. He is interested in bringing the benefits of traditional food, medicine and agriculture to modern society. An expert in viticulture and regenerative agriculture, Greg can be found in the classroom and online teaching the differences between sustainable, organic, Biodynamic® and regenerative agriculture.

Trial Description: The goal of this project is to compare remote sensing technologies, both local and satellite-based, for the purpose of automation to reduce labor and water usage. This first-year trial focuses on the key metrics: soil moisture and crop water use.

BACKGROUND

In the Western United States, farmers are acutely aware of drought conditions in their region. A combination of short labor supply and severe lack of water provides plenty of incentive for growers to improve and automate their irrigation systems beyond “Watering on Tuesday.”

Farming with greater precision and less labor requires the ability to assess the vineyard’s water status and turn the water on or off without a human. Remote sensing relies on probes, satellites, data transmission and controller technologies to assess vineyard water status then process the data into information that can be used and transmitted to controllers on pumps and valves for water delivery.

Government agencies, including the U.S. Bureau of Reclamation, the USDA and local municipalities, are providing grants to spur innovation in water conservation. This 2021 vintage trial was funded by a grant from the Innovative Conservation Program (ICP) through the Metropolitan Water District of Southern California. Project lead Reinier van der Lee, crop optimization specialist and founder of Vinduino, teamed up with Greg Pennyroyal, regenerative ag viticulturist and vineyard manager for Wilson Creek Winery and Vineyards, to collaborate on this project as a trial partner and end user.

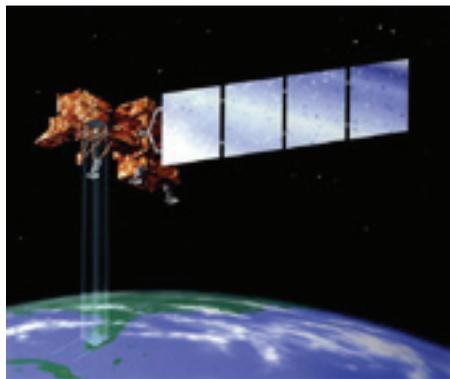
Current Best Practice

The best practice for determining how much water a plant needs has been to check how much water is already available in the soil by using data from an in-situ soil moisture probe versus calculating the rate of photosynthesis. The soil moisture probe functions as the control for this trial. To stay within the parameters for the vine's need for water, the grower must answer two questions:

- 1. How much water will the vine use?** This is a function of how much sun is available and how much leaf area is available to catch it. Growers in California use the CIMIS system, which transmits and processes weather data from a network of weather stations across the state. Part of this calculation involves the crop coefficient (K_c) in which leaf area is measured in terms of shade at intervals throughout the year to adjust for canopy growth and increased photosynthetic ability. These two factors together provide the grower a reliable reference standard for estimating the right volume of water required to irrigate a crop at any given time of year.
- 2. How much water is already in the soil?** Soil moisture probes tell the grower how much water is already in the soil so that unnecessary watering events can be avoided during the wettest parts of the year and excessive heat does not compromise the vines when the soils are dry.

Satellite Technology

Satellite technology provides an alternative to ground-based measurement systems. These satellites carry multi-spectral instruments that can process agricultural data in terms of measurements, such as leaf temperature, solar radiation, soil moisture and evapotranspiration. This information helps farmers determine their actual irrigation needs as an alternative to ground-based weather stations, such as CIMIS.



IrriSat: IrriSat is a cloud-based application that automates satellite processing and information delivery of Landsat and Sentinel satellite data and provides water management information. The IrriSat methodology establishes the Normalized Difference Vegetation Index (NDVI) for each vineyard, which helps determine plant canopy size and crop coefficient. Combining the crop coefficient with daily reference evapotranspiration observations from a weather network station, the crop water usage can be determined and transmitted to automated irrigation systems.

IrriWatch: The IrriWatch service uses the same network of satellites combined with a data processing algorithm called SEBAL (Surface Energy Balance Algorithm for Land). SEBAL extracts information from raw satellite data and includes meteorological data to compute actual evapotranspiration for each pixel in a multispectral satellite image, enabling more instantaneous results.

Automation

For valves to get turned on or off in the vineyard, data from either or both systems can be processed again through a control system where inputs, such as fertilizer or pesticides, may be added in-line during irrigation. Automation eliminates the human error that sometimes occurs when one person is running from vineyard block to vineyard block to open and close valves manually.

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Optimizing Irrigation Efficiency with Satellite Technology

TRIAL OBJECTIVE

The goal of this project is to compare remote sensing technologies, both local and satellite-based, for the purpose of automation to reduce labor and water usage by using current best practices. This first-year trial focuses on the key metrics: soil moisture and crop water use.

TRIAL DESCRIPTION

As described by Reinier in his final report to the water district, “The project recorded in-situ soil moisture sensors data together with satellite remote sensing data for crop fields selected for this project. Fields were selected for having the same grape varietal, and automated or manual irrigation. At the end of the season, crop results will be recorded as well as the amount of irrigated water used. This project monitored eight vineyard blocks and three avocado irrigation blocks during the 2021 growing season. All locations used remote satellite sensing, covering a total of 110 acres and in-situ soil moisture sensors. Crop yield and quality as influenced by the type of irrigation operation (manual or automated) were monitored by bi-weekly sap analysis [to look for nutrient deficiencies] and end-of-season harvested fruit weight.”

This study compares the following key parameters using old versus new technology:

Soil Moisture

Control: Ground sensor

Treatment: IrriWatch

Crop Water Use

Control 1: CIMIS + Manual

Control 2: Vinuino System (CIMIS-based, automation system integrated with moisture and fertigation)

Hybrid: CIMIS + IrriSat Kc

Treatment 1: IrriSat (IS)

Treatment 2: IrriWatch (IW)

CONCLUSIONS:

This section highlights major conclusions of this study following the first vintage of data collection. Conclusions were reported at the end of the first-year trial regarding soil moisture and crop water use. Irrigation quantity baselines were collected, and wine quality will be assessed by winemaking staff following aging. Below are the conclusions noted by van der Lee.

Soil Moisture

“Satellite soil sensor data were compared against soil moisture sensors in the fields, pressure bomb measurements and field observations. Remote soil moisture measurement using satellite data did not provide useful guidance for the best frequency of irrigation. During the project, we found that ‘Product A’ [IrriWatch] provided a consistently wrong indication of fields being too dry and in need of additional irrigation, even in well-watered situations. Although physical sensors require hardware in the field, installation and maintenance, their data are regarded closer to the truth, especially when averaged over multiple sensors. The team concludes that remote satellite soil moisture data are not sufficiently mature to be a viable alternative for soil moisture sensors in the field.”

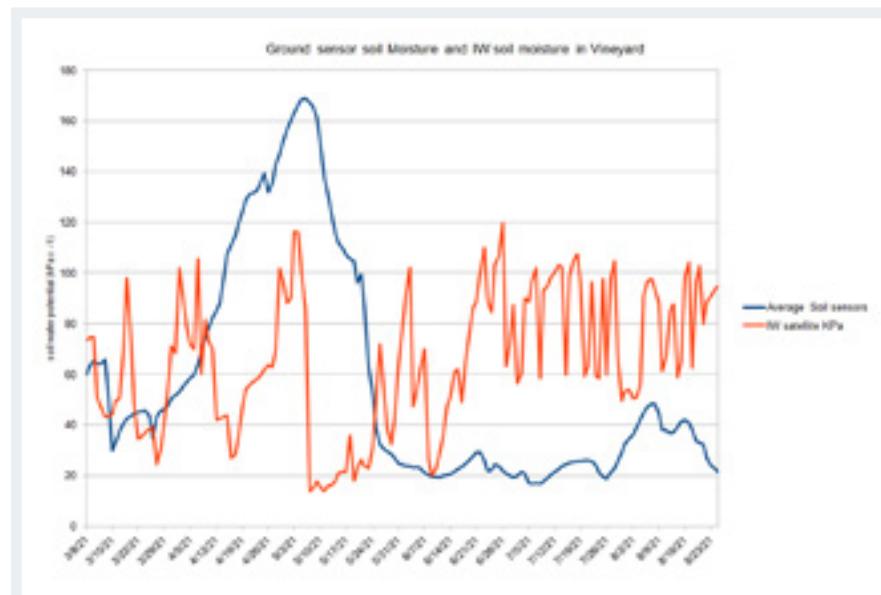


CHART A: This chart shows the difference in data quality from the in-situ (Watermark SS200) ground moisture probes (blue) versus IrriWatch satellite values (orange). The satellite values overstate soil moisture pKa as the vineyard heats up in the summer.

Crop Water Use

According to van der Lee, “Crop water use was estimated using tools available to the average grower. In this project we used soil moisture trend, frequent pressure bomb measurements [a direct water status measurement] and recorded the applied volumes of irrigation water per field. This project had no access to research-grade measurement of evapotranspiration, such as flux towers.

“Remote satellite ‘Product A’ crop evapotranspiration data were consistently 50 percent lower in vineyards but did closely follow the actual water use in the avocado grove. This technology appears to work better in orchards. The most consistent crop evapotranspiration estimates for vineyards and orchards came from using IrriSat crop coefficient (K_c) in combination with reference evapotranspiration data obtained from Spatial CIMIS. Outside of the early season where weeds dominate the planted area, IrriSat K_c tracks closely with manual K_c estimates and can save labor and accuracy by automatic collection of K_c data.

“[The crop water requirement] (ET_c) estimation in combination with soil moisture sensing, as feedback, provided usable results for irrigation volume guidance. In the tested avocado grove, managing irrigation volume by keeping soil moisture at the same level proved to be equally effective as the evapotranspiration method.”

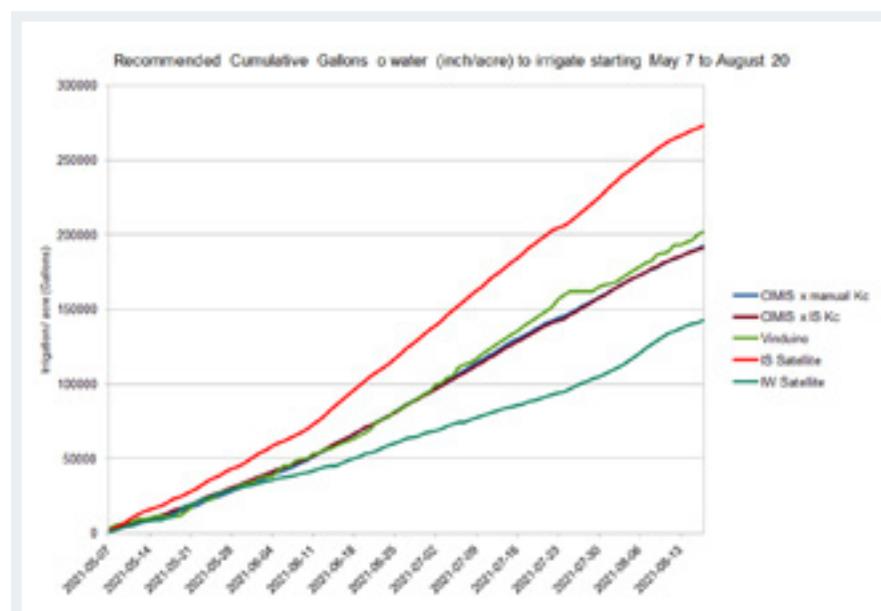


CHART B: This chart shows CIMIS weather station-based systems are still a better fit for evaluation of crop water use.

The IrriSat service is free of charge and appears to be more accurate compared to the IrriWatch system. This crop coefficient can be used with the CIMIS station to eliminate manual methods. One thing to be aware of with the satellite-produced data is that the grapevine canopy will be reported as cover crop data, shown in the vineyard crop coefficient chart below in both satellite data sets (IrriSat and IrriWatch). This trend can be seen as the satellite data are overstated compared to data from manual measurements.

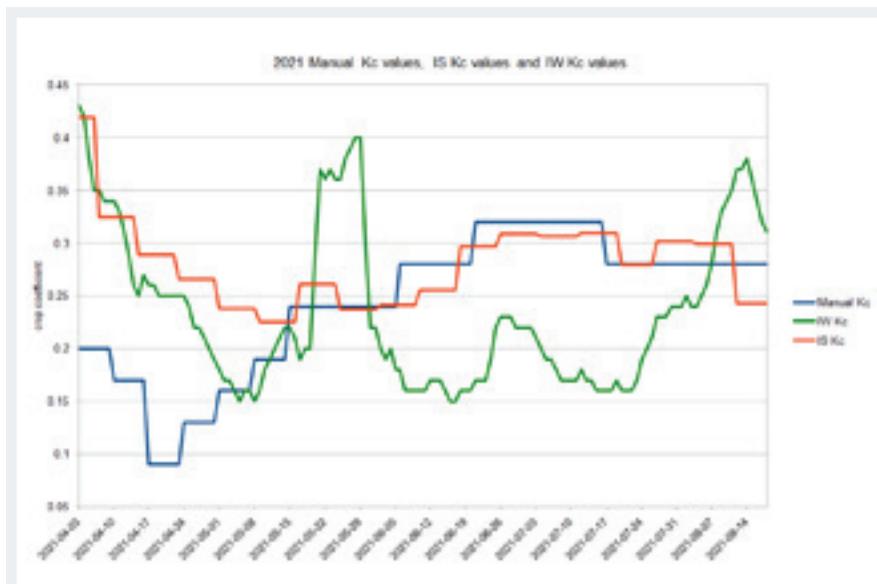


CHART C: Left circle shows both satellites tracking cover crop as vine crop coefficient until May. The right-hand side of the chart shows IrriWatch deviating from the reference method, the manually measured Kc while the IrriSat data track more closely.

Satellite technology keeps getting better. Eventually, it should work out the bugs and strengthen its algorithms for vineyard reporting in the future.

Post-Mort Q&A

What was the motivation to conduct this trial?

Pennyroyal: The current technology of only using soil-based sensors and evapotranspiration calculations from CIMIS wasn't matching up with what we were visually seeing in our fields. We needed more resolution in this area but could not afford the extra labor to do this manually. Satellite technology offers both water and labor savings.

Why were you interested in monitoring soil moisture and crop water usage in the vineyard? What system were you using previously?

Pennyroyal: A good vineyard manager can tell visually if a vineyard is stressed or not, but I just don't have that luxury. I have more than 80 blocks to manage. We're farmers; we're busy. The current technology of using gypsum block systems to measure soil moisture, along with a pressure bomb to measure water stress, gives you a good indication of plant water status, but it's slow, and you just don't have the time to go to every block every couple of days. While soil sensors and pressure bombs express what the plant is experiencing very well, I wanted to see if the satellite imaging technology would provide similar accuracy with what CIMIS is telling me. We're looking for the ultimate system that is good as "footprints in the vineyard."

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Optimizing Irrigation Efficiency with Satellite Technology

Who else worked with you on this trial?

Pennyroyal: The lead investigator for the trial was Reinier van der Lee of Vinduino, whose vineyard was also part of this project. Reinier asked me to help with this project because he wanted my perspective as a viticulturist, specifically my perspective about quality, in addition to water savings and yield. Quality is not often evaluated in other crops over tonnage. The usual success metrics for most crops are reported in the number of gallons per acre; however, in our case we would be happy with a smaller yield if it means better quality, but that is determined organoleptically. You'll have to talk to the winemakers to get that final determination as these wines are still in barrel.

It's true that Reinier is the owner of Vinduino, but he is a true scientist first with a high degree of integrity that cares most about getting it right. I appreciate that he is not in love with his own technology.

What were the initial hypotheses before beginning the experiment?

Pennyroyal: We were hoping that the satellite-based tech would replace the soil-based technology. It's fast, easy, cheap and we were praying for accurate.

Which vineyard did you study? Why did you pick this vineyard?

Pennyroyal: We studied Wilson Creek's estate vineyard, van der Lee Vineyard and two other vineyards, Lassley and Scaldione vineyards, totaling eight vineyard blocks. Plus, a significant amount of energy was invested in upgrading and testing all the irrigation lines. We used 2" feed lines and achieved about 96 percent distribution uniformity prior to beginning the trial. After all, why invest in state-of-the-art technology if the water delivery system isn't functioning properly? To minimize variables, all vines were Cabernet Sauvignon, all on 1103 Paulsen and all VSP trellis.

How did you set up your monitoring trials?

Pennyroyal: Scaldione, Lassley and Wilson Creek vineyards all yielded similar satellite data. Fortunately, the sat data were consistent from one site to the other. Each of these vineyards was irrigated on the same days, the same time and same amount. We made sure that we selected blocks that spanned the gamut of cover crops and canopy size. For example:

Lassley – An older vineyard block with a modest cover crop and a big canopy

Scaldione – Moderately sized canopy with a modest cover crop

Wilson Creek (block 9) – Large cover crop with a large canopy farmed biologically

Wilson (block 4) – Large cover and large canopy farmed biologically

What did you measure? How do you determine success?

Pennyroyal: One of the greatest weaknesses of anything that uses shaded canopy measurements is that grapes have a very small, shaded area at solar noon. All of us that use the crop coefficient must fudge it a little. At solar noon shaded measurements may work well for an orange tree but not so much for the grapevine. Grapes do most of their photosynthesis in the afternoon, so this is a blind spot for satellites.

I don't know that satellite technology is a lost cause: it's just not seeing enough, and the algorithms might be lost. It's possible that with a few slight changes in their algorithms, they will soon provide us with enough precision.

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**Did you encounter any difficulties during the trial?
If so, how did you address these complications?**

Pennyroyal: Sometimes you may have a problem with the soil sensor. I did not communicate with my irrigation crew well enough that one block was on a computer control irrigation system. (Block 9 got double-watered for a couple of weeks.) It's important to invite your vineyard guys to your research meetings. Once that mistake happened, I started walking all the vineyard blocks with my vineyard foremen. They have a real sense of the vineyard and could tell if a vine was stressed or not.

What was the most important outcome that growers should take note of?

Pennyroyal: Don't be too tempted to adopt a new technology that promises to save time until you test it. When looking at irrigation efficiency, we need to be sure that we don't reduce it down to only one or two variables. Also, be patient. If you are doing trials, be patient. Any decent trial should be at least three years because last year's pruning affects this year's growth.

Were the results as you predicted or did anything unexpected occur?

Pennyroyal: No. This was a first-year trial, meaning that we were confident that this would be a proof of concept to learn the strengths and weaknesses of how well satellite-based technology would work. In the end, a combination of ground-based moisture sensors, the CIMIS system and field observations provided the best data for now.

What was your impression of the water savings when it came to grape and wine quality?

Pennyroyal: It's too soon to tell. We have upgraded the maintenance of our irrigation systems, and we just started using the new technology. It will be some time before we can establish a new baseline and see how our new system is working. We will have more information to fill in these gaps in the coming years.

What was your greatest learning from studying soil moisture?

Pennyroyal: Satellite data, soil sensors and pressure bombs lined up well when the soil had residual moisture.

However, the sat data consistently told us to under-irrigate once things heated up. Also important is that you can't separate irrigation from soil composition and soil microbiology. Those two things are so interrelated that you must look at them in one system.

Do you plan to conduct a follow-up trial to re-test these results?

Pennyroyal: Yes. We would like to continue this trial for several more years to see how it changes the physiological aspects of the vine, regarding plant sap analysis and soil biology. We will also be able to compare water savings from vintage to vintage to the baseline created in 2021. **WBM**

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Glass Producers Pursue Sustainability Despite Persistent Headwinds

Michael S. Lasky

ASK ANY NUMBER OF glass companies what their definition of sustainability is and you will get any number of different answers. But probably the most succinct summarization comes from Randy Burns, the chief sustainability officer at glass giant O-I Inc.—thematically, it’s similar to the descriptions *Wine Business Monthly* received from all approached for this article.

“Sustainability is about finding the balance that allows us to reduce our negative impact on the environment, control some externalities [i.e., the various permutations of recycling collection practices] and increase our positive practices,” Burns said.

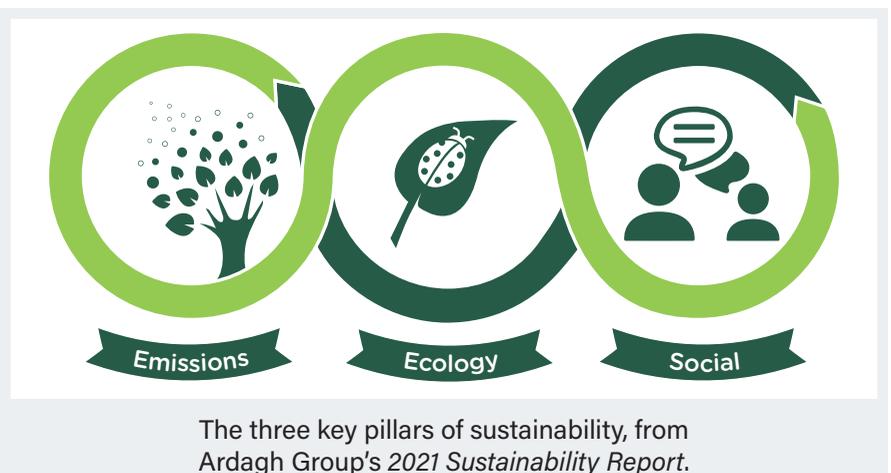
For O-I, there are a number of tasks the company focused on to create that balance. “The first is reducing energy consumption and energy usage. We’re looking at the availability and supply of recycled glass [i.e., cullets] all over the world to try to affect our energy consumption but also because we need to deal with the glass waste that doesn’t get reused,” Burns explained.

According to Scott DeFife, president of the Glass Packaging Institute, recycled glass uses less energy and produces fewer emissions than brand-new bottles because converting the raw materials—silica, limestone and soda ash—requires much higher furnace temperatures. This is part of the reason manufacturers utilize recycled glass as a standard part of the batch mix when making bottles. “And once you’ve made it into glass, it can be infinitely recycled,” he said. “The more recycled glass that’s used, the lower the temperature of the furnace, the less energy employed and the lower the carbon footprint. That’s part of the sustainability solution.”

The trend for companies across the globe has been to be more transparent about sustainability programs and their results—glass included. To that end, many of the wine bottle vendors have included voluminous details of their sustainability aspirations and environmental success posted on their corporate websites.

WBM reached out to sustainability executives at the major domestic and foreign glass companies that produce wine bottles. Some were more forthcoming about their programs while others, for varying reasons, left it to their website details as their sole response.

Without exception, all companies report the biggest obstacle to their sustainability efforts, particularly with obtaining clean recycled glass, is dealing with the wildly different or non-existent recycling practices of municipal and county waste systems (more on this later). For now, let’s focus on the positive enhancements and technical achievements glass companies are making in their quest for sustainability.



How O-I Advances Its Sustainability Practices

“We have a lot invested in research and development to bring our operations to state-of-the-art levels and beyond for the types of combustion, heat recovery and other processes that we use to produce glass,” said Burns. “Importantly, we continue to research how to make containers lighter. Lightweighting is really an efficient use of the raw material.”

The domino effect of lighter glass bottles on sustainability is far reaching. The lighter the bottle, the less energy used to create each bottle, along with lower shipping costs and transportation energy.

“O-I has also developed a proprietary reinvention of the glass furnace that addresses a number of sustainability characteristics across the spectrum. It’s not a large building of refractory bricks. It’s a smaller metal tank that is equally capable and more modular,” Burns offered. “This new furnace creates less waste and is easier to supply from a procurement standpoint. It will enable a number of technologies that will help bring glass manufacturing what it needs for many years to come.”

Currently, O-I has 70 production facilities around the world, each based on locally available technology. Conversion to the newest technologies is being introduced unit by unit. “Most recently, we have incorporated a significant amount of renewable electricity into our facilities. We’ve begun a program to convert more of our furnaces to gas oxygen combustion as the preferred way to fuel our furnaces,” said Burns. “We’ve begun to create lightweighting strategies in different locations to make thinner, more resilient containers.”

Collaboration from manufacturing line to bottling line

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Glass Producers Pursue Sustainability Despite Persistent Headwinds

“Sustainability is about finding the balance that allows us to reduce our negative impact on the environment, control some externalities [i.e., the various permutations of recycling collection practices] and increase our positive practices.”

Randy Burns, chief sustainability officer, O-I Inc.

But as ambitious as all of O-I’s sustainability plans are, they face significant headwinds, cautions Jim Nordmeyer, O-I’s vice president of global sustainability.

“The investment that may be needed in infrastructure, and even in R&D, to get to some of these net zero goals, whether it’s 2050 or 2070...the technology that’s needed to get there in today’s world doesn’t exist yet. If it exists, it’s still on the bench, and it needs to be developed,” he said.

“With all that, like many publicly traded companies, there’s the expectation that we turn profits, and that dictates the speed at which we move and how fast that R&D is happening, as well as access to the capital markets needed to make it all happen,” Nordmeyer added. “It’s very complex, and that’s the reason that we need all parties [the industry, the government and consumers, too] at the table in a collaborative manner.”

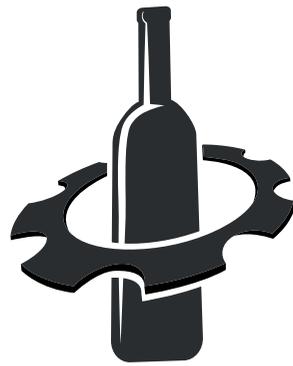
How Ardagh Group Manages Its Global Sustainability Balancing Act

According to Alex Winters, chief sustainability officer at Ardagh Group, there are many ways to tackle sustainability, whether it’s through emissions, waste, water or elsewhere. “It’s really about what you tackle without trying to do too much to the point you are ineffective. I really think the headwind is choosing the right projects that support the business and support our sustainability,” he said.

As part of a globally positioned corporation, Winters has to balance what sustainability practices and future plans can be achieved in Europe versus what can be accomplished in the United States.

“Europe has a much more evolved and progressive environmental sustainability culture, and that’s something that is really difficult to implement in the U.S., just based on geography and regional belief systems,” Winters noted. “I really aim for Ardagh to improve our recycling communication with municipalities and consumers so we’re capturing more glass and getting more cullet processors involved. To me, I think the long answer is cullet. That’s the one goal that is going to be difficult, and it’s one that I’m really passionate about us solving.”

This is a great example, Winters says, where Ardagh is leading a collaboration of all parties to foster an effective path to increase glass recycling awareness, divert glass from landfills, find true cullet processing partners, and ultimately help glass manufacturers increase recycled content and reduce their carbon footprint. “Our membership and active participation in groups, like the Glass Packaging Institute, the Glass Recycling Coalition and the Glass



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Recycling Foundation, underscore our commitment and desire to change the glass recycling status quo in the U.S.”

Even the activities not directly related to glass manufacturing are making sustainability progress in Ardagh facilities. “Simple tasks, like switching in LED lighting from legacy bulbs, clearly reduce our consumption of electricity while also reducing the amount of time employees are in a forklift, changing bulbs. Speaking of forklifts, Ardagh converted our forklift fleet from liquid propane gas to electricity, reducing noise exposure and eliminating tank exchanges,” Winters added.

Ardagh’s sustainability targets, as recorded in its *2021 Sustainability Report*, include a commitment to using 100-percent renewable electricity to operate its facilities by 2030 through its Renewable Energy Program. The company says it will achieve this with a combination of on-site, near-site and off-site renewable energy projects across its European and American facilities.

Saverglass Adapts Manufacturing Processes to Environmental Challenges

To lower emissions and find other sustainability opportunities, Saverglass called upon the Paris-based Carbone 4 consultancy in 2020 to perform a carbon footprint assessment. Using its Bilan Carbone® method, the firm had also carried out an initial assessment in 2009—which has since enabled Saverglass to assess the effectiveness of its efforts over the last 10 years.

Saverglass told *WBM* by email that this diagnostic “showed that for 1 ton of glass produced, 1 ton of CO₂ was emitted, which was an 11-percent drop since 2009. The assessment also enabled a detailed analysis of emission sources. Emissions related to decarbonization come from the glass melting process—for example, the liquefaction of raw materials in furnaces, where they fuse at approximately 1,500°C. As a result, an appropriate action plan to reduce Saverglass’ carbon footprint was redefined.”

By 2035, Saverglass aims to reduce the emissivity of its industrial process by 45 percent and by 36 percent across its entire value chain. Ultimately, the company wants to achieve carbon neutrality by 2050.

Since 2005, its entire finishing process has switched to organic glazes and inks, and its Premium Design Range incorporates lighter bottles. Saverglass is particularly proud of its proprietary service, the Organic Color Play process, with its range of organic ink-based colors. This process does not use heavy metals, such as lead, chromium, cadmium or mercury, during production and significantly reduces energy consumption.

Saverglass is one of the 18 glassmakers of the European Container Glass Federation (FEVE) that have teamed up to produce an industrial pilot to qualify fusion technology, which is considered the most developed for reducing direction emissions from the glass manufacturing process. This oven will process more than 350 tons of glass a day and will replace fossil energy sources with 80-percent green electricity. The oven is being built this year with first results available by 2023.

“The more recycled glass that’s used, the lower the temperature of the furnace, the less energy employed and the lower the carbon footprint. That’s part of the sustainability solution.”

Scott DeFife, president, Glass Packaging Institute

Efforts at Sustainability Face the Realities of Hastened Global Warning

Despite glass producers’ noble efforts to reduce their carbon output and sustainably manufacture glass, significant obstacles remain in their paths.

Inconsistent or negligible glass recycling practices in the U.S. are just some, albeit isolated, obstacles when it comes to sustainability efforts. As the Glass Packaging Institute’s DeFife told *WBM*, “The local single-stream curbside collection, if that’s the predominant way of collecting the material, is difficult. There is a disincentive for companies that own landfills but who also recycle, to clean up their material to a level that is necessary to put on the commodity market if they are also getting paid to put it in a landfill. Further, glass deposit returns only exist in 10 states and not all of those states include bottles larger than single-use containers.”

Landfill economics are largely driven by weight, DeFife added, so the more tons of material put into landfill, the more landfill operators get paid. The wine industry uses heavier glass, and therefore more wine bottles end up in landfill, not in recycled cullet.

Aware of this misdirected dynamic, O-I has created local recycling systems around their plants, featuring glass drop-offs within economically feasible distances. “We will supply the needed equipment with partnered communities if they spread the word that glass can be collected. O-I will reward partners with a donation to whatever charitable cause the community needs the most,” stated Burns.

“We call this program ‘Glass for Good,’ and it is up and running in several areas in the eastern U.S. and Canada. We’re doing that not because we think we can create a new recycling system in the U.S., but because we’re going to need multiple ways to collect material if we want to achieve anything that looks like circularity in the United States, due to the localized nature and the geographic spread that we have here that they don’t, for example, have in Europe,” he added. “We’ll need to figure that out to be able to do this, as well in Mexico or in Brazil or in Colombia or in a lot of the other places that we operate that don’t have organized recycling.” **WBM**



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VINEYARD ACREAGE: 185

FOUNDED IN 1972 BY David S. Stare, Dry Creek Vineyard winery in Healdsburg, Calif. is still owned by the same family and managed by Stare's daughter and current president, Kim Stare Wallace. Tim Bell has been winemaker since 2011.

The winery entered its Heritage Vines Zinfandel into the Package Redesign category of the 2021 PACK Design Awards; the new label retains the unique elements of Dry Creek's packaging while adding more information for consumers. In addition to the standard details on varietal, vintage and appellation, the redesigned front label also features tasting notes, oak use (14 months in American, Hungarian and French barrels) and details on the winery's commitment to sustainability and sourcing from local vineyards. The back label provides even more technical information on winemaking and grape growing. According to the winery, the redesign: "Illustrates the authenticity of our family winery in a bold new way."



Packaging Vendors

DESIGNER: Auston Design Group

BOTTLE VENDOR: TricorBraun WinePak

CLOSURE VENDOR: Cork Supply

CAPSULE VENDOR: Cork Supply

LABEL VENDOR: CCL Label

Additional winemaking information is in step with the trend to provide consumers with more transparency on the products they are buying. And with a suggested retail price of \$26, the wine is positioned for knowledgeable wine shoppers interested in such details as oak programs, vineyard sourcing and growing practices.

The new label still bears artwork of a sailing ship, which has been a Dry Creek motif since 1982. Created by Sonoma County artist Michael Surles, the labels depict not just any sailing ship but "J Class" yachts from 1929 to 1937. According to the winery, these boats represented the pinnacle of design during the time and were sailed by only the most experienced skippers. As the winery celebrates its 50th anniversary this year, it credits the consistent sailing ship label images—as well as the subtle irony of a ship under full sail next to the name "Dry Creek"—in helping to make the winery's brand recognizable and memorable. **WBM**

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RETAIL SALES ANALYSIS

Retail Wine Sales Down 5 Percent in February

Wines Vines Analytics

Produced by **Wines Vines Analytics**, the *Wine Analytics Report* is the industry's leading source of market insights, objective analysis and data.

Sales Value Down 5 Percent in February

Off-premise table wine sales fell 5 percent versus a year ago in the four weeks ended Feb. 26, NielsenIQ scan data showed, exceeding \$1.2 billion. Sales in the latest 52 weeks totaled \$16.1 billion, down 9 percent from the previous year. Sales in the latest four weeks exhibited a more modest decline than in recent periods, underscoring the stabilization in spending patterns that has been emerging as reopening continues. While pandemic-related concerns linger, off-premise sales are establishing a new baseline.

Sales Volume Down 8 Percent in February

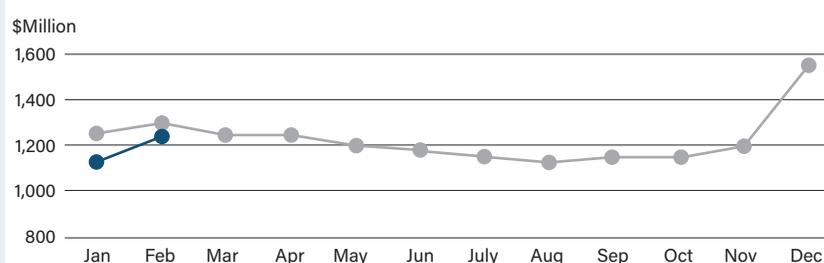
Off-premise table wine volumes dropped 8 percent versus a year ago in the four weeks ended Feb. 26 to 12.4 million 9L cases. The decline contributed to a contraction of more than 13 percent in the latest 52 weeks versus a year earlier to 159 million 9L cases. The sharper drop in sales volume versus value indicated that what is selling is, on average, more expensive than in previous periods. Similar to the trend in sales value, however, the shift in volume reflected the establishment of a new baseline for sales after two years of the pandemic.

Glass Packaging Maintains Its Value Share

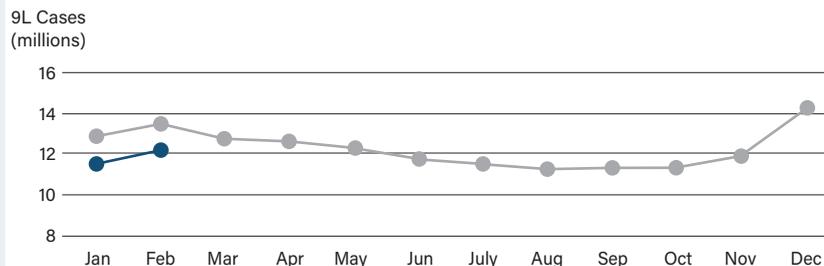
Supply chain challenges, environmental considerations and innovations in packaging materials have all raised questions regarding the status of glass as the dominant packaging material for wine. Yet in the latest 52 weeks, glass maintained an 88 percent share of wine sales through the NielsenIQ off-premise outlets. This was down marginally from 89 percent a year ago. The only other packaging material to lose share was boxes, while cans, plastic and Tetra packaging all picked up share. Plastic made the largest gains by far, increasing from 1.7 percent to 2.2 percent of off-premise sales, but it remains a relatively minor component of the channel with just \$443 million in sales in the latest 52 weeks. This is a fraction of the \$17.8 billion worth of wine and wine-based beverages sold in glass packaging during the period.

When the sales volume of wine by packaging material is considered, glass holds a 77 percent share, significantly less than the value of the packaged wine. The divergence between value and volume underscores the resilience of glass for premium wines even as other packaging materials gain ground. While premiumization is often called out in analyses of sales figures, the data for sales by packaging material also drives home the point. Drilling into average pricing per 750ml, wines sold in glass packaging averaged \$10 followed by cans at \$9.65 and plastic at \$7.46. But other packaging materials are closing in. The average pricing for wines in glass increased 5% over the previous year, on par with wines in plastic. Both remained well behind canned wines, which posted a 13 percent gain in average price. **WBM**

Trended Off-Premise Value

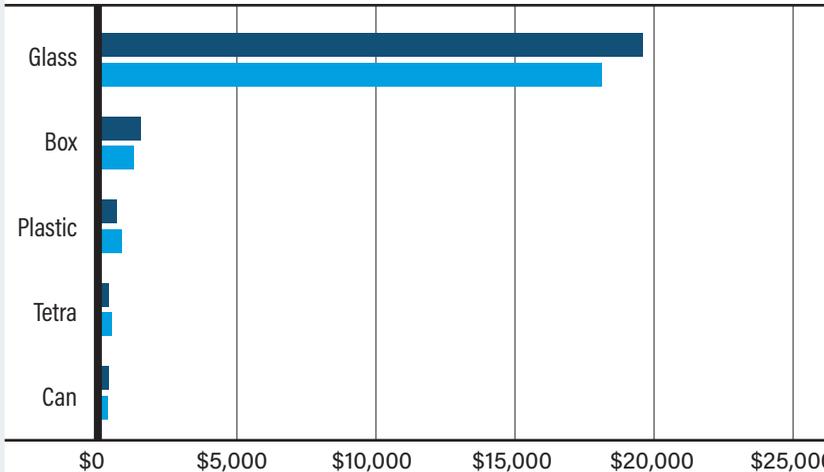


Trended Off-Premise Volume



SOURCE: NielsenIQ, Latest 4 Wks - W/E 02/26/22

Off-Premise Sales by Packaging Material in Millions \$



SOURCE: NielsenIQ, off-premise sales in the four weeks ended Feb. 26, 2022

Methodology

Sourced from NielsenIQ, these figures represent off-premise retailer wine sales to the consumer aggregated across a variety of channels nationwide, including grocery, drug, mass merchandisers, convenience, dollar, military, as well as a selection of warehouse clubs, and liquor channel geographies and liquor channel retail chains. NielsenIQ figures are updated and released every four weeks.

NielsenIQ Table Wine Category Segments MARKET: Total US xAOC+Conv+Military+Liquor Plus PERIOD: Week Ending February 26, 2022

		Dollar Value		Dollar Value % Chg YA		9L Equivalent Volume		9L Equivalent Volume % Chg YA		Avg Equivalent Price Per 750ML	
		Latest 52 Wks - W/E 02/26/22	Latest 4 Wks - W/E 02/26/22	Latest 52 Wks - W/E 02/26/22	Latest 4 Wks - W/E 02/26/22	Latest 52 Wks - W/E 02/26/22	Latest 4 Wks - W/E 02/26/22	Latest 52 Wks - W/E 02/26/22	Latest 4 Wks - W/E 02/26/22	Latest 52 Wks - W/E 02/26/22	Latest 4 Wks - W/E 02/26/22
TOTAL TABLE WINE		16,117,113,540	1,243,728,960	-9.5	-5.1	159,023,587	12,163,572	-13.4	-8.4	8.45	8.52
PRICE TIERS BY CONTAINERS	BOX	1,573,006,780	123,867,210	-12.1	-4.9	35,528,587	2,763,290	-12.9	-6.9	3.69	3.74
	\$0-\$3.99	560,647,819	43,467,999	-14.9	-8.9	18,752,755	1,427,310	-14.9	-10.7	2.49	2.54
	\$4+	1,011,334,115	80,243,282	-10.6	-2.8	16,755,676	1,333,189	-10.6	-2.6	5.03	5.02
	Total Table Wine Glass	14,205,989,187	1,095,263,305	-9.4	-5.2	119,747,846	9,131,191	-13.9	-9.0	9.89	10.00
	Value Glass \$0-\$3.99	487,032,559	36,945,273	-20.2	-14.0	12,054,991	898,869	-20.7	-15.4	3.37	3.43
	Popular Glass \$4-\$7.99	2,718,457,315	209,199,052	-17.6	-11.1	40,512,814	3,092,921	-18.1	-12.1	5.59	5.64
	Premium Glass \$8-\$10.99	3,126,908,184	240,977,050	-15.0	-9.7	27,421,154	2,094,108	-15.2	-10.5	9.50	9.59
	Super Premium Glass \$11-\$14.99	3,683,249,449	284,030,511	-7.2	-3.5	24,259,750	1,846,758	-7.8	-4.4	12.65	12.82
	Ultra Premium Glass \$15-\$19.99	1,939,759,279	152,825,975	-2.4	1.4	9,438,206	735,178	-3.2	0.8	17.13	17.32
	Luxury Glass \$20-\$24.99	827,661,376	63,556,144	1.1	4.1	3,143,093	239,456	0.1	3.2	21.94	22.12
Super Luxury Glass \$25+	1,406,412,538	106,214,090	8.2	3.0	2,794,372	213,315	5.0	1.4	41.94	41.49	
IMPORTED	IMPORTED	4,424,099,536	334,920,722	-11.0	-5.5	42,211,096	3,212,022	-14.1	-8.4	8.73	8.69
	ITALY	1,461,121,749	114,620,595	-10.1	-5.0	11,617,554	907,445	-12.7	-7.1	10.48	10.53
	AUSTRALIA	668,642,698	52,018,697	-17.1	-13.1	10,706,249	822,135	-16.9	-12.9	5.20	5.27
	FRANCE	631,023,178	41,307,953	-6.6	-1.9	3,421,347	219,255	-10.7	-8.0	15.37	15.70
	CHILE	360,511,023	28,850,526	-16.7	-8.1	6,198,302	498,419	-15.7	-7.4	4.85	4.82
	SPAIN	155,794,346	12,343,726	-10.7	-3.5	1,110,223	87,111	-16.7	-6.8	11.69	11.81
	GERMANY	80,002,579	5,844,433	-13.2	-3.7	682,941	49,581	-15.3	-5.8	9.76	9.82
	NEW ZEALAND	642,357,654	47,149,363	-4.2	4.7	4,419,537	317,593	-5.8	2.1	12.11	12.37
	ARGENTINA	309,836,118	24,625,712	-16.7	-11.6	3,119,210	246,165	-19.4	-13.1	8.28	8.34
	SOUTH AFRICA	26,278,010	1,979,108	-12.1	-9.4	217,885	16,412	-11.4	-7.0	10.05	10.05
	PORTUGAL	49,737,305	3,358,707	-12.7	-3.7	489,001	31,974	-13.9	-6.7	8.48	8.75
DOMESTIC	DOMESTIC	11,693,014,005	908,808,238	-8.8	-5.0	116,812,490	8,951,550	-13.2	-8.4	8.34	8.46
	CALIFORNIA	10,513,267,967	821,987,048	-8.5	-4.3	107,828,306	8,299,108	-13.0	-8.0	8.13	8.25
	WASHINGTON	599,691,497	44,244,446	-15.8	-14.7	4,748,682	346,320	-16.8	-15.0	10.52	10.65
	OREGON	308,294,980	23,221,175	-4.0	-5.7	1,507,751	110,826	-6.2	-7.6	17.04	17.46
	TEXAS	31,205,030	2,235,235	-16.2	-22.5	335,470	22,379	-18.6	-30.1	7.75	8.32
	NEW YORK	43,249,705	2,360,969	-10.6	-4.1	458,643	28,767	-15.4	-8.8	7.86	6.84
	NORTH CAROLINA	44,956,849	3,346,809	-5.9	-4.6	453,934	33,473	-7.6	-6.9	8.25	8.33
	INDIANA	25,305,182	2,112,537	-11.5	-6.2	272,855	22,510	-11.1	-6.5	7.73	7.82
	MICHIGAN	26,284,995	1,805,896	-12.3	-7.3	262,298	17,752	-14.9	-10.3	8.35	8.48
TYPES	RED	8,382,241,557	676,032,186	-10.0	-6.9	72,485,544	5,795,971	-14.7	-10.0	9.64	9.72
	WHITE	6,520,457,520	487,572,222	-8.0	-1.7	71,148,968	5,294,180	-11.3	-5.4	7.64	7.68
	PINK	1,208,995,162	79,990,882	-13.4	-8.9	15,339,031	1,072,192	-16.6	-13.2	6.57	6.22
VARIETALS	TOTAL CHARDONNAY	2,717,366,481	204,513,183	-7.8	-2.3	29,136,115	2,176,578	-11.0	-5.8	7.77	7.83
	TOTAL CABERNET SAUVIGNON	3,179,820,436	257,007,909	-7.2	-4.4	25,522,334	2,065,341	-12.9	-7.6	10.38	10.37
	TOTAL PINOT GRIGIO/PINOT GRIS	1,469,620,030	110,511,886	-7.2	0.6	18,088,712	1,357,148	-9.6	-2.4	6.77	6.79
	TOTAL PINOT NOIR	1,334,355,833	109,095,315	-7.0	-3.2	9,086,106	737,363	-11.4	-5.9	12.24	12.33
	TOTAL MERLOT	636,657,362	50,241,372	-15.2	-11.6	8,040,927	628,155	-18.1	-13.1	6.60	6.67
	TOTAL SAUV BLANC/FUME	1,295,100,362	95,850,488	-3.4	3.9	10,747,864	790,256	-5.8	0.7	10.04	10.11
	TOTAL MUSCAT/MOSCATO	618,265,293	48,174,848	-18.4	-12.6	8,658,561	663,426	-20.5	-14.9	5.95	6.05
	TOTAL WHITE ZINFANDEL	232,532,596	17,160,197	-17.1	-14.0	4,516,757	331,934	-18.3	-15.0	4.29	4.31
	TOTAL MALBEC	243,789,686	19,678,718	-16.2	-11.3	2,157,837	174,323	-18.4	-12.0	9.42	9.41
	TOTAL RIESLING	234,133,913	17,174,405	-15.5	-9.3	2,327,081	169,250	-18.1	-11.4	8.38	8.46
	TOTAL ZINFANDEL	217,878,513	16,881,775	-15.0	-13.7	1,409,477	106,319	-18.6	-17.5	12.88	13.23
	TOTAL SHIRAZ/SYRAH	114,552,084	8,874,585	-18.0	-14.4	1,175,088	90,913	-22.1	-17.1	8.12	8.14
	WHITE BLENDS (ex. 4/5L)	251,328,383	18,211,074	-10.8	-6.8	2,685,350	197,545	-14.5	-10.3	7.80	7.68
	RED BLENDS (ex. 4/5L + CHIANTI)	2,174,705,725	175,418,151	-11.3	-9.5	17,816,271	1,429,517	-15.5	-12.1	10.17	10.23
	ROSE BLEND	702,800,311	41,452,238	-10.3	-4.6	5,421,816	330,443	-13.9	-9.7	10.80	10.45
GLASS SIZES	750ML	12,034,329,606	928,305,597	-8.1	-4.7	84,241,661	6,423,010	-12.4	-8.5	11.91	12.04
	1.5L	1,876,387,841	144,937,429	-16.9	-8.3	30,852,878	2,365,732	-17.7	-9.8	5.07	5.11
	3L	51,574,617	3,962,402	-18.4	-9.9	1,201,536	89,426	-18.3	-14.0	3.58	3.69
	4L	67,433,300	5,064,714	-16.5	-10.6	2,060,588	153,236	-17.4	-12.1	2.73	2.75
	187ML	91,560,499	6,361,298	-12.7	-15.3	1,030,921	72,296	-13.9	-15.2	7.40	7.33
	375ML	60,783,649	4,967,765	22.7	17.4	225,221	18,292	28.8	18.4	22.49	22.63
BOX SIZES	ex. 4/5L	1,105,771,395	87,827,358	-11.1	-3.2	19,260,921	1,533,152	-11.4	-3.3	4.78	4.77
	1L	33,819,079	2,672,303	-4.8	4.0	479,790	38,120	-5.2	3.8	5.87	5.84
	1.5L	18,903,546	1,373,512	-25.3	-20.2	349,209	24,873	-29.0	-23.3	4.51	4.60
	3L	818,131,390	65,465,776	-15.0	-5.7	15,550,317	1,246,454	-13.5	-4.7	4.38	4.38
	5L	467,231,541	36,039,614	-14.3	-8.8	16,267,572	1,230,132	-14.6	-11.0	2.39	2.44
	TETRA	269,333,926	21,037,524	4.5	7.0	3,367,403	262,315	3.1	7.3	6.67	6.68

Source: NielsenIQ

Sustainability Meets Finance: **Eco-Performance Based Loans, Investors, Retailers and New State Regulations Fuel Climate Progress**

Pam Strayer

THE WORLDS OF FINANCE AND SUSTAINABILITY in wine are intersecting as both sectors begin requiring reliable, verifiable metrics reporting and transparency to combat climate change and ensure a successful and profitable future.

It's a revolution happening at scale, rippling through the industry and touching wineries of all sizes—from giant alcoholic beverage companies to small- and medium-sized wineries as well as banks.

"Sustainability is moving from storytelling to data," is the way Erica Landin-Löfving, the chief sustainability officer at Vintage Wine Estates (VWE), describes the shift. This data is becoming as vital to business success as a wine score or a balance sheet.

Banks, government agencies, retailers and the players in the stock market are all involved in driving wineries to measure, report and verify climate goals/achievements with a wide variety of incentives embedded in emerging systems.

The move toward sustainability in business first developed as a way of being greener, thereby reducing costs and risks, resulting in higher valuations. But the landscape is rapidly changing from the days of voluntarily discovering savings in inputs (energy, water) and increasing efficiency, to requiring businesses to participate with incentives at both public and private companies.

This growing overlap between finance and sustainability is also driving organizational change as companies hire more sustainability staff, often placing them in more senior levels of the company. "We see increased coordination across all departments, but perhaps the most notable change is the strong new link between sustainability and finance," said Landin-Löfving.

Sustainability may have its own C-suite seat, as it does at publicly owned companies like VWE and Treasury Wine Estates (TWE), or it may be nested in the office of the general counsel, the role that manages a company's risk, as is currently practiced at Duckhorn (a public company as of 2021).

Green Finance: Sustainability Linked Loans

When the publicly traded, Australia-based Treasury Wine Estates (TWE) announced in December 2021 that it had received a \$1 billion sustainability linked loan (SLL), heads turned. Many wondered: "What is a sustainability linked loan? (And should I get one, too?)"

First introduced in Europe in 2017, SLLs are loans with varied interest rates linked to progress on achieving measurable and verifiable environmental,

social and governance (ESG) goals. Goal examples include converting to renewable energy, reducing water use, or diversifying company leadership to include women.

As Maarten Biermans, the former global head of sustainable finance at Rabobank, explained in a company video posted to YouTube, "The idea is that when the company actually achieves the sustainability targets agreed upon, interest rates that the company needs to pay go down. However, in many cases, there's also the possibility of a penalty, meaning that if the company does not achieve any of the targets, the interest rate might actually go up."

The lender and the loan recipient decide upon the targets, review the baseline, and agree on the verification method that will validate outcomes.

Experts interviewed for this article said the TWE loan was the first SLL in the wine industry, adding that others may be in the works.

CASE STUDY: TREASURY WINE ESTATE'S SUSTAINABILITY LINKED LOAN

The SLL Treasury Wine Estates (TWE) received refinanced \$1.4 billion (AU) in debt, with three international banks—Westpac from Australia, Hong Kong's HSBC and BNP Paribas—participating.

Treasury Wine Estates reported that it was hit hard with Chinese tariffs of 170 percent in fiscal 2021, resulting in a 43 percent drop in its profits. The company's portfolio includes a wide variety of brands, ranging from its ubiquitous, low-cost [yellowtail] and Snoop Dogg-promoted 19 Crimes, to its high-priced, world-famous Penfold's.

"Westpac, HSBC and BNP Paribas acted as our sustainability coordinators and assisted in structuring our SLL framework and gaining participation from our global banking network," said TWE chief financial officer Matt Young. "These arrangements are increasingly common, but this is one of the largest sustainability linked loans in Asia-Pacific."

A prerequisite for many SLLs is that a company must have a publicly disclosed sustainability report. This was the case for TWE, which announced its sustainability strategy in May 2021, followed by its sustainability report in September 2021, three months in advance of the loan announcement in December.

In its May strategy announcement, chief corporate services officer Kirsten Gray said, "We have set clear emission reduction targets including 100 percent renewable electricity by 2024, paving the way for us to move towards our net zero emissions target by 2030 (Scopes 1 and 2). We'll also be playing our part in minimizing the impact of climate change across our value chain as we look to accelerate our assessment and reduction of Scope 3 emissions."



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The goals outlined in the May press announcement were part of the December loan agreement—which both bankers and company officials collaborated on—specified the KPI's, which included:

- 100 percent renewable electricity by 2024
- Reduced greenhouse gas emissions
- Undertaking a comprehensive review of water usage and footprint at a catchment level in Fiscal Year 2022
- Senior leadership to include 50 percent women and have 42 percent female representation overall by 2025.

“We also had a second-party opinion conducted by an independent external party to confirm our adherence to these principles and the appropriateness of the Sustainability Performance Targets (SPTs),” said Young. “We’ve worked closely with our sustainability coordinators to determine the relevant ESG incentives and as we progress and deliver against our SPTs, we’ll receive a favorable loan margin adjustment. The reverse is also true. Our performance is assessed annually.”

The company’s stock recouped some of its Chinese tariff induced losses on the Australian stock exchange after it refinanced its debt.

EXPLOSIVE GROWTH IN SLLS

Globally, interest in sustainability linked loans is skyrocketing because they are far more flexible than “green” loans, which must be used for specific projects, said Herve Duteil, chief sustainability officer for BNP Paribas Americas, the parent company of Bank of the West and provider of TWE’s SLL.

“We moved from financing the green [leaders] to financing the greening of the economy. We moved from niche to universal,” Duteil said. “Unlike the first generation of sustainable finance products, where banks really looked at what the money was being used for, with SLLs you don’t look at how the borrower is going to use the money but rather at its future sustainability performance.

“As a result, this shift in mindset has unlocked sustainable finance to many more borrowers. Now, you no longer need to have green use of proceeds, but instead strive to achieve some sustainability targets such as greenhouse gas emission reduction, water intensity improvement, or board diversity quotas.”

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The loans are being used across nearly all sectors of industry, Duteil said. According to him, the power and utilities sector accounts for 20 percent of the SLL market by volume, followed by consumer goods, tech, oil and gas, real estate, and financials, which account for approximately 10 percent of the market, each. The agriculture category, and all other sectors, account for 5 percent of the market or less.

“The point of these loans is to reward high levels of performance. Banks structuring these loans need to assess what is a realistic yet ambitious target,” he said. “That means having or building the capacity to measure and report on greenhouse gas emissions, water intensity, or other material metrics which have been chosen.”

Experts say the drivers to count and report metrics and data are only going to increase, and an SLL can help a company implement sustainability reporting that will be needed to compete.

“There’s going to be required disclosure mandated at some point, sooner or later,” said Ela Eskinazi, head of sustainable finance and clean energy at Bank of the West, at the time of the interview. (Since the January 2022 interview, the SEC has put forth its climate disclosure proposal.) “An SLL does bring alignment of sustainability strategy with corporate finance, a winery will need to bring more transparency and more disclosures, or improved measurement across key sustainability focus areas to take advantage of SLL financing structure. They will likely need to bring an external consultant to help build out of the program, and on measurement aspects.”

While the TWE loan was a \$1 billion loan, smaller scale SLLs could be more popular soon, said Robert Eyler, professor of economics and director, Center for Regional Economic Analysis (CREA) at Sonoma State University.

“Shifts in lending formats and policy often get rolled out by the larger players and then the smaller players try to figure out whether or not they can tolerate the reduced costs vis a vis the increase in the current risk environment,” he said.

Banks are also under the gun to show their progress on ESG and climate goals, Eyler added. “Just how much banks are going to be society’s police about social and environmental goals versus rates of return will play out over time,” he said. “Banks know that some businesses are going to want to do this naturally. And to gain their business, banks

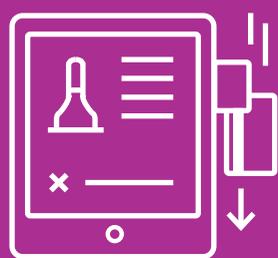
may provide some rate cuts on loans, because they’re sort of sharing the loss of inherent risk that otherwise they would face if those goals weren’t achieved.

“Is this something we should be expecting more and more in the future? The answer is yes. And in what forms and how well would it work? That is still an open question.”

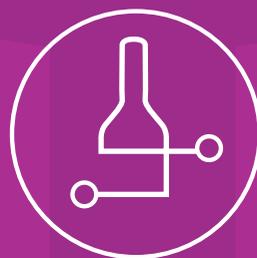
The SLLs are not without risk. Fire, water shortages, or other unforeseeable risks could disrupt a winery’s ability to achieve its targeted goals.

Eskinazi said wineries should seek advice from banks on how best to move forward on sustainability, available capital structures and climate initiatives. “The bank can be a partner on both creating the sustainable finance framework and execution,” she said. “It’s an important strategic conversation to have with our clients, how they are thinking about sustainability, what they expect in the future—the conversation can be advisory.”

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Sustainability Meets Finance

Market-Driven Green Business Levers: Investors and Retailers

ESG investors and retailers represent more key climate change business drivers for both public and private companies.

When Vintage Wine Estates (VWE) went public in 2021, president Terry Wheatley said questions about the company's sustainability initiatives were a frequent topic of investor and analyst calls. "I'd say it was about 30 percent of conversations last year. Now it's about double that number," she said. In addition, Wheatley noted that a significant portion of investors invest only in companies based on ESG metrics.

VWE will issue its first sustainability report later this year, providing data that ratings services and analysts can use in their calculations.

Feedback from the retailer front was quicker to arrive. When VWE announced its participation in the newly formed Sustainable Wine Roundtable in September, Wheatley said she immediately received calls from major retailers—including Whole Foods and Target—wanting to learn more about the company's sustainability efforts.

Retailers are also in line to reward suppliers who provide concrete sustainability metrics. Walmart's far-reaching Project Gigaton (announced in 2017) mandates flexible sustainability reporting for suppliers as of 2021.

"Through Project Gigaton, we aim to avoid one billion metric tons (a gigaton) of greenhouse gasses from the global value chain by 2030," the company says on its Project Gigaton website.

However, calculating data on Scope 3 emissions—those that result from activities from assets not owned or controlled by a reporting organization—is a challenging process that most companies require outside help to complete.

Says Wheatley, "Gathering data from the supply chain will be a difficult process, especially since about a third of our products use bulk wine and another large portion are farmed by third parties."

Added Landin-Lofving, "The industry will have to rely partially on estimates but that, as agriculture and winemaking contribute to only a third of the carbon footprint of wine, more focus will be placed on getting the true footprint of packaging, bottling and logistics."

VWE will issue its first public sustainability report later this year, providing baseline data on material sustainability that ratings services and analysts will be able to use for calculations. Analysts typically use baseline numbers to evaluate a company's accountability over time.

Government Drivers

While the Securities and Exchange Commission (SEC) finalizes mandatory climate disclosure requirements for public companies (which are anticipated this fall), in January the state of California announced a new law that requires large companies—public, or private with revenues of \$1 billion—to report on emissions, including the biggest bucket of Scope 3 emissions.

SB-260 Climate Corporate Accountability Act.(2021-2022) puts into place mandatory greenhouse gas reporting to be implemented by 2025.

The biggest impact to the wine industry would be that E. & J. Gallo Winery, a privately held company, would be added to the list of companies required to report. (Under new SEC federal regulations issued in April, public companies are now required to report climate disclosure risks and other ESG metrics.)

Wine industry leaders are not sure how all this will play out in terms of growers having to report sustainability data. Said John Aguirre, president of the California Association of Winegrape Growers, "We are discussing the matter and how it will affect our grower members."

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Accounting Executives Step into Sustainable Finance

How can wineries prepare for the likelihood of market-driven or government-mandated climate disclosure? Along with sustainability professionals and winery attorneys, CFOs and CPAs will face increasing pressure to learn and prepare for the new requirements.

As Eskinazi advised, “Big or small, you have to be on top of these things, because you’re going to have to scramble on this if you wait. These things don’t happen overnight. You’ve got to establish maturity, business alignment, functional alignment, core team accountability goals, metrics. I’m talking about at least two years.”

A key indicator of the changing trends in sustainability came in January 2022, when prominent sustainability leader Julien Gerveau, a founder of the International Wineries for Climate Action (IWCA), and formerly Jackson Family Wines’ vice president for sustainability, left the wine company to work with CPA Scott Anderson at the accounting firm of Sensiba San Filippo LLP, where Gerveau now serves as director of sustainability implementation and climate action planning.

“CFOs are getting pressure from the board to up their game. This is a board level conversation for most businesses, and it’s coming from the top and from shareholders,” said Anderson. “So, the finance industry is getting educated in a very quick way.”

He says financial professionals have a lot to contribute to sustainability progress, whether it’s with small or large steps. “From the CPA firm perspective, tax credits have been a motivator,” he said, adding that this includes research investment tax credits. “You could end up with \$15,000 to \$30,000

projects that are really meaningful. It’s not a huge rocket science analysis to figure out what those will be.”

For finance professionals interested in learning more about integrating sustainability into their job descriptions, he recommends getting a credential through the Sustainability Accounting Standards Board (SASB). “I learned an incredible amount in it, but it also gave me confidence to be more conversant in the topics of sustainability and sustainability metrics,” Anderson said.

Future Proofing: Aligning to the Coming Standards

Seeking hotspots and early wins has proven successful in business sustainability planning, according to Gerveau. “With greenhouse gas emissions accounting, you identify those hot spots, and that’s where you take action. Those are the priority areas. There’s a low hanging fruit for any organization. And obviously, the larger the organization, the more low-hanging fruit there is,” he said. “We’re helping vineyards and wineries identify that and start to take steps in the right direction, while understanding the broader context of what needs to happen over the next 10 to 30 years.”

“From a climate targets standpoint, it’s finding that sweet spot where you don’t get completely overwhelmed by the magnitude of what needs to be done,” Gerveau added. “You can start taking meaningful steps that actually have a measurable impact on your sustainability impact in your financial performance.”

In addition, this rigor can move organizations closer to new goal posts set by retailers, banks and both state and federal governments.



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Where Global Sustainable Finance and Reporting is Headed

While the SASB laid the foundation for unified financial standards in 77 vertical industries for a decade (which led to SEC buy-in), when President Trump was elected, progress in the area halted. In 2021, that changed when the International Financial Reporting Standards Foundation (IFRS), which represents the international banking community, announced at COP26 that it would back ISSB and elected environmentalist and entrepreneur Emmanuel Farber, founder and newly ousted president of the \$36-billion global food giant Danone, to head ISSB. Standards are once again moving forward and are expected to be published this Spring.

ESG pioneer Elisa Turner, a Napa resident and founder of www.ImpaktIQ.com, a sustainability consulting firm with a list of heavy-hitter global clients, is one of the experts who participated in setting the SASB standards (that ISSB will draw from) and will help ISSB as it moves forward.

In addition to SASB standards, ISSB will incorporate SBTi standards (and others). Yet SBTi has come under attack for potential greenwashing. Quoted in the Financial Times, critics, including one of SBTi's founders, say governance issues are concerning. "You can't be both judge and jury," said one expert.

Both Turner and Eskinazi said the beer industry, though different in culture and ownership, has already made significant progress in setting ESG reporting standards and is a model that the wine industry can look to.

"There is so much potential for the wine industry to move forward on its ESG goals," she said. "Along with numerous other industries, the wine industry is a laggard. The alcoholic beverage and beer industries are far ahead of the wine industry."

Meanwhile, Anderson and Duteil both think ISSB's major league standards will not likely affect small- to medium-sized companies very soon.

"I don't see that SASB or ISSB or any of the formalized reporting frameworks are going to get adopted right away," Anderson said. But he says being ESG savvy could be helpful to those who want to be targeted for acquisition.

"It makes things a lot easier because the acquirer will know how the winery fits into the risk profile of the acquirer's existing portfolio," he said. "If you're a winery and you're not keen on acquisition, then I think it's more of an introspective decision as to what you tell your consumers and you're probably using it to drive marketing in that respect, or potentially your distributors. It gives them more data to help make their supply chain as clean as possible."

It can also affect a bank's willingness to loan, as banks discover pressure to decarbonize and reduce their portfolio risks and achieve higher ESG rankings themselves, experts said.

In terms of mitigating climate risks, actions today are more effective than actions taken in five to 10 years, climate experts said in the UN Intergovernmental Panel on Climate Change's (IPCC) latest report released Feb. 28, 2022. UN Secretary General António Guterres warned "delay means death."

"As climate impacts worsen—and they will—scaling up investments will be essential for survival, he said. "Adaptation and mitigation must be pursued with equal force and urgency. That's why I have been pushing to get to 50 percent of all climate finance for adaptation." **WBM**



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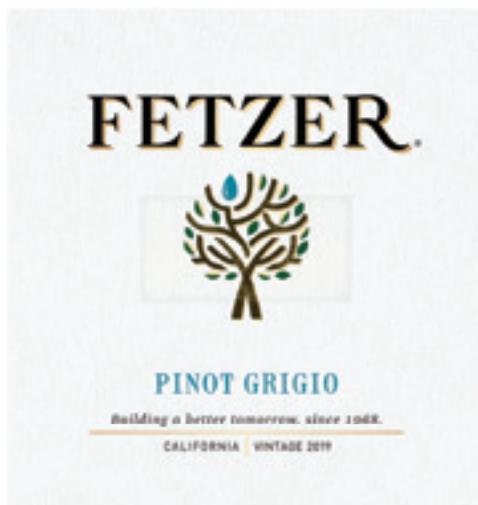
Climate Change Symposium

Part 1 - Viticulture



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What are Banks Looking For?

In establishing the goals (or key performance indicators, “KPIs”), banks prefer to see a multi-pronged approach, though environmental goals and targets should be most prominent, Duteil said. After that, other KPIs, such as social targets, are encouraged and at least one target should be considered a stretch goal.

“Overall, sustainability indicators should be material and performance targets ambitious,” he added. “Targets should be really impactful, not just window dressing.”

Since Scope 3 emissions—those that result from activities from assets not owned or controlled by a reporting organization—are often substantial contributors to a company’s overall emissions report, Duteil said that any SLL should address supply chain issues. (In the wine industry, packaging and transport carbon emissions are the primary Scope 3 emissions.)

“In the agricultural sector, it is key to consider the entire value chain,” he said. “We want to trace both direct and indirect supply chains.”

Today, banks look at these loans through two lenses.

“One is the traditional credit angle, where climate-related financial risks are starting to be accounted for, as we understand that transition risks are looming on the horizon in certain sectors,” said Duteil. “The second is the commitment that many banks have made: to align their portfolios with a net zero greenhouse gas emission trajectory, meaning they have to progressively reduce their exposure to carbon intensive actors.”

How preferential are SLL rates? “The SLL impact range on pricing is between 1 base points to 10 base points on what we have seen and participated in so far,” says Duteil’s colleague Ela Eskinazi, head of sustainable finance and clean energy at Bank of the West (who worked on the TWE SLL). “It depends on deal size and market region, investment grade versus leveraged finance (below investment grade), and down in middle market. The pricing can work both ways, as a reduction or an increase of rate based on actual performance against set goals and KPIs.”

One base point is equal to one one-hundredth of 1 percent.

A study conducted by Bloomberg Green looked at 77 revolving credit facilities and term loans which included sustainability adjustments and found that, “Forty percent of the borrowers agreed to pay a penalty of five basis points if they failed to meet their targets in exchange for a five basis point discount if they achieved their goals—a total swing of 10 basis points.”



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WINES VINES ANALYTICS

Private Labels Expected to Carve Bigger Slice of Market

Andrew Adams



Andrew Adams is the editor of the *Wine Analytics Report* and was a writer and editor at *Wines & Vines* magazine for nearly a decade. Adams grew up in the city of Sonoma, Calif. and graduated from the University of Oregon with a degree in journalism. In addition to working at daily newspapers for more than a decade, Adams worked in the cellar and lab at the former Starmont winery in Napa Valley.

THE PRIVATE-LABEL SEGMENT OF the retail wine market has steadily grown and is expected to continue to claim a larger segment of off-premise sales in the foreseeable future.

Reliable quality, approachable flavors and larger margins have made private-label wines a favorite for retailers and consumers alike as the share of these wines on retail shelves and in the wider market increased.

According to the New York-based Private Label Manufacturers Association (PLMA) and NielsenIQ, private-label wine sales grew 8 percent between November 2020 and November 2021, totaling \$45 million from 8 million cases, which represented a volume increase of 2.4 percent.

That's better than the overall off-premise sales in the same period but represents a sliver of the more than \$900 million total domestic wine sales in the same period. Those who work in the private-label sector say it represents a larger slice, closer to 10 percent of the total market, but its very nature makes it an opaque part of the industry.

It may be hard to track, but the private-label segment appears set for more growth as these wines, which also go by the name of store brands, exclusives and signature brands, likely will offer consumers bargains and the trade better profits in what is shaping up to be a brutally competitive year in a market expected to see little, if any, growth.

The PLMA's European office reports the share of private-label brands in the top wine producing and wine consuming nations there is higher than one may expect. In France, private labels accounted for 17 percent of total value in 2020 while the share was more than 21 percent, and in the United Kingdom, it was 22 percent. The share is much higher by volume: France 21 percent, Germany 34 percent and the UK 27 percent.

Market penetration in those nations, increasing sales here, a sophisticated—albeit currently stretched thin—supply chain and consumers who want consistent value and quality all indicate ongoing growth for the sector.



More Brands at Higher Prices

Recently, retailers have been more open about their investments in such brands. In July 2021, Walmart unveiled a new line of its wines at \$10 per bottle, Albertsons expanded its portfolio of store brands with a sustainable collection, and the convenience store chain 7-Eleven announced its own private-label brand, Plot + Point, that would be available in 500ml Tetra Paks. Private labels are also going premium, with Southern California grocery chain Gelson's announcing a new collection produced by Napa Valley wine-maker Julien Fayard.



One of the leading U.S. suppliers of similar store-brand wines is Summerland Wine Brands, based in the Central Coast town of Buellton, Calif. Previously known as Terravant Wine Co., the company's new ownership incorporated Summerland estate brands and has shifted the firm's strategic focus to supplying brands from the Central Coast.

The company's annual production is around 750,000 cases, and about 400,000 of that is for private labels supplied to national retailers, restaurant chains and wholesalers. Joe Padilla, senior vice president of strategic business development, said in the initial months of the pandemic—during the pantry loading surge—private-label demand moderated as retailers dealt with the initial crisis and tried to get a handle on how consumers would react.



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Private Labels Expected to Carve Bigger Slice of Market

Since then, and especially in the final six months of 2021, the sector has rebounded in a big way led by restaurant chains. Padilla said while most of what Summerland supplies is lower-priced California appellation wine, there is growing demand for wines priced between \$14.99 and \$19.99. “For our own business, we’re seeing a trade-up in terms of quality,” he noted. “We’re finding our Central Coast wines are gaining more traction versus the Californian tier.”

But while Summerland’s clients are looking to trade up in price, Padilla said the company is no exception when it comes to dealing with the increased costs of business, with glass leading a general increase of 15 to 20 percent. He said grapes and bulk wine are also challenging to secure at the moment, and the company is now taking a more strategic, long-range view to locking down the supply needed to support future growth.

Padilla is confident about that growth based on the demand Summerland is seeing, as well as the several other private-label suppliers that contract to use the company’s production and warehouse facilities.

Even with a positive outlook on growth, Padilla doesn’t expect to see private labels account for the same share of the market in the United States as they do in Europe. He said the American wine trade remains loyal to established brands even as surveys and consumer research show younger consumers are exceptionally brand agnostic. And, perhaps more importantly, in a flat market, sales growth comes from consumers who are switching brands rather than new buyers being brought into the channel.



Sales Strong Despite Challenges

Plata Wine Partners in Napa is a leading private-label supplier, and the company’s vice president of sales and marketing, Aaron Fein, said it enjoyed a 10-percent increase in total sales in 2021, and 2022 is projected to be its best year ever based on a 25 percent increase in total sales volume.

That success has come despite myriad challenges in terms of securing packaging supplies while also trying to stay ahead of skyrocketing costs. Logistical challenges aside, Fein said Plata’s sales, which are outpacing the market overall, are a good indicator that the private-label segment is robust and poised for future growth. “We’ve had some moderate increases in the number of our SKUs this year, so a lot of our growth is from our current SKUs in the market,” he observed.



Growth is also coming from retailers that are opening new stores, and Fein said Plata continues to invest in marketing support to help give the brands they create more resonance with consumers. “We want these brands to have as many of the bells and whistles that national brands put behind theirs,” he explained. “It gives us an opportunity to engage deeper and market smarter with our retail partners.”

Fein said demand remains strong, and retailers already invested in private labels appear to want to increase their business while others are looking to dive into the segment. “I have a very strong feeling there are more companies that want to get deeper into the game,” he acknowledged.

Depending on the strategy of the chain and even the location, Fein said the breakdown between store brands and those from wineries can vary. One significant new consideration is all retailers are more interested in stocking wines that are sustainable, organic or generally fall in that “better for me and better for we” category. “All of those things are almost going to be a new barrier to entry within five years.”

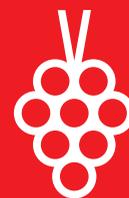
Plata is also developing brands in step with general retail trends. A new regional exclusive called Sea Wave is sourced from sustainable vineyards and comes in at 7 percent ABV, 70 calories per 5oz pour and packaged in a four-pack of 250ml cans. Fein said the wine has done well, but getting all the various pieces together for a new brand launch was not easy. “This has been the most difficult year ever to launch something new.”

Part of that challenge is securing supply.

Turrentine Brokerage president Steve Fredricks said while it’s hard to assess the size of the private-label market, he believes it’s been growing by both negotiant firms and wineries. “Large wineries that weren’t in this business in the past are probably more in this business now,” he noted.

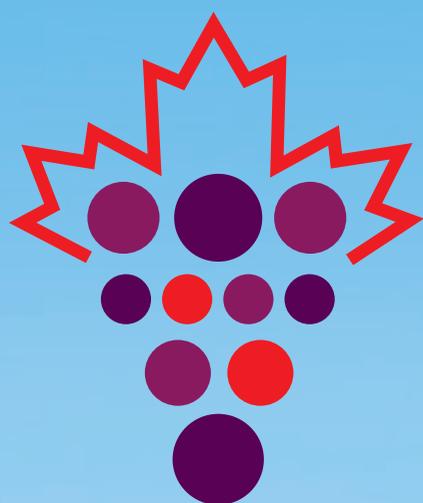
While the demand for such brands is as strong as ever, Fredricks said entering the private-label sector has become significantly more challenging as suppliers have to pay all the same costs of distribution but for brands with smaller margins. The unprecedented increases in costs and lack of shipping options have also made it much harder to put together deals for private labels.

In previous years, the right wine at the right price could be trucked to a bottling facility, packaged and shipped to retailers in time to make the deal work for everyone involved. If no domestic wines were available at the right price, import bulk could be available almost as quickly. But as with other “just-in-time” planning, those types of deals are largely off the table as trucks, bottles, cartons and labels are more expensive and scarcer than ever. “It’s more expensive, and you have to have a much longer lead time,” Fredricks stated. **WBM**



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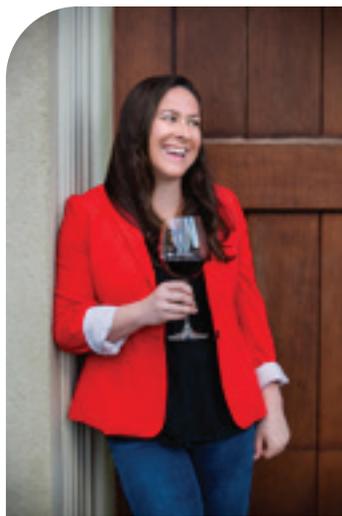
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Gloria Ferrer announced a new management team. Harry Hansen was named senior vice president of winegrowing and winemaking at Gloria Ferrer, where he launched his winemaking career over 30 years ago. Hansen's experience includes the role as Head Winemaker for Edna Valley and Sterling Vineyards. In addition, Melanie Schafer was promoted to vice president of direct to consumer and marketing for Gloria Ferrer. Since joining in 2020, Schafer has overseen DTC operations and implemented new hospitality and culinary programs. In addition, Gloria Ferrer appointed Miquel Salarich as vice president of operations. Salarich brings more than 20 years of experience working with several international brands.

Distributors, Importers & Wholesalers

Laura Booras joined her family's business, Freedom Beverage in Greensboro, North Carolina, as Vice President of Sales. Founded in 2002 by her father, Tim Booras, Freedom Beverage is a specialty wine and beer distributor. Previously, Booras was at Riverbench Vineyard & Winery in Santa Barbara County, where she rose through the ranks from brand manager to general manager, to CEO and Chairman.



Laura Booras

Associations & Education

The Garden State Wine Growers Association, a coalition of more than 50 New Jersey wineries and vineyards that support the Garden State's wine industry, appointed Devon Perry as executive director. Before joining GSWGA, Perry founded Segel Associates, a boutique interactive media firm specializing in brand strategy, social media, public relations, and crisis communication. She was director of marketing and business development for Kings Hall, executive director of Visit South Jersey, CEO of WineLovers LLC, and founder of ShareURMeal. She brings extensive non-profit experience with both the United Way and American Red Cross. **WBM**



Devon Perry



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World Bulk Wine Exhibition	<i>worldbulkwine.com</i>	83
World Cooperage	<i>worldcooperage.com</i>	41
Zenport Industries	<i>zenportindustries.com</i>	62

Of Dreams and Consequences

TRUTH OR CONSEQUENCES is a strange place. Bleached by New Mexico's high desert sun, the town sold its name to an old time radio show. More recently, tabloids had a field day when a nude woman, wearing only a studded black leather collar, made her barefooted way to the highway. Sordid tales of sexual torture led to arrests, and like an overturned stone uncovering an anthill exposed a humid, teeming sub-culture of depravity.

But that's not the strangest stuff in Truth or Consequences, not by a long shot. Between Elephant Butte and the town of Truth or Consequences, just a mile or two farther than a sex slave has to run to escape the clutches of evil, sits the town of Engle. There, in the middle of the Rio Grande Valley, Jake Lorenzo gazed out at more than 60 acres of vineyard. A dream flourishing in this nightmarish place. Rows of Chardonnay and Pinot Noir thriving in some desert oasis.

This dream was too strange for the locals, too strange even for most Americans. This was a foreigner's dream, a second-generation foreign dream at that. The dream saw first light in the Champagne region of France in 1952, where Gilbert Gruet was the first to plant vineyards in Bethon (Marne.) "Mon dieu," said his French neighbors. "He ees crazee to plant grapes in zat rockee desert." Gilbert's premier bottling of 400 cases came in the mid '50s. His tenacious dedication to quality and perfection created a legacy of beautiful champagnes, until Gruet Champagne now produces 1,000,000 bottles annually in France.

Who knows what it is with the French? Jake Lorenzo thinks it is their ability to focus. They simply refuse to see a reality other than the one they imagine. "Zoot alor," said Gilbert Gruet at a family meeting. "We must expand eef we are to provide for zee children. You must find your own rockee desert and make zee dream for yourselves."

So, in 1984 Laurent Gruet, Farid Himeur, and his wife Nathalie moved to New Mexico and planted their first grapes near Elephant Butte in Southern New Mexico. The first harvest came to fruition in 1987, and in September of 1989 the American contingent of Gruets released the first Gruet Méthode Champenoise Brut and Blanc de Noir. There were 2,000 cases, and it was good. It was better than good. It was terrific, so terrific that they now sell out of an annual production of 35,000 cases. Great sparkling wine, in New Mexico? Hard to believe, but true.

Jake Lorenzo went to visit Laurent and Farid at the beautiful new Gruet Winery in Albuquerque. Laurent popped the cork on a bottle of one of their initial 1987 releases. The wine had that gorgeous fat yeasty aroma that only the best sparklers ever think about. There was no hint of oxidation, but rather a crisp, elegant aroma of fresh fruit with the tiniest touch of roasted nuts. The fine beads enlivened the tongue, and the rich flavors washed down leaving a grand aftertaste that refreshed and satisfied at the same time. I complimented Laurent and Farid on the success of their dream.

Farid pointed across the table, "It is our dream, but we could not have done it without the help of our friends from the Wine Patrol." Indeed, for across the table sat Ken Shoemaker and Doug Diefenthaler, whose New Mexico Wine Patrol was the finest distribution company in all of America. Doug and Ken had more than 20 years of retail and wholesale experience when they started the Wine Patrol in 1989. Fed up with the consolidation of wholesalers, disgusted that fine small wineries were getting no representation, mindful that the wine world was a wonderland of tastes and flavors that went far beyond chardonnay, merlot and cabernet, they bit the financial bullet.

They put themselves on the line with a bank, and started the New Mexico Wine Patrol, a distribution company that would specialize in fine small producers.

Talk about a dream. Jake Lorenzo has to tell you, New Mexico is not the place you'd think could revolutionize the distribution business. The entire population of the state is 1.5 million, of which 16 percent are Native Americans and 45 percent are Hispanic, not your traditional wine consuming cultures. New Mexico is 47th out of 50 states in per capita income, and 50 percent of the New Mexico population is at or below federally mandated poverty levels. This is the truth of New Mexico. Doug and Ken now reap the consequences of their actions.

Their idea was to select the finest of the small wineries, to give the best service imaginable, and to educate anyone who would listen to the pleasures of fine wine. They began selling the best wine New Mexico had to offer, which meant Gruet and the small La Viña Winery. Next, they selected a tiny block of fine small wineries; Gundlach Bundschu, Qupe, Sanford, Babcock, Ventana, and Diamond Wine Imports. The wines quickly found their niche, especially among the great restaurants of Santa Fe, Taos, and Albuquerque.

Ken and Doug called themselves Wine Rangers. Their mission was to select and serve. They tore around the state in the van, making deliveries well into the night. Need something for Sunday? Call Ken and Doug. Need someone to train staff on Thursday night? Call Ken and Doug. Want to acquire a wine no one else has heard of? Call Ken and Doug. If you need it, they'll get it. If you want to learn about it, they'll teach you. You got a wine problem, they've got the answer. The New Mexico Wine Patrol had mounted up, and they were riding hard.

It didn't matter if you were big or small, rich or poor, pompous or down home. If the wine was great, if your heart was in it, if you loved the life, then the Wine Patrol was with you.

The word got out, and wineries came clamoring for their help. Want Oregon wines? How about Adelsheim, Bethel Heights, Elk Cove, Foris, Sokol Blosser and Willakenzie. California wineries lined up and took a number. Bonny Doon, Calera, Diamond Creek, Dunn, Duckhorn, Kistler, Laurel Glen, Marietta, Coppola, Pahlmeyer, Saintsbury, Seghesio and Spottswoode. They got best of France and Italy, Australia and Spain. It didn't matter if you were big or small, rich or poor, pompous or down home. If the wine was great, if your heart was in it, if you loved the life, then the Wine Patrol was with you.

As the Wine Patrol prospered, and their dream became reality, they deputized others to help. Soon they and their deputies were the most successful wine distributor in New Mexico. Southern Wine and Spirits came calling and made them an offer they could not refuse, so they sold their company in 2001. Meanwhile Gruet Winery became wildly successful, growing to 150,000 cases per year, before Precept Wine Company took over the business in 2014. Laurent Gruet continued to direct winemaking until 2019 when he decided he couldn't survive the corporate management any longer, so he joined old friend Doug Diefenthaler and his new VARA venture.

Frenchmen and Cowboys. There's no telling the consequences of that. **WBM**



ILLUSTRATION BY BOB JOHNSON

Spencer Spetnagel, winemaker, Durant Vineyards, Dundee Hills, Oregon

“As a small producer *Wine Business Monthly* is a fantastic resource for me. The articles can feel like I’m having a conversation with another winemaker/viticulturalist about the same issues I am wrestling with. Most recently was the article on Regenerative farming by Loni Lyttle and Dr. Mark Greenspan. This has been a concept I’ve been extremely intrigued by, and this article was presented as a brief conversation outlining the framework of Regenerative farming and how it can benefit not just our vineyard but help also in the greater fight against a changing climate.”



NAME & TITLE: Spencer Spetnagel, winemaker, Durant Vineyards

WINERY NAME AND LOCATION: Originally planted in 1973 to own-rooted Pinot Noir, the Durant family has been providing fruit from its vineyards to the Oregon wine industry for the last 45 years. The original 16 acres of property has slowly been built up to 135 acres with 65 acres under vine and 17 acres of olive trees that are utilized in its olive mill. Between the vines, winery, olives, olive mill and plant nursery the Durant family has built a gorgeous and unique piece of property in the Willamette Valley.

ANNUAL CASE PRODUCTION: 5,000 cases

PLANTED ACRES: 65

CAREER BACKGROUND: My passion for wine was cultivated while waiting tables in fine dining during my undergrad in Atlanta, GA. In 2004 I moved to Sonoma for my inaugural vintage. After a few years at Ravenswood, I moved to New Zealand to complete my oenology and viticulture degree at Lincoln University. When I returned stateside, I ended up in the Santa

Cruz Mountains at Bargetto Winery. From Santa Cruz I headed North to Oregon in 2012 and ended up at King Estate for 5 years. Then in 2017 I moved North, one more time, and took the opportunity to become the winemaker for Durant Vineyards. We built our winery in 2018 and I have been here since.

WHAT HAS BEEN YOUR BIGGEST PROFESSIONAL CHALLENGE? From start to finish, 2020 was a tough vintage in the Willamette Valley. Rain all through flowering really hurt our fruit set on the property. COVID protocols added new dimensions to working safely. Right as we were pulling the trigger to begin picking, a once in a century windstorm blew all of the Cascade wildfire’s smoke right into the Willamette Valley, where it settled for the next week. Across the board there were so many difficult conditions throughout 2020, this made it by far my biggest professional challenge.

VARIETALS THAT YOUR WINERY IS KNOWN FOR: Pinot Noir, Chardonnay, Sauvignon Blanc, Pinot Gris



Photo Courtesy of: Diam Bouchage / ASL Suberaie Varoise / JC Milhet / Serpe



Diam Bouchage Continues Environmental Advancements

Diam Bouchage, a French cork manufacturer and global leader in technological cork solutions, updates its commitment to the environment and measures its progress in meeting its goals.

The company established a comprehensive environmental policy that was launched in 2009. The policy was built upon its innovative Quality & Food Safety Management program that has been in place for many years. As part of this effort, Diam Bouchage committed to control its consumption of energy, reduce its carbon footprint, increase its recycling programs and develop more environmentally friendly products focused on eco-design. Here are some of the highlights of this successful effort:

Diam Bouchage has committed to reducing the company's total carbon footprint by 15% by 2025.

- Since cork is a renewable resource that contributes to CO₂ sequestration, **Diam Bouchage's use of cork contributes to the sequestration of more than 300,000 tons of CO₂ every year.**
- **All of Diam Bouchage's closures are FSC certified** and all of the company's facilities have completed accreditation and received FSC certification.
- Diam Bouchage offers its **Origine by Diam closures which are produced by using cork flour and natural bio-based materials like beeswax** instead of petroleum-based materials.
- Since 2020, the **Diam Bouchage production facility in San Vicente de Alcantara, Spain, has been solely reliant on green electricity.**
- Diam Bouchage contributes to reforestation and sustaining French cork oak forests. Through these efforts, **more than 200 tons of cork are carefully harvested annually in France** for use by local winegrowers in the cork producing regions of Pyrenees-Orientales, Maures Massif and Corsica.

- **Origine by Diam has a prestigious 4-star accreditation, the highest level of certification, and validation that 80% of the carbon contained in each closure is only of organic origin.**

- In fact, the company has developed innovative processes and procedures from the cork oak forests all the way through production, that have resulted in **Origine by Diam closures having a manufacturing carbon footprint of only 5%–10%** based on the product line, compared to traditional cork closures.

- By powering 100% of the facility with renewable energy sources, **the company has cut 11,000 tons of CO₂ and reduced the company's carbon footprint at that facility by 16%.**

- **Diam Bouchage powers its production facilities through heat generation instead of using fossil fuels** by recycling cork dust, which is produced during the production process, into a fuel source.

Diam Bouchage has committed to reducing its direct emissions from energy and processing by 55% by 2025.

These and other environmental achievements make a difference for all of us which is why Diam Bouchage is moving towards ISO 14001 certification at all its production facilities before 2023. Diam Bouchage is proud of its environmental success as a company and the commitment of its employees to lead with positive action in meeting the company's environmental goals.

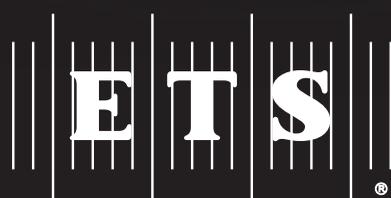
To learn more, visit Diam-closures.com or contact **G3 Enterprises**, their exclusive distributor in the United States, Canada and Mexico, at G3enterprises.com.



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