73rd Annual

LODI GRAPE DAY

HOSTED BY

Lodi Chamber of Commerce Agribusiness Committee
UC Cooperative Extension of San Joaquin County

February 4th, 2025 • Hutchins Street Square


100
YEARS
STRONG

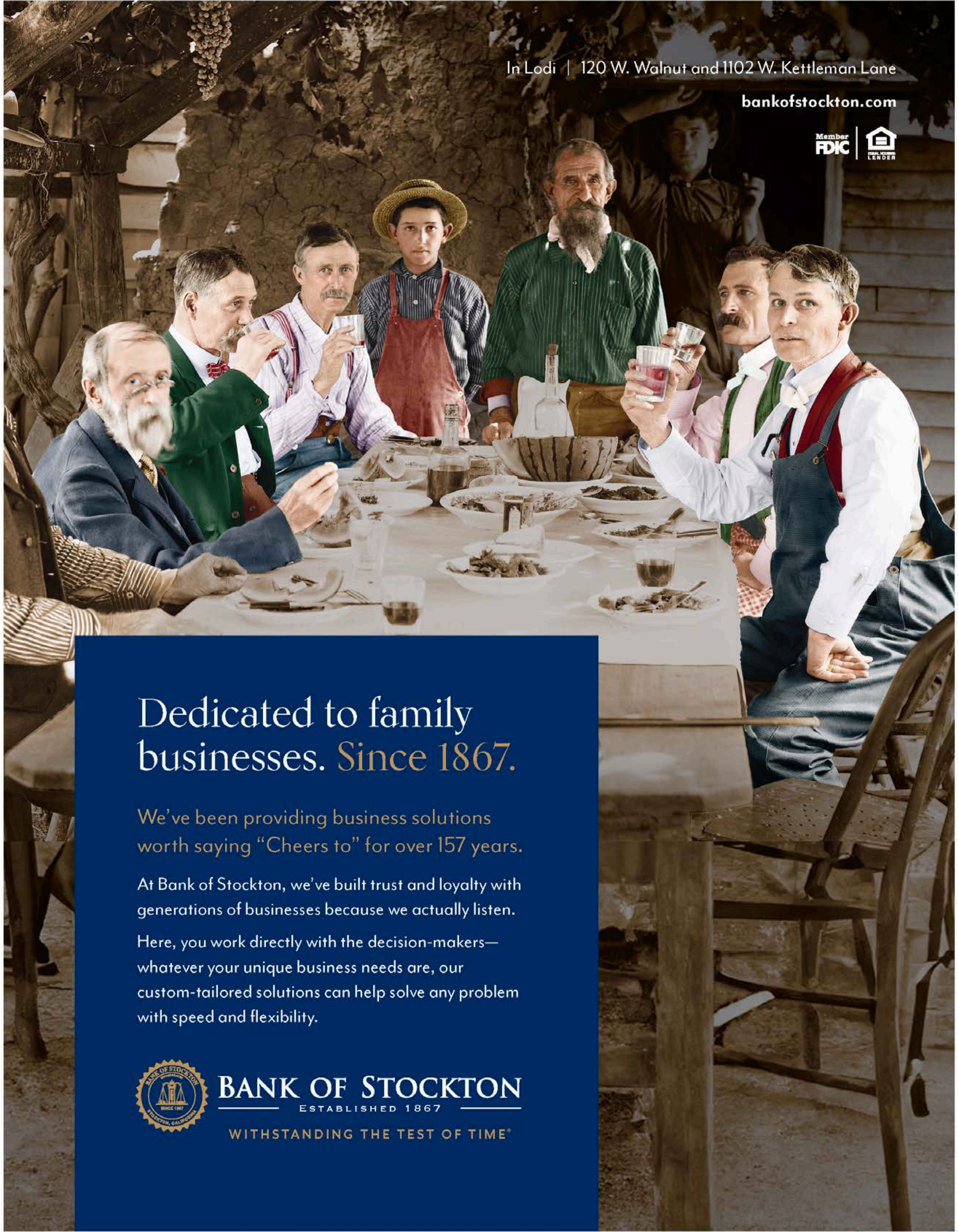
AGENDA

7:30 AM	**Registration and DPR Credit Sign-In**
8:00 AM	**Welcome & Introduction** *Justin Tanner, PhD, Viticulture Farm Advisor, San Joaquin and Stanislaus Counties, UCCE*
8:05 AM	**Which Irrigation Method is Best for Your Vineyard?** *Moneim Mohamed, PhD, Irrigation and Soils Advisor with the UCCE*
8:35 AM	**Vineyard Weed Management Update and Pending Label Changes Related to the Endangered Species Act** *Brad Hanson, PhD, Weed Specialist, UC Davis Plant Sciences Department* *Justin Tanner, PhD, Viticulture Farm Advisor, San Joaquin and Stanislaus Counties, UCCE*
9:05 AM	**Ultra-Sensitive Method for Rapid Screening of Leafroll 3 Virus** *Alan Wei, PhD, Owner & President Agri-Analysis LLC*
9:35 AM	**Break**
9:50 AM	**Soil Carbon in Practice: Methods of Monitoring, Testing, and Improving Soil Carbon in Vineyards** *Chris Chen, PhD, Integrated Vineyard Systems Advisor, UCCE*
10:20 AM	**How Can Weather Forecasts Help in Grapevine Management?** *Prakash Kumar Jha, PhD, Assistant Project Scientist (Climate & Agriculture), University of California Agriculture and Natural Resources*
10:50 AM	**Optimizing Irrigation for Heatwave Mitigation in Cabernet Sauvignon in Lodi** *Pietro Previtali, PhD, Research Specialist, Viticulture Research Group at Gallo*
11:20 AM	**Closing Remarks** *Justin Tanner, PhD, Viticulture Farm Advisor, San Joaquin and Stanislaus Counties, UCCE*
11:30 AM	**Lodi Wine Sensory Evaluation**
12:00 PM	**Lunch**
12:20 PM	**Luncheon Keynote Speakers:** **Stuart Spencer** *Executive Director, Lodi Winegrape Commission* **Natalie Collins** *President, California Association of Winegrape Growers*

Meeting Credits = 3 hours DPR CE credits in OTHER category

LODI 100 years CELEBRATION CHAMBER

UNIVERSITY OF CALIFORNIA
Agriculture and Natural Resources


In Lodi | 120 W. Walnut and 1102 W. Kettleman Lane
bankofstockton.com
Member FDIC
Dedicated to family businesses. Since 1867.
We've been providing business solutions worth saying "Cheers to" for over 157 years.
At Bank of Stockton, we've built trust and loyalty with generations of businesses because we actually listen.
Here, you work directly with the decision-makers—whatever your unique business needs are, our custom-tailored solutions can help solve any problem with speed and flexibility.
BANK OF STOCKTON
ESTABLISHED 1867
WITHSTANDING THE TEST OF TIME®

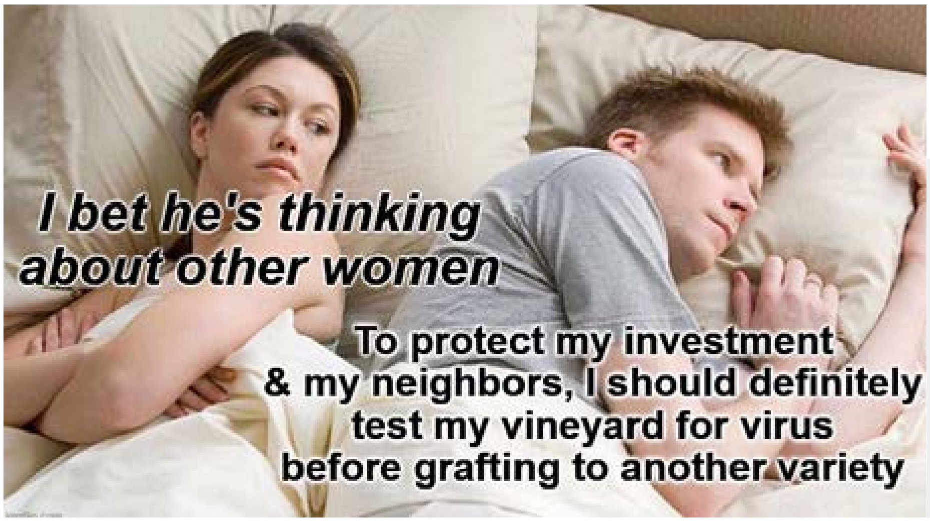
LODI GRAPE DAY

LODI DISTRICT CHAMBER OF COMMERCE

JP Doucette	*President & CEO*
Karen Alvarez	*Director of Operations*
Elizabeth Fillion	*Event Coordinator*
Matt Teresi	*Chair of the Board*
Marika Paternostro	*Member Relations*

2025 AGRIBUSINESS COMMITTEE

Amy Blagg	*Lodi District Grape Growers Association*
Dr. Stephanie Bolton	*Lodi Winegrape Commission*
Sara Cassinelli	*Bank of Stockton*
Natalie Collins	*California Association of Winegrape Growers*
Jerry Fry	*Mohr Fry Ranches*
Bruce Fry	*Mohr Fry Ranches*
Nicole Goehring	*Chief of Staff, Supervisor Ding - District Four*
Cameron Heinitz	*Kautz Farms*
Brie Hunt	*Corto Olive Co*
Luke Mann	*Kautz Farms*
Daniel Meza	*F&M Bank*
Dr. Justin Tanner	*UCCE San Joaquin County Viticulture Farm Advisor*
Matt Teresi	*Picked to Porch Farms*
Rebecca Towell	*Relation Insurance*
Joe Valente	*Kautz Farms*
Gary Valente	*Kautz Farms*



Win Free Lunch for the 2026 Grape Day Event!

This meme was brought to you by a local leader in the winegrape industry. Think you know who it is? ***Email us at events@lodichamber.com****. First one with the correct answer wins a free lunch ticket to next year's event*!

LODI GRAPE DAY

February 4, 2025

CONGRATULATIONS TO OUR PAST & PRESENT

AGRIBUSINESS PERSON OF THE YEAR

1967	Robert Carter
1968	Verne Hoffman Sr.
1969	Carl Mettler
1970	Jim Kissler
1971	Ole Mettler
1972	George Schmiedt
1973	Herman Diekman
1975	Leonard Thompson
1976	H.T. Woodworth
1977	Jeryl R. Fry
1978	Adam Van Exel
1979	Emil Bender
1980	Chester M. Locke
1981	John Kautz
1982	George Scheideman
1983	Nobie Matsumoto
1984	Joe Cotta
1985	Ted Holmstrom
1986	Carl Allison Wishek Sr.
1987	Aren Van Gaalen
1988	Philip J. Goehring
1989	Jim Sasaki
1990	Donald Phillips
1991	John Ledbetter
1992	Larry Mettler
1993	Howard Mason
1994	Duan Jungeblut
1995	Claude Brown
1996	Tom Hoffman
1997	Bob Hartzell
1998	Gall Kautz
1999	George Barber
2000	Bruce Mettler
2001	Brad & Randy Lange
2002	Steve Furry
2005	Pat Stockar
2006	Joe Valente
2007	Stanton Lange
2008	Jack Hamm
2009	Rod Schatz
2010	Paul Verdegaal
2011	Joe Peterson
2012	Kim Ledbetter-Bronson
2013	The Phillips Family
2014	Bruce Fry
2015	The Stokes Family
2016	Joe & Sherry Cotta
2017	Brad Goehring
2018	John Anagnos
2019	Amy Blagg
2020	Jennifer L. Spaletta
2021	Paul Burkner
2023	Aaron Lange
2024	Daniel Meza

2024 AGRIBUSINESS PERSON OF THE YEAR

Daniel Meza

The Lodi Chamber of Commerce proudly recognizes Daniel Meza as the 2024 Agribusiness Person of the Year. With nearly two decades of dedication to agriculture and community service, Daniel's impact on the local agribusiness sector is immeasurable.

Originally from Jalisco, Mexico, Daniel moved to Lodi at age 3. Raised in a farmworker family, he worked alongside his father at Lodi Farming Inc., where he learned the values of hard work and dedication—principles that have shaped his career and leadership roles.

Daniel earned a degree in Agricultural Business from Fresno State and began his banking career in 2003, working with Farm Credit, Bank of Lodi, Wells Fargo, and later F&M Bank. As Senior Vice President and Lodi Market Manager at F&M Bank, Daniel supports agricultural businesses and promotes regional agribusiness growth.

Beyond banking, Daniel is committed to agricultural education and community service. He chairs the San Joaquin Farm Bureau Foundation for Agricultural Education and has served on the San Joaquin Farm Bureau Board since 2014. He is an active member of the Lodi Chamber Agribusiness Committee and has volunteered with Lodi Farm Safety Day for over 15 years.

Daniel is also Vice Chairman of the Lodi Grape Festival Board of Directors and has coordinated fundraising for United Way through F&M Bank. His contributions to local organizations, including the Tokay FFA Ag Advisory Committee and Lodi FFA Booster Club, reflect his dedication to future generations of agricultural leaders.

A recent personal project, planting a small vineyard, highlights his continued passion for farming. His lifelong commitment to agriculture, banking, and community service exemplify the values of the Lodi Chamber of Commerce, making him a true asset to the Lodi region.

LUNCHEON KEYNOTE SPEAKERS

Stuart Spencer

Stuart Spencer began his career with the Lodi Winegrape Commission in 1999 as the Program Manager where he was instrumental in conceptualizing and guiding many of the region's successful marketing, research and education, and sustainable viticulture programs, including LODI RULES. Today, Stuart remains heavily involved in these areas serving as the Executive Director at the pleasure of the region's 750 winegrowers. As the principal spokesperson for the Lodi appellation and respected winegrower, winemaker, and Lodi industry expert, Stuart participates regularly in promotional and educational opportunities throughout the United States and abroad, raising awareness of Lodi's distinctive winegrapes and wines.

Natalie Collins

Natalie oversees the general operation of CAWG and manages its four-person team. She is responsible for CAWG's Board of Directors, federal legislation, pests and disease programs, sustainability, and trade policy. She also is responsible for ensuring that value is delivered to members through education, timely information updates and new benefit programs. Natalie is a graduate of California State University, Chico with a Bachelor of Science in agricultural business and a double minor in organizational communications and business administration. Natalie joined CAWG in 2015 as the director of member relations and was appointed as president in December of 2022. Prior to joining CAWG, Natalie worked for the San Joaquin Farm Bureau Federation as a program director.

LODI WINE
WINEGRAPE COMMISSION

CALIFORNIA ASSOCIATION of WINEGRAPE GROWERS

Where the vintage begins.
Premium quality grapevines since 1977
SUNRIDGE NURSERIES
Nicholas Podsakoff | (808) 333-9394 | nicholas@sridge.net | sunridgenurseries.com

BUILDING INTEGRITY
Diede Construction inc.
DEFINING QUALITY
PROVIDING COMPREHENSIVE
Design, Management & Construction
Reach out today for an estimate!
Call : (209)369-8255
Email : estimating@diedeconstruction.com

WE WOULD LIKE TO THANK OUR

SPONSORS

METHUSELAH

American AgCredit
Bank of Stockton
F&M Bank
Oak Valley Bank
Recology
Belkorp Ag

IMPERIAL

- Sunridge Nursery
- Fowler Brothers
- Diede Construction

DOUBLE MAGNUM

- Casa Cristal Nursery
- Duarte Nursery
- E&J Gallo
- Grow West
- Lange Twins
- Martinez Orchards
- Meras Water Solutions
- Petersen & Co
- Petrologix
- Round Valley Ranches
- Tiger Lines, LLC
- Vintage Crop
- San Joaquin Sulfur

JEROBOAM

- Bogle Family Vineyards
- DSW Ag
- LDGGA
- Pacific Biocontrol
- Vino Farms
- Wonderful Nurseries
- John Kautz Farms

MAGNUM

- Allied Grape Growers
- Arbor Vineyards Inc.
- BG AGRI Sales & Services
- Cal-Waste Recovery Systems
- KG Vineyard Management
- Kludt Oil & Propane
- Harney Lane Winery
- Mid Valley Agricultural
- Mohr-Fry Ranches
- Oak Ridge Winery
- Pacific Agri Lands
- Silva Trucking
- Sweetener Products

FIX DUTY DRAWBACK
ELIMINATE EXCISE TAX LOOPHOLE TO PROTECT U.S. WINE INDUSTRY AND JOBS

Stuart Spencer
Executive Director, Lodi Winegrape Commission

Introduction

Over the last six years, the federal government has spent more than $204 million subsidizing imported wine. In the first 10 months of 2024 alone, over 30 million gallons of inexpensive foreign bulk wine entered California—part of a five-year total exceeding 1.4 billion bottles. This loophole has primarily benefited the largest companies at the expense of domestic production.

Drawback Overview

The Duty Drawback program is managed by US Customs & Border Protection (CBP). Under standard duty drawback rules, importers who pay duties on foreign goods—including bulk wine—can claim refunds when they export a "like" product. Known as substitution drawback, the mechanism does not require the exported wine to be the exact same wine that was imported, only that it be deemed "similar" or "commercially interchangeable."

This has led to large-scale operations importing substantial quantities of low-cost wine, blending or bottling domestically, and then exporting a similar wine to recover 99% of the duties, taxes, and fees. This process allows millions of gallons of imported wine to enter the US market virtually tax free. Businesses have up to five years from the import date to match a qualifying export to claim the subsidy.

Although designed to encourage exports, the system has created significant market distortions. Domestic winegrape growers and wineries face unfair competition as this program effectively subsidizes the costs for imported bulk wine, undermining the competitiveness of American producers in the domestic market.

The Problem with US Trade Policy & Duty Drawback

- **Alcohol Tax Subsidy Loophole:** Over 99% of the drawback refunds are coming from the excise taxes paid; taxes that domestically produced wine must pay. This loophole in the duty drawback program is unique to products paying excise taxes and puts domestically produced goods at a competitive disadvantage.

- **Market Distortion:** The duty drawback program, as currently structured, has created an uneven playing field for U.S. winegrowers and wineries. By allowing large companies to sell imported wine in the U.S. with a significant tax advantage, it puts smaller, domestic wineries at a disadvantage.

FIX DUTY DRAWBACK
ELIMINATE EXCISE TAX LOOPHOLE TO PROTECT U.S. WINE INDUSTRY AND JOBS

The Problem with US Trade Policy & Duty Drawback Cont.

- **Reduced Domestic Demand:** This tax subsidy encourages the import of low-cost foreign wine rather than sourcing grapes locally, which has resulted in significant harm to domestic production and agricultural economies and communities.In many cases, the tax subsidy exceeds 50% of the value of the imported wine.

- **Limited Accessibility:** Only a handful of large corporate wineries both import and export wine and qualify for the duty drawback subsidy. Analysis of import and export data also suggests smaller producers are being squeezed out of export markets.

- **Lack of Transparency:** It is difficult to determine which companies are benefiting from these subsidies. This lack of transparency raises concerns about fairness and accountability.Accessing any data requires a FOIA request.

Drawback Affects US Winegrowers

This influx of inexpensive foreign wine has severely undercut demand for California-grown wines and grapes, driving down prices and leaving many growers without buyers for their fruit. In 2023, more than 400,000 tons of California winegrapes went unharvested due to a lack of market demand. In 2024, over 40,000 acres of winegrapes were removed, and the industry still faces an estimated 500,000 tons left on the vine. As bulk imports rise, the price and demand for California-grown grapes continue to decline, causing significant harm to local winegrowers and agricultural workers.

Taxpayer dollars are fueling these imports, displacing US-grown grapes in their own marketplace. The resulting plummet in grape prices and record drops in demand have led to vineyard abandonment, placing growers in severe financial jeopardy. As wineries increasingly opt for cheaper imported bulk wine over locally grown grapes, farmworkers and vineyard employees lose their livelihoods, creating a devastating impact on agricultural communities and local economies.

Duty Drawback Expanded

The U.S. Customs and Border Protection has recognized the loophole and has urged Congress to correct it. In 2009, CBP and Tax and Trade Bureau (TTB) proposed rulemaking to eliminate the drawback loophole. After public comment, including a statement from 18 legislators, the proposed amendments were withdrawn in 2010.

In 2018, the U.S. CBP proposed rules to implement changes to the drawback regulations as directed by the Trade Facilitation and Trade Enforcement Act of 2015 (TFTEA). After public comment, the proposed regulations with amendments were adopted, prohibiting the loophole.

FIX DUTY DRAWBACK
ELIMINATE EXCISE TAX LOOPHOLE TO PROTECT U.S. WINE INDUSTRY AND JOBS

However, in 2019, the National Association of Manufacturers and The Beer Institute filed lawsuits against the updated regulations in the United States Court of International Trade. In 2021 the court ruled in their favor, invalidating the regulations that would have ended the drawback loophole. Not only did that ruling allow the drawback loophole to continue for wine, but it opened the door for beer, spirits and tobacco producers to import "interchangeable" foreign products virtually tax free, putting domestic production at a competitive disadvantage and potentially costing taxpayers billions of dollars annually.

ACTION: CLOSE THE DUTY DRAWBACK LOOPHOLE

The current duty drawback policy is not only unfair but undermines the very foundations of California's wine industry and agricultural communities. By subsidizing imported wine at the expense of local growers and wineries, this policy tilts the market in favor of large global wine corporations, leaving small, family-owned businesses struggling to survive.

The time for change is now. The U.S. government must reform the duty drawback program to eliminate the excise tax subsidy to level the playing field and to stop using taxpayer dollars to support imported goods.

WHICH IRRIGATION METHOD IS BEST FOR YOUR VINEYARD?

Dr. Moneim Mohamed
Irrigation and Soils Advisor with the UC Cooperative Extension
Dr. Abdelmoneim Mohamed (Moneim) is the Irrigation and Soils Advisor with the University of California Cooperative Extension. He holds a Ph.D. in Biological and Agricultural Engineering from Washington State University. His work focuses on precision irrigation technology, irrigation scheduling, deficit irrigation, soil health, and groundwater sustainability in orchard and vineyard cropping systems.

Introduction

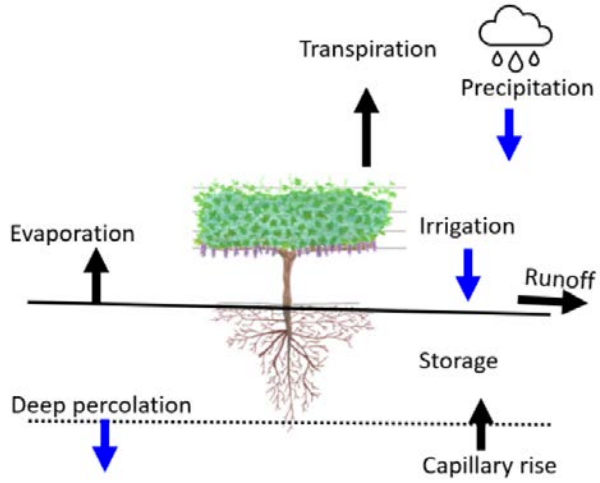
Proper irrigation management for vineyards is vital for the long-term health, growth, and productivity of the vines. Proper irrigation ensures that vines receive an adequate supply of water, which is crucial for photosynthesis, nutrient uptake, and overall vigor. Insufficient irrigation can lead to stunted growth, shallow root development, delayed production, and increased susceptibility to pests and diseases. On the other hand, over-irrigation can cause bunch rot, nutrient leaching, and waterlogging, which can adversely affect vine health and productivity. Good irrigation efficiency includes how well water applications matches crop water needs.

There are three main irrigation scheduling methods for vineyards: irrigation scheduling based on soil, plant, and weather measurements.

Weather-based method

Many growers are using calculated Evapotranspiration (ETC) reports available through University of California Cooperative Extension county-based offices. This method is based on replacing the amount of water used by the crop since the last irrigation. ETC refers to the losses from soil (evaporation) and canopy (transpiration) (**Figure 1**) and is calculated by multiplying reference crop ETo and crop coefficient (K) [ETC = ETo x KC]. Studies have found that ET is linked to how much ground or canopy they cover. For example, crops with full canopy coverage, like alfalfa fields, have the highest ET rates, slightly lower than if there was just water sitting out in the open. Scientists have used this information to create a weather measurement system. When this system is set up in a grassy area that is well-watered, it can accurately estimate the maximum daily ET.

Figure 1:
Evapotranspiration (ETC) Process: The losses from soil (evaporation) and canopy (transpiration)



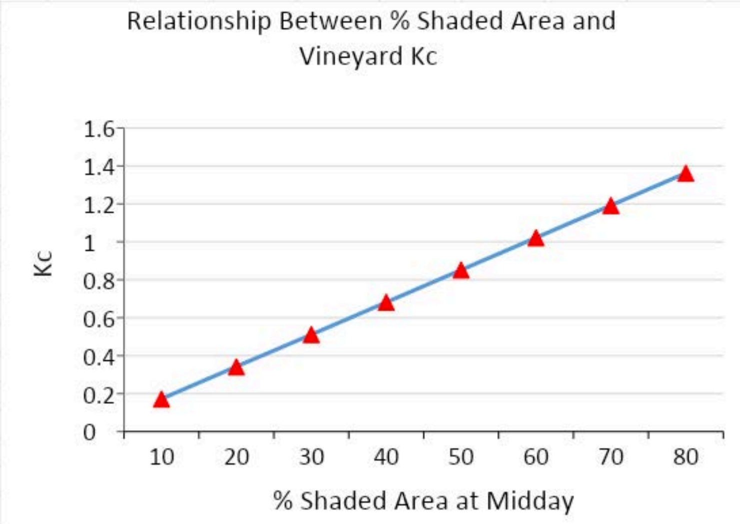


Figure 2: Relationship between % shaded area and vineyard Kc

This estimation, called ETo, is reported daily by weather stations. KC is the specific crop coefficient for a given stage of growth. It was found that vine water use increases linearly with % of ground surface shaded by the vines' canopy (L. Williams, 2002) (**Figure 2**). There is a chance to over-irrigate using this method since Kc values are outdated and used for different management practices and rootstocks than those currently in use. This can be avoided by using some sensors currently available in the market to measure actual ET in your vineyard or the free access satellite-derived ET (OpenET). You can use the following equations to calculate modified Kc and irrigation amount (gallons per vine):

CALCULATE MODIFIED KC & IRRIGATION AMOUNT

$$\text{Vine area} = \text{Row Spacing} \times \text{Vine Spacing}$$

$$\text{Single Vine Shaded Area at Solar Noon} = \text{Vine Space} \times \text{Shaded Width}$$

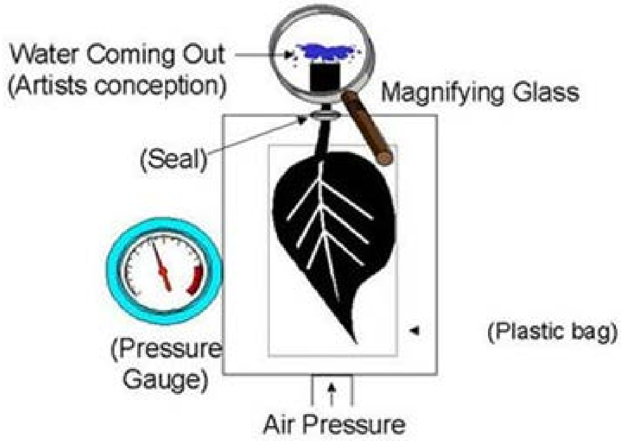
$$\text{\% Shaded Area (PSA)} = \frac{\text{Single Vine Shaded Area}}{\text{Total Vine Area}}$$

$$\text{Irrigation Amount (Galvin)} = \text{Water Use (ind)} \times \text{Vine Spacing ft} \times 0.623$$

Plant-based method:

Plants have different ways to regulate the equilibrium between their water uptake and requirement. Consequently, the plant-based methods of irrigation scheduling are based on assessing one or multiple mechanisms. Besides checking leaves by yourself for curl or wilt, there are many sensors available to detect plant water stress such as dendrometers, infrared radiometers, sap flow gauges, stomatal conductance porometers, leaf turgor probes and remotely sensed based tools. The sooner these sensors can detect water stress, the better they can assist in irrigation scheduling decisions. Out of the many plant-based irrigation scheduling sensors, the pressure chamber (**Figure 3**), which measures the tension of water within the plants, has shown its reliability as a physiological indicator of water stress in trees and vines. This method tells when to irrigate and to check on the other methods (weather and soil). Weather- and soil-based irrigation scheduling methods tell how much irrigation is required but you need to make assumptions about the root zone depth.

Figure 3: The Pressure Chamber



Thus, plant-based methods can determine if those assumptions are accurate. Pressure chambers measure the force required in a plant for the water to get pulled from the soil up through the leaves. This can be done by covering the sample leaf with a foil-laminate bag for at least ten minutes, to reduce the measurements' error to 0.5 bar, before being removed from the vine. This measurement happens during midday because the water potential stays constant at its highest deficit for the day. Then while the leaf is in the aluminum bag inside the chamber, the pressure required to force water out of the stem is equal to the water potential and is given in metric units of pressure (bars). The drier the soil is, the more tension there is in the plant, thus requiring more pressure to force water out of the stem. Choosing a healthy and representative vine for your measurements is the key to accurately monitoring plant water stress. Select 3 or 4 side-by-side rows of uniformly growing vines in a representative area.

Soil-based method:
The look and feel method of the soil used to be the most common field method to check soil moisture, but this method takes time and experience to train yourself and it is subjective especially when soil is dry or wet. There are many soil moisture sensors available in the market, sensors that can tell you when to irrigate (Tensiometers, Granular matrix Sensors). These sensors measure how strongly water is held by soil particles: the drier the soil, the higher the tension, and the more difficult it is for a plant to extract water. The reading provided by these sensors is in cb or kPa. On the other hand, some sensors tell you how much and when to irrigate (Neutron Probe, Resistance, Capacitance, Time Domain Reflectometry (TDR)). The Neutron Probe will give you the most correct answer while the others will give you a trend that is usable for irrigation scheduling.

When we talk about how much water soil can hold for plants, we use three terms. The first term is "field capacity" (FC). FC is the water that is left in the soil after most of it has drained away, usually about 3 to 4 days after watering. The second term is "permanent wilting point" (PWP). PWP is when the soil has so little water left that plants cannot take it up anymore. And the third term, "Total available water" (TAW), is the difference between field capacity and permanent wilting point, (**Figure 4**).

WHICH IRRIGATION METHOD IS BEST FOR YOUR VINEYARD?

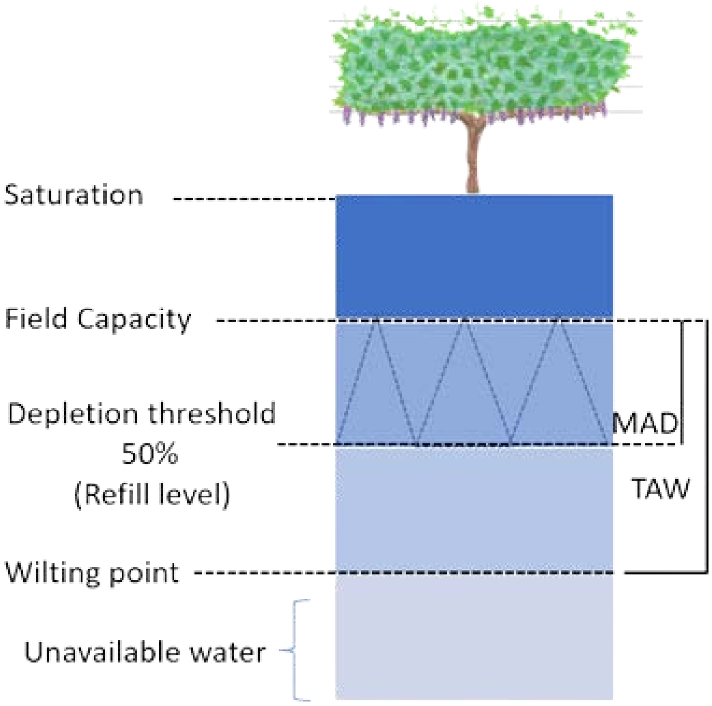


Figure 4: Soil-based irrigation scheduling

Table 1: Percent of Allowable Depletion for Different Tree Crops

Crop	Allowable depletion (%) non-stress
Citrus	50
Apples, Cherries, Pears	50
Apricots, Peaches, Stone Fruit	50
Avocado	70
Kiwi	35
Olive	65
Walnut	50
Almond	40
Pistachio	40
Grapes	**50**

TAW is the space required to manage your soil water depletion. Deciding how dry you are okay with the soil getting before irrigation, is called management allowable depletion (MAD) and is usually set around 50% (**Table 1**). Depleting the soil water beyond this point will negatively impact plant growth and yield. The type of soil you have affects how much water it can hold (**Table 2**). The key takeaway is that no irrigation scheduling method is perfect. Using just one irrigation scheduling method is still effective but using two is even better. However, combining all three methods is recommended, as it gives you more confidence in making informed and effective water management decisions.

Table 2: Total Available Water for Different Soil Textures

Soil texture	Soil water content			TAW
	SAT	FC	PWP	
	Vol%	Vol%	Vol%	in/ft
Sand	36	13	6	0.84
Loamy sand	38	16	8	0.96
Sandy loam	41	22	10	1.44
Loamy	46	31	15	1.92
Silt loam	46	33	13	2.4
Silt	43	33	9	2.88
Sandy clay loam	47	32	20	1.44
Clay loam	50	39	23	1.92
Silty clay loam	52	44	23	2.52
Sandy clay	50	39	27	1.44
Silty clay	54	50	32	2.16
Clay	55	54	39	1.8

Example: *If you have grapes grown in sandy loam soil, then the available water at 50% = 1.44/2 = 0.72 in/ft. For 3 ft root zone = 0.72 × 3 = 2.16 inches of net irrigation requirement. Then, you must account for the irrigation system's efficiency. Gross irrigation requirements = net irrigation requirements/system application efficiency.*

VINEYARD WEED MANAGEMENT UPDATE AND PENDING LABEL CHANGES RELATED TO THE ENDANGERED SPECIES ACT

Dr. Brad Hanson
Weed Specialist, UC Davis Plant Sciences Department

Brad Hanson is a Cooperative Extension Weed Specialist in the Plant Sciences Department at UC Davis. His statewide research and extension program is focused on weed management in orchards, vineyards, and annual crops with a special interest in herbicide performance and crop safety, herbicide-resistant weeds, and parasitic weeds. Brad earned his BS degree in agriculture at Iowa State University and his MS and PhD degrees in weed science at the University of Idaho.

Before joining the faculty at UC Davis in 2009, Brad led a USDA-ARS weed and nematode research program near Fresno, California. Brad's research is often done in direct collaborations with farmers, industry stakeholders, student and postdoctoral scientists, and UC Farm Advisors with the ultimate goal of reducing the impact of weeds and weed control practices on cropping system productivity.

Dr. Justin Tanner
UCCE San Joaquin County Viticulture Farm Advisor

Dr. Justin D. Tanner, a plant physiologist and viticulturist, serves as the Northern San Joaquin Valley Viticulture Farm Advisor for UCCE. His role focuses on addressing viticulture challenges in San Joaquin and Stanislaus Counties, and the Lodi American Viticultural Area. With expertise honed at Texas A&M University-Kingsville, Colorado State University, and UC Davis, Dr. Tanner specializes in sustainable agricultural practices, water management, and climate mitigation strategies. He is a committed educator, engaging with the viticulture community through research, field days, and farm calls.

Introduction

Weed management is an essential aspect of vineyard operations, directly influencing vine health, fruit quality, and overall productivity. However, changes are on the horizon due to regulatory updates related to the Endangered Species Act (ESA), which may significantly impact pesticide labels and usage. This article reviews foundational weed management strategies and examines how the ESA-driven label changes will affect vineyard weed control practices.

Understanding Weed Management in Vineyards

Vineyards present a unique ecological scenario. They are highly managed systems with ample water, nutrients, and periodic disturbances like mowing, tillage, and herbicide applications. These factors create an environment where weeds can thrive. Left unmanaged, weeds compete with vines for resources, impede airflow (increasing disease risk), and interfere with harvest operations. Effective weed control, therefore, plays a crucial role in maintaining vineyard profitability and sustainability.

VINEYARD WEED MANAGEMENT UPDATE AND PENDING LABEL CHANGES RELATED TO THE ENDANGERED SPECIES ACT

What Makes a Weed "Tough"?
"Tough weeds" are not inherently superior plants but are adept at surviving common control strategies. Their resilience often stems from traits such as:

- Seed persistence: Seeds that remain viable in the soil for years.
- Resistance: Adaptation to herbicides commonly used in vineyards.
- Growth habits: Early establishment, rapid reproduction, survival through repeated mowing or shallow tillage.

Over time, weed populations shift to favor species that evade or tolerate the primary control methods in use. Addressing these "tough weeds" requires an adaptive, integrated approach.

Essential Components of Vineyard Weed Management

Accurate Weed Identification
Knowing the species present in your vineyard is foundational to effective management. Most vineyard weeds belong to a few dominant families, such as the sunflower family (*Asteraceae*), grasses (*Poaceae*), and mustards (*Brassicaceae*). Proper identification allows you to select targeted control methods.

Tools such as Weeds of California and Other Western States, training from Cooperative Extension, and rapidly-improving weed ID phone apps can help vineyard managers identify and understand the biology of their most problematic weeds. Frequent scouting and record-keeping are also crucial to catching shifts in weed populations before they become unmanageable.

Responding to Shifts in Weed Populations
Weed management strategies should evolve over time. If the same herbicides or mechanical practices are used repeatedly, the surviving weed species or biotypes will dominate future populations. For example, over-reliance on a single herbicide mode of action can result in herbicide-resistant populations. Rotating strategies—including herbicides, mechanical controls, and cultural practices—is essential for maintaining long-term control.

Mechanical and Cultural Control Strategies

Mechanical methods such as tillage and mowing remain widely used in vineyards. While effective, these methods have limitations, including:

- **Soil erosion:** Particularly on sloped sites.
- **Fuel and labor costs:** Higher frequency of mowing or tillage increases expenses.
- **Dust generation (PM10):** A regulatory concern in some regions.
- **Root damage:** Particularly in young vines.

Cultural practices like cover cropping, optimizing irrigation, and managing fertilizer placement can also reduce weed pressure. For example, cover crops can outcompete weeds by occupying the same ecological niche, particularly during the winter season.

Chemical Controls

Herbicides are a critical tool for many vineyard managers, particularly in vine rows where mechanical options may damage roots. Key considerations when selecting herbicides include:

- **Target weed spectrum:** Are you trying to address winter annuals, summer annuals, summer perennials, or all of the above?
- **Timing:** Preemergence herbicides prevent seedling establishment shortly after germination, while postemergence products target actively growing weeds.
- **Resistance management:** Rotating herbicides with different modes of action helps reduce the risk of resistance.
- **Environmental considerations:** Avoiding runoff, drift, and contamination of sensitive habitats is increasingly important, particularly under ESA regulations.

New Challenges: ESA-Driven Herbicide Label Changes

Regulatory Context

The Endangered Species Act requires federal agencies, including the U.S. Environmental Protection Agency (EPA), to ensure that pesticide registrations do not harm listed species or their habitats. This process, known as “consultation,” is prompting updates to herbicide labels. California, with its diverse ecosystem and numerous endangered species, will likely see significant changes.

The EPA’s current focus includes developing a “herbicide strategy” that addresses the potential impacts of agricultural herbicides on over 400 endangered plants and 500 dependent animal species. Mitigation measures will likely target herbicide drift, runoff, and erosion.

VINEYARD WEED MANAGEMENT UPDATE AND PENDING LABEL CHANGES RELATED TO THE ENDANGERED SPECIES ACT

Key Label Changes
While final details are still being developed, some likely updates include:

- **Drift Reduction Requirements:** New labels may specify nozzle types, buffer zones, and wind-speed cutoffs to minimize off-target movement.

- **Runoff and Erosion Mitigation:** Herbicide applications may be restricted before heavy rains, and vegetative buffer zones could become mandatory. Growers may also need to adopt erosion-control practices.

These changes aim to protect endangered species and their habitats while maintaining the viability of agricultural operations. However, they will also increase compliance requirements for growers.

Staying Compliant
Growers can stay informed about region-specific requirements by consulting the EPA's "Bulletins Live! Two" website (https://www.epa.gov/endangered-species/bulletins-live-two-view-bulletins). This resource provides up-to-date information on pesticide use restrictions based on local endangered species considerations.

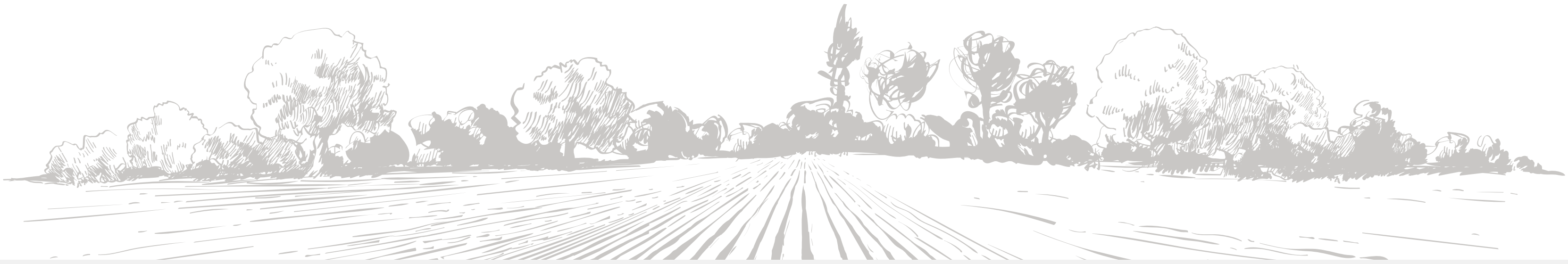
Practical Tips for Vineyard Weed Management Amid Regulatory Shifts

- **Diversify Weed Management Programs:** Avoid reliance on a single control method. Integrating mechanical, cultural, and chemical strategies reduces the risk of resistance and maintains flexibility as regulations evolve.

- **Improve Record-Keeping:** Detailed records of herbicide applications, weed species present, and control outcomes will help adapt your program and demonstrate compliance with label requirements.

- **Explore Alternative Practices:** Adopting new technologies, such as precision spot-spraying or robotic weeders, may reduce herbicide use while maintaining effective control.

- **Engage with Resources:** Leverage Cooperative Extension, industry groups, and professional societies for updates on regulations and best practices. These organizations often provide workshops, research findings, and technical guidance tailored to local needs.



Conclusion

Effective weed management in vineyards requires an adaptive, integrated approach. As the regulatory landscape evolves under the ESA, growers must be proactive in staying informed and compliant. By prioritizing accurate weed identification, rotating control strategies, and incorporating cultural practices, vineyard managers can maintain weed control while protecting endangered species and their habitats.

The changes ahead are challenging, but they also provide an opportunity to refine management practices, safeguard sensitive ecosystems, and ensure the long-term sustainability of vineyard production.

Resources:

- DiTomaso, J. M., & Healy, E. A. (2007). Weeds of California and other Western States (Vol. 3488). UCANR Publications.
- U.S. EPA "Bulletins Live! Two" website: https://www.epa.gov/endangered-species/bulletins-live-two-view-bulletins
- UC Integrated Pest Management Guidelines for Grapes: http://www.ipm.ucdavis.edu/PMG/selectnewpest.grapes.html
- Herbicide Registration on California Tree and Vine Crops – (reviewed April 2023 - UC Weed Science): https://wric.ucdavis.edu/PDFs/T&V_herbicide_registration_chart.pdf
- Weed Research and Information Center: http://wric.ucdavis.edu/
- EPA's Workplan and Progress Toward Better Protections for Endangered Species: https://www.epa.gov/endangered-species/epas-workplan-and-progress-toward-better-protections-endangered-species
- Weed Science Society of America – Herbicides and the Endangered Species Act; What You Need to Know: https://wssa.net/endangered-species/

ULTRA-SENSITIVE METHOD FOR RAPID SCREENING OF LEAFROLL 3 VIRUS

Dr. Alan Wei
Owner & President, Agri-Analysis LLC

Dr. Alan Wei is the owner and president of Agri-Analysis LLC located in Davis, California for almost 20 years since 2005. His clients are concentrated in the wine growing regions of U.S. where his work helps winegrape growers diagnose, prevent and mitigate economically important grapevine diseases and has positively impacted the multibillion-dollar wine industry. Dr. Wei received his Ph.D. degree in Bioengineering from University of Utah where he specialized in molecular detection. Dr. Wei is inventor or co-inventor of 20 United States Patents (19 issued and one pending). Dr. Wei serves/served on the research grant review committees of American Vineyard Foundation (AVF), National Institute of Health (NIH) and United States Department of Agriculture (USDA). He is member of California Wine Grape Growers Association, the American Vineyard Foundation, the Napa Valley Grape Growers Association, the National Grape Research Association, the Vineyard Team, the Wine Industry Network.

Introduction

Grapevine leafroll associated virus type 3 (GLRaV-3) is one of the most economically damaging grapevine viruses globally. It has a significant economic impact on grape production, leading to substantial yield losses (up to 50%) due to reduced fruit quality, delayed ripening, and ultimately, lower market value for the grapes. The economic loss of GLRaV-3 is estimated to be between $25,000 and $41,000 per hectare over the lifespan of a vineyard.

Mitigation Strategies

- Use certified grapevines whose mother vines are further tested and confirmed to be free of GLRaV-3.
- Regularly test and monitor vineyards for symptoms of GLRaV-3 to identify infected vines and remove them.
- Control insect vectors such as vine mealybugs with combination of chemical and biological methods.
- Engage in neighborhood groups to promote education, awareness, information sharing, and good practices, etc. The ability to detect the GLRaV-3 virus early and rapidly are integral part of these mitigation strategies.

ULTRA-SENSITIVE METHOD FOR RAPID SCREENING OF LEAFROLL 3 VIRUS

Lemberger **Chardonnay**

FIGURE 1: Symptoms of GLRaV-3 infection include downward rolling and cupping of leaves, interveinal reddening of leaves in red-fruited cultivars, chlorosis in white cultivars, poor fruit color development in red cultivars, and delayed fruit maturation and ripening.

Current diagnosis requires multiple steps and skilled operators and can only be performed in the laboratory. To improve management outcomes, it is imperative to make testing early, rapid, and available in the hands of growers to enable them to conduct testing in the field and in real-time. We have developed a convenient and sensitive test for the rapid diagnosis of GLRaV-3 suitable for field use. Agri-Analysis has a proprietary patent-pending technology for direct antigen detection without nucleic acid amplification. Specifically, our testing method uses highly specialized antibodies derived from llamas, called "nanobodies," for GLRaV-3 recognition and binding. For signal measurement, we use an extremely bright luminescent protein called nanoluciferase, derived from deep-sea shrimp *O. gracilirostris*.

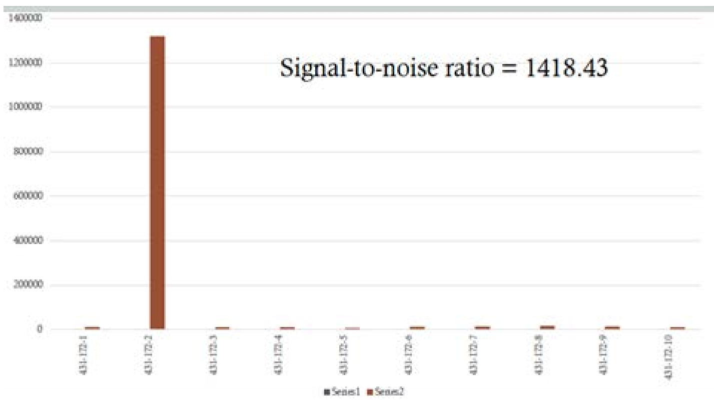
To develop a GLRaV-3 test, we first make molecular fusion proteins between the nanobodies and non-luminescent fragments of nanoluciferase. These fusion proteins have the dual function of binding and recognizing the GLRaV-3 virus and generating a strong luminescent signal upon binding to the target. These fusion proteins are designed such that they have no bioluminescence when GLRaV-3 is absent. When GLRaV-3 is present, the nanobodies bind to it, bringing the luciferase fragments together to form an active luciferase, producing a bright bioluminescence signal.

This method overcomes the disadvantages of poor sensitivity and specificity inherent in conventional ELISA. The high sensitivity is derived from the extremely low background noise because the enzyme fragments are inactive if they are non-specifically bound to the surface substrate. By comparison, in conventional ELISA, the enzyme-linked detection antibody is always active regardless of whether it is bound specifically to the target or nonspecifically to the substrate surface. The high specificity is derived from the fact that two nanobodies are required to bind simultaneously to the target to create a bioluminescence signal. If the enzyme-linked nanobody binds nonspecifically to a structurally similar interferent molecule, no signal will be produced because two independent binding events are required to produce the signal, hence the improved specificity.

ULTRA-SENSITIVE METHOD FOR RAPID SCREENING OF LEAFROLL 3 VIRUS

We have demonstrated a signal-to-noise (S/N) ratio of over 2200, whereas conventional ELISA typically has a S/N ratio of 15. This method was shown to be more sensitive than PCR and qPCR when compared side-by-side to test GLRaV-3 in serially diluted field samples. It is envisioned that reagents can be freeze-dried in the wells of 96-well plates, and signals can be read out upon sample addition without the need for additional wash steps.

This "mix-and-read" format, when combined with portable luminescence readers, enables high-throughput screening of multiple samples in vineyards and/or nurseries. It can also be adapted to handheld luminescence readers for single-sample testing. Although GLRaV-3 was used to demonstrate feasibility, this method represents a new way of designing and conducting ELISA for highly sensitive and specific detection of bacterial, viral, and fungal agents for plant protection and beyond. We coined the term "next-generation ELISA (ngELISA)" for this method.



Result of ONE-STEP Testing of GLRaV-3 in Individual Grapevine Cuttings

Rapid high throughput screening of large number of grapevine cuttings for GLRaV-3

SOIL CARBON IN PRACTICE: METHODS OF MONITORING, TESTING, AND IMPROVING SOIL CARBON IN VINEYARDS

Dr. Chris Chen
Integrated Vineyard Systems Advisor, UC Cooperative Extension
Christopher Chen is the UCCE Integrated Vineyard Systems Advisor for the North Coast region of California. His work through the North Coast Viticulture program focuses on Climate-Adaptive viticulture practices to help address the concerns related to climate change in vineyards and brings actionable research to the grape growing communities of Northern California. Chris received his doctorate from University of California Davis, focusing on climate centric research in grapevines.

Within agricultural communities, the term “Soil Health” is often used in reference to the observable properties in the soils of any given vineyard. This term is often poorly defined and can refer to any aspect of the soil that directly or indirectly affects grapevine growth, reproductive efficacy, or longevity; it may also be used to describe the functional capacity of the soil to host various organisms such as soil microbes, arthropods, weeds, and fungi. When using a broadly-defined term like “Soil Health” it's a good idea to specify the component of the term that is being discussed. Soil carbon is one such component of soil health, and one which can influence other aspects of soil health such as soil structural stability, water and nutrient retention, and more.

Carbon, as an element, is essential for life and is unique in its ability to bond with a wide variety of compounds and elements. It produces a strong and stable arrangements that are strong enough to persist in the soil but may also be broken and rearranged (Bering et al., 2021). Because of this, soil carbon is essential in the formation and retention of soil aggregates which mostly determine the structure and stability of any vineyard soil. Soil carbon also plays a major role in the adsorption and desorption of nutrients to the soil-mineral surfaces. While soil carbon usually makes up less than 10% of the soil volume it greatly influences the function of that soil (Jakšić et al., 2021).

Soil carbon comes in many different forms but is most often measured as Soil Organic Matter (SOM) or Soil Organic Carbon (SOC). These values may change year-to-year and will fluctuate more in vineyards implementing carbon-building practices like livestock integration, limited tillage, cover cropping, or applying organic matter like compost. In practice, monitoring soil carbon is necessary for the microbial health of the soil, physical structure of the soil, and overall health of our grapevines. But how we measure soil carbon can differ depending on our objectives for use of that carbon. When testing for carbon in the soil, you can do so directly or indirectly. Direct sampling requires soil sampling at different depths at regular time intervals; indirect sampling focuses on the impacts of carbon on microbial communities and their corresponding metabolic activity in the soil. These two approaches of testing aren’t often seen as substitutes for one another and help answer different questions about the carbon profile of your soil. Although, there aren’t rules that prevent us from using multiple tests to assess our soil’s carbon status.

SOIL CARBON IN PRACTICE: METHODS OF MONITORING, TESTING, AND IMPROVING SOIL CARBON IN VINEYARDS

One of the primary approaches to indirect, soil carbon testing is to measure soil biological indicators. These are indicators of activity of microbes and other organisms in the soil that utilize carbon in their metabolic functions. Microbial respiration of CO2 is often measured to quantify carbon losses via heterotrophic respiration (Dynarski et al., 2020). Multiple methods to test microbial respiration are used today, some more accurate than others. One method is to follow existing protocols to take soil samples which can then be analyzed by a soil testing laboratory; this may be the most costly method but will provide accurate and consistent results if done correctly. It also requires less knowledge on the part of the person taking the sample.

Another common method is to utilize a field testing kit which allows the sample-taker to test their soil carbon content on-site without the need for a testing laboratory. This method requires more work and knowledge from the sampler and may be less accurate than lab tests if done incorrectly. Both methods of testing microbial respiration have their merits and are useful in different situations. Another common, indirect measure of soil carbon in through measurement of soil enzyme activity. Similar to microbial respiration, this test provides information about specific microbial activities and functions; enzyme activity is related to the rates of chemical reaction and decomposition of organic matter in the soil (Dynarski et al., 2020). These tests are mostly submitted for laboratory analysis and are often charged per sample and per enzyme tested for.

Growers interested in testing for soil carbon can also measure it directly; although, it’s important to know which form of soil carbon you want to test for and for what purpose. There are many forms of soil carbon, some of which are more impactful than others on vine health and microbial activity. Here are the main forms of soil carbon and what roles they play in the soil:

- Soil/Total Organic Carbon (SOC)
    - Carbon in all organic compounds in the soil
- Soil Organic Matter (SOM)
    - Produced by living organisms
- Total Carbon (TC)
    - Both organic and inorganic carbon
- Permanganate oxidizable carbon (POX-C)
    - Labile (easily or frequently changed) carbon in the soil
- Water Extractable Organic Carbon (WEOC)
    - Carbon available to microbes
- Particulate Organic Matter (POM)
    - Partially broken-down SOM
- Mineral-Associated OM (MAOM)
    - OM stuck to mineral surfaces
- Microbial Biomass Carbon (MBC)
    - Carbon that comes from the bodies of soil microbes

SOIL CARBON IN PRACTICE: METHODS OF MONITORING, TESTING, AND IMPROVING SOIL CARBON IN VINEYARDS

For the majority of grape producers, Soil Organic Matter (SOM) is the most accessible and affordable, direct-measurement of soil carbon. It is a broad category of soil carbon and is widely applicable to various soil-carbon objectives; it can also be added on as a test to most soil fertility samples submitted to laboratories. There are also more specific tests such as the Haney Soil Test which measures soil biological health through measurements of nutrient availability and microbial activity. The Haney Soil Test measures plant-available nutrients, microbial respiration, and the water-soluble fractions of organic carbon and nitrogen. This test will tell you how microbially active a soil is, what forms of carbon and nitrogen are being used by microbes, and potentially highlight ways to promote microbial activity in the soil.

When sampling soils for carbon testing, it's often best to follow the instructions of the lab you are submitting samples to. It's also a good idea to follow some general guidelines like being systematic and consistent. Collecting all samples on the same day helps limit environmental variation in microbial activity, sampling at consistent depths and location types helps reduce variation by sample location, and collecting samples when the soil is moderately wet rather than fully soaked or very dry helps capture average carbon utilization in an irrigated vineyard setting. It's also a good idea to follow some general guidelines about testing; these might include sampling at the same time of year each year and at consistent time intervals. It would also be beneficial to send your soil samples to the same lab each year to ensure the same testing methods are used to measure soil carbon.

Soil carbon is unique to each vineyard and is good to keep track of. It's a major component of "Soil Health" and can impact soil structure, function, and microbial activity; all of these components can have a notable effect on vine health. If you have any questions about soil carbon, consider reaching out to your local University of California Cooperative Extension office for advice.

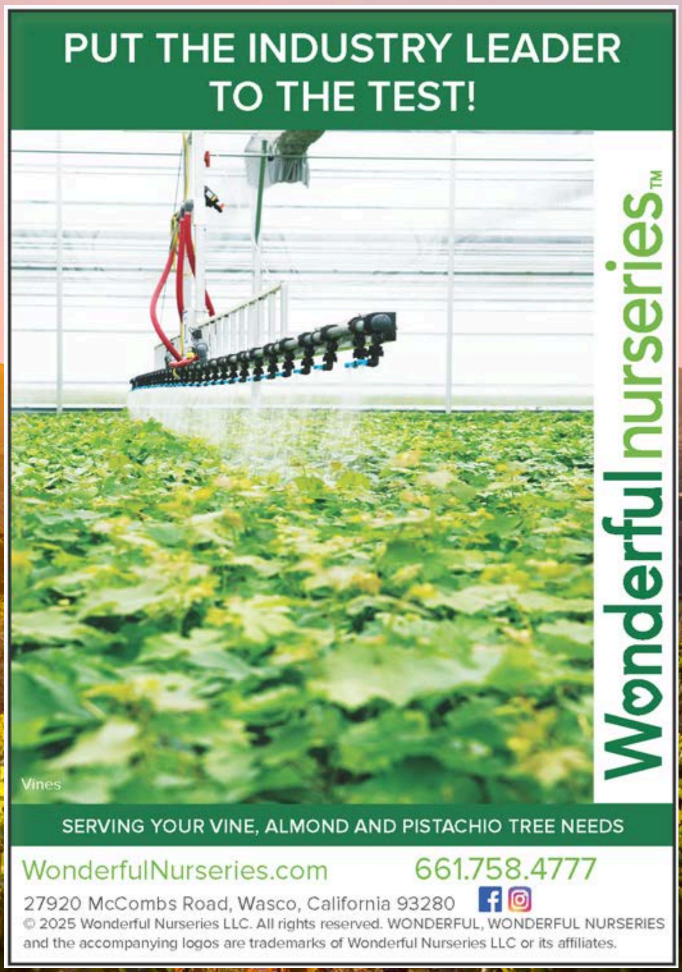
References

Bering, E., Torstensen, J., Lervik, A., & Wijn, A. (2021). Computational Study of the Dissolution of Cellulose into Single Chains: the Role of the Solvent and Agitation. https://doi.org/10.21203/rs.3.rs-679922/v1

Dynarski, K. A., Bossio, D. A., & Scow, K. M. (2020). Dynamic Stability of Soil Carbon: Reassessing the "Permanence" of Soil Carbon Sequestration [Review]. Frontiers in Environmental Science, 8. https://www.frontiersin.org/journals/environmental-science/articles/10.3389/fenvs.2020.514701

Jakšić, S., Ninkov, J., Milić, S., Vasin, J., Banjac, D., Jakšić, D., & Živanov, M. (2021). The State of Soil Organic Carbon in Vineyards as Affected by Soil Types and Fertilization Strategies (Tri Morave Region, Serbia). Agronomy, 11(1).

FOWLER
BROTHERS FARMING



HOW CAN WEATHER FORECASTS HELP IN GRAPEVINE MANAGEMENT?

Dr. Prakash Kumar Jha
Assistant Project Scientist (Climate & Agriculture), University of California Agriculture and Natural Resources

Dr. Prakash Kumar Jha is an applied climatologist specializing in sustainable agriculture, climate variability, climate change, and decision-support systems for enhancing crop resilience. Based at UC Merced, Dr. Jha works on advancing California agriculture's capacity to adapt to climate change through innovative tools and data-driven strategies.

With a Ph.D. in Science and Management of Climate Change from Ca' Foscari University of Venice and over seven years of postdoctoral experience across various regions of the world, Dr. Jha has led extensive research on climate impacts, crop modeling, and agricultural decision-making. His work spans diverse climates and crops, including rice in Nepal, common bean in East Africa, hazelnut in Australia, and specialty crops in California. He collaborates with multidisciplinary teams to integrate seasonal forecasts, machine learning, and process-based crop models, bridging science and practice.

Introduction

Weather conditions play a crucial role in the management of grapevines, affecting dormancy, budburst, pest and disease risks, frost events, and harvest timing. By leveraging weather forecasts and historical climate data, growers can make informed decisions to optimize yield and quality while mitigating risks. This article explores how grape growers can use weather forecasts to address various challenges and plan for climate resilience.

Preparing for Dormancy Break and Budburst

The grapevine growth cycle begins with dormancy during winter and transitions to budburst in early spring. For successful budburst and even growth, grapevines require sufficient chill hours—the cumulative hours between 32°F and 45°F (*Baldocchi and Wong*, *2008*). Depending on the variety, grapevines typically require 50 to 400 chill hours, though some varieties deviate from this range (*Londo and Johnson*, *2014*). Insufficient chill hours, exacerbated by warming trends due to climate change, can delay or unevenly trigger budburst, impacting both yield and fruit quality (*Jha and Pathak*, *2024*). Growers can assess the long-term viability of a vineyard site by using high-resolution climate projections, such as those available through Cal-Adapt **(https://cal-adapt.org/blog/climate-data-access/).**

These projections enable users to calculate chill hours for up to 20-30 years into the future. For year-to-year variability, historical temperature records from CIMIS stations (**https://cimis.water.ca.gov/WSNReportCriteria.aspx)** or similar sources can help growers understand how winter temperatures affect budburst timing on their farms.

HOW CAN WEATHER FORECASTS HELP IN GRAPEVINE MANAGEMENT?

Seasonal climate outlooks from NOAA (**www.cpc.ncep.noaa.gov/products/predictions/long_range/**) can also indicate whether the upcoming winter is likely to be warmer or colder than average. Early budburst can increase chances of frost risk in cooler years, while insufficient chill, can cause uneven bud-break, and reduce the quantify and qualify of fruits. This allows growers to plan interventions, such as pruning to delay budburst and reduce frost risk or applying dormancy-breaking agents like hydrogen cyanamide during warmer winters to ensure timely budbreak.

Managing Frost Risks

Spring frost poses a significant threat to tender grapevine buds. Accurate short-term frost forecasts, available up to a week in advance, are essential for implementing frost prevention measures. Tools such as the Frost Advisory Tool from CalAgroClimate (**https://calagroclimate.org/**) provide growers with localized predictions, enabling timely action. Growers can deploy sprinklers or wind machines, heaters etc. for frost protection (Minton et al., 2017). These measures protect the vines and help preserve the season's potential yield.

Timing the Harvest for Optimal Quality

Deciding the right time to harvest is critical to ensuring premium grape quality. Weather forecasts can guide harvest planning by predicting rainfall, which can dilute grape sugars and elevate disease risks, or forecasting heat spikes, which can compromise fruit integrity. Reliable precipitation forecasts, such as those from ECMWF (**https://cds.climate.copernicus.eu/datasets/seasonal-original-single-levels?tab=download**), extend up to seven to 10 days with good accuracy (Rasp et al., 2020), while long-term seasonal predictions are also available for planning purposes. Temperature thresholds for heat stress can be monitored using tools like the Heat Advisory feature of CalAgroClimate, helping growers schedule harvests at the most opportune times.

HOW CAN WEATHER FORECASTS HELP IN GRAPEVINE MANAGEMENT?

Enhancing Pest and Disease Control
Weather conditions, particularly temperature, humidity, and rainfall, significantly influence the prevalence of pests and diseases. By analyzing weather forecasts, growers can predict outbreaks, time pesticide applications, and reduce unnecessary sprays, aligning with sustainable practices. Several weather-based indices aid in assessing pest and disease risks:

- **Compound Sanitary Index** (**CSI**): The CSI quantifies the potential risk of fungal infections by integrating precipitation and temperature during critical growing periods (Dell'Aquila et al., 2023). Key components include:
  - **Spring Rainfall (SprR)**: Total precipitation from April 21 to June 21, weighted by the spring precipitation coefficient (offsp).
  - **Harvest Rainfall (HarvestR)**: Total precipitation from August 21 to October 21, weighted by the harvest precipitation coefficient (offhart).
  - **Growing Season Temperature (GST)**: Average daily mean temperature from April 1 to October 31, weighted by the growing season temperature coefficient (offgst).

Compound Sanitary Index Equation

$$\textbf{CSI} = offgst \times offsp \times (\ percentile\ (\textbf{SprR})\ ) + offhart \times percentile\ (\textbf{HarvestR}) + (\ 100 - percentile\ (\textbf{GST})\ )$$

Each variable is assigned a coefficient (default value = 1), which varies based on specific thresholds derived from historical observations:

Threshold adjustments:

1. **SprR Threshold:**
   - If SprR ⩾ 60th percentile of historical SprR values, the coefficient (offsp) is set to 1.5 (indicating a 50% higher risk of fungal diseases).

2. **GST Thresholds:**
   - If GST ⩾ 70th percentile of historical GST, offgst = 1.5 (warmer temperatures amplify fungal risks).
   - If GST ⩽ 40th percentile, offhart = 1.5 (cooler growing seasons delay grape ripening, increasing susceptibility to diseases associated with heavy harvest rainfall (HarvestR).

- **Powdery Mildew Risk Index** (from University of California Davis) (*Gubler et al., 1999*): Risk rises after 100 growing degree days (GDD) from budbreak, especially at temperatures between 68°F and 86°F and relative humidity above 40–70% for 6–12 hours .

- **Downy Mildew Risk Index:** This disease thrives under leaf wetness lasting 6–12 hours and temperatures between 46°F and 73°F, particularly on warm, humid nights (*Gent et al., 2010*).

- **Botrytis Bunch Rot Risk Index:** Risk peaks during warm and wet weather (temperatures between 59°F and 68°F, and at least 90% humidity) (Alzohairy and Miles, 2024).

By integrating these indices with seasonal climate outlooks, growers can predict high-risk periods, optimize fungicide applications, and estimate pest activity based on GDD models.

Planning for Climate Resilience

California's wine industry faces long-term challenges due to rising temperatures and erratic weather patterns caused by climate change. Integrating weather data with broader climate strategies is essential for future resilience. Growers should consider adopting heat-tolerant grape varieties, adjusting vineyard design (e.g., row orientation and canopy management), and exploring shading techniques to mitigate heat stress. Emerging technologies, such as artificial intelligence and predictive analytics, can combine historical data with climate projections to improve long-term planning and risk management.

Conclusion

Weather forecasts and climate data provide indispensable tools for modern grapevine management. From planning dormancy break and managing frost risks to optimizing harvest timing and controlling pests and diseases, leveraging these resources enhances decision-making, reduces risks, and supports sustainable viticulture. As the industry adapts to climate change, integrating advanced forecasting tools and climate resilience strategies will be key to maintaining productivity and quality in the face of evolving environmental challenges.

References

- Alzohairy, S. and Miles, T., 2024. Managing Botrytis Bunch Rot. Michigan State University, Department of Plant, Soil and Microbial Sciences.
- Baldocchi, D. and Wong, S., 2008. Accumulated winter chill is decreasing in the fruit growing regions of California. Climatic Change, 87(1): 153-166.
- Dell'Aquila, A., Graça, A., Teixeira, M., Fontes, N., Gonzalez-Reviriego, N., Marcos-Matamoros, R., Chou, C., Terrado, M., Giannakopoulos, C. and Varotsos, K.V., 2023. Monitoring climate related risk and opportunities for the wine sector: The MED-GOLD pilot service. Climate Services, 30: 100346.
- Gent, D.H., Ocamb, C.M. and Farnsworth, J.L., 2010. Forecasting and management of hop downy mildew. Plant disease, 94(4): 425-431.
- Gubler, W., Rademacher, M., Vasquez, S. and Thomas, C., 1999. Control of powdery mildew using the UC Davis powdery mildew risk index. APSnet Feature (January 1999).
- Jha, P.K. and Pathak, T.B., 2024. Seasonal climate forecasts show skill in predicting winter chill for specialty crops in California. Communications Earth & Environment, 5(1): 485.
- Londo, J.P. and Johnson, L.M., 2014. Variation in the chilling requirement and budburst rate of wild Vitis species. Environmental and Experimental Botany, 106: 138-147.
- Minton, V., Howerton, H. and Cole, B., 2017. Vineyard Frost Protection. A guide for a Northern Coastal California. United States Department of Agriculture, Petaluma, California, USA.
- Rasp, S., Dueben, P.D., Scher, S., Weyn, J.A., Mouatadid, S. and Thuerey, N., 2020. WeatherBench: a benchmark data set for data-driven weather forecasting. Journal of Advances in Modeling Earth Systems, 12(11): e2020MS002203.

OPTIMIZING IRRIGATION FOR HEATWAVE MITIGATION IN CABERNET SAUVIGNON IN LODI

Pietro Previtali
PhD, Research Specialist, Viticulture Research Group at Gallo

Pietro Previtali is a research scientist specializing in grapevine physiology and applied viticulture. With an M.Sc. from the University of Geisenheim and a Ph.D. in Wine Sciences from the University of Adelaide, he has joined the Viticulture Research group at GALLO in California in 2022. His research focuses on strategies to improve water use efficiency and mitigate heatwaves in vineyards. He also studies fundamental aspects of grape berry ripening, with a focus on the hormonal and transcriptomic mechanisms of slow ripening to counteract climate change.

Global warming and changing patterns for heatwaves: what's happening in Lodi?

The pressure of the changing environment on grape production is increasing annually. Among the most concerning trends associated with climate change are the warming conditions observed in wine regions worldwide, as well as the increased frequency of heat extreme events, often referred to as heatwaves. **Figure 1** shows the results of a climate analysis conducted for the Lodi region using historical data from 1981 to 2024.

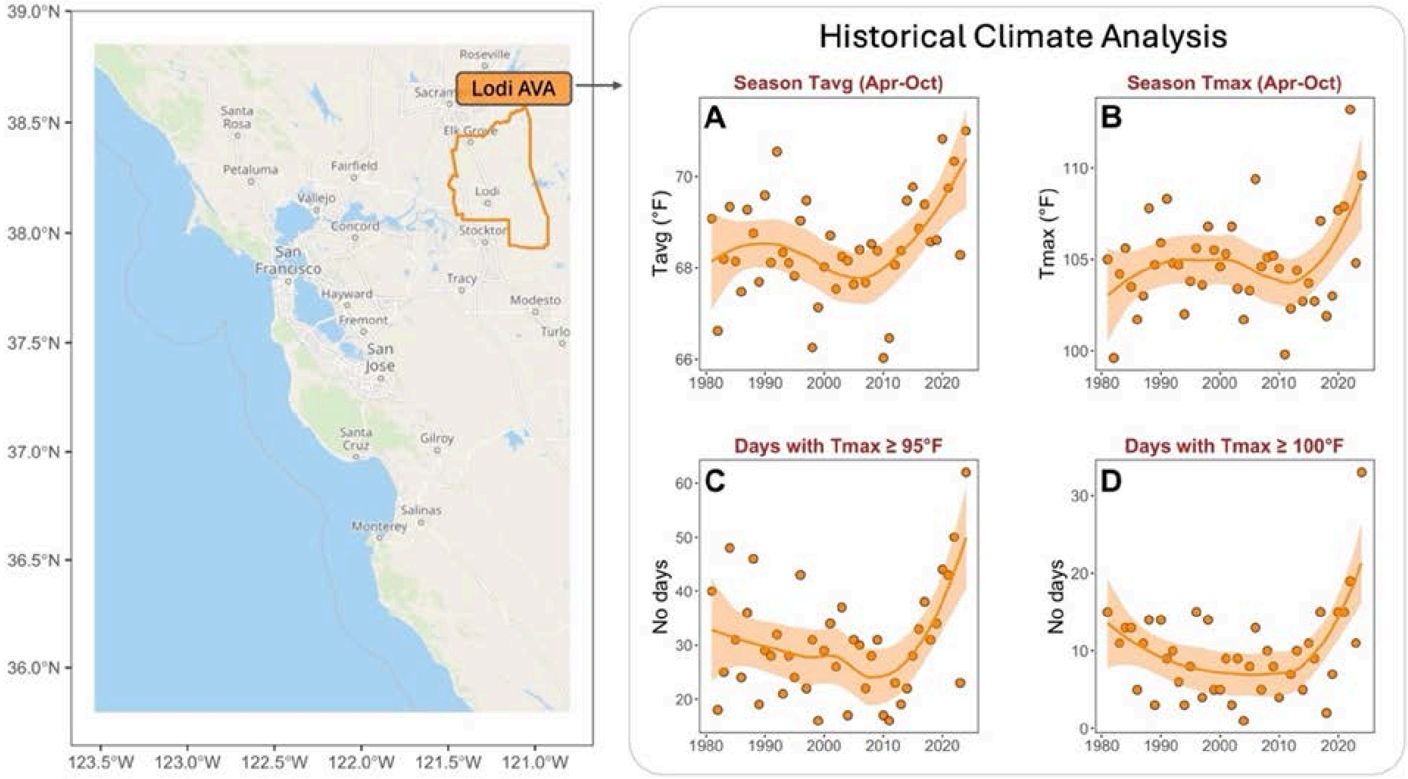


Figure 1. Historical climate analysis for the Lodi grape region. Long-term daily weather observations from 1981 to 2024 were retrieved from the PRISM database (PRISM Climate Group, 2024). Panels represent changes in A) average temperature (Tavg), B) maximum temperature (Tmax), C) number of days with Tmax ⩾ 95 °F and D) number of days with Tmax ⩾ 100F by growing season (April-October).

OPTIMIZING IRRIGATION FOR HEATWAVE MITIGATION IN CABERNET SAUVIGNON IN LODI

From the mid 2000s to present, average and maximum growing season temperatures (Apr-Oct) have steadily increased. Additionally, there has been a sharp increase in the number of days with temperatures exceeding 95 and 100 °F, considered the upper thresholds for optimal grape production (Jones & Webb, 2010). Future scenarios for the Lodi region have been modeled and projections show that these conditions will continue to worsen in years to come (Parker et al., 2020).

From the literature: broad effects of heat on grapevines

Studies on the effect of increasing temperature on grapevines have increased significantly in the past two decades. The studies have reported that increased heat leads to inhibition of photosynthesis at T > 95 °F, and greater evaporative demand (Greer & Weston, 2010). The level of water stress determines the timing and intensity of stomatal closure. There is a consensus that heatwaves impact yield negatively, but how much is dependent on the timing and intensity of the heat, growing conditions and management practices. Commercial Cabernet Sauvignon data show that yield losses are on average 30 and 20 % in seasons with severe pre-veraison and post-veraison heatwaves compared to cool seasons. Other reported effects of heat include accelerated ripening, harvest anticipation and compression, and a decoupling between technological and phenolic and aromatic maturity (Previtali et al., 2021; Sadras & Moran, 2012). In previous collaborations between GALLO and UC Davis, 2x and 3x irrigation applied during heatwaves had beneficial effects on yield (Forrestel, 2022). However, too much water (3x irrigation) did not cause additional yield improvements and severely reduced fruit quality.

Experiments to define the optimal irrigation timing and amount for heatwave mitigation

The trial was conducted over three years (2022-2024) in a commercial vineyard of Cabernet Sauvignon in Lodi. The experiment was designed to optimize treatments investigated in previous trials (Forrestel, 2022), to achieve maximum benefits with minimum water applied given the pressure of water regulations. Six treatments were applied in total and were compared to control vines deficit-irrigated at 80 % crop evapotranspiration (ETc) through the season. In the six experimental treatments, irrigation amount was increased by either 1.5x (120 % ETc) or 2x (160 % ETc), and ramp-up irrigation was started 0, 1 or 2 days prior to each heatwave and maintained through the heat event. Heatwaves were classified as two or more days with Tmax ⩾ 100 °F according to local weather forecast. Local temperature at the site is shown in **Figure 2**. The longest and most severe heatwaves were observed in 2022 and 2024, with heat events occurring mostly post-veraison (early September) and pre-veraison (early July) respectively. In 2023, heat exposure was limited to the first days of July.

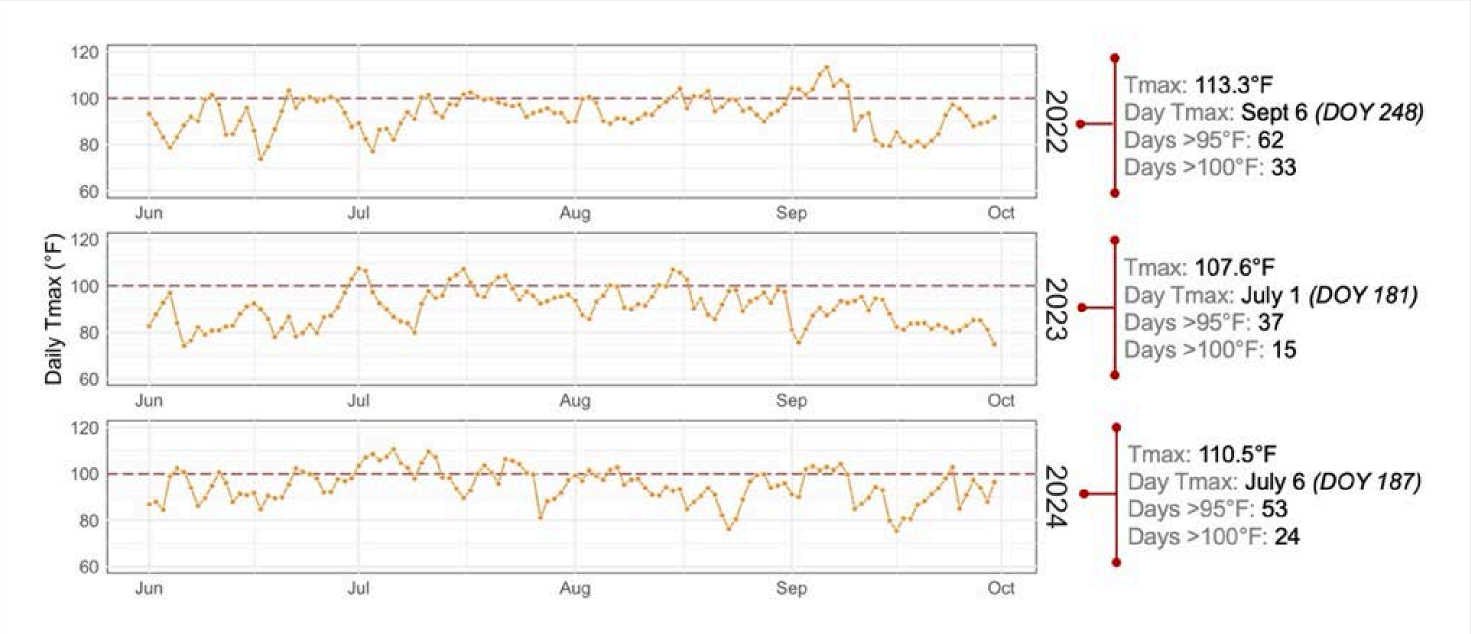


Figure 2. Daily maximum temperature (Tmax) over three consecutive seasons (2022-2024) at the experimental site in Lodi. Data are shown from June to September. Temperature records were sourced from the weather station present on site.

Calibrated drip irrigation during heatwaves alleviates water stress, reduces yield losses and improves fruit and wine quality

We characterized vine responses during the severe heat events of 2022 and 2024. Increased irrigation improved the water status of Cabernet Sauvignon vines, measured as positive changes in water potential. Mitigation effects on yield components were evident (**Table 1**). The rate of berry dehydration through the heatwave decreased as a function of the level of water applied, leading to significant differences at harvest in both years. In 2022, the year with the most sever late heatwave, berry dehydration was 22 % in the control and close to 9 % in the highest irrigation treatment. Yield at harvest followed trends observed for berry weight.

Fruit composition was highly affected by different levels of heat (**Table 1**). The highest irrigation treatments had sugar concentrations at harvest 2-3 °Brix lower than the control, indicating a protective effect against concentration driven by dehydration. This was confirmed by berry moisture levels, which were also negatively correlated to the irrigation levels applied. In 2022, anthocyanins were not significantly affected but trended toward higher values when extra water was applied during heatwaves. Trends for both berry moisture and total berry anthocyanins were significant in 2024, indicating that added irrigation was able to reduce berry dehydration and preserve berry quality components. These ongoing trials highlight the importance of adjusting irrigation levels during heatwaves to maintain adequate yields and quality targets in the Lodi region.

Table 1: Effect of irrigation timing and intensity during heatwaves on yield components and fruit composition of Cabernet Sauvignon in the Lodi region.

	Yield components		Fruit composition		
	Berry weight (g)	Yield (tons/acre)	TSS (°Brix)	Moisture (%)	Anthocyanins (mg/g)
2022					
Control	0.94 b	7.1 ab	29.8 a	71.0 bc	0.95 n.s.
1.5x_0dp	0.94 b	7.0 ab	29.1 ab	70.4 c	1.02
1.5x_1dp	1.04 ab	6.7 a	28.5 abc	71.5 bc	1.07
1.5x_2dp	1.05 ab	9.0 ab	27.8 bcd	72.1 bc	1.16
2x_0dp	1.04 ab	8.5 ab	27.9 bcd	72.5 ab	1.17
2x_1dp	1.15 a	9.7 b	26.5 c	74.2 a	1.05
2x_2dp	1.11 ab	8.4 ab	27.5 cd	72.8 ab	1.23
2024					
Control	0.90 c	9.9 b	28.7 a	66.6 b	1.06 b
1.5x_0dp	0.97 bc	11.5 ab	27.2 ab	68.3 ab	1.14 ab
1.5x_1dp	1.01 abc	12.3 ab	25.6 bc	70.2 a	1.20 a
1.5x_2dp	1.06 ab	12.4 ab	26.9 abc	69.2 ab	1.15 ab
2x_0dp	1.07 ab	12.7 ab	26.0 bc	69.2 ab	1.09 ab
2x_1dp	1.11 a	14.2 a	25.4 bc	70.9 a	1.13 ab
2x_2dp	1.13 a	12.7 ab	25.0 c	70.9 a	1.17 ab

Notes: different letters denote significant differences between treatments for a single year according to Tukey's post-hoc test at $p < 0.05$. Abbreviations: 1.5x = +50% irrigation; 2x = +100% irrigation; dp = days prior to the heatwave; TSS = total soluble solids.

References

- Forrestel, E. J. (2022). Effect of variable irrigation practices during extreme heat events on grapevine physiology and berry chemistry. Presentation at the Napa Valley Grapegrowers (9 March 2022).
- Greer, D. H., & Weston, C. (2010). Heat stress affects flowering, berry growth, sugar accumulation and photosynthesis of Vitis vinifera cv. Semillon grapevines grown in a controlled environment. Functional Plant Biology, 37(3), 206-214.
- Jones, G. V., & Webb, L. B. (2010). Climate Change, Viticulture, and Wine: Challenges and Opportunities. Journal of Wine Research, 21(2-3), 103-106.
- Parker, L. E., McElrone, A. J., Ostoja, S. M., & Forrestel, E. J. (2020). Extreme heat effects on perennial crops and strategies for sustaining future production. Plant Science, 295.
- Previtali, P., Dokoozlian, N. K., Pan, B. S., Wilkinson, K. L., & Ford, C. M. (2021). Crop load and plant water status influence the ripening rate and aroma development in berries of grapevine (Vitis vinifera L.) cv. Cabernet Sauvignon. Journal of Agricultural and Food Chemistry, 69(27), 7709-7724.
- Sadras, V., & Moran, M. A. (2012). Elevated temperature decouples anthocyanins and sugars in berries of Shiraz and Cabernet Franc. Australian Journal of Grape and Wine Research, 18(2), 115-122.

VINO FARMS, LLC

petralogix

geophysics - environmental - geology

Our team of expert geophysicists, geologists, hydrographers, and environmental consultants are dedicated to the work and projects in which we take part.

When our clients need help we are there to achieve success and act as a nimble and dynamic team member for all projects. Call or write to find out more about what we can do for your project.

WWW.PETRALOGIX.COM
DKRAMER@ PETRALOGIX.COM
209-400-5729

RVR
ROUND VALLEY RANCHES, INC.

Aaron Shinn
C: 209-747-9595
O: 209-369-6805
Aaron@roundvalleyranches.com
P.O. Box 885 • Victor, Ca. 95253
www.roundvalleyranches.com
CA INS LIC #0M81533

MARTINEZ
ORCHARDS, INC.

Elevate Your Vineyards Potential!

Rooted in Tradition, Growing Your Future!

Since 1969, Field-Grown and Greenhouse-grown California-Certified Plant Material. Expertly cultivated vines. Heritage and modern clones available. Trusted by industry for over 55 years.

Discover the perfect blend of tradition and innovation.

www.martinezorchards.com (530) 795-0859 or (707) 696-9709

GALLO®

CALIFORNIA'S ORIGINAL SUSTAINABLE WINEGROWING PROGRAM *circa 1992*

created by Lodi farmers and accredited by world-renowned scientists

WHEN YOU DRINK WINE MADE FROM LODI RULES CERTIFIED GRAPES, YOU ARE SUPPORTING

A FARMER, A VINTNER, *and an* ENTIRE AGRICULTURAL COMMUNITY

who embraces their responsibility to care for the environment and the people.

LODI RULES · SUSTAINABLE WINEGROWING · CERTIFIED GREEN

THE **LODI RULES** *seal signifies a third-party audited* **COMMITMENT** *to rigorous, scientifically sound* **SUSTAINABLE WINEGROWING**

2024

35,909 ACRES *are* CERTIFIED *in* LODI

38,156 ACRES *in* OTHER CALIFORNIA REGIONS

759 ACRES *in* ISRAEL

293 ACRES *in* WASHINGTON

75,117 ACRES TOTAL *in 2024*

"SUSTAINABILITY MEANS LEAVING *everything* - PEOPLE, PLACES, ETC - AS GOOD OR BETTER THAN HOW WE FOUND IT."

- Kevin Phillips, Michael David Winery

OVER **150** SUSTAINABLE PRACTICES *are* INCLUDED *in* **LODI RULES**

OVER **200 WINES** *bear the* **LODI RULES SEAL**

A WINE MUST *contain* **85%** *certified sustainable* **GRAPES** *to bear the* LODI RULES SEAL

OVER **75** PRACTICES REDUCE GREENHOUSE GAS EMISSIONS

GROWERS *receive a bonus of* $ PER TON **FROM** *some* **WINERIES** *for:* LODI RULES CERTIFIED GRAPES

$14 MILLION PAID IN BONUSES *since 2010*

DISCOVER WINES MADE FROM LODI RULES CERTIFIED GRAPES AT lodirules.org

SAVE THE DATE

FARM SAFETY DAY

Receive 4 hours of continuing education units (Laws & Regulations) for Agricultural Pest Control Advisers and pesticide applicators.

Classes Available in English and Spanish

TUESDAY MARCH 4TH

7:00am - 2:00pm

Grape Festival Grounds

QUESTIONS? CONTACT THE LODI CHAMBER OF COMMERCE AT 209.367.7840.

LODI 100 year CELEBRATION CHAMBER

PURCHASE TICKETS ONLINE

$25 BY FEBRUARY 15TH · $30 AFTER · $35 AT THE DOOR