

Napa Valley Grapegrowers
Water Mitigation Strategies in Napa Valley Vineyards
*Presentation to the Technical Advisory Group for the Napa
Groundwater Sustainability Agency*

Garrett Buckland

Partner, Premiere Viticulture and Board Member, Napa Valley Grapegrowers

Molly Moran Williams

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Presentation Outline

PART I: Molly Moran Williams, Industry & Community Relations Director, NVG

- NVG 2023 Water-Focused Survey Results
 - Growers Want to Conserve Water
 - Water Conservation Tactics
 - Monitoring Plant Water Status
 - Water Sourcing
 - Water Use Practices in the Last 5-10 Years
 - Survey Takeaways

PART II: Garrett Buckland, Partner, Premiere Viticulture and Board Member, NVG

- Dry Viticultural Areas and Rainfall
- Application & Efficacy of Supplemental Irrigation
- Plant Adaptation
- Tactics and Farm Practices
- NVG's Proposed Data Collection Project to Improve County Water Use Model

PART III: Concluding Remarks & Q&A with Molly and Garrett



Growers Want to Conserve Water

Report on Water-Focused Survey 2023

- Napa Valley Grapegrowers conducted a water-focused survey of members in January 2023
- A total 100 growers/companies responded to the 2023 survey. 89% of respondents are interested in more programs related to water use and water conservation, a slight increase over 2022.
- In 2023, NVG was awarded a grant from the US Department of Agriculture's Risk Management Agency allowing us to expand education on water management strategies, converting to recycled water, and complying with the Groundwater Sustainability Plan as it rolls out.



Groundwater Sustainability Plan

[Home](#) | [Sustainable Viticulture](#) | [Water & Irrigation](#) | [Groundwater Sustainability Plan](#)

Groundwater Sustainability Plan

The Groundwater Sustainability Plan is a basin wide plan that lays out a path for sustainable management of a groundwater basin over a 20-year period, and focuses on avoiding undesirable results. It was designed to keep groundwater resources at or above 2015 levels. The plan was designed through the lens of 6 different sustainability indicators and safeguards against:

1. Lowering of Groundwater Levels
2. Reduction in Groundwater Storage
3. Seawater Intrusion
4. Degradation of water quality
5. Land subsidence
6. Surface water depletion



NAPA COUNTY'S GSP

STATEWIDE GSP'S

ANNUAL GROUNDWATER REPORT

Source: <https://www.napagrowers.org/groundwater-sustainability-plan.html>

Water & Irrigation

[Home](#) | [Sustainable Viticulture](#) | [Water & Irrigation](#)

Water & Irrigation

California droughts are becoming more frequent and persistent, as warmer winter temperatures driven by climate change reduce water held in the Sierra Nevada snowpack and result in drier soil conditions. To increase our resilience to future droughts, Californians must use water more wisely and efficiently.



External Resources

[Napa County WICC](#)

[Napa County UCCE](#)

[Napa BCD](#)

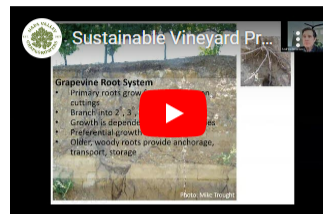
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Heat & Drought



Water Conservation Seminar: Drought Farming Strategies 2023



Sustainable Vineyard Practices: Drought & Irrigation 2022



Farming Strategies for Drought 2021



Sources:

<https://www.napagrowers.org/water--irrigation.html>

Recycled Water

Recycled water is wastewater effluent that has been further treated and disinfected to provide a non-potable (non-drinking water) water supply. Recycled water is safe and suitable for uses such as vineyard irrigation and is an environmentally responsible way to conserve scarce and expensive water supplies. Learn more at [Napa Sanitation District](#).



Sources:

<https://www.napagrowers.org/water--irrigation.html>

https://youtu.be/vRYU_E6o1sA

Water Conservation Tactics

January 2023 Survey

Question: What water conservation methods do you employ in your vineyards?

Conservation Practice	2023	Change YOY
Cover crops	82%	-2%
Rootstock selection	81%	6%
Soil management practices (cultivation)	75%	3%
Soil nutrition	64%	8%
Vineyard trellising and design	64%	13%
Vineyard site selection	30%	2%
Dry farming	20%	-1%
Drip Irrigation	94%	n/a
Irrigation system evaluation	72%	n/a



Monitoring Plant Water Status

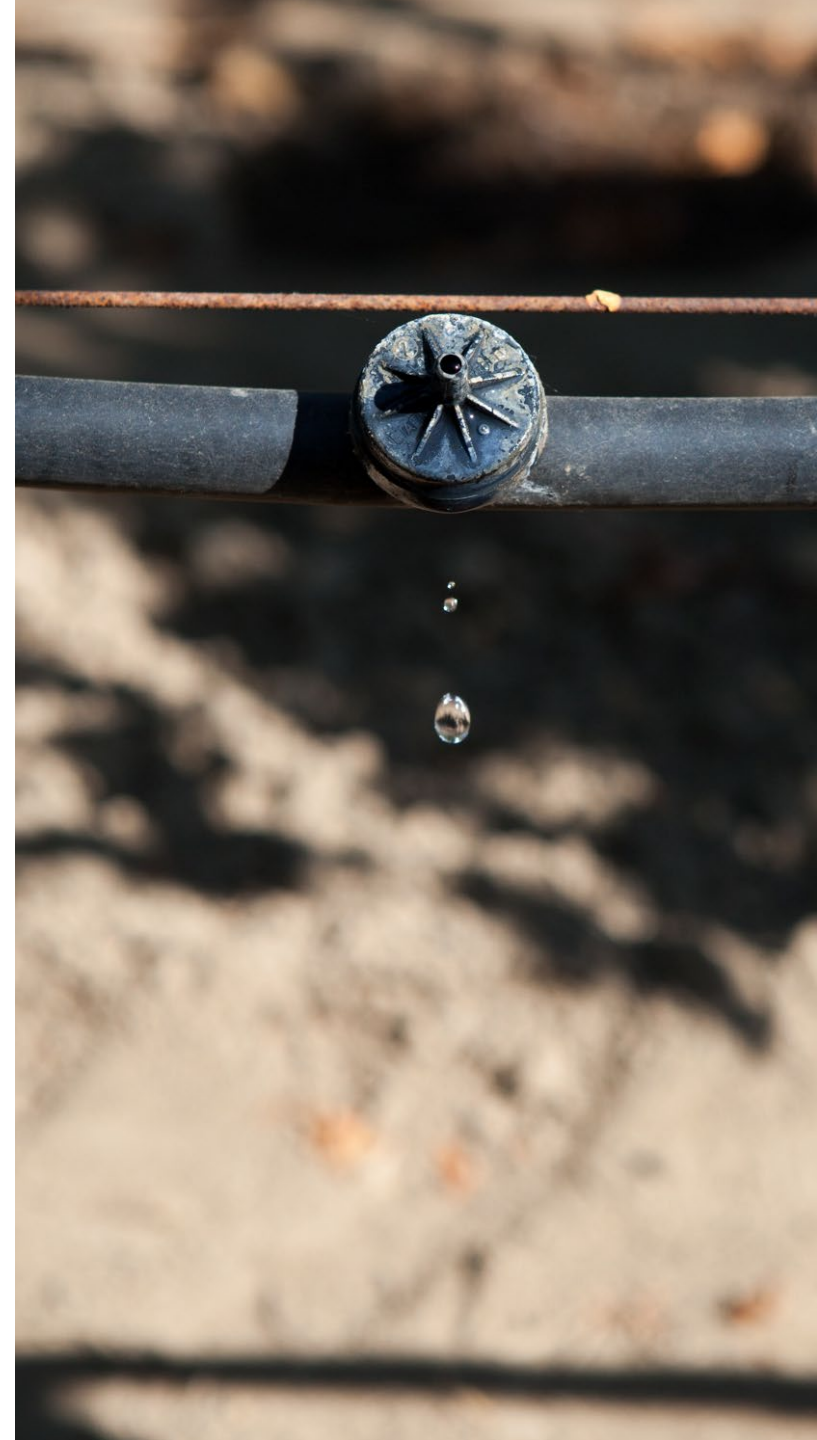
January 2023 Survey

Question: How do you monitor plant water status?

Monitoring Practices	2023	Change YOY
Visual symptoms in the field	74%	-3%
Soil moisture probes	51%	-1%
Pressure bombs	45%	0%
Remote imaging (NDVI)	39%	-2%
Specialized software	28%	14%
Leaf temperature	12%	1%
Surface renewal technology	26%	17%
Sap flow	11%	2%
Leaf porometer	4%	-1%

7% responded with “Other” that includes:

- Neutron probes, dendrometer
- Direct plant sensing and data analytics
- Water monitoring wells



Water Sourcing

January 2023 Survey

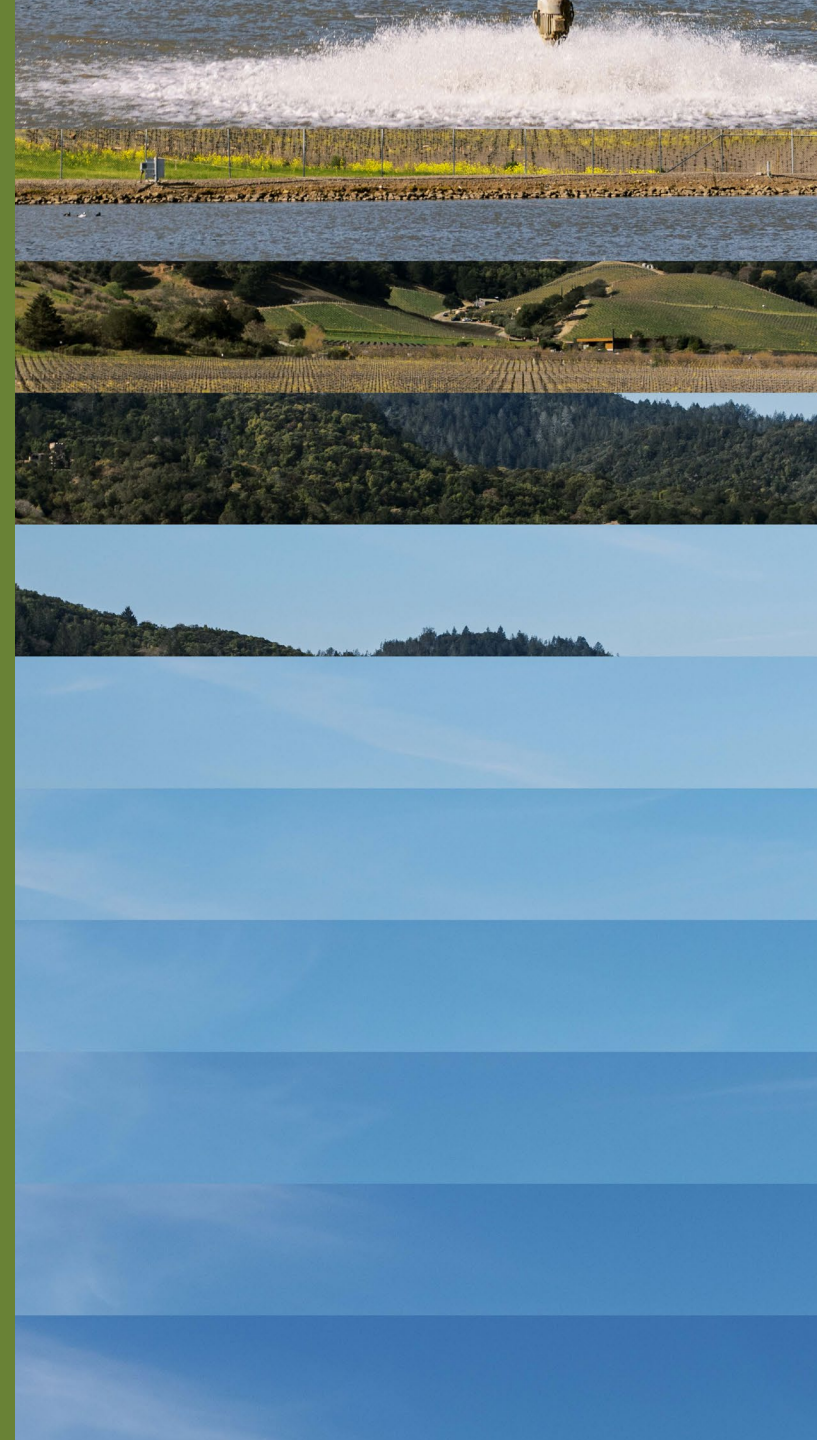
Question: Where do you source water for irrigation?

Water Source	2023	Change YOY
Groundwater	81%	-2%
Surface water	50%	6%
Recycled water - NapaSan	16%	0%
Municipal water	6%	-5%
Water delivery by truck	8%	-1%
Recycled water - private source	11%	5%
Other (please specify)	9%	-3%

*Other includes:

- Reservoirs
- Other municipal recycled water
- Captured drain tile water

NOTE: This slide exhibits that growers use more than one source of water within a growing season, allowing for seasonal flexibility and leveraging water supplies when they are at highest levels.



Measuring Applied Water

January 2023 Survey

***New* Question:** Do you measure the amount of applied water?

Measures Applied Water	Yes	No	Other
2023 Respondents	88%	9%	3%

Applied Water Measured	2023
Yes, we use irrigation schedules to calculate the amount of applied water	33%
Yes, groundwater pumping is metered	28%
Yes, applied surface water is metered	21%
Yes, surface renewal technology/remote sensing is used	6%
No, we dry farm; the vines use what they need	5%
No, we use other technologies to assess vine health and water needs	4%
Other (please specify)	3%

*Other includes:

- Vineyard irrigation is automatized
- Visually assesse when pumping into a pond
- NapaSan meters
- Planning to add meters this year
- Dry farm



Retaining Stormwater

January 2023 Survey

***New* Question:** Do you retain stormwater on site?

Retain Stormwater	2023
No, stormwater runoff is managed with drainage ditches	48%
Yes, temporarily in a pond	38%
Stormwater runoff is managed with drain tiles	30%
Yes, manage drainage to retain water on fields	18%
Other (please specify)	8%

*Other includes:

- Flat site / little or no runoff
- Use rainwater for vegetable garden irrigation
- Not allowed to retain stormwater hillside

NOTE: This data needs clarification and the question will be edited in the 2024 survey to better align with growers' methods for retaining stormwater.



Conservation Barriers

January 2023 Survey

***New* Question:** For the vineyard(s) that you manage, what are the most significant barriers to the implementation of conservation methods above and beyond what you're already doing?

Challenges	2023
Cost	35%
Uncertainty about the efficacy of a given method	23%
Uncertainty about a potentially negative effect on yields or quality	17%
Timing to align with vine maturity and replacement	11%
Inability to convince owner/decision maker to adopt a new practice(s)	6%
Other (please specify)	8%

*Other includes:

- Need for evidence and a plan to make the argument at decisionmaker level
- Variability of soil and vineyard; would need too many probes/meters/data points
- Not enough labor for monitoring and analysis
- We've already maximized water efficiency; only irrigate when absolutely necessary
- Difficult to measure water usage
- Young vines need more water
- Climate change





Water Use Practices in the Last 5-10 Years

January 2022 Survey

Question: Please explain how your water use practices have changed over the last 5-10 years.

“[Irrigation] used to be on a calendar schedule. Now its tailored to specific blocks/varietyals based on climatic demand and water stress.”

“We've gotten better at monitoring our water use and are continually looking for ways to reduce consumption.”

“[We are taking a] different approach to vineyard design and rootstock choice. Defined the goal of having a self-sustaining vine, encouraging deep roots and stronger, bigger vines.”

“Doing larger, less frequent irrigations, have reduced water use by more than half in most locations.”

“All irrigation recommendations are driven by data from multiple sources.”

“Installation of subsurface delivery of drip irrigation. Monitoring of soil moisture levels combined with vineyard observation to delay and schedule irrigation. In general, using 30 percent less water than 10 years ago.”





Survey Takeaways

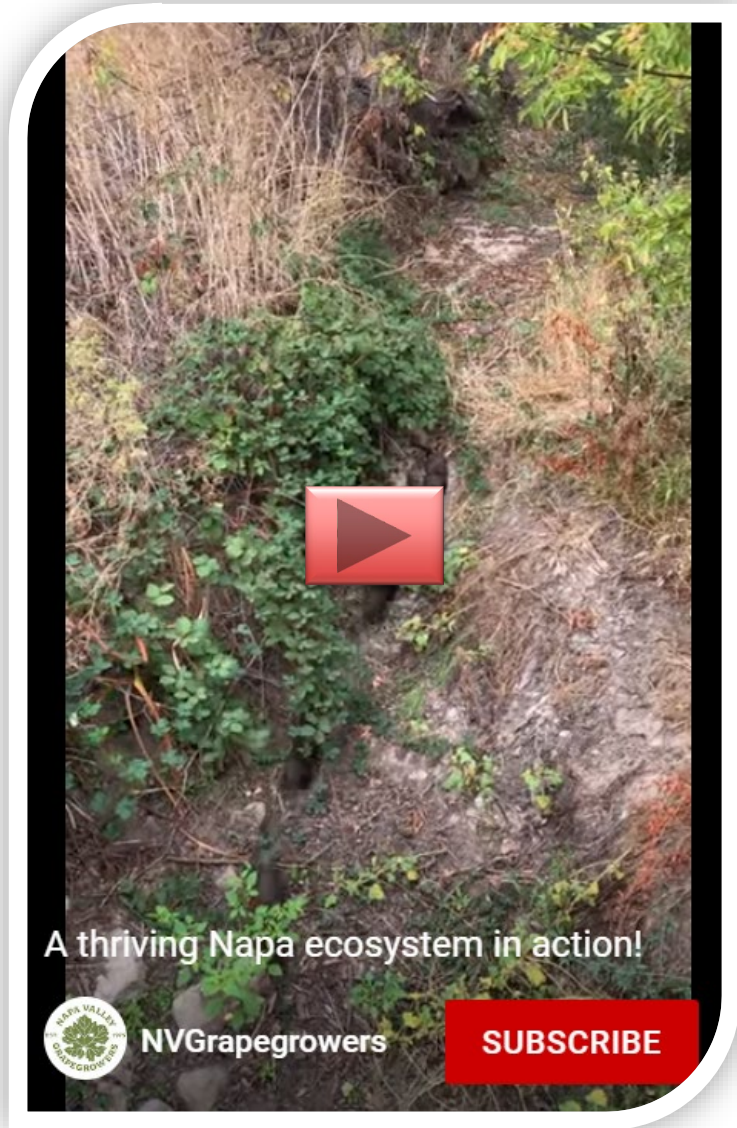
- Napa County growers want to be part of the solution when it comes to protecting communitywide water resources; growers in Napa County are deeply committed to water conservation and have been employing best practices since the beginning of this long-term drought
- There are an array of tactics currently being employed in Napa County vineyards, and in most cases several tactics are being employed; it's not a "one size fits all" approach due to different sites, soil types, vineyard designs, and farming practices
- Many growers use more than one source of water allowing for seasonal flexibility and leveraging water supplies when they are at highest levels
- As a community, we can proactively meet the goals of the GSP. We've hit a trigger when it comes to sustainable yields, which gives an opportunity to respond to achieve over all 10% reductions across the industry; 2023 survey results indicate positive trends that we will continue to track in 2024
- Education is desired and key in achieving the results the County would like to see; since the survey, NVG hosted a comprehensive Water Forum for growers and has increased tools and resources related to water conservation
- NVG added survey questions to get more into the nuance of some of these tactics; NVG has identified willing vineyard sites when it comes to a pilot data collection program that would inform the County's GSP work plan





The Otters of Bale Slough!

An example of the volunteer efforts being taken on by growers is the restoration of Bale Slough. Saving water isn't just about using less, but also supporting the natural systems that help our aquifers recharge.





Patterns of Land Use & Future Development

Through Analysis of Napa County Crop Reports and ECPAs, we know:

- Vineyard acreage is increasing at an annual rate of less than a half percent over the last 5 years – a .4% annual increase as of 2022
- In 2020 and 2021 Napa County saw a slight decrease in over all vineyard acreage
- Pending ECPAs represent a .009% increase over current vineyard acreage

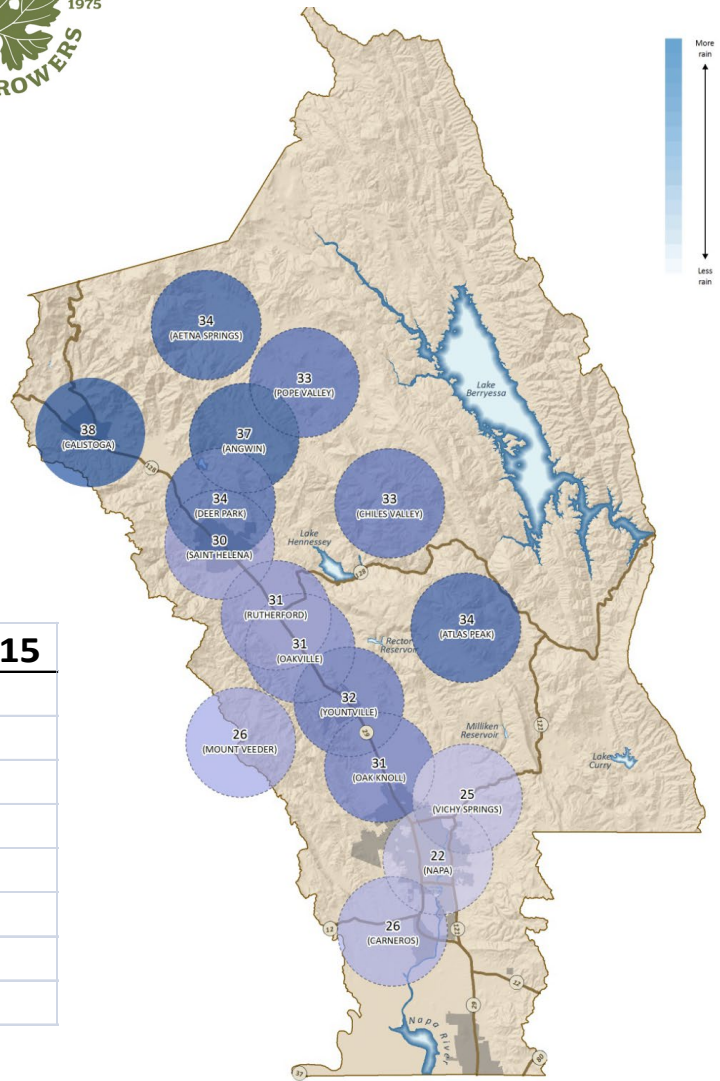
What does this mean in the context of the GSP?

- We are seeing very slow growth when it comes to anticipated vineyard development
- In the subbasin being monitored by the GSP, acreage has remained virtually the same or even, in some years, decreased over the last five years
- It is possible that in areas of decreased acreage water uses are being traded for other uses, whether commercial, landscaping, or housing related



What are Other “Dry” Viticultural Areas?

	Average Rainfall Amounts
• California	
• Paso Robles	14”
• Fresno	11”
• Coachella Valley	3.2”
• Australia (not as dry as you’d think)	
• Barossa Valley	21”
• McLaren Vale	20”
• Washington	
• Walla Walla	20”
• Prosser	8.9”
• Western Idaho	10”
• West Texas & New Mexico	8”
• Argentina	
• Almost every area	4-8”
• Napa River Sub-Basin	22-36”



Area	Rainfall (inches) 7/1/14 - 5/28/15
Atlas Peak	33
St. Helena	32.5
Angwin	34
Calistoga	33
Rutherford	29.3
Coombsville	28.8
Oak Knoll	29
Carneros	22.6



Rainfall Total versus Rainfall Timing

- Timing is everything
 - After reaching field capacity, the plant only cares about timing of rainfall
 - Most soils in the sub basin “hold” no more than 8-10 inches of water available to grapes
 - Rainfall in April/May has a much larger outcome on the type of season than cumulative rainfall
- The last day of “field capacity” is what concerns growers in a low rainfall year
 - Nutrient status is affected in a dry spring
 - Canopy growth is affected in a dry spring
 - Supplemental irrigation can often be initiated earlier in a dry spring, but not always



Supplemental Irrigation Application and Efficiency

- Conventional tools
 - Neutron Probes
 - ET Deficit Irrigation Model
 - A Shovel
 - Our own Eyes
- Pressure Chamber
 - Pre-Dawn LWP
 - Mid-day Leaf Water Potentials
 - Stem Water Potentials
 - Porometer
- Real Time (constant) vineyard sensors
 - Weather stations
 - Soil Moisture probes
 - Sap Flow Sensors
 - Actual ET sensors (Tule Technologies)
 - Phytogram
 - Dendrometer
 - AI technology to replace Pressure the Pressure Chamber



Plant Adaptation

Grapevines are extremely drought tolerant but need to balance commercial viability with resource conservation.





Rootstocks

- Wide variety of rootstocks, many drought tolerant options
- Replanting today is focusing primarily on drought tolerance and water stress tolerance
- We have a wide variety of options for different soil types

Table 4. Rootstocks with Some Degree of Tolerance to Soil Limitations

Water Stress	Wet Soils	Saline Soils	Sodium & Chloride	Acid Soils	Alkaline Soils
99R	R. Gloire	140R	140R	99R	5BB
110R	SO4	101-14	Schwarzmann	140R	420A
140R	Schwarzmann	Schwarzmann	1616C		140R
1103P	1616C	1616C	Ramsey		
SO4	Harmony	Harmony			
5BB		Ramsey			
125AA		Dogridge			
Freedom					
St. George					
Ramsey					
Dogridge					
1616C					



Row Orientation

- Can have a dramatic impact on baseline and supplemental water use
- 30-40% reduction by shading the canopy and fruit at peak radiation intensity 1:00-4:00pm mid-summer
- Most vineyards being replanted to better row orientations than 30 years ago



Canopies

New, fleshy leaves using water-inefficiently

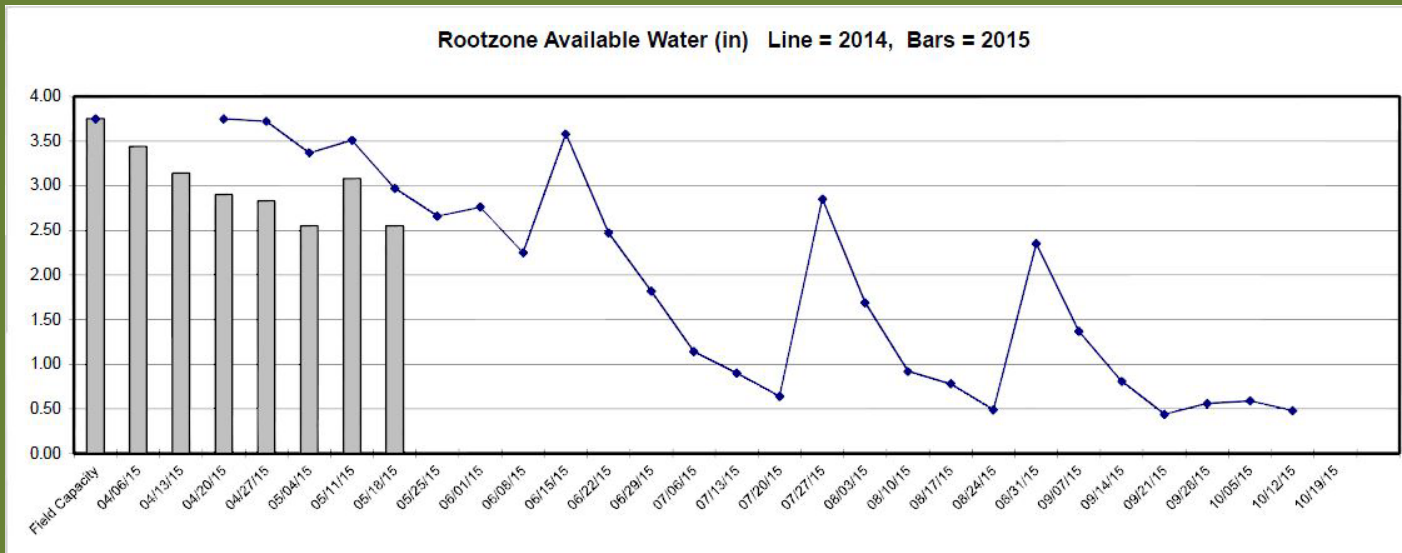


Water-conserving canopy





Soil Moisture View of Drip Irrigation: Drip Irrigation Delays Soil Drying Trend





Proposed Data Collection to Improve Water Use Model

- Choose 5 representative volunteer sites throughout the basin
 - Collect water usage data on well water, surface water, recycled water
 - Collect method of use i.e. drip, overhead, microsprinklers, misters, etc...
 - Classify main soil types, water holding capacity, depth, clay content, depth to hardpan, etc...
 - Aggregate historical usage, integrate ET modeling through weather station and crop coefficients
 - Document cover crop usage and estimated increase in water usage
 - Interview property manager about water use strategy and changes over time
 - Test captured data against assumptions in the model and revise data collection as needed to improve water usage estimates
- Query membership on water use trends, decision making around water use over time



Example Site: Yountville South

- Cole Silt Loam
 - A horizon 0-24" Silt Loam
 - C1 horizon 24-45" Silt Loam
 - C2 horizon 45-60" Silt Loam
 - Restrictive layer at 80+", no rust mottling
 - Effective rooting depth 80"
 - Fairly well drained
 - Hydrologic soil group B
 - Medium susceptibility to compaction
 - Plant available water: 0-150 cm (effective rooting depth): 30 cm (11.8")





Example Site: Yountville South

- Vineyard Details
 - 039-16 Rootstock (medium drought tolerance)
 - Cabernet Sauvignon: 9 tons/acre
 - Average Length of season budbreak-harvest: 180 days
 - Row orientation: 55 degrees east of north (moderate/low water use orientation)
 - Seasonal Kc factor = .9 (VSPquad with crossarms)
 - Average supplemental drip irrigation= .21 acre ft/acre/year
 - frost sprinklers used & heat mitigation (micro-sprinklers)
 - Onsite rainfall average = 32”
 - Well water use, Surface Water use, Drainage recapture and storage
 - 50% disked, 50% Fescue permanent cover crop





Example Site: Yountville South

- Comparison by blocks
 - Highest water use blocks 2023
 - .41 acre ft/acre
 - Lowest water use blocks 2023
 - .06 acre ft/acre
 - Lowest use blocks had one primary irrigation, 5 double poly irrigations, no heat suppression, no overhead sprinklers
 - Cover crop was reduced to 1/4 of rows to reduce TCAH habitat in the vineyard and 3/4 rows tilled
 - 1/4 rows that remained were mowed extremely tight, reducing water use.
 - Supplemental water was used from 8/7 through 10/24
 - Groundwater use was significantly reduced
 - Surface water use was significantly reduced





Q&A and Additional Resources

Napa Valley Grapegrowers Community Resources:

- [Water & Irrigation](#)
- [Heat & Drought](#)
- [NVG Groundwater Sustainability Plan Page](#)
- [Climate Resilience](#)
- [2023 NVG Water Conservation Seminar](#)
- [Water Reclamation in the Napa Valley – NVG Viticultural Best Practices Video Series](#)
- [Napa County's Conservation Landscape](#)

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