Vineyard Water Management

CHAPTER 5
BACKGROUND

WINEGRAPEs use less water than most crops. However, because of increasing statewide demand for a constrained water supply, it is imperative that all users maximize their effective and efficient use of this crucial natural resource. Winegrowers should continue to lead the state’s agriculture sector by implementing high levels of beneficial practices for conserving and ensuring the quality of California’s water.

Where soils are deep enough, some winegrowers practice dry farming, the ultimate in irrigation water conservation. However, not all vineyards can be dry farmed and reliably produce a crop of desired size and quality. Thus, most growers use some form of irrigation in their vineyards.

Drip irrigation has revolutionized viticulture throughout most of the state. With drip irrigation, water is applied directly to each vine in quantities needed to support that vine’s growth. Unfortunately, drip irrigation systems are not always managed for optimal efficiency and problems, such as clogged emitters, rob growers of the full benefits of the system. Growers must commit to routinely monitoring flows, inspecting lines, and recording water use to ensure efficient delivery of intended quantities and to track and potentially further reduce water use over time. The great benefit of drip irrigation is the control it gives growers in deciding exactly how much water to apply and when. This flexibility, however, brings with it the responsibility to schedule irrigations properly. Numerous plant- and soil-based methods exist for determining the need for and scheduling irrigation.

The context of water conservation and use efficiency is reflected in the water management strategy that growers develop and implement. The target is to provide the minimal amount of necessary water to achieve yield and quality goals. Excess irrigation can lead to runoff and excessive vine growth, resulting in more canopy management and often lower quality grapes and wines. Many growers use deficit irrigation approaches, i.e. intentionally causing moderate vine water stress during specific growth stages, as a means to improve fruit quality. In terms of conservation and protection of natural resources and saving money, deficit irrigation reduces water use and the energy to pump it.

CHAPTER 5. VINEYARD WATER MANAGEMENT BENCHMARK DATA

**5-1. WATER MANAGEMENT STRATEGY**
Development and implementation of a water management strategy is key to making effective and efficient vineyard water use decisions. 92% of the growers have defined comprehensive water management strategies and grape-growing goals, with 58% having in place the tools to accomplish those goals and 33% having implemented the strategy for over one year. 7% of the growers have not developed a water management strategy for their vineyards. Less than 1% of the growers replied N/A, not applicable or information not available.

**5-2. MONITORING & AMENDING WATER QUALITY**
Knowledge of water quality can help growers prevent problems with irrigation systems. For example, some areas have high levels of iron, which can plug emitters. 40% of the growers are testing their water quality at least annually, with 21% conducting even more comprehensive testing. 41% test occasionally, and 11% have never tested the quality of their irrigation water. 8% replied N/A, not applicable or information not available.

**5-3. OFFSITE WATER MOVEMENT**
Preventing water runoff not only conserves water for the vineyard, but eliminates off-site contamination of waterways from chemicals and siltation. 97% of the growers create no runoff from their irrigation practices. 81% have incorporated additional practices such as cover crops to minimize or eliminate runoff, with 46% adding drainage systems and maintaining soil permeability as well. The remaining 16% do have runoff from high rainfall events. 1% have irrigation runoff, and 2% replied N/A, not applicable or information not available.

**5-4. IRRIGATION SYSTEM**
At the heart of vineyard water management is the irrigation system itself. 78% of the growers have an engineered micro-irrigation system installed in their vineyard, with another 7% having an engineered sprinkler irrigation system. 7% have a high volume irrigation system, and 6% have a non-engineered system. 2% replied N/A, not applicable or information not available.
5-5. MONITORING IRRIGATION SYSTEM

Having an irrigation system to conserve water is only effective if the system is in good working order. That requires checking and monitoring the system to make sure it is not leaking and the emitters are not clogged. 49% of the growers are monitoring the irrigation system annually, with 22% checking the emitters and the pressure differences across the block, and 27% only focusing on the emitters. 33% of the growers are only checking the emitters occasionally, while 14% never check their irrigation system. 4% replied N/A, not applicable or information not available.

5-6. FILTERS & LINES

Water filters in the irrigation system are important components for the systems to operate effectively. 67% of the growers inspect the filters and flush the lines 2-4 times yearly. 35% also operate automatic flushing systems for the filters and include the irrigation systems as part of a regular maintenance program. 24% flush lines each spring and check filters when they notice a pressure difference, and 5% did not inspect filters or flush lines. 4% replied N/A, not applicable or information not available.

5-7. FLOW METERS

Knowing the amount of water used can aid the grower in producing higher quality fruit. It is also part of the energy equation since each gallon of water requires energy to move it out of the well and through the lines. 56% of the growers have flow meters on their wells or pumps, with 34% also monitoring the irrigation flow and checking the flow meters as part of a regular maintenance schedule every 2 years, and another 18% of these growers also recording the volume of each irrigation. 36% do not have flow meters, and nearly 8% replied N/A, not applicable or information not available.

5-8. SOIL WATER-HOLDING CAPACITY

Knowing the water holding capacity of the vineyard soil is important to understanding the water balance for the vineyard. Just over 12% of growers have quantified the soil water-holding capacity and have used the information to develop a water budget for the vineyard. Another 42% have knowledge of their soil and use this in their irrigation scheduling and overall water management. 32% are guessing at the capacity, and 13% don’t know. Less than 1% replied N/A, not applicable or information not available.

5-9. SOIL MOISTURE & PLANT WATER STATUS

MONITORING METHODS

Soil and plants must also be checked to ensure that the correct amount of water is available in the soil to provide the vine what it needs to produce fruit before scheduling irrigation. 22% of growers use soil and plant based tools to measure water availability in addition to visual methods, while another 33% use soil based tools and visually monitor shoot tips and tendrils to monitor water status. 32% use a shovel or bucket auger to judge water availability in the soil, while 12% do not measure soil moisture for determining irrigation scheduling. Less than 1% replied N/A, not applicable or information not available.

5-10. EVAPOTRANSPIRATION

Having water in the soil is only part of the equation of developing an effective water budget and applying the correct amount of water to the vineyard. Another key part of the equation is evapotranspiration (ET), or how much water the vines are using. 51% of growers use a California Irrigation Management Information Service (CIMIS) station to determine irrigation requirements. 18% of these growers also use CIMIS to verify their in-field weather station, and another 14% use CIMIS to verify a weather station near the vineyard. 45% do not monitor ET, and 4% replied N/A, not applicable or information not available.

5-11. WATER BUDGET

Creating a water budget allows the grower to get the “whole picture” of the water needs of the vineyard before scheduling irrigation. About 16% know the amount of water used by the vineyard between each irrigation by determining the ET, soil moisture availability and plant moisture status. Another 28% base the amount applied on soil moisture availability and plant moisture status. 49% use vine appearance and general weather conditions. 5% go by the calendar, and 2% replied N/A, not applicable or information not available.

5-12. PLANNED DEFICIT IRRIGATION THROUGH RDI OR PARTIAL ROOT ZONE DRYING

Information collection becomes more critical for growers practicing planned deficit irrigation. This requires that the grower monitor and restrict water availability to stress the vine between bloom and veraison. 23% of growers use a predetermined level of regulated deficit irrigation (RDI), partial root zone drying (PRD), or dry farming. 26% are experimenting with RDI or PRD, while 38% apply stress by backing off on the irrigation. 9% use plenty of irrigation so no stress occurs, and nearly 4% replied N/A, not applicable or information not available.
5-13. FERTIGATION

Understanding the irrigation demands and flows allows growers to deliver fertilizers and amendments to the vines through the irrigation system. This process is known as fertigation. 84% of the growers practice fertigation. 59% of these growers also calculate the timing and frequency of applications to prevent leaching of fertilizer below root zone and have back-flow prevention devices in place between the well and the injection pump. Another 20% have back-flow devices but base their applications on convenience and don’t know if fertilizer is leaching below the root zone. The remaining 5% of these growers practice fertigation without checking soil or vine nutrient status. 8% apply fertilizers without the irrigation system, and nearly 8% replied N/A, not applicable or information not available.

Best Practices

With the entire state of California in a drought cycle of undefined duration, it is critical for winegrape growers to understand the amount of water used in their vineyards and when that water is needed. David Gates Jr., Vice President of Vineyard Operations at Ridge Vineyards, employs several methods each season to track vineyard water use.

“Water is always precious,” David said, explaining that, while traditional methods – such as soil tensiometers, pressure bombs and neutron probes – are some of the best tools available, they only provide part of the picture and do not accurately reflect how a vine is doing. “The scatter plot for neutron probe information can be very wide, and what does that really tell you about the vine?”

Therefore, Ridge Vineyards recently invested in new technology to monitor the sap flow of the entire plant. This cutting-edge technology, known as a sap flow meter, is used to track the sap flow in four vines in the same row of the vineyard. The sap flow reveals what the vine is actually taking up, combining all of the complex variables like vine size, root depth, soil moisture and atmospheric dynamics in one reading. It also shows when the sap flow falls below a critical value and the vines are shutting down. Even with high tech assistance, the basics still come into play. For instance, David’s water management strategy combines his experience in the vineyards and extensive soil knowledge with numerous backhoe pits and monitoring of the development of the vines early in the season. At the heart of his strategy is the careful maintenance of the drip irrigation system. “The drip irrigation system is a great tool,” David points out, “but if it is inefficient you can shoot yourself in the foot.” David invests time each season to not only clean out and flush lines, but also to test emitters for performance. “Just because an emitter is dripping doesn’t mean the correct amount is being delivered.” Last season such a test revealed one line was performing at only 60% capacity.

Water is also increasingly important to neighbors and community. “We’re now seeing a reprioritization of water in the minds of all Californians.”

Comparative Results & Next Steps

THE FOLLOWING shows average scores from the 2004 Sustainability Report and the change in those scores since 2004. A total of 12 of 13 criteria increased with a maximum increase of 21% for criterion 5-7 Flow Meters. Despite this result of generally improved performance, winegrowers should continue to assess their operations and implement site-specific plans to continuously improve the sustainability of practices for vineyard water management.

To drive additional improvements in vineyard water management, CSWA needs partners. If you are interested in improving irrigation and vineyard water management practices, please email info@sustainablewinegrowing.org.

![Comparative Results Graph](image-url)
“The Code of Sustainable Winegrowing Practices demonstrates leadership in the wine community. It shows how agriculture continues to progress. Benchmarking continuous improvement in farming practices, using limited natural resources wisely, strengthening the community and keeping family businesses viable is key to the wine community’s success. Working with the Sustainable Winegrowing Program improves quality and helps focus on the success of future generations.”

— Stacie Jacob  Executive Director, Paso Robles Wine Country Alliance