Irrigation in Action

How Soil, Volume, and Intervals Drive Grapevine Performance

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A practical field session was held on the 3rd of December 2025 at Skilpadvlei Farm, hosted by ADVICO in collaboration with Netafim and South Africa Wine RDI. The session built on the August workshop, which covered core irrigation principles and their practical implementation in vineyard systems. While the programme was primarily designed for younger vineyard managers and producers, several more experienced industry professionals also attended to revisit and refine their understanding. The session was led by Francois Viljoen (Vinpro) and Charl van Reenen (Netafim).

Vineyard managers are routinely required to juggle multiple operational priorities, which can result in irrigation being scheduled according to fixed time intervals rather than informed by the actual effectiveness of the applied irrigation volumes. Francois Viljoen observed that poor scheduling often results from irrigation system design limitations, which restrict the ability to apply larger volumes at longer intervals. Consequently, many producers depend on short, frequent cycles rather than deeper, more effective irrigations, even though deep wetting is a key principle for producing high-quality grapes.

This field session aimed to provide producers and managers with the opportunity to observe, under practical conditions, how different irrigation strategies influence soil and grapevine response. This laid the foundation for excellent discussions on irrigation scheduling across different seasonal and growth-stage scenarios.

Irrigation Intervals and Soil Wetting

Before the session, 4-hour (4.44 mm/h/ha), 6-hour (6.66 mm/h/ha), 12-hour (13.32 mm/h/ha) and 18-hour (19.98 mm/h/ha) irrigations were applied in a Merlot block using a 1.6 L/h drip delivery system.

Profile pits opened the following morning showed clear differences in wetting patterns. In the deep loamy soil, the 12- and 18-hour applications achieved deeper penetration and effective root-zone refill without runoff or deep losses, while the 4- and 6-hour sets resulted in shallow, incomplete wetting.

These results highlight that irrigation schedules must be aligned with soil properties and profile depth. Soil texture, effective rooting depth, and stone content determine both the water-holding capacity and the appropriate irrigation frequency. Stony soils have reduced storage because coarse fragments displace fine soil, requiring shorter, more frequent applications.

Sandy or gravelly soils also drain rapidly and are best managed with smaller, more frequent pulses. In contrast, deeper, heavier soils can store more water and are better suited to larger, less frequent irrigations that promote deeper wetting.

Wetting depth plays a central role in vine performance. Deeper wetting encourages deeper root development and improves buffering against heat and dry periods, while allowing partial drying between irrigations helps control vigour and supports wine quality. Effective scheduling, therefore, aims to balance deep wetting with controlled drying cycles, matched to the specific soil profile.

Maximising Irrigation Effectiveness

Effective irrigation management requires a multipronged approach, as no single measurement provides a complete picture. Integrating soil, plant, weather, and system monitoring data enables more accurate planning and scheduling, supports better irrigation timing and volumes, and ultimately improves water-use efficiency and vine performance**.**

Key tools and practices include:

• **Match irrigation to soil properties**: Adjust irrigation according to soil type, effective soil depth, and water-holding capacity. Profile pits and soil augers are valuable — yet often underutilised — tools for assessing soil conditions, rooting depth, and verifying whether irrigation is wetting the intended zone.

• **Climate data and forecasts:** Weather stations are valuable decision-support tools for planning irrigation, spraying, and other field operations. A key parameter is evapotranspiration (ET), which estimates crop water use by combining soil evaporation and grapevine transpiration. ET can be used as a practical guideline to estimate how much water has been used and how much may need to be replaced through irrigation.

• **Soil moisture monitoring**: Continuous logging probes and direct profile inspections help track how water is distributed and retained in the root zone, and whether irrigation is reaching deeper roots or moving beyond them.

• **Plant-based measurements** such as pressure chamber (pressure bomb) readings provide direct insight into grapevine water status and are useful for refining irrigation timing and volumes.
Locally-developed, cultivar-specific thresholds, such as those proposed for Merlot (Table 1) by Myburgh in the Handbook for Irrigation of Wine Grapes (Myburgh, 2018: 169), can be used as practical guidelines, but should be interpreted in context, as water potential responses vary with cultivar, rootstock, soil type, phenological stage, and local climate conditions.

• **Scouting and visual assessment:** Routine field inspections remain essential. Observing shoot tip activity, canopy colour, leaf orientation, and early signs of stress (such as leaves turning away from the sun) provides immediate, practical insight into grapevine condition and irrigation adequacy.

• **Irrigation system maintenance:** System performance can decline due to friction losses, dirty filters, or blocked drippers.

Regular inspection and maintenance ensure uniform and accurate water delivery across the vineyard. Francois Viljoen emphasised that combining these tools enables informed decisions that optimise water-use efficiency, maintain consistent soil moisture, and support grapevine health, even under water-limited conditions.

Table 1. Thresholds for water constraint classes for midday leaf water potential (Ψ_L) and stem water potential (Ψ_S) in Merlot.
Source: Myburgh (2011a), as cited in Handbook for Irrigation of Wine Grapes in South Africa (2018: 170)

Class	Water Constraint	Water Potential (MPa)	
		Ψ_L	Ψ_S
I	No	$\Psi_L \geq -1.1$	$\Psi_S \geq -0.5$
II	Low	$-1.1 > \Psi_L \geq -1.4$	$-0.5 > \Psi_S \geq -1.0$
III	Moderate	$-1.4 > \Psi_L \geq -1.6$	$-1.0 > \Psi_S \geq -1.4$
IV	Strong	$-1.6 > \Psi_L \geq -1.8$	$-1.4 > \Psi_S \geq -1.6$
V	Severe	$\Psi_L < -1.8$	$\Psi_S < -1.6$

Key Takeaways for Producers

- **Match irrigation to soil type and water-holding capacity:** Longer applications (12–18 hours) are more effective at wetting the root zone than short 4–6 hour applications, provided volumes remain within the soil's holding capacity.

- **Understand soil texture:** Sandy soils require more frequent irrigation than soils with a higher clay content, due to lower water retention.

- **Plan for water-limited conditions:** Monitor soil and plant water status to prevent severe stress during dry seasons.

- **Prioritise correct soil preparation utilising the most suitable implement:** Compacted layers restrict water infiltration and root development, reducing irrigation efficiency.

- **Maintain irrigation systems:** Regular checks and maintenance ensure uniform and effective water delivery.

- **Integrate multiple monitoring tools:** Combining weather forecasts, soil moisture probes, plant-based measurements, and system checks provides a complete picture for precise irrigation decisions.

- **Translate irrigation hours into applied volume:** Knowing the millimetres applied per hour allows accurate planning for each application. Post-irrigation soil inspection ensures wetting depth meets root-zone requirements.

By applying these principles, vineyard managers can optimise every millilitre of water applied, promote deeper root development, and sustain vineyard performance under challenging, water-limited conditions.

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