Managing irrigation during dry winters to sustain yield and wine styles

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Introduction
Grape production in premium Australian regions relies on water accumulated in the soil during winter to support canopy growth. Low winter rainfall means the vines face water stress in spring if supplementary irrigation is not applied. We investigated the effects of the timing and method of irrigation during dormancy on vine growth and wine composition in a Shiraz vineyard where late autumn and winter rainfall were excluded using shelters.

Materials and method
- Rainout winter shelters, deployed from May to August, at SARDI’s Nuriootpa Research Station, SA (Fig. 1).
- Five treatments were arranged in a complete randomized block design with four replications (Fig. 2).
- Vine development and growth were assessed during three seasons (2015-18).
- Composition of wine and descriptive sensory analysis were conducted after three months of bottle ageing²,³.

Results
- Dry soil at the end of winter delayed development; a 10% reduction in soil moisture corresponded to around 13 days delay in the time of budburst.
- Only the vines irrigated with micro-sprinklers yielded close to the Control vines (-6%), followed by dripper-irrigated vines (-15%) (Fig. 3).
- Reduced rainfall in winter had the largest impact, reducing yield (up to 42%) and decreasing canopy size (up to 31%) compared to Control.
- Irrigation at budburst (Spring-Irri) also decreased yield (-20%) but increased canopy size.
- Wines from the Spring-irrigated vines were lighter in phenolic concentration, and were associated with undesirable attributes such as vegetable aromas and spritz (2016) (Fig. 4), earthy and drain aromas (2017), and stalkly and drain aromas (2018).
- Reduced rainfall in winter increased wine phenolic composition and colour intensity at the expenses of a reduction in yield.

Conclusion
- Season-to-season variability in winter rainfall is associated to major changes in development, yield, and wine composition.
- Treatments which restored soil water content at budburst only partially offset the drop in yield.
- Refilling the soil profile at the end of winter increased vigour over yield and had a detrimental effect on fruit and wine composition.
- Scheduling irrigation against climate change will need to incorporate winter irrigation that ensure sufficient soil water availability early in the season.

Figure 1: Vines under rainout shelters during winter
Figure 2: Schematic representation of treatments. Values on the right correspond to water applied per treatment.
Figure 3: Differences in yield between control and irrigation treatments across seasons 2015-2018. Mean ± one standard deviation.
Figure 4: Principal component analysis of significant wine sensory attributes in vintage 2016.