Summary 163

Water economy by Italia grapevines under different irrigation treatments in a Mediterranean climate

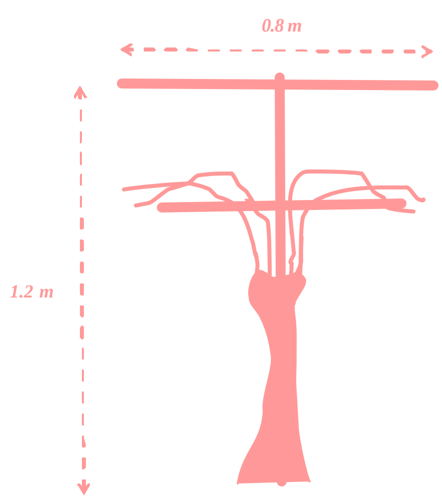
By: A. Ezzhaouani, C. Valancogne, P. Pieri, T. Amalak, and J. Gaudillère

In: International Journal of Vine and Wine Sciences. 41(3): 131-139. 2007

• Irrigation water in Morocco is becoming a limiting resource due to increasing grapevine acreage and more frequent drought events. So saving water without affecting yield and berry quality has become an important priority for table grape growers. To this purpose, two important irrigation techniques have emerged: *Deficit irrigation* (DI) and *Partial rootzone drying* (PRD). In DI, water is supplied to compensate for only a portion of the water transpired. In PRD, only half of the rootzone is watered at each event, allowing the other half to dry out, which triggers the vines to reduce transpiration (and decrease stomatal conductance).

• The main goal of this study was 1) to compare the efficiency of DI and PRD in a commercial table grape vineyard. Additionally, the authors wanted 2) to quantify the water needs for the main table grape –and trellis system- growing in a Mediterranean climate, and 3) to test the ability of a water balance model created by the authors to help in scheduling irrigations.

• The study was conducted in a coastal region close to Rabat, Morocco, using 8 yr-old *V. vinifera* cv. Italia/110R table grapes. The vines were head-trained and pruned to 4 canes. The trellis was a double T, with 4 canes tied to the lower arm. *[We don't have information about foliage wires].* The soil was sandy and acidic. Daily mean temperatures for the location were 15-20^{o}C (59-68 ^{o}F) before fruit set, and 20-25^{o}C (68-79^{o}F) after set. Annual rainfall was 53 mm (2 inches), with 2 major events occurring after bloom. Evapotranspiration was between 1 to 5 liters per m^2 per day (1.2 to 5.8 gallons per vine per day, at 10 x 5 ft spacing).



• The authors compared 4 treatments: traditional irrigation using 1 emitter per vine and applying either 4 or 8 liters (1 or 2 gallons) per hour (TI4 and TI8), and PRD irrigation using 2 lines of emitters per row –one on each vine side- and applying 4 or 8 liters per hour (PRD4 and PRD8). For all treatments, water was applied daily for half an hour (2 and 4 liters per vine per day) from Day of Year 90 (about budbreak) to 137; and increased to one hour daily (4 and 8 liters per vine per day) from Day of Year 137 to 210 (harvest). *[The authors don't tell us what % ET these water amounts represent].*

• **Effect of irrigation method on vine transpiration**. The authors determined transpiration by measuring sap flow using stem-inserted sensors. Daily transpiration for TI8 and PRD8 was higher compared to TI4 and PRD4, that is, as irrigation increased, vine transpiration also increased. For the same irrigation amount, traditional irrigation (TI) resulted in more transpiration than PRD. Some examples of maximum transpiration recorded were 1.1, 0.9, 0.7, and 0.5 liters per hour for TI8, PRD8, TI4, and PRD4, respectively. Both PRD4 and PRD8 showed a significant decrease in transpiration rates after Day of Year 150.

• **Effect of irrigation method on water potential**. Both the stem and leaf water potentials of TI4 and PRD4 were much lower than those of TI8 and PRD8, whereas the difference between traditional irrigation and PRD was much smaller. Based on midday stem water potential, the most intense stress was experienced by PRD4, followed by TI4, then PRD8, and finally TI8, which never experienced stress.

• **Effect of irrigation method on yield and grape quality**. Vines grown at TI8 showed a significant increase in yield (21% more). This increase was due to higher cluster weight, not to higher berry weight (that is, on average there were more berries per cluster). Brix was also higher in the TI8 treatment, despite the higher yield. Brix was not significantly affected in the rest of the treatments. Titratable acidity was not affected by irrigation treatment. Vegetative growth was also significantly higher in TI8, as shown by higher pruning weights.

• The authors also tested the ability of a mathematical model they had created – a *water balance model* - to predict vine water needs. This model calculated daily water needs based on a sophisticated list of inputs: total transpirable soil water (based, in turn, on soil texture and root depth); height, width and porosity of the foliage; row orientation with respect to the sun (called azimuth); latitude of the vineyard; and day of the year. The authors found that this model mimicked satisfactorily the actual transpiration rates of TI8 and TI4. However, it failed to describe the important decrease in transpiration rates experienced by PRD8 and PRD4 after Day of Year 150.

Here are the highlights of the author's discussion:

_ the difference in transpiration between TI and PRD (lower for PRD) could be explained by one of these hypotheses: 1) PRD could have induced a root signal that would trigger stomatal closure; or 2) PRD may have made water less available to the roots by lowering soil-root hydraulic conductivity;
_ the water *efficiency* (ratio of water supplied to water transpired) of PRD was lower than that of TI;
_ grape quality was not affected by PRD;
_ to these authors, PRD did not appear to be a promising technique, since irrigation water efficiency was lower, and the crop performance was not improved, when compared to traditional irrigation
_ the water balance model tested can be applied to traditional irrigation in Morocco to estimate the water needs of the vines, but it cannot be applied to PRD irrigation. This is because soil water availability in PRD is difficult to estimate, and there is no model explaining the possible role of a PRD-driven hormonal effect on stomatal conductance.

Author: Bibiana Guerra, Editor: Kay Bogart. This summary series funded by J. Lohr Vineyards & Wines.