



Thermal imaging as a viable tool for monitoring plant stress

By: Manfred Stoll and Hamlyn Jones

In: International Journal of Vine and Wine Sciences. 41(2):77-84. 2007

- The idea of using canopy temperature as an indicator of vine stress was initially suggested in 1982. But the recent development of portable thermal imagers has introduced the opportunity to measure the surfaces of interest, without interferences from non-transpiring surfaces, such as trunks, soil or air. Another study showed that temperature variation within a canopy is greatest for sunlit leaves, as compared to shaded leaves.
- The goal of this study was two-fold: 1) to evaluate the application of *infrared thermography* (“thermal pictures”) to measure canopy temperature using shaded leaves, rather than exposed leaves; and 2) to measure the effects of solar radiation on berry temperature.
- The study took place in 2001 at Pegões, Portugal, on the varieties Muscatel and Castelão. The authors implemented 2 irrigation treatments: no irrigation, and full irrigation (100% ET). Then, they took a series of thermal images, and measured stomatal conductance, of both *sun-exposed leaves* and *shaded leaves*, for both *irrigated* and *non-irrigated* vines, and analyzed the results.
- **Results.** 1) The temperature frequency distributions for sunlit and shaded leaves were quite different, with the sunlit leaves displaying a much wider range of temperature variation. The authors believe this is due to the fact that natural leaf orientation has little effect on the energy balance of a shaded leaf, but a large effect on exposed leaves. 2) The canopies of non-irrigated vines were significantly hotter than fully irrigated vines, as well as having greater differences between the sunlit and shaded canopy sides. 3) However, at the berry level, there was no significant difference in temperature between the irrigated and non-irrigated vines. When ambient temperature was 28°C (82°F), some individual berries in both irrigation treatments were up to 15°C hotter than air temperature, that is, up to 43°C (110°F).

In summary, the authors believe that the temperature differences found between the leaves in stressed and non-stressed vines are encouraging for the application of **thermal imaging as a useful tool to distinguish between different water stress treatments**. The images were able to give a reliable measurement of leaf temperature and, and so, they could be implemented for the early detection of the onset of plant water stress. In the authors’ opinion, thermal imaging could also help improve canopy management, by revealing those points in the canopy with the most heat stress. Even though more research is needed, this study is a step forward towards the development of a promising vineyard tool.

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