Infrared Thermal Images Of Grapevines: From Manual to Complete Automated Analysis.

C. Poblete-Echeverria[1*], S. Fuentes[2], R. De Bei[3], MP Diago[4] , S. Ortega-Farias[1] and J. Tardaguila[3]

[1] Universidad de Talca. Centro de Investigacion y Transferencia en Riego y Agroclimatologia. Avda. Lircay s/n Talca, Chile.
[2] The University of Melbourne, Melbourne School of Land and Environment. Building 142 Royal Parade University of Melbourne Parkville Victoria 3010 Australia.
[3] The University of Adelaide, School of Agriculture, Food and Wine, Plant Research Centre PMB 1 Glen Osmond, 5064, SA., Australia.
[4] Instituto de Ciencias de la Vid y del Vino (University of La Rioja, CSIC, Gobierno de La Rioja). C/ Madre de Dios, 51. 26006 Logroño. Spain.

[*]Corresponding author: cpoblete@citrautalca.cl

Abstract

Infrared thermal images (IRTI) have been used for grapevine research since the early 90's. However, despite its promising results in the assessment of canopy conductance and plant water status, from the beginning and recent research publications, it has not been fully applied on a commercial scale yet. It is believed that the bottleneck for this technology is the lack of reliable automation tools for IRTI analysis. Accurate and reliable automation tools will allow the use of this technique to assess spatial variability of canopy physiological processes using IR cameras mounted on moving vehicles, drones, octocopters or robots. Automated analysis systems are the requirement of The Vineyard of The Future initiative, which is an international effort to establish fully monitored vineyards in the most prominent viticultural and winemaking areas of the world. In this work, manual, semi-automated and automated IRTI analyses, performed using a code written in MATLAB® based on the computational water stress index analysis method proposed by Fuentes et al. (2012) were compared. Results obtained from this research (cv. Tempranillo) showed good and statistically significant correlations between the manual IRTI analysis methods (using T_{dry} and T_{wet} references) compared to the semi-automated statistical method (by analysing the temperature distribution histogram) and the completely automated method. The latter method consisted in estimating T_{dry} and T_{wet} using the leaf energy balance approach with micrometeorological data obtained in parallel with the IRTI. This work constitutes an additional step forward in the implementation of thermal imaging as an automated routine technique for physiological vineyard assessment from proximal sensing and unmanned aerial vehicles (UAV) platforms.