Using Infrared Thermal Images To Detect Smoke Contamination For Different Grapevine Cultivars

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Abstract

Bush fires are an important problem for the viticultural industry in Australia and have caused substantial economic losses in recent years. The exposure of grapevines to smoke from nearby fires can negatively affect berry quality and produce wine affected by smoke taint. Recently, much research has been conducted to understand the chemistry of smoke taint in wine however the effect of smoke contamination on grapevine physiology is yet poorly understood. A smoke trial was established in the Coombe vineyard of The University of Adelaide (Waite campus) in the 2010-11 season. In this trial, vines were smoked under a tent for one hour and physiological processes measured immediately after smoking and in time up to 14 days. The cultivars studied were: Shiraz, Merlot, Chardonnay and Sauvignon Blanc. Leaf conductance (g_L) and infrared thermography index (I_g, proportional to g_L) were used as physiological indicator of smoked and control vines status. Infrared thermography images (IRTI) were automatically analysed using a code written in MATLAB®, allowing the spatial study of g_L response within canopies. Results showed a differential cultivar response one hour after smoke application.. Measurements conducted seven days after smoke exposure showed that all cultivars returned back to control situations. Chardonnay and Merlot were the most affected cultivar by smoke exposure. IRTI were analysed by division into three horizontal layers (top, middle and low) and results showed that Merlot canopy was not affected differentially in the three areas while Chardonnay was more affected at the lower section of canopy, with both cultivars reducing considerably g_L compared to control vines. Sauvignon Blanc and Shiraz did not show an effect of smoke exposure on the physiology measured. The expected high correlations between the infrared index (I_g) and g_L were found for the control vines while they were highly variable in the smoke treated vine for all cultivars studied, specially the lower part of canopies. These results were compared to stomata density for the four cultivars and results showed that Chardonnay, the cultivar that was most affected by smoke exposure, presented higher number per leaf and bigger stomata compared to the other cultivars studied. This study demonstrates that IRTI could be a potential sensitive tool to assess the level of smoke contamination for different grapevine cultivars.