Water Stress and Chlorosis Detection in Crop Canopies with AHS Thermal Imagery and CASI and ROSIS Hyperspectral Sensors: Implications on Yield

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POSTER ABSTRACT

Methods for water stress and chlorosis detection in crops are presented using the *Airborne Hyperspectral Scanner* (AHS), *Compact Airborne Spectrographic Imager* (CASI) and the *Reflective Optics System Imaging Spectrometer* (ROSIS) airborne sensors. The AHS sensor was used to acquire images of 2-m spatial resolution in the visible, near infrared and thermal spectral regions over an olive orchard in southern Spain to study the spatial variability of water stress and the potential for detecting water deficit conditions at the tree level. ROSIS and CASI sensors were flown at 1 m spatial resolution over 24 vineyard fields with a gradient of nutrient deficiencies, comprising 103 study areas of 10x10 m in size. The AHS sensor was equipped with 20 channels of 20 nm bandwidth for visible and near infrared, 1 channel of 200 nm bandwidth and 42 channels of 13 nm bandwidth for mid infrared, 7 channels of 300 nm bandwidth for short-wave infrared and 10 channels of 400 nm for long-wave infrared. AHS aircraft flights at 7:30, 9:30 and 12:00 GTM in July 2004 were scheduled to study the spatial and temporal variation of the orchard tree temperature as a function of the diurnal variation of water stress. Water and bare soil temperatures were measured simultaneously with airborne sensor flights to calibrate the thermal AHS imagery, acquiring atmospheric optical thickness at the time of image collection. Imagery was processed applying geometric, radiometric and atmospheric correction, obtaining surface temperature with Split-Window algorithms from 17 AHS thermal infrared channels. Water potential, photosynthesis, and stomatal conductance were measured in the field under 3 different water stress treatments weekly from July until November 2004 to track the effects of water stress on the tree status and functioning. Yield data on each olive tree and vineyard 10x10 m study site were measured, including indicators of yield quality. Results obtained between different indicators of yield and quality with i) crown temperature as function of water deficit in olive trees, and ii) chlorosis detection in vineyards as function of nutrient deficiencies will be presented. This methodology shows potential for mapping the spatial variability of water stress and nutrient deficiencies in precision agriculture, enabling the connection with yield reduction as function of stress detection.