Remote Sensing in Peach Orchards: Monitoring from Unmanned Aerial Vehicles (UAVs)

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ABSTRACT:

High quality production of horticultural crops, such as fruit trees and vines, require continuous monitoring to optimize their water status, mineral nutrition and plant health. Most of the available methods to monitor these parameters are based on visual inspection or point measurements that rarely allow showing the spatial variability of the whole orchard caused by differences in soil, canopy architecture or irrigation non-uniformities. Moreover, these point measurements are used to manage the entire farm which could lead to potential problems in orchards with high spatial variability. Remote sensing linked to precision farming was considered as the future of crop management and would solve this problem. However after many years, its use is still very limited and there are almost no application on woody crops.

Two novel remote sensing platforms for agriculture have been developed to solve the lack of spatial and spectral resolution of currently available satellite platforms, including the high cost and operational complexity of airborne sensors, yet providing short turnaround time required for crop monitoring and management. These platforms, based on Unmanned Aerial Vehicles (UAVs) are equipped with a narrowband multispectral camera and a thermal imager. Vegetation indexes calculated from the multispectral images coupled to radiative transfer models enable the estimation of biophysical parameters such as chlorophyll content, leaf area index (LAI), radiation interception, plant photochemical status, among others. Thermal imagery can be used to monitor crop water stress and to estimate evapotranspiration which could be a very valuable tool for irrigation management, but at the same time can be used to detect problems in the irrigation systems such as water leaks or blocked emitters.

The use of these platforms in a commercial peach farm in Southern Spain during 2007 and 2008 is presented here. The results achieved suggest that techniques shown here could be used in peach to map canopy conductance, water stress, chlorosis and radiation interception using both thermal and multispectral imagery.