4.5 Assessment of Various Spectroscopic Techniques for Detection of HLB

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Although real-time Polymerase Chain Reaction (PCR) is an accepted method of determining an HLB infection in citrus, this technique can be time consuming and expensive. In this study, several spectral techniques were tested for their ability to rapidly screen leaf samples for HLB. In the first trial, 179 HLB positive and negative leaf samples were collected from greenhouse- and farm-grown orange and grapefruit trees. In the second trial, 238 leaves were collected from greenhouse-grown grapefruit trees which had one of several diseases (HLB, canker, CTV, CLRV, or CPsV), one of several nutrient deficiencies (copper, iron, magnesium, manganese, zinc, or “water only”), and control samples. In both trials, the samples were individually analyzed with hyperspectral imaging (HSI, 400-1000 nm), fourier transform infrared-attenuated total reflection spectroscopy (FTIR-ATR, 700-1765 cm⁻¹), near-infrared reflectance spectroscopy (NIRS, 450-2500 nm), and real-time PCR. The data from HSI was not promising, with multiple false positive and negative results in both trials. FTIR-ATR did well in trial 1 with an error rate under 5%, but had markedly higher false positive issues in trial 2. NIRS also did well in trial 1, but in trial 2 as with the FTIR-ATR analysis, the predictor models suffered from false positives. After combining the datasets and removing the visible portion of the spectrum (450-700 nm), the accuracy of the NIRS improved and was in agreement with the data from the first trial. Overall, there is a good possibility of using a spectral analysis of leaf tissue as an alternative, rapid, and inexpensive assay for HLB infection.