Quantifying the effects of fruit position in the canopy on physical and biochemical properties and predicting susceptibility to rind breakdown disorder of 'Nules Clementine' mandarin (*Citrus reticulate* Blanco) using VIS/NIR spectroscopy

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Abstract

The development of rind breakdown disorder (RBD) of 'Nules Clementine' mandarins (*Citrus reticulate* Blanco) limits postharvest storage capability and causes commercial losses. In this study, the use of diffuse reflectance Vis/NIR spectroscopy in the wavelength range of 350-2500 nm was explored as a non-destructive tool to predict susceptibility to RBD by detecting rind physico-chemical properties of individual intact fruit from different canopy positions. NIR spectra were obtained using a LabSpec® Vis/NIR spectrometer. Reference physico-chemical data of the fruit were obtained after 8 weeks of storage at 8°C using conventional methods and included colour index, fruit mass loss, RBD index, rind dry matter content, rind sugars (sucrose, glucose, fructose, total sugars). Partial least squares (PLS) regression was applied to spectral data to develop prediction models for each quality attribute using cross validation for each canopy position (n=40) and for all fruit combined (n=80). Fruit position within the canopy had significant effect on rind biochemical properties. Outside fruit had higher rind sugar and lower RBD index than inside fruit. NIR calibration and cross validation results demonstrated that sugars, dry matter, colour index and water loss were predicted with significant accuracy. The prediction performance of models developed using combined fruit were better than those developed using fruit from inside and outside separately. Calibration models developed using fruit from the outside position of the tree canopy were better than for those developed using inside fruit. The good correlation between spectral information and sugar content demonstrated the potential of Vis/NIR as a non-destructive tool to predict fruit susceptibility to RBD.