Non-destructive prediction and detection of internal physiological disorders in 'Keitt' mango using a hand-held Vis-NIR spectrometer

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Abstract

Mango (*Mangifera indica* L.) is a major tropical fruit that can develop internal physiological disorders at late ripening stages. These include jelly seed characterized by a transparent and jelly tissue around the seed that eventually becomes a brown ring enclosing the seed, and black flesh characterized by a diffuse brown discoloration that covers the seed. Both disorders can result in high postharvest losses due to the fact that little information is available about mechanisms involved and efficient control approaches. The objective of this study was to establish the feasibility of using a visible and near-infrared (Vis-NIR) portable spectrometer for predicting at harvest and detecting mangoes with internal disorders, such as jelly seed and black flesh after storage. A total of 141 'Keitt' mangoes from two commercial harvests were measured spectrally between 400–1100 nm on two opposite cheeks, at harvest and after 30 d at 12 °C. Spectra data and the incidence of jelly seed and black flesh after storage were used to develop classification models using logistic, linear discriminative analyses (LDA), supporting vector machine, functional data and random forest modeling approaches. The results show that wavelengths between 550 and 650 nm can be used to predict at harvest and detect after storage, fruit with internal physiological disorders, such as jelly seed and black flesh. However, it was not possible to differentiate internal disorders from each other. The spectral data show that healthy fruit have higher reflectance intensity than jelly seed and black flesh ones, both at harvest and after storage. The best classification models were obtained with Logistic and LDA model development approaches. In the validation process for internal disorder prediction at harvest, the Logistic model showed accuracy of 65 %, sensitivity of 78 % and specificity of 49 %, whereas the LDA model showed accuracy of 63 %, sensitivity of 76 % and specificity of 46 %. In the validation process for detecting internal disorders after storage, the Logistic model showed accuracy of 71

%, sensitivity of 75 % and specificity of 67 %, whereas the LDA model showed accuracy of 76 %, sensitivity of 78 % and specificity of 73 %. In conclusion, Vis-NIR technology associated with Logistic and LDA modeling approaches can be used to predict at harvest and detect after storage the incidence of jelly seed and black flesh in mangoes.