

NIR spectral models for early detection of bitter pit in asymptomatic 'Fuji' apples

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Abstract

Bitter pit (BP) is a physiological disorder that develops in apples, mainly during storage. This study sought to develop NIR spectral models for prediction of future BP incidence and severity in 'Fuji' apples using spectral data collected at harvest and during storage. Partial Least Square classification models obtained from spectra reflectance between 950 and 1200 nm were compared, starting at harvest, at 10 days postharvest and every 20 days thereafter over 110 days at 0 °C in relation to BP severity (number of pits per fruit) after 150 days at 0 °C. The models used data from a total of 3000 fruit, collected over two seasons (2018 and 2019) from two orchards. All models were evaluated for Accuracy, Sensitivity, Specificity, Positive Predicted Value (PPV) and Negative Predicted Value (NPV). In the validation dataset, Accuracy, Specificity and NPV values varied between 60 and 80 % and were independent of the time of evaluation during storage. Sensitivity and PPV values did not exceed 60 % in the same dataset. Here, BP incidences in fruit with severities of <8 pits per fruit, achieved accuracies and NPVs between 60 and 70 % in the calibration and validation datasets using spectral data collected at harvest. For comparison, the detection of high BP severities (8–9 pits per fruit), these same metrics achieved between 80 and 90 % using spectral data collected during the first 10 days of storage.