Title Improving apple fruit firmness predictions by effective correction of multispectral scattering images

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Abstract

Firmness is an important parameter in determining the maturity and quality grade of apple fruit. The objective of this research was to improve the multispectral imaging system used in our previous studies and refine scattering analysis methods for more effectively measuring apple fruit firmness. An improved multispectral imaging system equipped with a light intensity controller was used to measure light scattering from 'Red Delicious' apples at seven wavelengths and 'Golden Delicious' apples at eight wavelengths. A correction method was proposed to reduce noise signals in the scattering images during radial averaging of image pixels. Apple shape/size affected scattering intensity and distance, and two methods were proposed for correcting their effects. The corrected scattering images were reduced to spatially symmetrical profiles by radial averaging. A modified Lorentzian distribution (MLD) function with four parameters was used to fit the scattering profiles. Firmness prediction models were developed by multi-linear regression against MLD parameters for two apple cultivars. The improved system yielded better firmness predictions with the correlation (r) of 0.898 and the standard error of validation (S.E.V.) of 6.41 N for 'Red Delicious' apples and r = 0.897 and S.E.V. = 6.14 N for 'Golden Delicious' apples.