

Title Postharvest firmness changes as measured by acoustic and low-mass impact devices: a comparison of techniques

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Abstract

Two commercially available non-destructive firmness sensors, one based on acoustic impulse response (AFS) and one on low-mass impact (SIQ-FT), were compared for the quality assessment of apples and tomatoes during a storage experiment. The aim was to quantify the repeatability of the sensors, the correlation between them, their ability to sense firmness decay during the storage experiment and their ability to sort fruit of a given batch. Our study shows that for apples, both sensors have a good repeatability and overall, the correlation between the measurements of both devices was rather high ($r = 0.88$), but when considering the practical case of a given batch at a given time, inherently possessing smaller variability, the correlation was low. It was further shown that for AFS the uncertainty (measurement error by the device augmented by eventual model error) is lower than the natural heterogeneity of the considered batch during the whole experimental period denoting that the device is capable of sorting fruit for firmness. In case of SIQ-FT, the uncertainty was larger than the batch heterogeneity. For tomatoes, the repeatability was worse than for apples, but still acceptable during the whole experimental period for SIQ-FT. During softening, AFS showed low repeatability. The correlation between both techniques was also lower ($r = 0.70$ overall). For both instruments, uncertainty was larger than the true batch heterogeneity, and increased during the experimental period indicating that tomato sorting is difficult, and should be performed as soon as possible after harvest.