Application of non-destructive x-ray computed tomography technique for assessing pomegranate fruit juice content

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Acta Horticulturae 1054: 237-244. (2014)

Abstract

In the present work, the amount of juice content of two Iranian local pomegranate fruits ('Rabab Malas' and 'Rabab Torsh') in two different sizes was studied using the non-destructive x-ray computed tomography (TC) technique. Whole fruits were scanned by the x-ray CT technique and then used for non-destructive tests. The Matlab software was used for segmentation of the internal structure of the CT-scanned fruit images to the three parts of peel, aril and seed. Linear regression equations were applied in order to estimate the whole fruit volume and its internal components. Results indicated that the fruit cultivar has a significant effect on the amount of fruit volume and its components, especially the amount of juice content ($p<0.05$). The fruit size had a significant effect on some fruit biophysical properties, but not on the ratio of juice to fruit volume. A high correlation was observed between extracted image features from x-ray images and experimental measurements. The actual volume of whole fruit, peels, arils, seed and juice was estimated by x-ray imaging to be nearly 97.8, 97.2, 95.1, 93.5 and 94.4%, respectively for the 'Rabab Malas' cultivar. Correspondingly, it was nearly 97.3, 94.7, 94.4, 91.8 and 91.9% for 'Rabab Torsh'. Statistical analysis indicated that the x-ray CT as a non-destructive method can be suitably employed for an on-line fruit juice content monitoring system.