Title Non-destructive seed detection in mandarins: Comparison of automatic threshold methods in FLASH and COMSPIRA MRIs

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Abstract

Magnetic resonance imaging was used to acquire images of the internal structure of mandarins for non-destructive seed identification. Two different types of fast MRI sequences were investigated: a gradient echo and a spiral–radial, with 484 ms acquisition time for the former compared to 240 ms for the latter. The radial–spiral option allows over-sampling of the central area of the *k*-space maintaining the contrast within the MRI images and so the feasibility of seed segmentation. Three segmentation techniques were applied for image post-processing: region-based, one-dimension histogram variance, and two-dimension histogram variance, among which the latter procedure has been demonstrated to give the most promising results. Image features including perimeter, compactness, maximum distance to the gravity centre, and aspect ratio were employed in a linear discriminant function, by which seed identification of mandarins could be achieved with 100% accuracy using radial–spiral sequence and 98.7% accuracy with gradient echo images.