# X-ray CT and porosity mapping to determine the effect of 'Fuji' apple morphological and microstructural properties on the incidence of $CO_2$ induced internal browning

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## Abstract

There is considerable variability in the distribution of porosity within a fruit, hence non-destructive methods to map porosity of the entire fruit are essential. The objective of this study was to use X-ray computed tomography (CT) to map the porosity of 'Fuji' apple and help determine the extent to which different fruit morphological and microstructural properties influence the susceptibility of the fruit to $CO_2$ stress-induced internal browning (IB). X-ray CT based porosity mapping and high-resolution X-ray CT were used to determine porosity changes in fruit tissue following exposure to an atmosphere enriched with 50 % $CO_2$ at room temperature (21 °C) for 3 d after harvest. Low-resolution X-ray CT scans enabled the construction of porosity maps for intact fruit based on a linear regression model and a juice scan which acted as a 0 % porosity reference. Short-term exposure of fruit to a high level of $CO_2$ markedly induced IB in the core region of the fruit. Axial porosity profiles measured before the $CO_2$ stress treatment showed that porosity along the axial plane was usually lower in fruit that developed IB. Larger sized fruit were more susceptible to the $CO_2$ stress-induced IB disorder. The porosity in the IB affected fruit tissue declined from 8.6 to 5.4 % following the $CO_2$ stress treatment. It is recommended to ensure that levels of $CO_2$ and $O_2$ in the controlled atmosphere (CA) storage environment are carefully controlled to minimize the risk of IB incidence.