Title Extension and Fracture of Cell Walls after Parenchyma Tissue Deformation

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**Abstract**

Cell wall extension and fracture were analysed after tissue deformation. The lateral cell wall extension was obtained as a difference in length of the cell wall faces from tissue cross-sections between deformed and intact samples of the same tissue.

Confocal scanning laser microscope (CSLM) was used and the image analysis procedure was applied in order to obtain quantitative results. Potato and carrot were examined in the experiment. The compression test used strain rates of 0·012, 0·71 or 60 $s^{-1}$ which compressed the sample until a pre-determined stress or strain was achieved.

The experiment has shown that cell wall extension within the plane perpendicular to loading (lateral cell wall extension) increases with the sample strain up to extension limits of around 12–16% for potato and 4–8% for carrot. Cell walls cannot be extended more because of dissipation of energy of loading for cracking propagation through cell walls within parenchyma tissue. The permissible strain was determined in two ways: (1) by direct microscopy observation as the onset of cracking and (2) by calculating the sample strain at maximum secant modulus on a third-order polynomial model from least-squares fit of the relationship between the mean cell wall extension in the direction perpendicular to compression and the sample strain. These two methods give almost the same values of the permissible strain. The permissible strain decreased with the strain rate and was especially low at the dynamic deformation. However, the onset of cracking was not noticeable on the stress–strain curve of quasi-static deformations.