Abstract

The micromechanical behaviour of apple tissue was studied using a miniature tensile stage positioned underneath a microscope that allowed for simultaneous acquisition of force-displacement curves while the deformation of the individual cells was followed and recorded. Tensile and compression tests were performed on small samples of apple parenchyma from two different cultivars (Jonagored and Braeburn) and two firmness categories (*soft and firm*). Turgor pressure in all samples from every batch was equalised by soaking them overnight in an isotonic mannitol solution. A number of micromechanical parameters such as Young's modulus (E), stress at failure (δ_{max}) and strain at maximum stress (σ_{max}) were calculated. We found a clear difference in the shape of the strain-stress curves. While S-shaped strain-stress curves were observed for apple specimens under compression loadings, almost linear curves were obtained for samples under tensile tests. Moreover, Braeburn apples were found to have a higher modulus of elasticity in tensile tests than Jonagored apples, indicating a stiffer material. However, in compressive tests these differences were not found. *Fresh Jonagored* apples proved to be more compressible in compression tests and, to a lesser extent, more extensible in tensile tests than *fresh Braeburn* apples. Unexpectedly, we also found higher values for maximal stress for *Jonagored* apples in compressive tests. Deformations of individual cells were found higher in tensile than in compression tests, while at tissue scale it is the other way round.