Role of fruit flesh cell morphology and MdPG1 allelotype in influencing juiciness and texture properties in apple

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Abstract

Apple fruit quality is strongly influenced by the interplay between juiciness and texture. To better decipher the complexity underneath the control of such quality traits, a multidisciplinary approach combining the mechanic and acoustic profiling of texture, juice analysis, cell morphology, sensory and genetic analysis was carried out. The analyses were conducted after 1.5 months of cold storage on fourteen accessions employed in novel breeding schemes for texture and juiciness. The food matrix structure was exploited focusing on both the cell morphology (employing an optical microscope) and the intercellular space (using an X-ray computed micro-tomography scanner). The mechanical and acoustic properties of texture were profiled with a texture analyser, while the juice was extracted using a mechanical press. In parallel to the analytical assessments, fruit texture, juiciness and flavour were also evaluated by sensory analysis. The results highlighted a positive correlation between cell shape and the intercellular volume. Apple accessions distinguished by round cells were characterized by a reduced intercellular space, while cell with an angular cell shape had a higher intercellular space. While the cell shape was associated with juiciness, the firmness response was more influenced by cell size. The interplay between cellular morphology and juiciness was also investigated together with the allelotype variability of a genetic marker designed for *MdPG1,* a polygalacturonase gene known to control the regulation of fruit texture in apple. The highest juiciness was found in apples with both a high fraction of round cells and the presence of the *MdPG1* allele associated with low softening rates. The elucidation of the role of cellular morphology in the control of fruit texture and juiciness, and their association with the *MdPG1* alleles, provided valuable information for a more detailed and informative analysis of fruit quality, enabling a more precise characterization and selection of superior apple accessions.