Title New approaches for determining juiciness in apple fruit

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Abstract

Texture is a major driver for consumer choice in apples. Consumers generally prefer apples with a crisp and juicy texture, and dislike those that are soft and mealy. Currently there is a range of textural characteristics amongst commercially available apple cultivars, but no universal agreement on the best instrumental approaches for measuring these characteristics. This disparity is partially driven by a limited understanding of the biophysical drivers behind complex textural traits such as crispness and juiciness. Our present research utilises mechanical, microscopy and sensory approaches to determine juiciness. Apples from four cultivars were rated for juiciness using a trained sensory panel and the scores were related to the mechanical and structural properties of apple tissue. The mechanical properties were determined using small amplitude, controlled stress oscillatory rheometry. This technique showed that the response of apple tissue was frequency dependent, with responses at low frequencies showing a higher ratio of elastic/viscous behaviour for cultivars with low juiciness. This suggests that juiciness could be related to the ability of water to move within tissues in response to oscillating torsional stresses at low frequencies. Cultivars with lower juiciness also tended to have less free fluid in the apoplast, suggesting the lower contribution of the viscous components identified by rheometry could be related to the amount of apoplasmic fluid and/or the ability of the fluid to move within tissue subject to deformation. These cultivars also showed differences in tissue structure, with the cell size being smaller in cultivars with lower juiciness. Collectively these results show that juiciness is determined by a complex interaction between tissue structure, fluid location, and fluid movement during deformation. Opportunities for the development of new instrumental techniques for determining juiciness will be discussed.