Title Ascorbic acid as an effective antioxidant in apple to alleviate browning: Molecular studies of control of the biosynthesis

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Citation Thesis, Doctor of Philosophy (Food Science and Technology), Washington State University. 152 pages. 2009.

Keywords Ascorbic acid; Antioxidant; Browning; Apples

Abstract

Apple fruit are subject to multiple stressors during pre- and post-harvest development that can cause an increase in detrimental reactive oxygen species (ROS). In addition, many cultivars are prone to postharvest storage disorders such as internal browning and soft scald that may result from ROS accumulation. To determine the role AsA plays in maintenance of apple fruit integrity, a baseline was established using apples that are standard in the industry, 'Delicious,' 'Golden Delicious' and 'Fuji.' There was more AsA in peel than cortex for all cultivars during on-tree development and in storage. The quantity declined as ripening progressed. AsA was highest in, and at later stages localized to, the core line and vascular bundles of the fruit. To determine the role of AsA in the development of soft scald in 'Honeycrisp' apples, the amount was quantified via HPLC and RT-PCR for the enzymes involved in the AsA recycling pathway was performed. AsA was higher in peel than cortex at all time points. The results showed a complex AsA recycling cycle, indicating it may play some role in preventing soft scald. The role AsA plays in Braeburn browning disorder was examined comparing 'Braeburn' and 'Gala' AsA levels in CA storage that was inducing to browning. AsA does not seem to play a role in the prevention of browning, as levels were higher in brown cortex tissue from 'Braeburn' than healthy cortex in 'Gala.' To determine what mechanisms control BBD, two suppressive subtractive hybridization libraries were constructed. Healthy cortex displayed stress related and cell maintenance genes, whereas brown cortex had no stress response genes. 'A lack of properly functioning pathways, rather than a specific gene causing browning, may be involved in the development of browning.