

Title Extensive metabolomic change precedes superficial scald development
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Citation Abstracts Book, 6th International Postharvest symposium, 8-12 April 2009, Antalya, Turkey.
256 pages.
Keyword 1-MCP; metabolism; apple

Abstract

Superficial scald development and metabolomic changes were compared in peel tissue of diphenylamine (DPA) treated, 1-methylcyclopropene (1-MCP) treated, or untreated 'Granny Smith' apples stored for up to 6 months at 1°C in air. Metabolomic evaluation, including 600+ metabolites, was employed to characterize scald-related metabolism. Statistical modeling revealed differentiation of metabolomes based on treatment and storage duration. The 1- MCP treated fruit peel metabolome differentiated from the other treatments within the initial 2 weeks of storage. DPA-treated and control metabolomes differentiated beginning at 4 weeks, 1 to 2 months prior to the appearance of scald symptoms. Peel content of many metabolites increased or decreased in control compared with DPA-treated fruit. Metabolites associated with scalded peel or peel that would develop scald included many sesquiterpenoids and triterpenoids, some of which were localized primarily in the epidermis/hypodermis rather than the cuticle/wax layers. Methanol and various methyl ester content increased together with scald symptom development while other metabolites, including typical varietal esters, alcohols, and aldehydes were associated with healthy, DPA treated fruit. Overall, the results revealed that wide-spread metabolomic changes leading to scald precede symptom development and reflect changes in peel tissue health.