

Title Changes and postharvest regulation of activity and gene expression of enzymes related to cell wall degradation in ripening apple fruit

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Citation Postharvest Biology and Technology, Volume 56, Issue 2, May 2010, Pages 147-154

Keywords Cell wall enzyme activity; Fruit softening; Gene expression; *Malus domestica* Borkh.; Regulation

Abstract

To elucidate the roles of cell wall-modifying enzymes in apple fruit, we investigated the activity and gene expression of β -galactosidase (β -Gal), α -l-arabinofuranosidase (α -l-Af), polygalacturonase (PG), and pectin methylesterase (PME). Their regulation by ethylene and cold storage (0 °C) was also assessed. ‘Golden Delicious’ and ‘Fuji’ fruit showed differences in their rates of respiration and decline of firmness, as well as demonstrating unique regulated effects. Activities of β -Gal and α -l-Af were higher in ‘Golden Delicious’ than in ‘Fuji’ fruit, although both had similar patterns of change. They were dramatically inhibited by 1-methylcyclopropene (1-MCP) and 0 °C, and enhanced by exposure to ethephon, with stronger response in ‘Golden Delicious’ fruit. Gene expression of cell wall enzymes also was significantly affected by 0 °C, 1-MCP, and ethephon. The difference in α -l-Af expression among treatments in ‘Golden Delicious’ was more significant than in ‘Fuji’ fruit, especially early in storage. In contrast, expression of β -Gal was inhibited by 1-MCP at early stages in ‘Golden Delicious’ fruit and over the entire storage period in ‘Fuji’ fruit, and was significantly enhanced by ethephon treatment in the former but only slightly in the latter. At 0 °C, β -Gal mRNA accumulation was inhibited in both cultivars. PG and PME activities increased during softening, and differed at different stages for each cultivar, and were obviously regulated by ethylene and 0 °C. PME expression was higher in ‘Golden Delicious’ fruit, with far greater differences between cultivars than that detected for PG. Both PME and PG mRNA were more intensively influenced by ethylene and cold storage in ‘Golden Delicious’ fruit. The results confirm that cell wall enzymes play an important role in fruit softening. Of these, β -Gal and α -l-Af may be more closely related to the storability of apples than PG and PME, especially when fruit ripening and softening begin.