

Title Survey of the expression of genes for ethylene synthesis and perception during maturation and ripening of ‘Sunrise’ and ‘Golden Delicious’ apple fruit

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Abstract

Ethylene is important in the ripening of apple fruit and different cultivars of apple show very different ripening patterns. The patterns of expression of the currently known genes for ethylene synthesis and perception in apple were examined for the summer apple, ‘Sunrise’ (SR), and the later season ‘Golden Delicious’ (GD). Comparisons were made during the last 4 weeks of maturation on the tree and after post-harvest ripening using reverse transcriptase quantitative PCR. Increases in gene expression for ACC synthase 1 (*ACS1*) and ACC Oxidase 1 (*ACO1*) were 1000- and 10,000-fold, respectively, for both cultivars confirming the importance of these genes in the climacteric ethylene burst. *ACS1* levels remained below detection level until the ripening stage. Additional apple genes for ACS and ACO did not appear to contribute to this ripening-associated ethylene. *ACS3* gene expression in both cultivars increased 100-fold during maturation and reached near maximum levels a full week before commercial harvest. Unique DNA sequences for apple ethylene receptors *ETR2* and *ETR5* and ethylene control element *CTR1* were determined. Expression of four ethylene receptors (*ETR1*, 2, 5 and *ERS1*) and two control elements, *CTR1* and *EIN2*, were evaluated. Only small changes (less than 5-fold) were observed for these perception elements. Splice variants of *CTR1* did not appear to be differentially expressed in these tissues. Genes for *ACO3* and *ERS1* (in GD) responded in a fashion consistent with feedback inhibition of ethylene production in ripening tissue. Differences between the cultivars included a more gradual increase for *ACO1* in GD, an increase in *ERS1* for GD upon ripening that was not seen in SR, and a larger decrease in expression of *CTR1* for GD compared with SR.