Title Ethylene-regulation of fruit softening and softening-related genes in peach

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Abstract

To investigate the role of ethylene in peach fruit softening during ripening, stony hard peach fruit, in which ethylene production is suppressed during ripening, were treated with various concentrations of ethylene. There was no noticeable decrease in flesh firmness without ethylene treatment, while applied ethylene, in the range 0.1-100 μl l^{-1}, resulted in fruit softening. Furthermore, the fruit softened more rapidly when the applied ethylene concentration was higher. When ethylene treatment was interrupted, the degree of softening was greatly reduced. These results indicated that continuous ethylene treatment was required for the initiation and progression of fruit softening and that ethylene concentration is also an important factor in regulating the rate of softening. Eight genes, which putatively encode cell wall metabolism-related proteins, were investigated for mRNA accumulation patterns in the two different softening phenotypes of melting and stony hard peaches. All of the mRNAs investigated accumulated in fruit of the melting-flesh 'Akatsuki' during ripening. By contrast, in the stony hard-flesh 'Manami', the mRNAs for a putative endopolygalacturonase (PpPG), an α-L-arabinofuranosidase/β-xylosidase (PpARF/XYL), and an expansin (PpExp3) showed either much lower levels or did not accumulate, and were identified as softening-related genes. Interruption of ethylene treatment indicated that these genes were regulated at the transcriptional level, and quickly responded to the presence or absence of ethylene before the softening response occurred, suggesting that ethylene directly regulates the transcription of these softening-related genes. These results suggested that cell wall metabolism, causing a rapid loss of firmness in peach fruit, may be controlled by ethylene at the transcriptional level.