Title Ethylene regulation of avocado ripening differs between seeded and seedless fruit

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Abstract

We studied the contribution of the seed to avocado ripening, emphasizing its role in ethylene biosynthesis and response pathways. Transcription profiles of genes involved in ethylene biosynthesis (*PaACO*, *PaACS1* and *PaACS2*) and action (*PaETR*, *PaERS1* and *PaCTR1*) were studied in seeded and seedless avocado fruit during ripening at ambient and low temperatures and in response to exogenous ethylene and 1-methylcyclopropene (1-MCP). Seedless mature fruit had a shorter preclimacteric lag, faster softening, and higher respiration during ambient temperature ripening than seeded ones. Advanced ripening in seedless fruit was accompanied by higher levels of *PaACO* and *PaACS1* expression at harvest, and these levels increased dramatically towards the climacteric peak. The expression of *PaETR*, *PaERS1* and *PaCTR1* increased in parallel with the onset of the ethylene burst in seedless fruit, whereas *PaETR* increase predominantly in seeded ones. Seedless fruit exhibited an earlier response to exogenous ethylene at the day of harvest, than seeded fruit. On day 1 after harvest, ethylene application elicited lower levels of ethylene in seeded than in seedless fruit, concomitantly with massive *PaCTR1* augmentation. This suggests that the negative regulator PaCTR may moderate the effect of ethylene on seeded fruit. Cold storage induced biosynthesis and regulatory genes in both seedless and seeded fruit relative to their levels at ambient temperature. However, in the first and second weeks in cold storage, *PaACO*, *PaACS1* and *PaACS2* expression levels were much higher in seedless than in seeded fruit, which could explain the higher levels of ethylene and accelerated softening of the seedless fruit in cold storage. Seeded and seedless fruit responded similarly to ethylene or 1-MCP application prior to cold storage. Ethylene slightly induced ethylene production, but significantly increased CO_2 output. 1-MCP equally and effectively delayed softening, reduced ethylene and CO_2 production and expression of genes involved in ethylene biosynthesis and ethylene action in seeded and seedless fruit. Both at ambient temperature and in cold storage respiration was higher in seedless than seeded fruit. Our findings demonstrate that the seed is involved in regulation of ethylene responsiveness during ripening, and acts to delay climacteric in mature seeded fruit.