

Title Degreening behavior in 'Fallglo' and 'Lee × Orlando' is correlated with differential expression of ethylene signaling and biosynthesis genes

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Abstract

Two citrus types ('Fallglo' and 'Lee × Orlando') exhibiting differential fruit degreening response when treated with ethylene were selected. Fruit were harvested at commercial maturity but at different developmental periods (Harvest I, II and III). Rate of color change was greater in 'Fallglo' than in 'Lee × Orlando' when fruit were treated with $5 \mu\text{L L}^{-1}$ of ethylene for 24 h. After 24 h of transfer of fruit to ethylene-free storage, rate of change decreased in 'Fallglo' and exhibited varied response in 'Lee × Orlando' depending on harvest date. 'Fallglo' fruit from Harvests I and II were completely degreened at the end of storage for 7 d; however 'Lee × Orlando' were not and were green in color. No difference in seedling triple response was observed between 'Fallglo' and 'Lee × Orlando' and sequences of the four ethylene receptors were identical between them. Expression of genes involved in ethylene biosynthesis and signaling pathways were studied in flavedo to test if differences in these pathways were correlated with differential ethylene sensitivity of the citrus types. Basal levels of *ACS2* and *ACO* expressions declined as maturity progressed, and ethylene-induced expression of *ACS1* and *ACO* were influenced by fruit maturity. At Harvests I and II, ethylene-induced increase in *ACS1* and *ACO* expressions and ACC levels were greater in 'Fallglo' than in 'Lee × Orlando'. Ethylene treatment influenced MACC content only during Harvest I in 'Lee × Orlando'. MACC levels were generally higher in 'Lee × Orlando' than in 'Fallglo'. Expressions of *ETR1* and *ETR2* were ethylene responsive in 'Fallglo' and only *ETR1* expression was ethylene responsive in 'Lee × Orlando'. Ethylene had more impact on *ETR1* expression in 'Fallglo' than in 'Lee × Orlando'. Ethylene had a negative effect on *ETR3* expression which was more pronounced in 'Lee × Orlando' than in 'Fallglo'. Expressions of *ERS1*, *CTR1*, *EIN2*, *EIL1* and *EIL2* were not affected by ethylene in both citrus types. Expression of chlorophyllase gene and rate of total chlorophyll degradation were higher in 'Fallglo' than in 'Lee × Orlando' during ethylene treatment. Differential degreening behavior of 'Fallglo' and 'Lee × Orlando' correlated with peel maturity, and factor(s) downstream of ethylene signaling but upstream of ethylene biosynthesis play a role in the differential sensitivity.