Title Natural senescence processes in navel orange

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Abstract

Postharvest storage strategies for navel oranges are designed to prevent moisture loss and chilling injury; the latter believed to be linked to membrane lipid peroxidation-caused by reactive oxygen species (ROS)-resulting in membrane rupture, cell death and tissue collapse. This may occur because ROS are generated faster than antioxidant capacity in sensitive genotypes. Similar processes, albeit slower, are thought to occur as fruits senesce naturally, but there is no direct evidence of this. Two navel orange selections of similar seasonality but differing susceptibility to chilling injury were used for this study. As fruit matured and senesced naturally in situ, the oxidation products of polyunsaturated fatty acid, viz. lipid hyfroperoxides (LOOH), and antioxidant capacity in flavedo tissue were measured using the ferrous oxidation-xylenol orange assay and the 2,2'-azino-bis-3-ethylbenzthiazoline-6-sulfonic acid radical cation scavenging assay, respectively. Fruit were sampled at 3 week intervals between Julian Day 158 and 263. Over this period, the Colour Index increased from 2.5 to 8 and 6 to 8.5, for 'Thompson' (chill sensitive) and 'Navelina' (chill tolerant), respectively. Over the same period, the Maturity Index increased from 11.5 to 20; the selection behaving similarly. Flavedo LOOH concentrations were similar in the two varieties at the commencement of the sampling period and generally increased as fruit senesced. LOOH concentrations increased significantly after 220 Julian days in both varieties. LOOH concentrations were significantly higher in 'Thompson' compared to 'Navelina' flavedo at the end of the sampling period. Flavedo tissue lipophilic antioxidant activity gradually increased in both selections up to Julian Day 220. Subsequently, lipophilic antioxidant activity in 'Thompson' flavedo increased dramatically, but there was no increase in 'Navelina' flavedo. Hydrophilic antioxidant activity did not change significantly over time in either variety. These data suggest increased rates of lipid peroxidatiion are part of the natural senescence process in flavedo tissue, and that these rates differ between navel orange selections in a manner consistent with their relative tolerance to low temperature. The concurrent increase in lipophilic antioxidant activity indicates that although the antioxidant system is functional, it is insufficient to prevent significant lipid peroxidation, suggestion that enzyme-mediated peroxidation is important during fruit senescence, more so in 'Thompson' compared to 'Navelina' fruit.