Title Extended low-temperature shipping adversely affects rind colour of 'Palmer Navel' sweet orange [*Citrus sinensis* (L.) Osb.] due to carotenoid degradation but can partially be mitigated by optimising post-shipping holding temperature

Author Angelique A. Van Wyk, Marius Huysamer and Graham H. Barry

Citation Postharvest Biology and Technology, Volume 53, Issue 3, September 2009, Pages 109-116

Keywords Carotenoids; *Citrus*; Cold-sterilisation; Holding temperature; 'Navel' orange; Rind colour; Shipping temperature

Abstract

Shipping temperature has a large effect on eventual rind colour of *Citrus* fruit and is one of the final interventions which can be used to influence rind colour in the fruit production and supply chain. Therefore, optimal shipping temperatures must be carefully chosen according to fruit condition and market destination. To satisfy the phytosanitary requirements of some importing countries, cold-sterilisation at sub-zero temperatures is required. For example, fruit is shipped at −0.6 °C for a minimum period of 24 d when exporting citrus fruit from South Africa to the USA. However, when shipped at such a low-temperature and for a long period the fruit sometimes arrive with poor rind colour. The effect of shipping at −0.6 °C or 4.5 °C for durations ranging from 21 d to 32 d and the influence of initial rind colour ("orange" or "yellow") on 'Palmer Navel' sweet orange [*Citrus sinensis* (L.) Osb.] fruit colour upon arrival in the market were evaluated. 'Palmer Navel' sweet orange fruit shipped at a higher temperature (4.5 °C) had a marginally better rind colour than fruit shipped at −0.6 °C. The perceived loss of rind colour following shipping at sub-zero temperatures was due to carotenoid degradation. Therefore, initial rind colour plays a critical role in final product quality. Depending on market destination and shipping temperature, pale-coloured fruit should not be packed for markets sensitive to rind colour. To overcome the adverse effects of shipping at −0.6 °C on rind colour, 'Palmer Navel' sweet orange fruit were subjected to various post-shipping holding temperatures (low, intermediate and high) to determine whether rind colour could be improved following extended low-temperature shipping. A high holding temperature (20 °C) caused colour degradation, whereas rind colour remained stable when fruit were held at a low holding temperature (4.5 °C). Intermediate holding temperatures of between 11 °C and 15 °C were most effective in limiting the negative effects of extended, sub-zero shipping temperatures on rind colour and re-initiated rind colour development, as perceived by increased carotenoid content.