

Title Dynamic controlled atmosphere (DCA) storage by the means of chlorophyll fluorescence response for firmness retention in apple

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Abstract

Storage life of fruit increases as its respiration rate decreases. Decreasing the oxygen concentration to the lowest levels tolerated by the fruit would optimize the benefits of ultra low oxygen (ULO) CA storage without risking losses caused by anaerobic conditions. A non-destructive monitoring system that assesses low-oxygen stress of chlorophyll-containing fruit (HarvestWatchTM; Satlantic Inc., Halifax, N.S., Canada) was applied during storage. It allows to adapt the atmospheric composition in the CA-room dynamically (DCA) to the actual physiological state of the fruit, in contrast to the usually static conditions of CA storage. According to the fruit's fluorescence response to low oxygen stress, O₂ was set at values below 0.7 kPa, as low as 0.4 kPa, maintaining CO₂ at the same ratio applied for optimal ULO-CA storage. DCA is a further development of CA technology, that has already been applied on a commercial scale, mainly in South-Tyrol (Italy) in 80 storage rooms (330 t apple average content) in the year 2006 and in 120 rooms in 2007. Under experimental conditions different cultivars have shown specific response to the storage conditions applied. On 'Gala' apple fruit O₂ levels lower than 1 kPa, as well as 1-MCP in 1 kPa oxygen didn't improve consistently firmness compared to optimal ULO-CA, however sub-optimal CA, maturity and storage temperature had a relevant impact. 'Golden Delicious' indeed benefitted from extremely low O₂ concentrations in DCA, as well as from 1-MCP. On 'Fuji', firmness was not affected by decreasing the O₂ concentration in DCA, neither by 1-MCP. However, DCA can exert other positive effects during storage life, such as the control of superficial scald or the prevention of many senescence related physiological disorders.