

Respiratory quotient level variation during storage: Critical period for low oxygen tolerance, metabolism, and quality of ‘Galaxy’ apples

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Abstract

New technologies for apple preservation include storage under dynamic controlled atmosphere (DCA) with respiratory quotient (RQ) monitoring or chlorophyll fluorescence (CF). Therefore, this study aimed to evaluate the effects of RQ variation on the metabolism, overall quality, and volatile organic compound concentration of ‘Galaxy’ apples after long-term storage and compare them to fixed RQ levels, controlled atmosphere (CA), and DCA-CF. We also aimed to identify the period during storage in which apples are more susceptible to low oxygen damage. Fruit were evaluated after nine months of storage plus 7 d of shelf life at 20 °C. Higher RQ (1.5 and 2.0) levels throughout the storage period or the first three months resulted in higher anaerobic metabolism, increasing the internal disorders and reducing overall fruit quality, healthy fruit and flesh firmness. The results evidenced that the critical period for low oxygen damage is the first three months of storage. Overall fruit quality is better maintained when fruit were stored under DCA-CF, DCA-RQ 1.1, DCA-RQ 1.3, and changing RQ from 1.1; 1.3; 1.5, being three months at each RQ level. Moreover, more healthy fruit, higher flesh firmness, and lower physiological disorders were observed under these storage conditions, although the main ester accumulation was reduced. In general, higher 2-methylbutyl acetate and butyl acetate were observed in fruit stored under CA and high RQ levels (1.5 and 2.0). This demonstrates that even with RQ level variations during storage, it was not possible to obtain apples with high overall quality and ester concentrations under the same storage condition.