Title Dynamic CA storage of apples: Monitoring of the critical oxygen concentration and adjustment of optimal conditions during oxygen reduction

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Abstract

The concept of dynamic CA storage (DCA) involves the reduction of the oxygen level in the storage atmosphere near to the lowest tolerated by the fruit, the so called anaerobic compensation point (ACP). Fruit quality loss during DCA storage is assumed to be slower than in normal ULO storage. Storage conditions below the critical oxygen level will cause anaerobic conditions followed by severe quality losses in stored fruit. Ideally fruit should therefore be stored just above the compensation point. The concept of dynamic CA storage is feasible, provided that the low-oxygen stress of apples, caused by anaerobic conditions, can be reliably detected. The calculated respiratory quotient (RQ), based on respiration measurements as well as the measurement of the chlorophyll fluorescence allowed the non-destructive monitoring of ACP in our storage trials. Apples of the 'Golden Delicious' (2 harvest dates), 'Braeburn', 'Idared', 'Maigold' and 'Elstar' varieties were stored in a flow-though system, where oxygen was decreased by steps until the critical level was reached. Both methods based on RQ and fluorescence signal F-α monitoring yielded identical oxygen values for ACP. The ACPs measured were at concentrations as low as 0.2 - 0.4%, depending on the apple variety. 'Braeburn' at 0.4% exhibited a higher critical oxygen level than the other varieties tested (0.25 - 0.30 %). After the critical oxygen limit was reached, the oxygen concentration was increased by about 0.1 - 0.3% above the critical limit. In this way, the fruit were kept at oxygen levels of 0.3% to 0.6% for 200 days without causing physiological disorders. Fruit firmness values of DCA stored apples generally significantly higher than in control ULO stored fruit after a storage period of more than 200 days. Further trials with Gloden Delicious (2 harvest dates) during 2 storage seasons showed that the rate of oxygen reduction, within the setup of the trials, had no influence on the level of ACP nor the fruit quality after storage. During oxygen reduction, the CO_2-concentration was held at a constant level recommended for ULO storage for one option while, for the other, CO_2- concentration was decreased proportionally to the oxygen concentration. Both variants resulted in identical values for ACP and fruit quality in terms of fruit firmness after storage.