

III.II.S2.3.P11. Can an optimized airflow save energy in apple storage?

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Over three consecutive years, we investigated the impact of airflow modifications in controlled atmosphere (CA) apple storage rooms. Two 40 ton CA rooms were used for the experiments, one without ('non-optimized') and one with ('optimized') air deflection and evaporator sealing-off. We recorded air and fruit temperatures, relative humidity (RH), air velocity, fruit weight loss, fruit quality parameters and the electrical energy consumption for cooling and ventilation. Fruit temperature probes were placed at fixed positions inside the rooms, and at the same positions, air velocity was measured with a hand held anemometer and RH and air temperatures were logged. Weight loss (%) and fruit quality parameters were determined after 7 months CA storage. After the first year, rates of water loss ($\text{mg of H}_2\text{O} \cdot [\text{cm}^2 \text{ of skin surface area} \cdot \text{h}]^{-1}$) were determined. In the third year, mobile vertical measuring arms on the room ceilings, fitted with hot-wire anemometers, determined the airflow distribution between the stacks of fruit bins. In addition, on the front and back walls hot-wire anemometers determined vertical air movements. In each CA-room, an evaporimeter, two psychrometers and two capacitive humidity sensors were installed to determine RH and to compare the different measurement methods. Sealing-off the evaporator clearly influenced the airflow, while air deflectors on the wall corner opposite the evaporators had no effect. Mean fruit temperature was lower in the 'optimized' room at all room positions during the first two years. No differences in fruit quality were observed between both rooms and at different positions within the rooms. Results from the third year are presented and the potential for energy savings discussed. Further experiments will determine the minimum necessary air turnover required, taking into consideration the need for cooling and fruit quality, because the energy demand in fruit storage rooms correlates directly with the ventilator runtimes. Air turbulence will also be determined to support a comprehensive interpretation of the air velocity measurements.

Keywords: *Malus domestica*, air velocity, relative humidity, fruit temperature, fruit quality, weight loss, transpiration rate