CAN DYNAMIC CONTROLLED ATMOSPHERE STORAGE BE USED FOR 'HASS' AVOCADOS?

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There is a trend for static controlled atmosphere storage (CA) of fruit, where the O_2 level remains fixed during storage, to be replaced by dynamic CA, where the O_2 level changes according to the fruit response. The objective of this study was to assess whether dynamic CA can be used for New Zealand 'Hass' avocados by determining the changes in ethanol and chlorophyll fluorescence in response to low O_2 or high CO_2 atmospheres.

The accumulation of ethanol (EtOH) in mesocarp tissue was measured for fruit exposed to O_2 atmospheres of 0.1, 0.5, 1, 2, 5, 10 or 21% O_2, or 0, 1, 2, 5, 10 or 20% CO_2 at 5°C. The effect of O_2 and CO_2 on recovery from anaerobic conditions was determined by exposing fruit to 0.1% O_2 for 24, 48, 96 or 120 hours, then transferring to back-off atmospheres of 1, 2, 5 or 21% O_2, 2% O_2 with 10% CO_2, 5% O_2 with 10% CO_2, or 0, 5, 10 or 20% CO_2. EtOH was not detected in fruit held in O_2 between 0.5 and 21%, but a marked accumulation of EtOH occurred in fruit held in <0.5% O_2. EtOH accumulated exponentially in fruit held in 0.1% at 5°C to approx. 2, 14 and 20 nmol/g FW after 24, 48 and 96 hour, respectively. Accumulated levels of EtOH in these fruit generally decreased to trace levels after 24, 48 or 96 hours respectively, when transferred to back-off atmospheres regardless of level of O_2 and CO_2 of the back-off atmosphere. EtOH did not accumulate in fruit exposed to atmospheres of 0, 1, 2, 5, 10 or 20% CO_2.

The chlorophyll fluorescence yield ((Fm-Fo)/Fm) was measured for fruit from three orchards exposed to 0.25, 0.5, 0.75, 1, 2, 5 or 21% O_2, or 0, 2, 5, 10, 15 or 20% CO_2 at 0° or 6°C. Fluorescence yield remained at approx. 0.8 for fruit at 6°C held in O_2 between 21 to 1%, but yield decreased sharply to 0.68 within 1 day of exposure to <1% O_2. When fruit held in <1% O_2 for 6 days were returned to air at 6°C, fluorescence yield recovered from approx. 0.67 back to 0.8. Yield decreased slightly at when levels of CO_2 were greater than 5%, but recovered to approx. 0.8 on return to air after 6 days at 6°C. However, at 0°C the decreased fluorescence yield became more marked with increasing levels of CO_2. Fruit from the three orchards had similar fluorescence responses within all treatments.

It is concluded that the physiological behaviour of New Zealand 'Hass' avocado, and in particular the kinetics of ethanol and chlorophyll fluorescence responses, makes dynamic CA commercially realistic.