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THE KINETICS OF ACETALDEHYDE AND ETHANOL ACCUMULATION IN 'HASS' AVOCADO DURING INDUCTION AND RECOVERY FROM LOW O_2 AND HIGH CO_2 CONDITIONS

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There is little detailed information on the relationships between controlled atmosphere conditions and the pattern of accumulation of anaerobic metabolites or the activity of enzymes during induction or recovery from low O2 or high CO2 conditions. In this study the kinetics of acetaldehyde (AA) and ethanol (EtOH) accumulation during the induction and recovery from anaerobic conditions was studied in New Zealand 'Hass' avocado. In addition, the activity of pyruvate decarboxylase (PDC) and alcohol dehydrogenase (ADH) was measured at specific times during induction and recovery. The induction of anaerobic metabolites was studied by exposing fruit to 0.1, 0.5, 1, 2, 5, 10 or 21% O2, or 0, 1, 2, 5, 10 or 20% CO2 (balance air). The effects of O2 during recovery was determined by exposing fruit to 0.1% O2 for 24, 48 or 96 hours, then changing the atmosphere to 1, 2, 5 or 21% O2, or 2% O2 with 10% CO2, or 5% O2 with 10% CO2. The effect of CO2 on recovery was determined by exposing fruit to 0.1% O2 for 120 hours, then changing the atmosphere to 0, 5, 10 or 20% CO2 (balance air).

During induction, AA and EtOH accumulated rapidly in an exponential manner when O2 levels were less than 0.5%. AA accumulated with increasing CO2 level of up to 20% but EtOH remained at basal levels. During recovery, AA and EtOH decreased in an exponential manner back to basal levels when returned to 2, 5 or 21% O2. The longer the duration in low O2, except when induction was 96 hours or less, the greater the time required decrease to basal levels. When induction was longer than 96 hours, O2 level affected the rate of AA and EtOH decrease such that the rate of decrease was lower with decreasing O2. Including CO2 in the recovery atmosphere delayed the rapid decrease of AA and EtOH but only in atmospheres of low O2 or only if CO2 was greater than 10 or 20% in air atmospheres. In a recovery atmosphere of 20% CO2, the initial rate of EtOH decrease was affected more than the initial rate of AA loss, although both AA and EtOH reached basal levels at the same time. PDC and ADH activity was not significantly changed by induction in 0.1% O2 for 120 hours. With decreasing CO2, PDC and ADH activity was decreased.