Title Responses of some fruits to gas and heat stress

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Abstract

Quarantine insect control systems are required for the national and international trade of several food commodities. Historically these have been developed using fumigants, most have been shown to cause negative health and environmental effects, and therefore their use has been restricted and alternative physical (non-chemical) treatments have been sought. We have developed an alternative method combining "insecticidal controlled atmospheres" (< 0.5 kPa O_2 + > 50 kPa CO_2) and high temperatures (43ºC). This system do not cause health and environment problems, its cost is comparable to fumigants, can be used in permanent locations as well as during shipping, but being a stress it can cause injury to some fresh commodities. Some fruits (such as mango) are very tolerant to both types of stress (gas and heat) while others (such as avocados, pears, guavas) are very sensitive. Potential problems that hinder the possibility for developing this system for fresh horticultural commodities include possible fermentation (due to the use of anaerobic atmosphere) and heat injury. Exposure of sensitive fruits to insecticidal gas stress decreases pH, which inhibits aerobic enzymes such as piruvate dehydrogenase and activates anaerobic enzymes such as piruvate decarboxylase, alcohol dehydrogenase and lactic dehydrogenase. The production of fermentative metabolites, such as acetaldehyde and ethanol, is increased significantly, and energy production is decreased significantly. Some sugars, such as trehalose, are associated with the resistance of some plant species and some micro-organisms to some environmental stresses. We have reported the presence of trehalose and trehalase in fruits and vegetables, and there seem to be some correlation between the resistance/sensitivity of some fruits to heat stress and the presence/absence of trehalose and the activity of trehalase. The understanding of the mechanism behind the sensitivity/tolerance of different fruits and vegetables to gas and to heat stress can help in the manipulation of sensitive fruits, and thus to increasing their tolerance and allowing the establishment of these techniques in a global commercial basis.