BIOCHEMICAL/PHYTOTOXIC RESPONSES OF FRESH COMMODITY TO ALTERNATIVE MB TREATMENTS

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Phytotoxicity of fresh commodities is a major impediment for successful application of efficacious regulatory pest disinfestation treatments (Jones, 1940; Claypool and Vines, 1956). As biological entities, fresh fruits and vegetables continue their developmental and senescent processes after harvest. The various handling procedures, and the imposition of stringent regulatory quarantine treatments accelerate or aggravate the natural metabolic processes to the detriment of fruit quality and shorten storage life. Also, the diversity of market cultivars and stage of maturity harvested complicate the reliability of certain promising disinfestation treatments. The challenge to postharvest science is to understand and ascertain the underlying biochemical/physiological changes that are associated with the phytotoxic/injurious responses in fresh commodities in order to devise new approaches to minimize the undesirable changes. Effective, acceptable postharvest quarantine treatments involving chemical fumigants heat and cold for pest disinfestation must therefore be predicated upon: 1) maintenance of the quality of fresh commodity; 2) avoidance of unacceptable level of injury as to make the fruits unmarketable; and 3) recognition of the unique biological and horticultural characteristics of fresh commodities.

Methyl bromide (MB) is a potent chemical toxicant used worldwide in agriculture for over half a century to control of a broad spectrum of pests. However, due to its impending ban, recent environmental and health concerns have made it necessary to find alternative methods for pest disinfestation. The use of heat and cold for disinfestation of fresh commodities has been revived as an alternative to MB. This is due in part to advances in instrumentation and computer technologies that provide more precise control of heat and cold treatments which lessen the potential phytotoxicity to fresh commodities.

Cold treatment (0°-2.2°C) for varying duration of up to 24 days is an approved quarantine procedure for citrus fruit pest disinfestation (APHIS Manual, 1985). But cold treatments cause chilling rind injury in some fruits and vegetables and may increase fruit decay. Intermittent warming for 7 days at 13°C following 21 days at 2°C reduced chilling injury and maintained lemons in good marketing condition (Cohen, 1988). Prestorage treatment of lemons at 47°-53°C for 1-3 minutes before subsequent storage of 2-6 weeks at I °C significantly reduced phytotoxicity (McLauchlan et al., 1977). They indicated that the physiological changes caused by temperature conditioning involved certain unknown biochemical factors and not just a restriction of water loss from the rind. Predebon and Edwards (1992) also found curing of lemons at 10°-16°C for varying periods before disinfestation storage of 16 days at 1 °C lessened chilling injury, but observed an increase of oleocellosis in fruits subjected to prolonged curing.

In work with Arizona-grown desert lemons, curing fruits at 15°C and 95% relative humidity for 1 week significantly reduced phytotoxicity of fruits stored at 1 °C for 2-6 weeks (Houck et al., 1990). Further studies in our laboratory indicated that fruit injury may be associated with the emanation of d-limonene, and yellow and green lemons showed a distinct phytotoxic response to heat and cold treatments (Obenland et al., 1996, 1997). Recently, preconditioning treatment of lemons in air at 15°C for several days or in water at 55°C for five minutes induced significant changes of soluble sugars in the flavedo which may be related to temperature adaptation and stress tolerance by citrus fruit tissues.

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