Methods for Management of Ripening in Mango:
A Review of Literature

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1 Abstract

A review of the literature on methods for management of ripening in mango was conducted. Most of the recent research on this topic involves methods to delay ripening by modified atmosphere packaging using edible films or by inhibiting ethylene action through the use of 1-methylcyclopropene (1-MCP).

2 Introduction

To facilitate successful marketing of mangoes using conventional packaging and postharvest handling methods, mangoes destined for import into the USA are harvested at the green stage while still firm. The fruit are then ripened after they arrive in the USA by the whole

Being a tropical fruit, mangoes are subject to chilling injury if held below 13°C (55°F) for

4.2 Controlled Atmosphere Storage and Modified Atmosphere Packages

Based on studies with Florida mango cultivars, the optimal range of oxygen is 3 to 5% and carbon dioxide is 5 to10% in modified or controlled atmospheres (Bender et al, 1994, 1995, 2000, 2000a, 2000b; Hatton and Reeder, 1965; Kim et al, 2007; Spalding and Reeder,1974 and 1977; Yahia,2006). Yahia and Vasquez-Moreno (1993) found that mangos tolerate short exposures to insecticidal atmospheres with very low oxygen and elevated carbon dioxide. However, exposure of mature-green mangos to oxygen levels below 2% and/or carbon dioxide levels above 10% for longer than a few days may induce skin discoloration, grayish or pale flesh color, uneven ripening, and off-flavor development due to fermentative metabolism

al., 2005; Hoa et al., 2002; Hoa and Ducamp, 2008; Menezes et al., 1996). All studies show that wax coatings are effective at reducing water loss in mangoes during storage. Most of the studies observed that wax coatings were not effective in delaying the ripening of mangoes. A few studies (e.g., Dhalla and Hanson, 1988; Dang et al., 2008; Feygenberg et al., 2005) have observed a delay in ripening from a few to several days. Feygenberg et al. (2005) observed that the wax coated fruits did not develop any off-flavors, and were preferred over uncoated fruit by taste panelists.

A number of other coating materials have been studied for their ability to delay ripening in mangoes. Baldwin et al. (1999) observed a delayed in ripening of 'Tommy Atkins' mangoes when coated with hydroxypropyl methylcellulose (a polysaccharide). Hoa et al. (2002) conducted a study on the effects of different coatings formulated from several materials including protein, carnauba wax, shellac, and cellulose on 'Lirfa' mangoes to determine their ability to delay fruit ripening and maintain fruit quality. They observed that coatings based upon hydroxypropyl methylcellulose and zein (a plant protein from maize) were most effective for delay of softening and color development and that these coatings were able to delay ripening of mature green fruit by several days. Mature green harvested mangoes coated with zein showed elevated levels of ethanol after storage, however their evaluation did not show significant differences in sensory panel ratings between of the zein coated fruit and the control fruit at the end of the storage period.

Carrillo-Lopez et al., (2000) observed ripening delays of several days in 'Haden' mangoes coated with "Semperfresh" (a mixture of esters of mono- and di- glycerides, sucrose, and carboxymethylcellulose). Dang et al. (2008) evaluated Semperfresh, and *Aloe vera* gel coatings on 'Kensington Pride' mangoes. They observed a few days ripening delay due to Semperfresh, and *Aloe vera* gel coatings, however these coatings also reduced the fruit aroma volatile development during ripening. Hoa and Ducamp (2008) observed ripening delays of about 3 days

e period.

observed skin injury to ‘Kensington Pride’ and ‘Willard’ mangoes, respectively, when treated with 8% calcium chloride solutions.

5 Conclusions

Postharvest management of mangoes is important to their successful marketing. The most critical factor affecting the postharvest shelf life of mangoes is their temperature management. The temperature range of 20 to 23 °C (68.0 to 73.4 °F) will result in fruit of the best appearance, palatability, and decay control when ripening mangoes. Mangoes can be held at 10 to 13°C (50 to 55°F) to extend their shelf life. Holding mangoes outside these temperature ranges will result in fruit with less than optimal quality, and can injure the fruit. The ripening rate can be accelerated by the treatment of mature-green mangoes with 100-ppm ethylene for 24 hours. Relative humidity of 90 to 95% should be maintained during all postharvest handling steps to minimize water loss and shriveling of mangoes.

Several methods have been evaluated to extend the shelf life of mangoes beyond that possible through postharvest temperature management. These methods generally rely on the control of the availability or action of O_2 and CO_2 and ethylene during ripening. Research studies of these techniques typically demonstrate a delay in ripening (and thus an extension of storage life) in the range of 2 to 10 days.

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