Title Papaya postharvest physiology and handling - problems and solutions

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Abstract

Over the last decade, papaya fruit ripening and handling research has taken on renewed importance. This importance is due to an increased worldwide consumer's awareness of this fruit and the subsequent expansion in production and exports. The major research issues are quality retention and postharvest storage life that place constraints on marketing. Quality problems seen in the markets include variable fruit sizes and shapes, mechanical injury, blemishes (freckles), dehydration, and though not seen, taste as determined sweetness. Another frequent problem is postharvest diseases, coupled in some cases to chilling injury. At the molecular level, we are beginning to have a better suite of tools to answer biochemical and physiological ripening-related questions. Access to multiple cDNA and BAC libraries and efforts to sequence the whole of the small papaya genome have greatly assisted this research. Numerous biochemical and physiological studies have been published, involving ripening-related cell wall changes and the enzymes possibly involved in this process. The work in Malaysia and Portugal on β-galactosidase, our work on endoxylanase and the older work on polygalacturonase have given insights into the complexity of the softening process. The role of ethylene-independent and -dependent biochemical systems in fruit ripening have illustrated the difficulty of modifying ripening. In Hawaii, we have been interested in fruit sugar levels and the pathway for sugar uptake during the final phase of fruit development. Sugar accumulation by papaya is tied to the difficulty that we must harvest papaya after ripening has started as judged by skin color changes. Fruit-fly egg lay, and, susceptibility to mechanical injury imposes upper limits of 25 and 45% skin color on the harvest window, respectively. The above more basic studies have been tied to a number of efforts to modify ripening and to thereby extend postharvest life. The collaboration between South East Asian nations to modify ethylene synthesis, the Malaysian and Portugal efforts to down regulate β -galactosidase and our efforts with endoxylanase by transgenic approaches hold potential for practical application. The approaches are all proof-of-concept, and commercial application will require more study. Variation already exists among papaya varieties in ripening patterns and this offers another approach to delaying fruit ripening. The ethylene receptor inhibitor (MCP, 1-methylcyclopropene) has been widely tested and holds some promise, though there are problems in its use at certain stages of papaya ripening.