Abstract

Pawpaw [*Asimina triloba* (L.) Dunal] fruit displayed increases in ethylene production and respiration rate during postharvest ripening similar to other *Annona* species. The onset of ethylene evolution coincided with an increase in respiration and a rapid decline in firmness. Ethylene production and respiration rate increased as ripening progressed and reached maximum values 3 days after harvest. This occurred coincident with the highest activities of both 1-aminocyclopropane-1-carboxylic acid (ACC) synthase (ACS) and ACC oxidase (ACO) enzymes as well as the maximum flesh ACC content. As ACC content increased, malonyl ACC (MACC) content declined, suggesting a regulation of ethylene production by malonylation of ACC. Therefore the climacteric development of ethylene production may be regulated by an increase of ACS and ACO activities as well as a decrease in ACC malonyltransferase activity. The activities of the major fruit softening enzymes including pectin methylesterase, polygalacturonase, cellulase, and endo-β-1,4-mannanase increased as fruit softened. The loss of flesh firmness was associated with high activities of these four softening enzymes. All of these enzymes may act synergistically and contribute to cell wall disassembly and fruit softening in pawpaw. In unripe pawpaw fruit, carbon was largely stored in the form of starch. After harvest, the starch content decreased and soluble sugars increased. The activity of the sucrose-metabolizing enzyme acid invertase increased as ripening progressed. Heat treatment by hot water immersion at 46°C for 30 and 60 min slowed the ripening process by disrupting ethylene production, respiration rate and activities of the fruit softening enzymes. The mechanism by which heat treatment delayed fruit ripening and hindered cell wall softening enzymes may be tied to changes in gene expression and/or protein synthesis. Application of the ethylene action inhibitor 1-methylcyclopropene (MCP) at room temperature reduced fruit respiration rate but it failed to inhibit ethylene production and loss of firmness. The general lack of an MCP effect suggested that once pawpaw ripening began, ethylene was no longer required for the process to continue. Therefore, fruit might require treatment at an earlier stage when the critical ethylene receptors responsible for initiating ripening are first expressed.