

Effect of 1-methylcyclopropene and activebag packaging on the postharvest characteristics of Mango fruits

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Abstract:

Mango is one of the major fruits produced in Kenya for the domestic and export markets. Mango production is a source of livelihoods for many smallholder farmers and other stakeholders involved in its value chain. Although production volumes in Kenya have significantly increased over the years, a high proportion of the fruits (up to 50%) are lost along the value chain. Mango is a highly perishable climacteric fruit with a postharvest shelf of up to ten days depending on harvest maturity. Due to high perishability, seasonality of fruiting and poor harvest and postharvest handling practices, mango is prone to high losses. There are applicable postharvest technologies that can be used to slow down deteriorative processes thereby extending the shelf life of mango fruits and minimize postharvest losses. Therefore, two studies were conducted to test the efficacy of two postharvest technologies (1-methylcyclopropene, I-MCP and modified atmosphere packaging, MAP) on prolonging the postharvest shelflife of mango fruits, variety 'Tommy Atkins'. The mango fruits used in the study were harvested from a commercial farm in Embu County of Eastern Province and all measures taken to deliver fruits to the laboratory in the best condition. In the first experiment, efficacy of I-Methylcyclopropene (I-MCP), a postharvest technology, known to prolong the postharvest shelf life of perishable horticultural commodities by inhibiting the action of phytohormone ethylene was evaluated. I-Methylcyclopropene was applied at 1 ppm for 24 hours at ambient room conditions to mango fruits harvested at two stages of maturity. The two stages of maturity included stage 1 (mature green) and stage 2 (advanced maturity). The treated and untreated (control) fruits were subjected to normal ripening at ambient room conditions (25±1°C and RH 60±5%). A random sample of fruits was evaluated every two days for physiological and physicochemical parameters associated with mango ripening and quality. These parameters included ethylene evolution rate, respiration rate, firmness, hue angle, cumulative weight loss, total soluble solids (TSS), total titratable acidity (TTA), soluble sugars (fructose, glucose and sucrose), ascorbic acid and beta carotenes. In the second experiment, a newly introduced modified atmosphere package, Activebag[®] was compared with ordinary polythene bags which are commercially used in packaging perishable commodities. Three batches of mango fruits (at advanced maturity stage) were separately packaged using Activebag[®], ordinary commercial polythene or left unpackaged (control) and allowed to undergo ripening at similar ambient room conditions. From each treatment, a random sample of five fruits was evaluated every three days for physiological and physicochemical parameters as described above. The results showed significant ($P=0.05$) effect of I-MCP treatment on the postharvest shelf life of mango fruits harvested at stage 1. There was no significant I-MCP treatment effect for fruits harvested at stage 2, for most of the parameters. Treatment with I-MCP delayed ripening in stage 1 fruits by 3 days, relative to the untreated control. The delayed ripening was accompanied by a lag in respiratory climacteric (3 days) and lower levels of respiration throughout the storage period. At the end of the storage period, I-MCP treated fruits (stage 1)

were 2: 40% firmer and retained a higher flesh hue angle compared to the untreated control. Cumulative weight loss was significantly reduced in I-MCP treated fruits which lost only 8.5% of the initial weight compared to 11.7% lost by untreated controls. Additionally accumulation of total soluble solids (obrix) associated with mango ripening was slowed down in I-MCP treated fruits which also retained higher levels of total titratable acidity throughout the storage period. At the end of the storage period, I-MCP treated fruits had higher levels of total soluble sugars (54%) and ascorbic acid (60%) relative to the untreated controls. Modified atmosphere packaging, I especially using Activebag[®] was effective in maintaining quality and extending the shelf life of mango fruits compared to the unpackaged controls. Slow ripening in Activebag[®]-packaged fruits was evidenced by a delayed respiratory climacteric and generally lower respiration rates, higher firmness, lower soluble solids (brix') and higher II A. Modified atmosphere packaging significantly reduced cumulative weight loss by 2: 4.5% compared to unpackaged controls. The results of these studies show that I-MCP and Activebag[®] packaging are effective in delaying ripening-related changes in mango fruits at ambient room conditions, thereby maintaining or prolonging their shelf life. Commercial application of the twotechnologies should be explored to enhance the postharvest shelf life of mango fruits, thereby increasing their marketing period and minimizing postharvest losses.