FEASIBILITY OF COOLBOT™ COLD STORAGE TECHNOLOGY TO PRESERVE QUALITY AND EXTEND SHELF LIFE OF MANGO FRUITS

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DECLARATION

I declare this proposal as my original work and has not been presented for award of a degree in any University.

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ABSTRACT

Poor cold chain management is one of the main causes of post-harvest losses (>50%) reported in most vegetable and fruit value chains. Therefore maintenance of low temperature for horticultural commodities is critical in postharvest handling of these perishable crops. However, conventional cold rooms are expensive and unaffordable for majority of the horticultural smallholder farmers. This has necessitated research in alternative low-cost storage systems. The Coolbot™ technology is one such technology that has been used effectively in other countries and various commodities. Transfer of the technology to Kenya requires extensive research to validate its efficacy under local conditions. The present study was conducted to establish efficacy of Coolbot™ technology to lower and maintain cold temperatures during storage of mango fruits. The study also sought to evaluate the synergistic effect of cold storage and modified atmosphere packaging (MAP) using Activebag® in preserving quality and extending shelf life of mango fruits. The study site was Makueni County and it was conducted over 2 seasons, between 2014 and 2015. A Coolbot™ cold room was constructed from locally available materials including structural insulated panels made of polystyrene to provide insulation; an LG air conditioner (24,000 BTU) and the Coolbot™. Temperature probes were strategically positioned in the cold room and ambient room to monitor temperature changes during the storage period. Temperature changes in the cold room were monitored after every one hour until the preset temperature (10±1°C) was attained. The Coolbot™ cooling efficacy studies were conducted using 'Apple' mango variety harvested at physiological maturity stage and stored in the cold room and ambient room. Three fruits were sampled randomly from the two storage conditions at regular intervals to compare progression in ripening based on changes in respiration rate, peel/flesh color and firmness. A replicate experiment was conducted using 'Apple' and 'Ngowe' mango varieties. The fruits were then either packed in Active bags or left unpacked. Random

sampling of three fruits was conducted after every three days to measure ripening progression and change in quality attributes. Parameters measured include respiration rate, ethylene evolution, cumulative weight loss, peel/flesh color and firmness, total soluble solids, total titratable acidity, soluble sugars (fructose, glucose and sucrose), Vitamin C and ß-carotene. Results show that Coolbot™ effectively lowered and maintained temperature at 10±1°C throughout the storage period whereas the ambient room temperature fluctuated between 25 – 28°C. Cold-stored fruits had an extended shelf life of 35 days (compared to 12 days for fruits in ambient room) as evidenced by slower ripening-related changes. 'Apple' mangoes in the ambient room reached climacteric peak (53.9 ml/Kg/Hr) earlier on day 12compared to the delayed one observed on day 35 for cold stored fruits., The synergistic effect of cold storage and MAP in preservation of quality and extension of shelf life of 'Apple' and 'Ngowe' mango varieties was demonstrated. In 'Apple' mango, the 35 days shelf life under cold storage was extended to 40 days under cold storage + MAP. Respiration, ethylene evolution, color changes and softening rate were all significantly reduced under cold storage, with or without MAP. Changes in all the fruit quality attributes including vitamin C, beta-carotene and sugars were significantly slowed down under cold storage. Cold-stored 'Apple' mangoes that were packed in Active bag® retained higher Vitamin C content (59.77 mg/100ml) at the end of storage period, compared to unpacked fruits (51.8 mg/100ml). Overall, cold storage and MAP slowed down ripening and senescence as shown in the results. The findings confirm efficacy of the Coolbot™ technology to lower and maintain low temperatures in an insulated storage room thereby preserving quality and extending shelf life of mango fruits. The technology can therefore be promoted as a low-cost alternative cold storage option for adoption by smallholder mango farmers.

Key words: Coolbot™, cold storage, cold chain, post-harvest losses, MAP