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Preservation of fresh fruits, vegetables and quality standards during storage utilizing energy-efficient technologies for improved livelihoods

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Food and energy security are two key global challenges. In Kenya, agriculture is mainly characterized by dominance of primary production with little post-production interventions such as preservation. Preservation of fruits and vegetables can provide rural households with better diets year round and incomes. Therefore, the study focused on developing energy-efficient cooling technology utilizing renewable energy for preservation of fresh fruits and vegetables. Through a renewable energy for food processing (christened RE4Food) project; an evaporative charcoal cooler was purposely developed for use by a registered farmer group in Kirinyaga County, Kenya. The developed cooler measured 4 m long, 4 m wide and 2.5 m high with a storage capacity of 40 m3. Preliminary results indicate promising results in terms of microclimate conditions (temperature and relative humidity), shelf-life and quality of the produce. The charcoal cooler should be optimized to ensure a favorable microclimate and controlled wetting of charcoal walls thus saving water for other agricultural activities. To improve capacity among farmers, training of beneficiaries was conducted focusing on operation and maintenance of the facility, quality standards, packaging, business aspects and book keeping, group dynamics and marketing. To ensure sustainable and maximum returns from the facility, farmers were also trained on the development of health foods for subsistence as well as for export. Further, the farmer group was linked with renowned fresh produce exporters in order to maintain required quality standards along the entire value chain of fruits and vegetables. Through established marketing linkages, farmers can package their value-added products and deliver them to ready markets, thus generating incomes to the rural poor. These linkages provide valuable business opportunities badly needed in rural communities. Overall, the interventions undertaken by this study are vital in minimization of postharvest losses, enhancing food security and realizing nutrition sensitive agriculture in Kenya and beyond.

Performance indicators

- Charcoal cooler section: 4 m × 4 m × 2.5 m
- Preparation area: 5 m × 4 m × 2.5 m
- Office (records keeping): 3 m × 4 m × 2.5 m
- Cold storage space (capacity): 40 m³
- Temperature difference: 8.4±0.9°C
- Relative humidity difference: 30.7±6.4%
- Weight loss of kales after 2 days: 9.3%
- Weight loss of tomatoes after 2 days: 6.2%
- Total colour difference after 2 days, ΔE (kales): 8.27 (cooler), 16.75 (outdoors)
- Total colour difference after 2 days, ΔE (tomatoes): 1.07 (cooler), 5.54 (outdoors)

Fig. 1: Evaporative charcoal cooler.

Recent Publications

1. Basediya A L, Samuel D V K and Beera V (2013) Evaporative cooling system for storage of fruits and vegetables – a review. Journal of Food Science and Technology 50(3):429-442.
2. Camargo J R (2007) Evaporative cooling: Water for thermal comfort. Ambiente e Agua - An Interdisciplinary Journal of Applied Science 3:51-61.
3. Hodges R J, Buzby J C and Bennett B (2010) Postharvest losses and waste in developed and less developed countries: Opportunities to improve resource use. Journal of Agricultural Science 149:37-45.
4. Zahra G and John A B (1996) A passive evaporative cooling system by natural ventilation. Build Environment 31(6):503-507.

Biography

Erick K Ronoh is a Lecturer in the Department of Agricultural and Biosystems Engineering, School of Biosystems and Environmental Engineering, Jomo Kenyatta University of Agriculture and Technology (JKUAT), Kenya. He has obtained his PhD in Horticultural Sciences (Dr. rer. hort.) in June 2016 at the Leibniz Universität Hannover, Germany. He also holds an MSc in Agricultural Processing Engineering and a BSc in Agricultural Engineering, both from JKUAT. In addition to his teaching career, he has been actively involved in a number of research projects in the fields of Agricultural Processing Engineering, Agricultural Structures, Renewable Energy and value addition for enhanced food and nutrition security as well improved rural livelihoods. His vision is to be a reliable, dependable and result oriented professional by advancing knowledge in the field of agricultural processing engineering aimed at mitigating food insecurity, alleviating poverty and enhancing management of available natural resources.

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