Implementing Charcoal Coolers to Reduce Post-Harvest Losses

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Introduction

Post harvest handling of produce is important for food safety and longevity. Produce shelf life increases when properly stored at lower temperatures *(Table 1)*. Nakanyonyi and Namasagali Primary Schools in Kamuli, Uganda maintain school gardens to grow vegetables. Produce could be stored in a charcoal cooler which uses evaporative cooling as a means to refrigerate the interior. It requires no power input and is constructed with easily accessible materials. This simple design solution reduces loss of vegetables harvested at the schools, and allow them to be utilized for longer.

Table 1: Average Shelf Life of Vegetables

Vegetable	Without Refrigeration	Shelf Life in Cool Area
Cabbage	1 week	3 weeks
Carrots	7-10 days	3-4 weeks
Green Onions	3 days	1 week
Spinach	Shouldn't Be Left Out	5-7 days
Squash	1-5 days	5-7days
Eggplant	2 days	3-4 Days

Table 1: FDA, 2017

Objectives

1. Assess need of a charcoal cooler at the schools. Determine if produce goes to waste and how big of a cooler would be needed to prevent spoilage.
2. Build and test a cooler to see how long it will extend shelf life of produce local to the area *(Fig. 2)*. Estimate how often water needs to be applied to maintain a consistent interior temperature.
3. Then implement the cooler at the a primary school as a trial run.

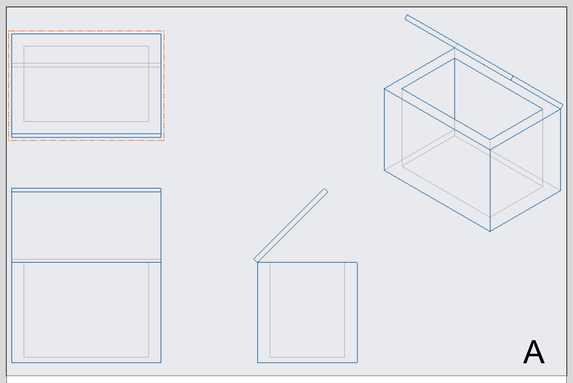

Figure 1: The initial charcoal cooler design (A) compared to our design recommendations (B)

Materials and Methods

1. At Nakanyonyi and Namasagali Primary Schools teachers were interviewed to understand what problems they face with produce loss because of unsafe storage practices. Both of the schools agreed increasing produce shelf life would decrease their food waste and would increase the amount of vegetables for their school feeding programs.

1. A charcoal cooler was built and used at the Iowa State Uganda Program compound to test workability. Temperatures of inside and outside air were measured over a 12 hour period using an infrared thermometer. Produce stored in the cooler was visually examined to see if the charcoal cooler was effective *(Fig. 3)*.

2. The test charcoal cooler was implemented at Nakanyonyi Primary School as a test run.

Figure 2: Grain amaranth leaves, which are grown in the school's gardens, were used to test shelf life

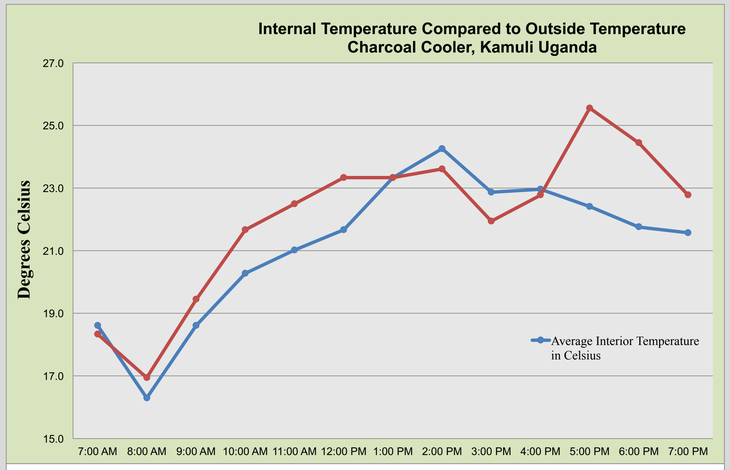

Figure 3: Interior cooler temperatures compared to outside temperatures from 7:00 am to 7:00 pm.

Results

1. Discussion with teachers and chefs at the schools confirmed that there is a need for a charcoal cooler. One cubic meter would be adequate storage space for the amount of produce harvested.

2. Temperature test showed an average inside cooler temperature of 21.1 with the outside temperature ranging between 16.9 and 25.6 throughout the day. Saturation tests need to be run.

3. Currently being utilized at Nakanyonyi Primary School. Future service learners will follow up with evaluation.

Recommendations

- There is high potential for charcoal coolers to be implemented at all schools.
- Data may have been skewed due to the cooler being opened every hour over the course of the day which may have raised the temperature. To avoid this see below.
- Design changes include *(Fig. 1)*:
  - Unit raised on legs to increase airflow underneath the cooler
  - Front facing door on hinges rather than a lid on top
  - Shelving within cooler to separate and organize contents
  - Thermometer records temperature on the interior but displays on the outside of the unit for better control and recording of temperature flux
  - Water funnel to walls of the cooler to increase ease of use

Resources

https://www.fda.gov/downloads/Food/ResourcesForYou/HealthEducators/ucm109315.pdf
https://chemung.cce.cornell.edu/resources/storage-guidelines-for-fruits-vegetables
https://visual.ly/community/infographic/food/shelf-life-food

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