Term UROP is offered: Summer
UROP Department, Lab or Center: D-Lab
MIT Faculty Supervisor Name: Eric Verploegen

Project Title: Design optimization of evaporative cooling technologies for fruit and vegetable storage in low-income rural communities

Project Description: We are looking for a student to conduct experiments, analyze data, and propose design improvements for two types of evaporative cooling devices that D-Lab is deploying in collaboration with our partners in Mali, Uganda, Kenya, and India. When affordable and effective post-harvest storage solutions are not available or affordable, people living in off-grid rural communities will often experience vegetable spoilage, loss of income, lack of access to nutritious foods, and large amounts of time spent purchasing vegetables.

Clay pot coolers are low-cost devices that operate through the principle of passive evaporative cooling to provide a cool and humid environment for small-scale storage of fruits and vegetables. Information on the work D-Lab is doing in Mali can be found here: https://d-lab.mit.edu/research/evaporative-cooling-vegetable-preservation/clay-pot-coolers. Students will use experimental setups at D-Lab to investigate the impact of factors such as cover thickness and material, pot size, and watering frequency have on the performance of the devices, so that we can provide users with better guidance on how to best make these devices.

The second technology is a larger room sized storage chamber able to store 3-5 metric tons of produce. By using forced air evaporative cooling, the approach developed by D-Lab can cool produce more quickly than a conventional refrigerated cold room, and with less power consumption. D-Lab has a full-sized outdoor chamber based on a used 10' shipping container, as well as an indoor test chamber for conducting experiments in a controlled environment. Students will conduct experiments to investigate the impact of airflow rate, chamber geometry, and many other factors on the cooling performance. Pilot chambers using 20' shipping containers are currently being built in Kenya and India, and research conducted this summer will help inform the design of those systems and future deployment of this technology throughout Africa and India. More information on this project can be found here: https://jwafs.mit.edu/projects/2021/mobile-evaporative-cooling-rooms-vegetable-preservation

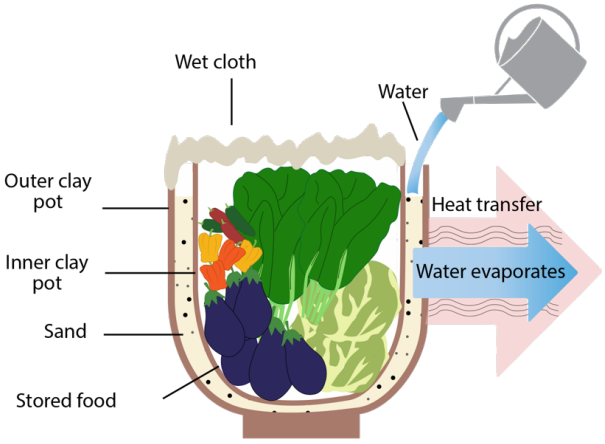
Interested candidates should email ericv@mit.edu with a brief explanation of why they are interested in this project and describe any relevant previous experience.

Prerequisites: Applicants should have an attention to details, and an interest in practical solutions to global poverty challenges. Experience with experimental design, using Arduinos, and data collection through electronic sensors, is preferred but not required.

Relevant URL: https://d-lab.mit.edu/research/evaporative-cooling-vegetable-preservation/clay-pot-coolers

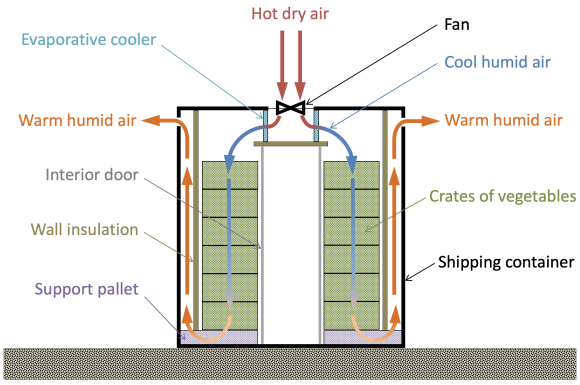
Contact: Eric Verploegen (ericv@mit.edu)

Clay pot coolers



A clay pot cooler in a rural household in Mopti, Mali

Forced-air evaporative cooling chambers



20’ shipping container converted into a forced-air evaporative cooling chamber Gujarat, India.