Low Cost Storage Technology for Farmers, SMEs and entrepreneurs

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Training workshop on Characterisation of Fresh and Processed Fruit Quality, organised by the CUC, University of Southampton and the Nong Lam University, Vietnam funded by Leverhulme Trust, UK. Dated: 23-25 July, 2012

The Need

- Temperature management- the most crucial step
  - to increase the shelf life of produce
  - maintain its nutritional characteristics
- Mechanical refrigeration
  - very costly
  - practically and economically unfeasible for small and marginal farmers
- Cost of mechanical refrigeration- $ 3,500/sq. mt
- Cost of coolbot room air conditioner- $ 35-$ 40/ sq.mt.

What is CoolBot?

- A device developed by **Mr. Ron Khosla**
- CoolBot turns a conventional room air conditioner into a produce cooler.
- There are three sensors-
  - First to sense the room temperature
  - Second one connected to the Air conditioner temperature sensor
  - Third one is the frost sensor

Existing CoolBot

Improved CoolBot

What does it do?

- The air conditioner's thermostat is regulated so that the unit keeps running until the room temperature reaches the CoolBot set point.
- To prevent icing of the fins, the CoolBot measures the fin temperature and regulates the compressor when ice builds up.
- The room temperature is set as desired for the commodity and is maintained during the storage period.

Amity University Project

- The project was awarded by HortCRSP USAID in collaboration with University of Californa, Davis
- Partner countries- USA, India, Hondarus, Uganda
- Objectives of the project
  - Selection of low cost locally available insulating material
  - Testing the effectiveness of CoolBot/room air conditioner combination over and above the mechanical refrigeration

Construction Methodology

- The internal dimension of the room is 12 ft X 12 ft.
- The thickness of the wall is 2ft 9 in.
- The insulation selected was a thick mud wall with rice husk as binder.
- To provide support and stability to the wall 9 inch thick untreated bricks are used on all walls.
- On both side of the brick there is 1 ft wide mud wall made of special clay mud.
- This mud is mixed with rice husk in the ratio 2:1 i.e. 2 parts mud and 1 part rice husk.
- An air lock room of 5ft X 6 ft is constructed so that the cool room door is opened only when absolutely necessary.

Construction Methodology (contd..)

- The door of the cool room is a standard cold store door with 30 mm thick PUF s with appropriate hinges and locking.
- Roof has been made with girder, kota stone, thermocol enclosed inside polythene to also act as vapour barrier, tiles and on top two layers of small stone chips and cement.
- Thermocol has been used for insulation with density 20 Kg/ sq. mt and thickness- 6 inches.
- The roof has a slope on one side for easy drainage of rain water.
- Four coatings of the paint are given.
- First is the clay coating, second cement based coating called 'Putty', a layer of water proof coat branded 'FIXIT' and a layer of heat reflective paint.
- A videocon window air conditioner 21,000 BTU was installed.
- The CoolBot is connected to the air conditioner

Installation of the CoolBot

- Install the air conditioner and CoolBot in the wall
- There are three labeled wires coming out of CoolBot: one measures the temperature of the room, let it hang free.
- The second wire (labeled frost sensor) has to be stuck into the cooling vent fins of the A.C. unit.
- Attach the third wire to the temperature sensor which sticks out of the front of the A/C unit.
- Wrap the CoolBot wire and the end of that temperature sensor together using a small 1/2 inch by 1 inch piece of aluminum foil to ensure a good thermal connection.
- There are three buttons on the CoolBot - Set the first one (labelled Room temperature) to your desired temperature and the frost button.
- The temperature on the frost button should be lower than the room temperature.

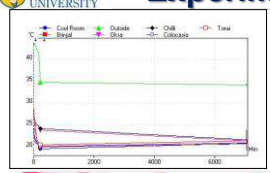
Construction Cost

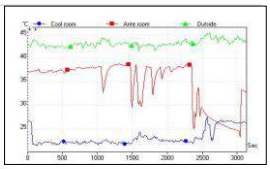
Component	Cost (Rs. Lakh)	Cost (US $)
Construction cost including labour and transport	1.65	3121
Equipment cost (AC, Invertor, CoolBot)	1.21	2288
Total Cost (144 sq. Mt.)	2.86	5409
Cost Per sq.mt.	0.019	37.56

Experimental Results

- The preliminary results indicated a temperature level down to 4-8^{o}C when the temperatures in the outside showed a great fluctuation.
- The insulation material we used with 2ft 9 in thickness mud and 6 in thermocool in the roof was found satisfactory in maintaining the desired temperature at the experimental level.
- The experiments conducted showed that the CoolBot cool room maintains the lower temperature below 10^{o}C when the outside temperature ranges from 42-45^{o}C in the peak summer month of May-June.

Experimental Results





Vegetable inside the cool room

Experimental Results

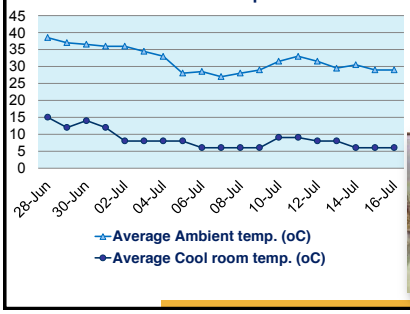
- Core temperature of some crops in control and cool room

No of days	Cauliflower		Tomato		Cabbage		Okra	
	Control	CoolRoom	Control	CoolRoom	Control	CoolRoom	Control	CoolRoom
3	25.06	9.53	31.6	9.23	28.61	8.61	29.8	9.09
7	25.05	9.53	32.8	9.24	28.31	8.61	29	9.08
14	25.03	9.54	36.5	9.23	28.31	8.61	29.6	9.08

Storage life of indigenous fruit in coolroom

Commodity	Storage Life	Temperature (^{0}C)	Relative Humidity (%)
Aonla	15 days	2	85-95
Bael	12 weeks	9	85-90
Jackfruit	6 weeks	10-12	85-90
Phalsa	7 days	5-7	85-90

Results at Sultanpur Cold Storage




Vegetables inside coolroom


Data Recording through Picologger

Benefits

- The major outcomes of the technology are increased profits through:
  - Enables access to a key postharvest management tool – cold storage
  - Low cost technology puts cold storage within the financial reach of small and marginal farmers
  - Extends shelf life of produce – quickly lowering produce temperature after harvest extends shelf life by reducing metabolic activity and microbial growth.
  - Therefore, cold storage extends the life of vegetables without effecting (after taking out of the cold storage) their natural rate of decay.
  - Allows farmers to leverage market factors such as price fluctuations, thereby minimizing potential for distress sales by small farmers
  - Reduces the power consumption

New Project

- Try five new methods with different insulating material (rice husk, hollow tiles) and different designs (underground, mound etc.)
- Going to submit to Ministry of Food Processing
- Any one interested?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Thank You