



## Low Cost Storage Technology for Farmers, SMEs and entrepreneurs

**Dr. Neeru Dubey,  
Assistant Professor,**

Amity International Centre for Post Harvest Technology &  
Cold Chain Management (AICPHT & CCM),  
Amity University Uttar Pradesh, Noida, India

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 Amity University Project

- The project was awarded by HortCRSP USAID in collaboration with University of California, Davis
- Partner countries- USA, India, Honduras, 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



## AMITY UNIVERSITY 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.



## AMITY UNIVERSITY 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



## AMITY UNIVERSITY Installation of the CoolBot

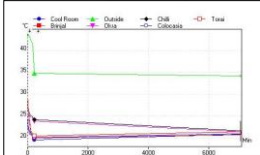
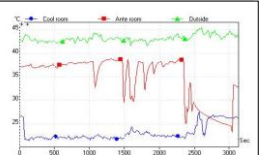
- Install the air conditioner and CoolBot in the wall
- There are three labeled wires coming out of CoolBot: one measures the temperature of the room, let it hang free.
- The second wire (labeled frost sensor) has to be stuck into the cooling vent fins of the A.C. unit.
- Attach the third wire to the 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.



### AMITY UNIVERSITY 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

- ### AMITY UNIVERSITY Experimental Results
- The preliminary results indicated a temperature level down to 4-8°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°C when the outside temperature ranges from 42-45°C in the peak summer month of May-June.

### AMITY UNIVERSITY Experimental Results

Vegetable inside the cool room

Data Recording through Picologger

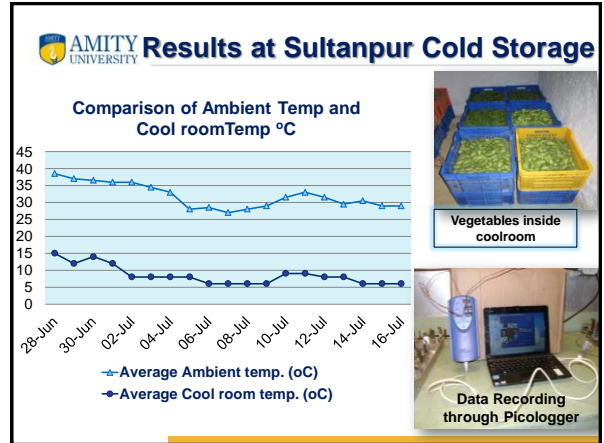
### AMITY UNIVERSITY Experimental Results

• 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

AMITY UNIVERSITY Storage life of indigenous fruit in coolroom

Commodity	Storage Life	Temperature (°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



AMITY UNIVERSITY **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

AMITY UNIVERSITY **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?



**Thank You**