

**TRAINING AND DEMONSTRATION – 2**  
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**i) LOW COST TECHNIQUE OF STORAGE: Zero Energy Cool Chamber**

- The Pusa zero energy cool chamber (Pusa ZECC) works on the principles direct evaporative cooling.
- The greatest importance of this low cost cooling technology lies in the fact that it does not require any electricity or power to operate and all the materials required to make the cool chamber are available easily and cheaply.
- Even unskilled labor can build the chamber, as it does not require any specialized skill. Bricks and most of the raw materials used in the cool chamber are also reusable.
- The cool chamber is kept saturated with water either by sprinkling of water once in the morning and once in the evening or fixing a drip system in order to maintain temperature and humidity.
- The cool chamber can reduce the temperature by 10-15 °C and maintain high humidity of about 95% throughout the year (See diagram Pusa ZECC).

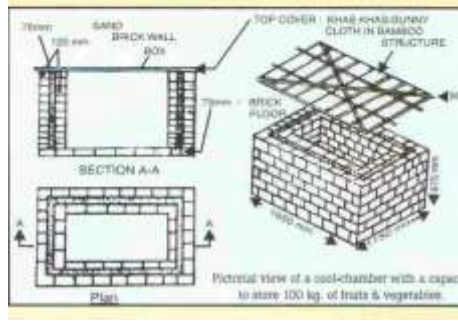
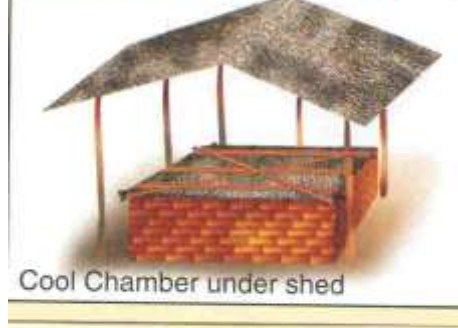
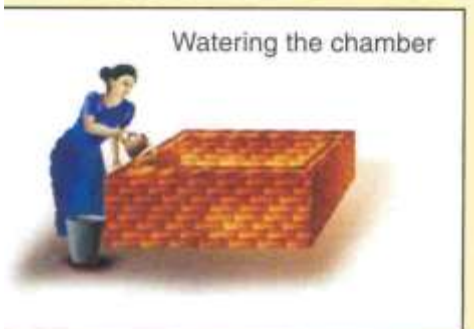
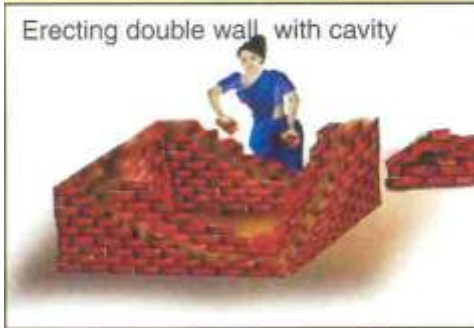
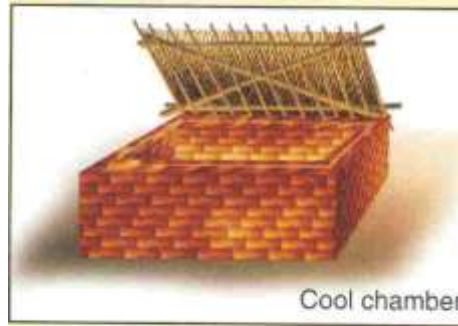
**Construction:**

- Select an-upland having a nearby source of water supply.
- Make floor with brick 165 cm x 115 cm.
- Erect the double wall to a height of 67.5 cm leaving a cavity of 7.5 cm.
- Drench the chamber with water.
- Soak the fine river bed sand with water.
- Fill the 7.5 cm cavity between the double walls with this wet sand.
- Make a frame of top cover with bamboo (165 cm x115 cm ) frame and 'sirki' straw or dry grass. Make a thatch/tin shed over the chamber in order to protect it from direct sun or rain or snow.

**Operation:**

- Keep the sand, bricks and top cover of the chamber wet with water.
- Water twice daily (morning and evening) in order to achieve desired temperature and relative humidity.
- Alternatively fix a drip system for watering with plastic pipes and micro tubes connected to an overhead water source.
- Store the fruits in this chamber by keeping in perforated plastic crates. Cover these crates with a thin polyethylene sheet.
- The cool chamber should be reinstalled once in 3 years with new bricks utilizing the old bricks for other purposes.

# DIAGRAM FOR CONSTRUCTION OF PUSA ZECC



## A PICTORIAL VIEW OF CONSTRUCTION OF ZERO ENERGY COOL CHAMBER



WATERING OF BRICKS



CONSTRUCTION OF FLOOR



DOUBLE BRICK WALL



CAVITY FILLED WITH SAND



WATERING OF COOL CHAMBER



CLOSEUP VIEW



CONSRUCTION OF COVER



PUSA ZECC READY FOR USE

**Monthly average Minimum and Maximum Temperature (<sup>0</sup>C) in cool chamber and out side  
(Under Delhi condition)**

	Inside		Outside	
Months	Minimum	Maximum	Minimum	Maximum
January	10.92	13.00	7.20	21.24
February	12.29	14.26	9.60	23.65
March	15.81	17.51	13.50	28.01
April	18.90	21.38	17.56	35.75
May	21.63	24.33	25.81	40.15
June	24.34	25.80	27.03	39.29
July	25.65	27.07	25.59	34.46
August	25.60	26.65	25.72	33.36
September	24.57	25.54	24.14	33.43
October	19.59	21.87	17.16	33.21
November	15.37	17.36	11.52	28.53
December	12.27	13.45	7.77	23.21

**COST OF COOL CHAMBER (100 Kg. capacity) : Tentative**

Bricks (400 Nos.)	Rs. 2000.00
Sand (10 bags)	Rs. 500.00
Bamboo, Khaskhas, etc. for top cover	Rs. 500.00
Corrugated Tin Shed	Rs. 1500.00
Water Tank , pipes tubes, polyethylene sheet etc.	Rs. 1000.00
Labour	Rs. 500.00
<b>Total</b>	<b>Rs. 6000.00</b>

**Advantages:**

1. Can be constructed by an unskilled person. No mechanical or electrical energy needed
2. Allows small farmers to use it for on farm pre-cooling system or to store produce for a few days so that the growers are not forced to sell at low prices.
3. Reduces losses and pays for itself in a short time. No mechanical or electrical energy needed. Can keep the temp 10-15°C cooler than the outside
4. Maintain about 90% relative humidity. Ideal for short term storage of fruits.

**Precautions:**

1. Try to select a site where breezes blow. Build in an elevated place to avoid water logging.
2. Use clean, unbroken bricks with good porosity.
3. Sand should be clean and free from organic matters, clay etc.
4. Keep the bricks and sand saturated with water. Roof over to prevent direct exposure to sun.
5. Use plastic crates for storage; avoid bamboo baskets, wooden/fibre board / boxes, gunny bags.
6. Prevent water drops coming in contact with stored material.
7. Keep chamber clean and disinfect the chamber periodically with permitted insecticide/ fungicide/ chemical, to protect from fungus, insect / pests, reptiles, etc.

## (ii) DEMONSTRATION OF DIFFERENT PACKAGING AND CUSHIONING MATERIAL

- The main objective of packaging is to keep the fruits in good condition until it is sold and consumed.
- Good packaging gives more choice to consumers in terms of food availability and encourages the customers to purchase the product.
- Packaging also enhances the income of rural producers from surplus produce.
- Post-harvest losses are occurring in the period between harvesting and consumption.
- The term losses include all types of losses for the farmers, traders and consumer.
- There is an urgent need to adopt proper post harvest management practices by adopting improved packaging, handling and efficient transportation methods.

### Advantages :

#### Crate liner :

- Reduces abrasion
- Preventing secondary infection
- Better quality
- More return to farmer



#### Film wrapping:

- Reduces weight loss,
- Induces controlled atmosphere
- Extends shelf-life
- Acceptable to consumer



#### CFB Box :

- Efficient handling unit
- Protects from mechanical damage
- Cushioning material not required.
- Convenient for palletization and loading and unloading
- Reduces cost of transport and marketing
- Maintains quality and freshness



### (iii) PREPARATION AND PRESERVATION

#### Minimal Processing :

- It is more easy to eat an apple than a pineapple or pomegranate. Consumer will be more inclined to buy Pomegranate if it is sold in a ready to eat form packet.

#### Minimal Processing - Pomegranate



Selection of pomegranate



Washing of pomegranate



Cutting of pomegranate



Taking out arils



Packing the arils

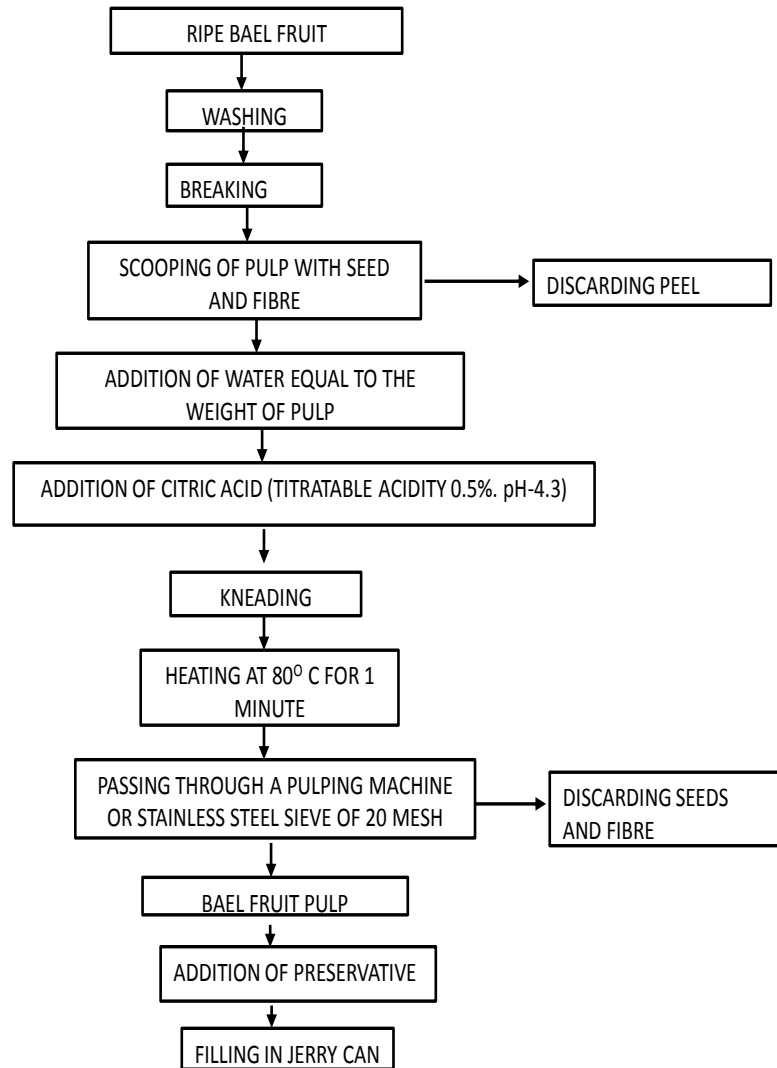


Packaging, storage & Transportation

### Extraction of Bael Fruit Pulp :

- The extraction of Bael fruit pulp is very difficult because of its hard shell, mucilage, seed and fibre.
- Method have been standardized for the extraction of Bael fruit pulp for preparation of different product which is given below :

### Flow Sheet for the Extraction of Bael Fruit Pulp



# Pictorial view of Extraction of Bael Pulp





### **Advantages of Minimal Processing:**

- Consumers are increasingly demanding convenient, ready to use/eat fruit with a fresh like quality and containing only natural ingredients.
- Pre-packaging allows for more efficient portion control.
- Solid waste disposal problems are reduced.
- Demand on limited refrigerated storage space are reduced.
- If the fruits are available in ready to eat form a large number of working women in metro cities will be greatly benefited.
- One should keep in mind that while supplying minimally processed fruits the maintenance of quality and hygiene must be of topmost priority.
- Rapid urbanization, breakdown of joint family system, increase in the cost of household labour, increasing number of working women, rise in per capita income etc., have all contributed to the rapid growth and change in demand patterns.
- In metro cities minimally processed fruits can solve one of the greatest problems of garbage disposal