

## Directorate of Horticulture

### Ripening Chamber

#### Introduction

Presently the fruit ripening is done in a very dangerous manner. Most climacteric fruits in Bihar are ripened with industrial grade calcium carbide. Industrial-grade calcium carbide usually contains traces of arsenic and phosphorus, and, thus, use of this chemical for this purpose is illegal in most countries. Calcium carbide, once dissolved in water, produces acetylene which acts as an artificial ripening agent. Acetylene is believed to affect the nervous system by reducing oxygen supply to brain. Arsenic and phosphorus are toxic, and exposure may cause severe health hazards.

#### Strategy

The only safe and worldwide accepted method is using ethylene, which is a natural hormone for ripening when done under controlled temperature and relative humidity conditions.

Fruits are ripened with ethylene exposure at certain prescribed Temperature and Relative Humidity level of 90-95%.

#### Following is Broad Guide for Fruit Ripening Condition

Sr. No	Fruits/ Vegetables	Ethylene Concentration (PPM)	Ethylene Exposure Time (Hour)	Ripening Temperature (°C)	Storage Temperature After Ripening (°C)
1	Banana	100-150	24-48	15-18	13-14
2	Mango	100	24	20-22	10-13
3	Papaya	100	24-28	20-25	About at 7
4	Tomato	100-150	24-48	18-20	12.5

#### Benefits:

- Ethylene being a natural hormone does not pose any health hazard. It has been known for a long time that treatment of unripe fruits with ethylene would merely stimulate natural ripening until the fruit itself starts producing ethylene in large quantities.
- It is a de-greening agent, which can turn the peel from green to perfect yellow (in the case of bananas) and maintain the sweetness and aroma of the fruit, thus value

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addition in the fruit is possible as it looks more appealing.

- Increased shelf life of fruits
- As the rates of the fruits ripened from these ripening chambers will be higher the farmers will get more profit.
- The consumers will be aware about the benefits of the safe food so they will prefer to buy the products from this area only

### **Financial Assistance**

An entrepreneur can avail assistance for establishment of ripening chamber @ 50% of admissible project cost in general areas and @ 75% in case of FPO/FPC as credit linked and back ended subsidy. The admissible cost for ripening chamber is Rs. 1.00 lakh per MT (Max 300 MT). Ripening chambers can be designed for multi-tiered pallet-based storing or structures for basic storage.

**Suppose.** If an entrepreneurs want to establish five chambered ripening chambers (for Banana) with 7 MT capacity of each chamber, Then, total capacity would be 35 MT. As per MIDH guideline total cost will be 35 lakhs (1.00 Lakh/MT). Subsidy amount would be 17.50 Lakh.

Subsidy amount would be decided only after physical verification by Joint Inspection Team (JIT). First installments (35%) will be released after construction of civil structure and purchasing of equipment and machineries. Once the commercial operation start, second installments (65%) will be released duly verified by JIT.

#### **Important Note for Civil Construction:**

For 1 MT capacity 11 cubic meter/389 cubic feet volume is required.

**Following technical parameters may be followed for establishing ripening chamber**

Sr. No.	Items Particular /	Minimum Technical Specifications
1	Civil Structure - building design	<ul style="list-style-type: none"> <li>a. Structural Safety - Structural design as per BIS Code</li> <li>b. Adherence to local Building Regulations</li> <li>c. Concrete floor with sufficient load bearing capacity</li> <li>d. Chamber size is not smaller than 50 Cu M for preventing building up of high concentration of ethylene</li> </ul>
2	Ripening Room	<ul style="list-style-type: none"> <li>• 11 cubic metres of storage space is considered equivalent to 1 Metric Ton ripening capacity.</li> <li>• Number of chambers may vary from four to eight depending on ripening cycle in terms of number of days. Chambers will be generally identical in dimension.</li> <li>• Ripening Room Chambers should be designed and constructed to hermetically seal with appropriate closures / doors.</li> <li>• The airflow within the ripening rooms is to be designed to penetrate all boxes of fruit with an even airflow throughout the room resulting in all fruit being ripened uniformly</li> </ul>
3	Temperature & Humidity levels Heat Load Calculation and Refrigerant	<ul style="list-style-type: none"> <li>• Ripening is preferred at a lower temperature but above level of chilling injury. System has to be designed to achieve prescribed ripening conditions in terms of temperature and relative humidity for target fruits. Generally, RH level of 90-95% is recommended to prevent moisture loss</li> <li>• Eco-friendly refrigerant is recommended</li> </ul>
4	Ethylene Generator and Dosing device	<ul style="list-style-type: none"> <li>• Ethylene may be introduced in ripening chambers in one of the three ways by using independent ethylene generator with regulator; ethylene cartridges and ethylene-nitrogen mixture (5% ethylene + 95% nitrogen) cylinder. Whichever method is used, the duty holder should ensure that there are adequate means of dispersing the ethylene gases throughout the ripening room on its release.</li> </ul>

5	Specification for Air circulation and Ventilation System	<ul style="list-style-type: none"> <li>• Minimum air flow should be 2000M3 per hour, per MT of product ripened at 95%.</li> <li>• When fruits are ripening, they release carbon dioxide which will build up in a ripening room. The CO2 production begins as the fruit ripens enters the “climacteric” phase, or the period when bananas release ethylene and have an elevated rate of respiration (along with a great deal of other physiological changes). Respiration involves the uptake of oxygen, the release of carbon dioxide, and the breakdown of starches. Carbon dioxide concentrations above 1% (10,000 ppm) will retard ripening, delay the effects of ethylene and cause quality problems.</li> <li>• Suitable venting system consisting of fans/dampers/open – shut valves should be installed to maintain CO2 concentration below 5000 ppm</li> </ul>
6	Sensor and Control devices	<ul style="list-style-type: none"> <li>• Suitable sensors are controlled devices should be used for maintaining following parameters. For this, temperature &amp; humidity loggers and Ripening Chamber Air Analysis Kit (for Ethylene and CO2 levels) may be used. <b>i. Temperature; ii. Relative humidity iii. Ethylene concentration; iv. CO2 Concentration</b></li> </ul>
7	Pallet Racking and Material Handling	<ul style="list-style-type: none"> <li>• Ripening unit with single tier stacking should have a manually operated pallet lifting and carrying device.</li> <li>• For multi-tier stacking motorised forklift should be provided.</li> </ul>
8	Some useful Appliances and Instruments	<ul style="list-style-type: none"> <li>• Weighing Scales and Fruit Inspection Instruments such as follow</li> <li>• a. Weighing scale b. Firmness Tester c. Refractometer d. Sizers and Callipers e. Produce Knife</li> </ul>
9	Safety Certification	<ul style="list-style-type: none"> <li>• Various fire detection and prevention systems include detectors for heat and smoke; fixed water-sprinkling system, inert gas snuffing systems shall have been tested at low temperatures.</li> <li>• Safety for workers against suffocation must be ensured.</li> </ul>

\*All Mandatory rules & regulations (BIS, ISO, IS etc.) relevant to the item must be complied with.



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