

# Impact Evaluation Study of NHB Schemes — Capital Investment Subsidy Scheme for Cold Storage and Accreditation & Rating of Nurseries

(Draft Report)



*Submitted to :*

**Deputy Managing Director,  
National Horticulture Board,  
Ministry of Agriculture & Farmers Welfare,  
Government of India,  
85, Institutional Area, Sector-18,  
Gurgaon-122 015**

*Submitted by :*

**AMS**

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## Executive Summary

National Horticulture Board (NHB) was set up by the Government of India in 1984 as an autonomous society under the Societies Registration Act 1860, on the basis of recommendations of the "Group on Perishable Agricultural Commodities" constituted under the Planning Commission of India. NHB has been working with the aim to improve integrated development of horticulture industry and to help in coordinating, sustaining the production and processing of fruits and vegetables. In order to achieve this and to streamline the efforts required for functions and objectives of various sectors and of varying nature, NHB has divided its functions under 6 different schemes. Among them are the scheme for "Capital Investment subsidy scheme for construction/ expansion/ modernization of cold storages and storages for horticulture products" and scheme for "Accreditation and Rating of Fruit Plant Nurseries".

As per one among the objectives of the board to carry out studies and surveys to identify constraints and develop short term and long term strategies for systematic development of horticulture, this study has been conceived to evaluate the impact of two of the above mentioned schemes. AMS Consultancy Pvt Ltd. has been entrusted with the conduct of the study with the specific objectives as mentioned ahead:

### **Scheme 1: Capital Investment subsidy scheme for construction/expansion/modernization of cold storages and storages for horticulture products**

- ☞ Comprehensive analysis of the capacity created in various (Type 1, Type 2, CA etc.) categories, capacity utilization and reasons for less capacity utilization, if any;
- ☞ Viability of the cold stores and measures to enhance financial viability;
- ☞ Analyze technology adopted by the cold stores and its comparison with NHB standards
- ☞ Pattern of utilization and profiling of beneficiaries in terms of own, traders, farmers, processors, exporters etc.;
- ☞ To review the present status of capacity utilization of cold storages;
- ☞ Profiling of commodities being stored, period of storage and assessment of losses over three months, six months, and more than six months;
- ☞ To conduct impact analysis of Cold Storage scheme of NHB in respect of:
  - ❖ Providing additional storage capacity for horticulture produce in production and consumption center,
  - ❖ Enhancing income of grower and other stakeholders,
  - ❖ To evaluate investment through private/bank participation,
  - ❖ Reduction in glut conditions and distress sale during peak harvest etc.,
  - ❖ To fill-up gaps in the area of storage of horticulture produce and to suggest:



- Potential area/locations with additional cold storage capacity of horticulture produce in the country,
  - Medium and short term strategies and requirement of interventions for systematic development of cold storage with respect to specific location/crops of horticulture importance.
- ☞ Analysis of benefit to growers, reduction in post-harvest losses and other benefits like salvation of glut situation, meeting market demand in off season etc.;
  - ☞ Gaps in infrastructure created which could enhance the value of stored produce, increase shelf life and marketability;
  - ☞ Constraints faced by beneficiary in terms of credit, documentation and ease of access to the scheme, funds release etc.

#### **Scheme 2: Accreditation and Rating of Fruit Plant Nurseries**

- ☞ To evaluate the status of implementation and operation of the nurseries with respect to the process, manpower, and infrastructure as per the guidelines prescribed by NHB;
- ☞ Visits to operating nurseries for evaluating the rating system and processes adhered to by the nursery including evaluation of accreditation agency, process followed for annual rating;
- ☞ Evaluation of the impact of the nurseries with regards to:
  - ❖ Production of quality planting material,
  - ❖ Benefits accruing to users through use of quality planting material such as production, yield and crop quality, incidence of pest and disease, and overall increase in farm incomes.
- ☞ Recommendations on improving the process for accreditation and annual ratings.

The study followed a mixed methods approach with focus on field level data collection to evaluate the impact of the two schemes that have been provided assistance by NHB across the country. Research tools for both studies were developed to capture the impact of these schemes on its beneficiaries and other related stakeholders. Besides doing a thorough analysis of secondary data available from various sources, a rich data base was generated from personal field visits to the selected samples and individually administered questionnaires.

#### **Scope of Work**

The Board has assisted around 300 cold storage/CA store projects involving 14.5 lakh MT capacity during the said period all over the country. For studying the impact of cold storage capital subsidy scheme, subject to and satisfying the rider condition put forward by NHB, that; "Minimum 1 project is to be physically visited in a state where project(s) have been given subsidy by NHB and maximum of 15 projects are to be visited in a state", 44 cold storages in the country were visited, among which 42 Co-operated with the study. Besides administering structure interviews with the owners, user

farmers and traders, in-depth interviews were conducted with State level officials. The total sample for cold storages came to 42 owners, and 374 users including farmers and traders.

At the time of field study being carried out, the board has accredited 1600 nurseries. To get a sizeable and representative sample, as provided in the rider clause for the study that; "Minimum 1 nursery is to be physically visited in a state where nursery(s) have been accredited by NHB and maximum of 25 nurseries are to be visited in a state", 160 nurseries were physically visited. In total 1600 user farmers were interviewed with a structured questionnaire.

Apart from undertaking the qualitative and quantitative interviews, the survey also consisted of observations of the cold storages projects and the nursery project across the country to understand their compliance with the approved guidelines by NHB. The observations consisted of understanding and evaluating the entire procedure pertaining to operational, maintenance and technical aspects of both the schemes in each state of the country.

Some of the key findings from the study are summarized ahead for quick reference. It is hoped that the insights received from the study can prove to be a path reckoner for NHB in its policy formulations.

### **Findings from Evaluation of Cold Storage Capital Subsidy Scheme**

1. It was found that 88% of the cold storages were of type 1, while 5% were of type 2 and 7% were type CA. The reasons for establishing more number of type 1 cold storage compared to other types were related to the higher costs involved in installation of Types 2 and 3.
2. The highest proportion of capital cost has been dedicated to the establishment of plant and other equipment (38%). Therefore it can be noted that this is the primary reason why cold storages of type 1 are chosen by investors over the other types.
3. The cold storages lag behind in modernization and automation. Only half of 42 cold storages (52%) had any Grading, sorting, washing and packing line in place. All of them except two were manual. While nearly one-third (33 %) had no mechanism in place for grading and sorting, two cold storages had automatic grading and sorting facilities in place and one had a semiautomatic facility.
4. It was observed that the fuel expenses came up to a third of the total recurring expenses (30%). Also for an installed capacity of 6000 MT, from various studies, it was found that in comparison with the cold storages having advanced insulation materials and technology, the conventional type 1 cold storages incur more than 3 lakh rupees per annum as additional charges on energy requirements.
5. The cold storages lack in the use of advanced technology and materials. Only two-fifth (42%) of the cold storages have used the better alternative of PUF as the insulation material over the inferior, thermocol/EPS. Similarly, it can be seen that nearly four-fifth (79%) of the cold

storages have preferred using ammonia as the refrigerant instead of Freon. Therefore, it can be noted that capital cost reduction is the largest factor which determines the selection of material and technology.

6. The key factor riding the choice of cold storage's specification by investors, is the amount of capital cost to be invested. This has led to the establishment of cold storages with the basic facilities only. Though a capital cost escalation can be avoided by using low grade materials and technology (including the use of cheaper materials for insulation), this can lead to escalation of operational cost which affects financial viability.
7. There is underutilization of capacity in the existing cold storages at most of the places. The capacity utilization of cold storages varies from 50% to 100%. Out of the 42 sample units, 18 cold storages recorded 100% capacity utilization. Of the remaining 24 cold storages, 17 recorded a utilization of 80% or less, which is undesirable. Summarizing, we find that while slightly more than two-fifth of the cold storages reported full utilization of capacity, the remaining reported underutilization.

One among the major reasons for underutilization is the seasonal nature of crops being stored as most of the cold storages can cater to single commodity only. Different commodities require different temperature conditions, which cannot be provided with the basic technology available with most of the cold storages, resulting in poor capacity utilization and low financial viability. Similarly lack of awareness among farmers of the benefits of using cold storage also constituted one among the reasons for underutilization. There were only two-fifth of the farmers utilizing cold storages to store their entire produce.

8. There is dissatisfaction with cold storage promoters regarding the amount of subsidy provided. In some cases, the subsidy amount was often released after a considerable time lag. This puts the burden of interest over subsidy amount on the investors. Such bottlenecks in provision of subsidy needs to be addressed.
9. Cold storages does not provide any insurance coverage to the crops stored.
10. There has been a significant increase in the income levels of both the users of the cold storages, viz; farmers and traders after starting to utilize the facility. All the traders and 97% of the farmers reported an increase in income after starting to use cold storages.
11. Saturation Levels have been reached in parts of Agra, Meerut and Kanpur of Uttar Pradesh State and certain parts of Punjab as per the State officials. No other area in the country have been reported as saturated.
12. Potential areas for new cold storages have been identified in the States of Andhra Pradesh, Chhattisgarh, Gujrat, Haryana, Himachal Pradesh, Jammu Kashmir, Karnataka, Maharashtra, Punjab, Tamil Nadu, Telangana, Uttar Pradesh and Uttarakhand.

## **Findings from Evaluation of Scheme for Accreditation and Rating of fruit plant Nurseries**

1. The proportion of nurseries belonging to higher rating is less (4 star and above only 12%).
2. Awareness about the accreditation process is very less among the user farmers. Only less than one-third (30%) were aware about the existence of a rating system for nurseries. This will act as a hindrance to achieve the objectives of Nursery accreditation scheme.
3. Only 275 farmers (17%) had experience or knowledge of using planting material from both accredited and non-accredited nurseries.
4. The farmers who had experience of using plants from both accredited and unaccredited nurseries, clearly affirmed the positive effect created by accredited nurseries in terms of increase in yield, improvement in the quality of crop, reduction in plant diseases and attack by pests and insects.

**Quality of planting material:** Nearly four-fifth (78%) of them observed that there is a difference in the quality of planting material sourced from nurseries when compared to other sources.

**Increase in yield:** The increase in yield when compared to plants from non-accredited nurseries was reported by four-fifth (82%) of the farmers with previous experience or knowledge in using plants from other sources.

**Quality of their crop:** More than a four-fifth (84%) of the farmers told they had an increase in the quality of their crop by using plants from nurseries.

**Damage caused due to insects and pests:** Nearly two-third (62%) of the farmers had observed a reduction in damage caused due to insects and pests after starting to use plants from accredited nurseries.

**Decrease in plants diseases:** Almost two-thirds (65%) reported that there has been a decrease in plants diseases.

Therefore, it can be observed that the nursery accreditation scheme has started to create a positive impact on the horticulture sector.

5. The nursery owners preferred to get trained and guided by government agencies throughout the accreditation process and afterwards.

## **Recommendations**

The recommendations which may help in policy formulation and betterment of the schemes implemented are presented ahead:

### **Cold Storage Capital Subsidy Scheme**

1. Improve the dynamic nature of subsidy by introducing various packages for different levels of technology and automation included in each cold storage. This should ensure that there is

a proportionate increase in the subsidy amount available for subsequent levels of sophistication/modernization included by cold storages.

2. There may be a gestation period given before the starting of loan repayment. This can help in improving the financial viability of the project.
3. Dissemination of knowledge among the investors about the advantages of using modern materials and technology while establishing cold storage is the need of the hour. This can help in reducing the operation cost to a large extent and thereby make the cold storages more financially viable. This part is not only vital to achieve success of the proposed dynamic subsidy scheme but will also facilitate savings of crucial electricity energy. The provision in the existing scheme for modernization of cold storages must also be utilized to a larger extent.
4. The cold storage facilities established outside the subsidy scheme must be encouraged to improve up on their infrastructural facilities by publicizing the lateral subsidy inclusion scheme whereby the facility may avail subsidy against loans for the improvement/upgradation proposed. This is vital as the lion's share of facilities offer basic facilities only.
5. Provisions should be made to make subsidy available for Cold storages with less than 5000 MT, especially, in Hilly Areas due to their peculiar topography. The terrain makes it difficult for cold storages to serve large catchment areas.
6. Insurance schemes for the produce stored in cold storage may be introduced at nominal rates and must be made mandatory for all cold storages.

### **Scheme for Accreditation and Rating of fruit plant Nurseries**

1. A quality improvement program should be introduced as part of the scheme which will help the nurseries to improve their rating on a continuing program.
2. As part of the above mentioned program continuous training and assistance should be given to nurseries for improving the operation, management and overall quality provided by nurseries.
3. Focus should be given on creating awareness among farmers about the merits of using plants from accredited nurseries.
4. There should be arrangement of exhibition of varieties of fruit trees during the events like Kisan Mela, where advantage of use of planting material from accredited nurseries may be disseminated.
5. There was a wide spread demand for increasing the period of accreditation from 3 years to 5 years.
6. The user farmers suggested to have a forum, where nursery functionaries may interact with farmers for knowledge transfer to improve the output from their orchards.

It is hoped that the findings and recommendations offered under this study will be useful for NHB to better interfere in these schemes with a renewed insight and vigor.

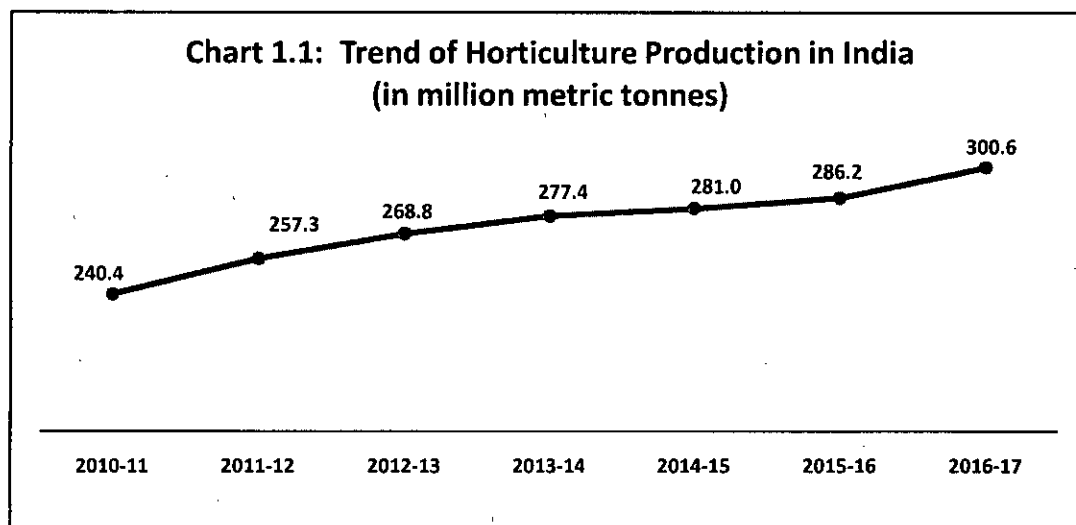
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# Introduction

### 1.1 Background and Context of the Study

Fruits and vegetables account for nearly 90% of the total horticulture production in the country. India is now the second largest producer of fruits and vegetables in the world, and leader in several horticultural crops, namely mango, banana, papaya, walnut, areca nut, potato, and okra (lady's finger). Horticulture sector occupies around 21 million hectares of land in 2009-10, accounting for around 10 percent of the gross cropped area of the country. With production of 223 million tonnes in 2009-10, the sector contributed more than 30 percent in the total value of output in agriculture.

**Increased Demand for Horticulture Produce:** The demand for horticulture products has been increasing significantly both at the national as well as at the international fronts due to their high nutritional values. This switch in demand towards nutritious and high value commodities in the recent decades is probably due to a general rise in people's purchasing power. This enormous increase in demand for such products has actually led to a shift in cropping pattern in favour of horticultural crops in the country. The trend of fruit and vegetable production has been depicted in the chart below —



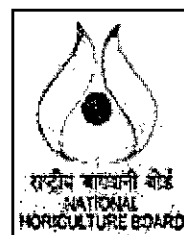
**Flipside of the Horticulture Sector:** Frequent crop failures and heavy dependence on monsoon have been the concerning issues of Indian agriculture. Horticulture is no exception to this and there is frequent variation in the production of horticultural crops, especially vegetable crops. Such seasonal variation in production of crops like onion and potato has a direct impact on the Indian Economy.

Most fruits and vegetables are highly perishable in nature. Lack of adequate post-harvest infrastructure in terms of collection centres, packing houses, packaging materials, post-harvest

treatment, pre-cooling and cold chain facilities etc., lead to huge wastage to the tune of 30 per cent, i.e., nearly 34 million tonnes of fruits and vegetables worth Rs. 25 to 30 thousand crore.

The country experiences wide fluctuations in prices of horticultural produce, particularly, potato and onions. The lack of efficient storage and marketing infrastructure for perishable products are the missing links in the supply chain management. **Creation of adequate storage facility is remedy that could reduce perishability and enhance value addition.** Thus, there is an urgent need for creation of adequate capacity especially for the perishable products to protect the interest of producers and consumers. To avoid this, adequate infrastructure with various measures like financial support, fiscal incentives and enabling legal provisions need to be created.

**Establishment of NHB:** In the mid-1980s, the horticulture sector was identified by the Government of India as a promising emerging sector for agricultural diversification to enhance profitability through efficient land use, optimum utilization of natural resources and creating employment for rural masses. During 1980 to 1992, there was consolidation of institutional support and a planned process for development of horticulture. It was during this period that the National Horticulture Board was set up by Government of India in April 1984 on the basis of recommendations of the "Group on Perishable Agricultural Commodities", headed by Dr. M.S. Swaminathan, the then Member (Agriculture), Planning Commission, Government of India, to allow focussed attention for horticulture development through enhancement of planned allocation for improving the post-harvest management, storage facilities and ensuring all season availability of horticulture products in the country.



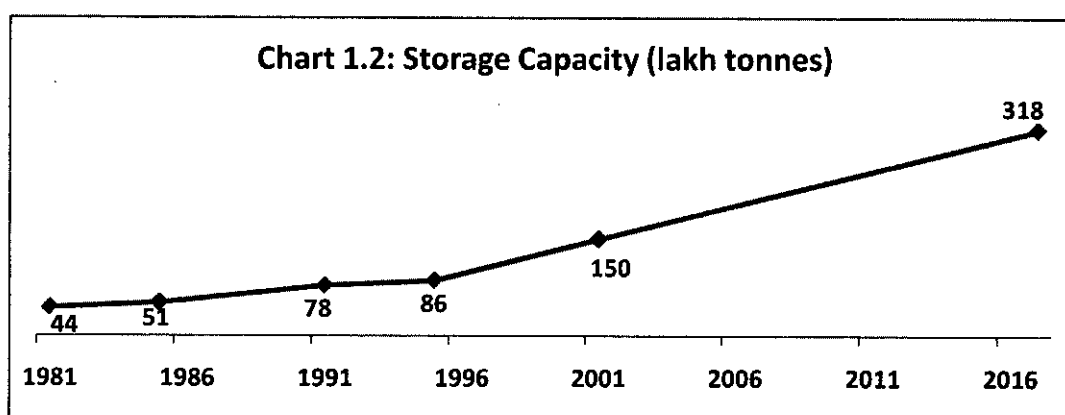
## 1.2 Evolution of Cold Storage in India

India has been bestowed with wide range of climate and physio-geographical conditions which ensures availability of most kind of fruits and vegetables. The country is the second largest producer of the Fruits (81.285 Million tonnes) and vegetables (162.19 Million tonnes) in the world, contributing 12.6% and 14.0% of the total world production of fruits and vegetables respectively. (Source: Source FAO Website- February 2014 and Indian Horticulture Database 2013). Banana, mango, citrus, papaya, guava and grape account for major share in total fruit production across India. The major fruit producing states are Andhra Pradesh, Maharashtra, Karnataka, Bihar, Uttar Pradesh, Tamil Nadu, Kerala and Gujarat. These eight states account for 70 per cent of the area under fruit cultivation. Potato, tomato, onion, brinjal, cabbage, and cauliflower account for maximum share in vegetable production in the country. India is a front runner in many fruits and vegetables with share in world production (Indian Horticulture Database 2013).

In spite of that, per capita availability of fruits and vegetables is quite low because of post-harvest losses which account for about 25% to 30% of production. Besides, quality of a sizable quantity of produce also deteriorates by the time it reaches the consumer. This is mainly because of perishable nature of the produce which requires a cold chain arrangement to maintain the quality and extend

the shelf-life, if consumption is not meant immediately after harvest. In the absence of a cold storage and related cold chain facilities, the farmers are forced to sell their produce immediately after harvest which results in low price realization. A cold storage facility accessible to them, therefore, goes a long way in removing the risk of distress sale to ensure better returns. The cold storage facilities now available are mostly for a single commodity like potato, orange, apple, grapes, flowers, etc. which results in poor capacity utilization. Present availability of cold storage capacity is only 318 lakh tonnes.

As a result of the Government of India's new focus on food preservation, the cold storage sector is undergoing a major metamorphosis. The Government has introduced various incentives and policy changes in order to curtail production wastage and control inflation; increase public private participation and improve the country's rural infrastructure. As a result, the growth rate, which was hovering around 7% till 1995 took a leap (7% to 17%) from 1996 onwards.



National Horticulture Board had commissioned a study to assess the operational capacity of cold storages established in the country so far. According to the report submitted by Hansa Research Group study on 23.12.2013, there were 6256 cold storages (31.28 million tonnes capacity) across the country out of which 1030 cold storages (5.15 million tonnes capacities) were found to be permanently closed. It was recommended that lessons drawn from the study may be shared with state government and central ministries so that suitable measures could be taken to prevent closure of cold storages.

In order to promote setting up of cold storages/storages in the country for reducing post-harvest losses, a Capital Investment Subsidy scheme for Construction/ Expansion/ Modernization of Cold Storage and Storages for Horticulture Products under NHB/ NHM came to force on 01.04.2014. Under this scheme, Credit linked projects relating to Cold Storages including Controlled Atmosphere (CA) and their modernization are eligible for assistance. Subsidy need not be credit linked for the institutions like Public Sector Units, Panchayats, cooperatives, registered societies/trust and public limited companies provided they can meet remaining share of the project cost out of their own resources. Such projects will have to be appraised by appraising agency approved by NHB. The



assistance is given as subsidy @ 35% of the capital cost of project in general areas and 50% in case of NE, Hilly & Scheduled Areas for a storage capacity up to 5000MT from NHM & above 5000MT up to 10000MT from NHB.

### **1.3 Necessity of Nursery Accreditation**

Availability of true to type, quality planting material is crucial for success of commercial horticulture. This necessitates having a network of Horticulture Nurseries which conform to Model Nursery Standards in terms of Infrastructure, Quality of Seed and Planting Materials and adoption of Nursery Management Practices.

State Governments ensure supply of quality planting materials for fruit crops by enactment of Fruit Plant Nursery (Regulation) Act and enforcement of its provisions through licensing of horticulture nurseries. However, all the States have not enacted Horticulture Nursery Acts. As per the information available in report of the working group on Horticulture for the XI Five Year Plan, at present only 8 states have adopted Nursery Act and in 9 states some system of registration/monitoring exists for nurseries whereas in 13 states there is no nursery act at present. Further, rules framed under existing acts generally do not provide for Technical Specification for Quality of Planting Material and Process of Production, Infrastructure required for production of quality planting material and Good Nursery Management Practices. The Acts in present form also do not deal with planting materials of flowers, ornamental plants, plants and vegetables. Therefore, it has become necessary to find a solution to the problem by putting in place a system of Recognition of Horticulture Nurseries.

National Horticulture Mission has taken initiative to specify the Nursery Standards by specifying Infrastructure required for setting up of Model Horticulture Nursery etc. ICAR has recently come out with technical specification of horticulture planting material and its production procedure in a recently published document titled as "Handbook of seed and planting material testing manual for Horticultural crops". Existing Rules framed under Horticulture Nursery (Regulation) Acts provide for record keeping part for such nurseries. However, each one of them individually does not completely define a Model Horticulture Nursery. Therefore, it is imperative to define a Model Nursery in all the three aspects of Nursery Infrastructure, Production System & Quality Parameters of Planting Material and Good Nursery Management Practices in a comprehensive manner and put a Nursery Recognition Regime in place. A recognized Model Horticulture Nursery should function as a reliable source of supply of quality planting material for horticulture crops.

With a view to ensure availability of Good Quality planting material as outlined above, NHB has started a system of Recognition of Horticulture Nurseries on voluntary basis.

### **1.4 Rationale for the Study**

Under the study, Impact Assessment Study of NHB Schemes (Cold Storage Capital Investment Subsidy and Nursery Accreditation Schemes), a total capacity exceeding 15 lakh MT, which forms

about 5% of the total cold storage capacity of country, has been added by NHB. More than Rs. 328 crore has been paid as subsidy by NHB during the study period. Further, more than 1600 nurseries have been accredited by NHB since inception of the scheme.

In view of the above, an evaluation of the current state of affairs regarding both the schemes is the need of the hour.

## 1.5 Objectives of the Scheme

The objectives of the scheme have been given under the respective heads-

1. Objectives of Capital Investment subsidy scheme for construction/ expansion/ modernisation of cold storages and storages for horticulture products -
  - ☛ To promote setting up of cold storages/storages in the country for reducing post harvest losses.
  - ☛ Creation of 12 lakh tonnes and modernization/rehabilitation of 8 lakhtonnes of cold storages and addition of 4.5 lakh tonnes onion storages.
2. Objectives of Accreditation and Rating of Fruit Plant Nurseries -
  - ☛ To establish a network of quality nurseries across the country for the purpose of propagation and distribution of quality planting material of specified horticulture crops. The recognition shall be accorded to the nurseries for:
    - Production of quality planting material of one or more specified crops by adopting Good Nursery management Practices,
    - Nursery Premise only where sale of specified quality planting material of recognized source are being carried out by creating necessary infrastructure facilities and proper record keeping.

## 1.6 Objectives of the Study

The horticulture sector is generally characterised by highly unorganised production of fruits and vegetables and their perishable nature. The government has taken certain measures to curb the heterogeneity aspect of cultivation, but the perishable nature of the commodity still remains a major issue to be tackled. Thus, it becomes a major prerogative to improve the production and processing of fruits and vegetables by providing credit linked subsidy for various schemes related to post-harvesting and storage facilities for horticulture products in India.

The current study looks to evaluate the impact of two schemes running under NHB in the country. The specific objective that needs to be assessed under each scheme has been mentioned below:

**Scheme 1: Capital Investment subsidy scheme for construction/expansion/modernisation of cold storages and storages for horticulture products**

- ☞ Comprehensive analysis of the capacity created in various (Type 1, Type 2, CA etc.) categories, capacity utilization and reasons for less capacity utilization, if any;
- ☞ Viability of the cold stores and measures to enhance financial viability;
- ☞ Analyze technology adopted by the cold stores and its comparison with NHB standards
- ☞ Pattern of utilization and profiling of beneficiaries in terms of own, traders, farmers, processors, exporters etc.;
- ☞ To review the present status of capacity utilization of cold storages;
- ☞ Profiling of commodities being stored, period of storage and assessment of losses over three months, six months, and more than six months;
- ☞ To conduct impact analysis of Cold Storage scheme of NHB in respect of:
  - ❖ Providing additional storage capacity for horticulture produce in production and consumption center,
  - ❖ Enhancing income of grower and other stakeholders,
  - ❖ To evaluate investment through private/bank participation,
  - ❖ Reduction in glut conditions and distress sale during peak harvest etc.,
  - ❖ To fill-up gaps in the area of storage of horticulture produce and to suggest:
    - Potential area/locations with additional cold storage capacity of horticulture produce in the country,
    - Medium and short term strategies and requirement of interventions for systematic development of cold storage with respect to specific location/crops of horticulture importance.
- ☞ Analysis of benefit to growers, reduction in post-harvest losses and other benefits like salvation of glut situation, meeting market demand in off season etc.;
- ☞ Gaps in infrastructure created which could enhance the value of stored produce, increase shelf life and marketability;
- ☞ Constraints faced by beneficiary in terms of credit, documentation and ease of access to the scheme, funds release etc.

#### **Scheme 2: Accreditation and Rating of Fruit Plant Nurseries**

- ☞ To evaluate the status of implementation and operation of the nurseries w.r.t. to the process, manpower, and infrastructure as per the guidelines prescribed by NHB;
- ☞ Visits to operating nurseries for evaluating the rating system and processes adhered to by the nursery including evaluation of accreditation agency, process followed for annual rating;
- ☞ Evaluation of the impact of the nurseries with regards to:
  - ❖ Production of quality planting material,
  - ❖ Benefits accruing to users through use of quality planting material such as production, yield and crop quality, incidence of pest and disease, and overall increase in farm incomes.
- ☞ Recommendations on improving the process for accreditation and annual ratings.

## **Chapter 2**

# **Methodology**

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The current chapter outlines the research framework of the study. It then goes on to discuss the key stakeholders and key parameters of each scheme. Sampling approach and data collection procedure have been discussed at length, as also the various steps taken to ensure the quality of the data during processing and analysis.

### **2.1 Research Framework**

The current evaluation study followed a mixed methods approach with prime focus on field level data collection to evaluate the impact of the schemes that have been provided assistance by NHB across the country. Both the schemes had separate research tools with questions that were administered to respective respondents comprising of individuals, associations, CBOs, FPOs, partnership or proprietary firms, SHGs, bank associations etc.

The current study evaluated various factors of the scheme pertaining to its current functioning as per prescribed guidelines under the NHB, its benefits to the individuals or associations involved in production of horticulture crops, improvement in overall availability of the fruit and vegetables during the off season, improved storage conditions of horticulture crops, reduced distress sale during the peak harvest season, and production of quality planting material from the nurseries etc.

All these factors were considered in detail for preparation of questionnaire for the study. A thorough review of literature including the review of the annual reports and subsidy structure for various schemes was read through by the experts for preparation of the questionnaire. The same was administered to respondents across the country for understanding the impact of the scheme for the ground level beneficiaries (i.e. farmers) in terms of improved seed health, improved productivity, better transportation infrastructure, increased income and improved standards of living.

The quantitative survey for the study basically consisted of structured interviews designed to evaluate several parameters that were analyzed to understand the working efficiency of the NHB assisted schemes across the country. The evaluation also consisted of qualitative interviews with key experts pertaining to scheme for understanding the gaps in the achievement of the objectives that have been specified for the NHB assisted schemes in each state of the country.

Apart from undertaking the qualitative and quantitative interviews, the survey also consisted of observations of the cold storages projects and the nursery project across the country to understand their compliance with the approved guidelines-by NHB. The observations consisted of understanding and evaluating the entire procedure pertaining to operational, maintenance and technical aspects of both the schemes in each state of the country.

### 2.1.1 Key stakeholders to be involved in the assignment

A table representing the research tools used in the study and the key stakeholders involved has been provided below in Table 2.1:

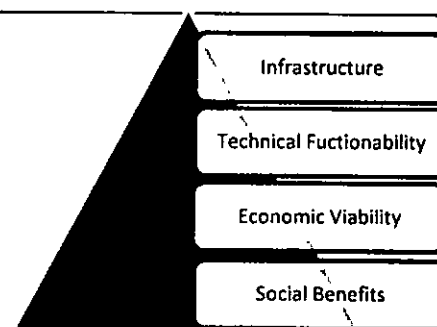
Table 2.1: Research Tools Used and Key Stakeholders Involved		
SN	Research Tools	Key Respondents / Sources of Information
<b>A. Primary Research</b>		
i.	Face-to-face Interviews	<ul style="list-style-type: none"> <li>☛ Users of Cold Storage</li> <li>☛ Farmers or growers using nursery produce for horticulture crop</li> </ul>
ii.	In-depth Interviews (IDIs)	<ul style="list-style-type: none"> <li>☛ Official of NHB at the central level</li> <li>☛ Official of NHB at the state level</li> <li>☛ Owner/functionaries of Cold Storage Unit</li> <li>☛ Owner/functionaries of the nursery</li> </ul>
iii.	Observation	<ul style="list-style-type: none"> <li>☛ Sampled Cold Storage Units</li> <li>☛ Sampled Nurseries</li> </ul>
<b>B. Secondary Research</b>		
iv.	Desk Research of available information	<ul style="list-style-type: none"> <li>☛ Review of documents and reports available through NHB</li> <li>☛ Review of similar studies undertaken within the country pertaining to evaluation of the scheme in the horticulture sector</li> </ul>

## 2.2 Study Design

The current evaluation study followed a cross-sectional study design, wherein data was collected from various personnel in different states of the country during the particular time period. In keeping with the objectives of the entire study, as the current assignment looked to assess the impact of the two schemes running under NHB, it was imperative to evaluate the impact of these schemes in terms of following domains as depicted in the table below.

The data collected was analyzed using quantitative analysis tools to understand the impact of the scheme on several parameters, like increase in the number of cold storage units and the positive role played by the private/co-operative societies in development of cold storage infrastructure. The evaluation study highlights the pattern of capacity utilisation of the cold storage units across the states, and also the variation in rental values of commodities stored in them. The scheme also assessed the ability of farmers to get a better price besides an improvement in the quality of their produce through value addition, as a result of grading and packing. Further, the study also brought out action points worth considering by the implementing agencies and the entrepreneurs at the grassroots level by undertaking SWOT analysis.

Chart 2.1: Log Frame for the Evaluation of Scheme I



**Scheme 1:** A detail of the different components that were covered under scheme 1 along with the different sub-components has been presented in the form of project log-frame for the study. The following four components form the entire crux of the evaluation for the scheme in the study.

### **2.2.1 Key Parameters for Scheme 1**

Key parameters and mode of data collection for Capital Investment subsidy scheme for construction/ expansion/modernisation of cold storages and storages for horticulture products have been given below-

#### **1. Infrastructure-**

##### **a. Location and Accessibility of Cold Storage Units**

- Location closure to the point of production
- Location of the cold storage in the local mandis and the wholesale market
- Distance between cold storage units

##### **b. Current Capacity and Future potential of the Cold Storage**

- Current capacity created (Small, Medium, Large)
- Capacity for single commodity storage or multiple commodity
- Potential for expansion of storage capacity

##### **c. Utilisation Pattern of the Cold Storage**

- Operating months
- Capacity Utilisation
- Commodities stored

##### **d. Ownership pattern and Management**

- Ownership of the cold storage unit in the different states of the country-
  - Private Limited Company
  - Partnership
  - Proprietorship
  - Co-operative Society
- Management of the cold storages:
  - Primary source of living for the owner or secondary source
  - Frequency of visit/Inspection undertaken by the owner to the cold storages
  - Number of skilled and unskilled employees at the cold storages

#### **2. Technical Functioning of the Cold Storage Units-**

##### **a. Technical aspects of running the cold storage units**

- Type of technology and equipments used for refrigeration purpose.
- Other components involved include:
  - Compressor
  - Insulation material

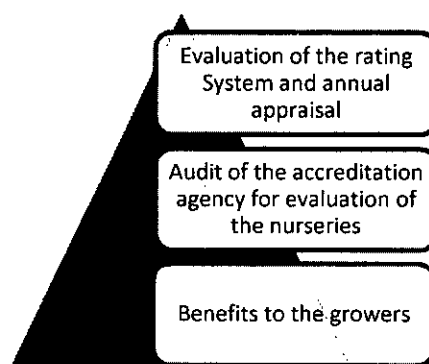
- Material Handling Procedure
- b. Operation and Maintenance of running the cold storage scheme.**
  - Expenditure on electricity and/or diesel
  - Expenditure on repairs and spare parts
  - Expenditure on salaries and wages
  - Establishment and administrative expenses
- 3. Economic viability**
  - a. Cost of Investment**
    - The major items that come under the cost of investment for running of the cold storage units include the following:
      - Land
      - Plant and Machinery for refrigeration system
      - Electrical fittings and fixtures
      - Construction and functioning of chambers
      - Thermal Insulators
  - b. Operational Cost (trend in rental charges, pledge finance)**
    - Financial Cost of operating the cold storages units includes:
      - Running the cold storage unit (equipment, infrastructure, repair, expenditure on electricity and/or diesel)
      - Revenue Cost in terms of Rental Charges and transportation cost, insurance cost collected from the farmers as well as storage of own produce
      - Salaries and Wages
      - Interest on Loan
      - Depreciation of plant machinery
- 4. Availability of Bank Loan**
  - a. Ability to pay back the loan and Operating profit**
    - The average capacity utilisation and the net income generated
    - Annual interest burden due to loan
- 5. Social Benefits**
  - a. Farmers and Growers of fruit crops**
    - Avoid distress selling
    - Opportunity to store
    - Sell commodities during lean season and get profits

Quantitative and qualitative data for the impact evaluation of this scheme was collected through IDIs and structured questionnaire.

**Scheme 2:** The evaluation of the second scheme also undertook a detailed study of the nurseries that were sampled for the study, the infrastructure available in the nurseries for taking care of the mother plants, procurement of disease free planting material that have an impact on production, productivity and quality of the of produce.

Therefore, it was imperative to define a Model Nursery in all the three aspects of Nursery Infrastructure, Production System & Quality Parameters of Planting Material and Good Nursery Management Practices in a comprehensive manner and put a Nursery Recognition Regime in place. A recognized Model Horticulture Nursery should function as a reliable source of supply of quality planting material for horticulture crops. All these components were evaluated for understanding the current functioning of nurseries, the process of rating, accreditation and appraisal as well as the benefits to the farmers using planting materials from these nurseries in terms of reduction in incidence of pests, improved production and improved standard of living.

Chart 2.2: Log Frame for the Evaluation of Scheme II



### 2.2.2 Key Parameters for Scheme 2

Key parameters and mode of data collection for Accreditation and Rating of Fruit Plant Nurseries have been given below-

1. **Evaluation of the rating System and annual appraisal-**
  - Location of the Scheme and the area
  - Source and Quality of mother plants used in the nursery
  - Technology used for care and protection of mother plants and the saplings
  - Infrastructure provided for production of healthy saplings of mother plants
  - Regular care of the nursery
2. **Audit of the accreditation agency for evaluation of the nurseries**
  - Understanding of the personnel involved
  - Process of evaluation of nurseries
  - Parameters for regular evaluation and appraisal
  - Evaluate the coverage of different aspects pertaining to evaluation of nursery
  - Understand and evaluate the accreditation system of the sampled nursery in the respective states



### 3. Benefits to the growers

- Easy availability of healthy planting material to the horticulture farmers
- Increased Productivity of crops
- Improved quality of horticulture produce
- Increase in availability of fruits
- Improved living standards of the growers involved in horticulture farming
- Overall increase in farm income for the horticulture farmers

Quantitative and qualitative data for the impact evaluation of this scheme was collected through IDIs and structured questionnaire.

## 2.3 Sampling Approach

### 2.3.1 Sample Selection

The sample selection of farmers/growers in and around the NHB assisted cold storage facility or nursery were undertaken to understand the impact of the scheme on the living standards of farmers. For the same, initially it was thought to randomly select maximum of 30 farmers each of the sampled cold storage and nursery. However, during the field work, it was observed that obtaining list of 30 user farmers for each was mostly not possible. Further, some of the owners approached NHB complaining against the field team putting pressure for list of user farmers, which was subsequently informed to us NHB. As a result of this, the number of user farmers was reduced to the convenience of the cold storage/nursery owner. The final state-wise list of user-farmers/traders has been tabulated under section 2.3.2.

For **scheme 1**, the farmers were the one who were using the cold storage facility to preserve their commodities and sold the same during lean season. The total number of farmers that were selected under the study came to **1320**.

For **scheme 2**, the farmers were the one who were using the nursery grown plants for further cultivation and processing. The total number of farmers that were selected under the study came to **1320**.

### 2.3.2 Sample Summary

The sample for the current study covered the entire country where NHB has its schemes operating in full swing. The first step toward the sampling was to get the idea of number of NHB assisted cold storage schemes and nurseries running in each state of the country. As suggested by the Department, following is a table representing the number of NHB assisted cold storage schemes and the sample to be selected from each state:

Table 2.2: Sampling Plan for Cold Storages				
S. No.	State	No. of Cold storages assisted by the Schemes	No. of assisted Cold Storages to be evaluated	No. of User Farmers/ Traders Covered
1	Andhra Pradesh	10	2	21
2	Assam	7	2	10
3	Chhattisgarh	8	2	19
4	Delhi	2	1	0
5	Gujarat	7	1	0
6	Haryana	36	3	30
7	Himachal Pradesh	5	1	1
8	Jammu & Kashmir	1	1	6
9	Jharkhand	1	1	11
10	Karnataka	3	1	10
11	Madhya Pradesh	7	2	20
12	Maharashtra	20	3	25
13	Odisha	1	1	10
14	Punjab	16	2	1
15	Rajasthan	14	2/1	3
16	Tamil Nadu	4	2	20
17	UP	150	15	168
18	Uttarakhand	3	1	10
19	West Bengal	5	1	10
Total		300	44/43	374

*Note: The sample provided to us did not include 1 each of Chandigarh, Meghalaya and 2 of Tripura.*

The States that are being covered have been categorized into the following regions:

Table 2.3: States to be covered in different regions for the Study of Cold Storages					
North	South	East	West	North East	Central
Delhi (1)	AP (2)	Chhattisgarh (2)	Gujarat (1)	Assam (2)	UP (15)
Haryana (3)	Karnataka (1)	Jharkhand (1)	Maharashtra (3)	Tripura (1)	MP (2)
HP (1)	Tamil Nadu (1)	West Bengal (1)	-----	-----	Rajasthan (2)
Punjab (2)	-----	Odisha (1)	-----	-----	-----
Uttarakhand (1)	-----	-----	-----	-----	-----
J&K (1)	-----	-----	-----	-----	-----
9	4	5	4	3	19

Similarly, as suggested by the Department, following is a table representing the number of accredited nurseries and the sample to be selected from each state:

Table 2.4: Sampling Plan for Evaluation of Nurseries				
S.No.	State	Total number of nurseries accredited	Total number of selected nurseries	No. of User Farmers Covered
1	Andhra Pradesh	46	5	41
2	Assam	5	1	2
3	Bihar	39	4	32
4	Chhattisgarh	50	4	40
5	Gujarat	109	12	103
6	Haryana	26	2	10
7	Himachal Pradesh	126	14	177
8	Jammu & Kashmir	242	25	248
9	Jharkhand	4	1	10
10	Karnataka	101	10	100
11	Kerala	27	2	21
12	Madhya Pradesh	64	5	52
13	Maharashtra	181	17	160
14	Mizoram	3	1	12
15	Nagaland	5	1	3
16	Odisha	126	14	110
17	Punjab	47	5	51
18	Rajasthan	24	2	20
19	Sikkim	25	2	20
20	Tamil Nadu	63	7	70
21	Telangana	3	1	9
22	Tripura	11	1	10
23	UP	100	11	107
24	Uttarakhand	69	6	117
25	West Bengal	62	7	70
	<b>Total</b>	<b>1559</b>	<b>160</b>	<b>1605</b>

States that are being covered have been categorized into the following regions:

Table 2.5: States to be covered in different regions for the Study of Nurseries					
North	South	East	West	North East	Central
Haryana (2)	AP (5)	Bihar (4)	Gujarat (12)	Assam (1)	UP (11)
HP (14)	Karnataka (10)	Chhattisgarh (4)	Maharashtra (17)	Mizoram (1)	MP (5)
J& K (25)	Kerala (2)	Jharkhand (1)	-----	Nagaland (1)	Rajasthan (2)
Punjab (5)	Tamil Nadu (7)	Odisha (14)	-----	Sikkim (2)	-----
Uttarakhand (6)	Telangana (1)	West Bengal (7)	-----	Tripura (1)	-----
<b>52</b>	<b>25</b>	<b>30</b>	<b>29</b>	<b>6</b>	<b>18</b>

## 2.4 Data Collection

Given the nature, scope and objectives of the study, the necessary information was gathered using

structured questionnaires designed particularly for the purpose. Once AMS was allotted the assignment, the list of indicators along with detailed questionnaire was finalized with the NHB. The questionnaires were duly translated into the local language of the respective states for the study. Thereafter, they were subjected to field-testing on pilot basis. This was done in order to plug the gaps in the questionnaires and fine tune their progression. For the same, pilot interviews were carried out for assessing the following—

- ☛ Flow of questionnaires
- ☛ Ease in understanding of the questionnaires by the respondents
- ☛ Ease in administering the questionnaires
- ☛ Comprehensiveness in terms of information coverage
- ☛ Testing of the language used

The primary data collection exercise began immediately after the completion of initial listing exercise in respective states (photos of sampled cold storages and nurseries are provided in Photo Gallery as Annexure 3). The listing exercise involved identifying the cold storage units and the nurseries in each of the states that had been assisted by NHB for the study.

Accordingly, the field teams conducted face-to-face interviews by canvassing the questionnaires with the respective respondents at the household of the respondents. During this exercise, particular care was taken to ensure the highest level of privacy and confidentiality of information collected from the respondents.

## **2.5 Data Processing & Analysis**

The field level data was converted into soft format by the in-house Data Entry Operators who were engaged full time for the same. A system of double entry of data was followed to minimize the human errors while entering them into the system. Thereafter, the data sets were validated by duly subjecting them to range and consistency checks.

The validated quantitative data was then analyzed by using SPSS software. Descriptive statistics (range, mean, standard deviation, etc.) were calculated for each variable. Proper weights were computed and appropriately assigned to generate their estimates for the targeted population. Both point and interval estimates were generated. Cross-tabulation was done and suitable statistical analysis was performed to study the association / relationship between various variables. Statistical significance of these relationships was tested using appropriate statistical tests.

As regards the qualitative information, the first step was verbatim transcription of all in-depth interview schedules and any other qualitative information collected. The same was then analyzed a systematic and methodological manner, scrutinizing the text for its primary as well as latent content. The following procedure was adopted for the content analysis of all the information gathered—

- ◆ Free Listing: For synthesizing the qualitative information, available responses to a particular question were listed to obtain the range of responses for all open-ended questions in the schedules for various stakeholders. The responses that were considered irrelevant under a specific question were moved under the appropriate question. During this process, the important statements or quotable quotes with their reference was extracted verbatim for use in the report as reference material.
- ◆ Coding: During final screening, for every open-ended question, responses were coded according to the domains. Some responses were placed under more than one domain as a range of views could be stated in a single sentence. After careful scrutiny, the responses found to be completely irrelevant were discarded.

Summarizing: Similar information sought from different stakeholders was triangulated to arrive at a conclusion with greater degree of accuracy as also from the viewpoint of reliability and validity. Analysis was done according to the study sites to check for 'between sites consistency' and other differences, if any. The results were then summarized for each of the issues.

## Chapter 3

# Cold Storage

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In this chapter, an overall analysis of the Cold storage samples is covered. There is a detailed description on the profile of cold storages, their owners, and users including farmers and traders. Attempt has been made to analyze the functioning of cold storages along with its profile, financial viability and pattern of utilization. The chapter also analyze the existing capacity, its sufficiency and the changes brought about by the cold storages on the income levels of different users. The effect of cold storages on glut condition and post-harvest losses have also been studied.

### 3.1 Capital Investment Subsidy Scheme

For the purpose of this study, the Capital Investment Subsidy Scheme assisted by NHB across the country during the period 2012-13 to 2016-17 is being evaluated. Later it was suggested that the schemes may be evaluated under two time periods, these are; 2012-14 and 2014-17.

#### 3.1.1 Capital Investment Scheme Subsidy Released during 2012-14

Following are the guidelines of Capital Investment Subsidy Scheme for 2012-14:

**Components-**Credit linked projects relating to Cold Storages including Controlled Atmosphere (CA) and Modified Atmosphere (MA) Stores, pre-cooling units, other Storages for onion, etc., their modernization are eligible for assistance under this component.

**Pattern of Assistance-** The assistance will be as credit linked back-ended subsidy @ 40% of the capital cost of project in general areas and 55% in case of Hilly & Scheduled Areas for a maximum storage capacity of 5000 MT per project.

#### 3.1.2 Capital Investment Scheme Subsidy Released during 2014-17

**Components-** Credit linked projects relating to Cold Storages including Controlled Atmosphere (CA) and their modernization are eligible for assistance under this component. Subsidy need not be credit linked for the institutions like Public Sector Units, Panchayats, cooperatives, registered societies/trust and public limited companies provided they can meet remaining share of the project cost out of their own resources. Such projects will have to be appraised by appraising agency approved by NHB.

**Pattern of Assistance-**The assistance will be given as subsidy @ 35% of the capital cost of project in general areas and 50% in case of North East (NE), Hilly & Scheduled Areas for a storage capacity above 5000 MT up to 10000 MT.

### 3.1.3 Types of Cold Storages Covered Under the Scheme

There are three types of cold storages covered in the scheme. These are detailed below —

1. **Cold storage units Type 1** -Cold storage units of Type 1 are for storage of fresh horticulture products which do not require pre-cooling but there is crop specific rate of pull down and storage conditions, like Fresh Potato Tubers for following purposes - Early Crop (pre mature), Seed Potato, Table Potato, Process Potato, French Fries, Chipping, and Onion, garlic, tamarind etc. CS Type 1 have basic mezzanine structure with large chamber (of > 250 MT) type with single temperature zone.
2. **Cold storage units Type 2** – These type of cold stores are meant for storing different types fresh fruits and vegetables and other horticulture products which require pre-cooling or rapid room cooling to “seven-eighth-cooling” in a short time period of 4 hours to 24 hours depending on requirements in order to preserve their freshness, quality and shelf life. Multi commodity cold stores are provided with multiple chambers enabling them to store a wide range of fresh horticulture products together with respect to their storage requirements for temperature, relative humidity, protection from odour and sensitivity to other gases like ethylene. The refrigeration system is designed to adjust and operate to a range of temperature and humidity conditions, depending on the compatibility group for storage of fruits and vegetables. They are Pre Engineering Building (PEB) type for multiple temperature and product use, it generally has more than 6 chambers (<250 MT) and basic material handling equipment.
3. **CA- Controlled Atmosphere (CA)** storage uses oxygen and carbon dioxide concentrations of about 1% to 5% for each gas in most applications. Normal room air has an O<sub>2</sub> concentration of about 21% and CO<sub>2</sub> levels near 0.03%. Low O<sub>2</sub> and high CO<sub>2</sub> levels slow the ripening process, stop the development of some storage disorders such as scald in apples, and slows the growth of decay organisms. All of these effects increase storage life of fresh produce compared with conventional refrigerated stores. These facilities are recommended for long term storage of fruits and vegetables like Apple, Pears, Kiwi, Cabbage etc. for up to 10 months. CA storages are generally multiple chambers with each chamber of capacity of 50-250 MT.

The Cost Norms for calculating subsidy is given as ahead in table 3.1 —

Table 3.1: Cost Norms for calculating subsidy		
No.	Description	Cost Norms
1	Cold Storage units Type 1- basic mezzanine structure with large chamber of > 250 MT type with single temperature zone.	@ Rs. 8000/ MT for capacity up to 5000 MT. @ Rs. 7600/ MT for capacity between 5001 to 6500 MT. @ Rs. 7200/ MT for capacity between 6501 to 8000 MT. @ Rs. 6800/ MT for capacity between 8001 to 10000 MT.
2	Cold Storage units Type 2- Pre Engineering Building (PEB) Type for multiple temperature and product	@ Rs. 10000/ MT for capacity up to 5000 MT. @ Rs. 9500/ MT for capacity between 5001 to 6500 MT.

	use, more than 6 chambers of <250 MT and basic material handling equipment.	@ Rs. 9000/ MT for capacity between 6501 to 8000 MT. @ Rs. 8500/ MT for capacity between 8001 to 10000 MT.
3	Cold Storage units Type 2 with add on technology for controlled atmosphere	Additional Rs. 10000/MT for add on components of control atmosphere technology as per component wise cost
4	Technology Induction and Modernization of cold chain	@ Rs. 5000/ MT for capacity up to 5001 MT to 10000 MT. Components of modernization includes PLC equipment, packaging lines, dock levers, advanced graders, alternate technologies. Stacking system, modernization of insulation and refrigeration etc.

## 3.2 Profile of Stakeholders

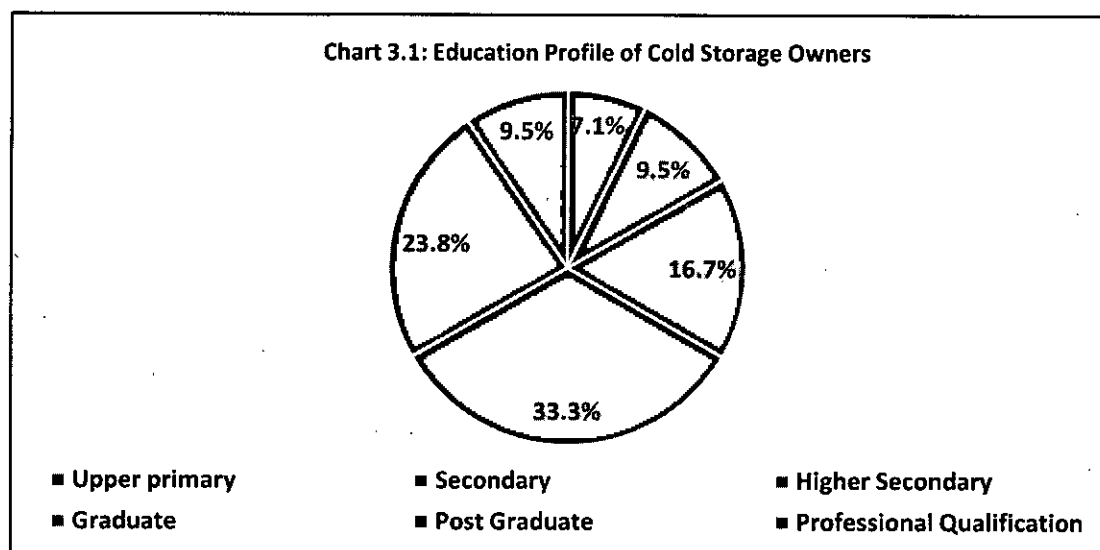
The various stakeholders involved in the establishment, operation and maintenance and utilization of cold storages were interviewed to get an in-depth knowledge of the various components related to the study.

### 3.2.1 Profile of Cold Storage Owners

The profile of cold storage owners was analysed on the basis of their educational qualification, whether cold storage is their primary or secondary occupation and their frequency of visit to the cold storage etc.

#### 3.2.1.1 Educational Profile of Cold Storage Owner

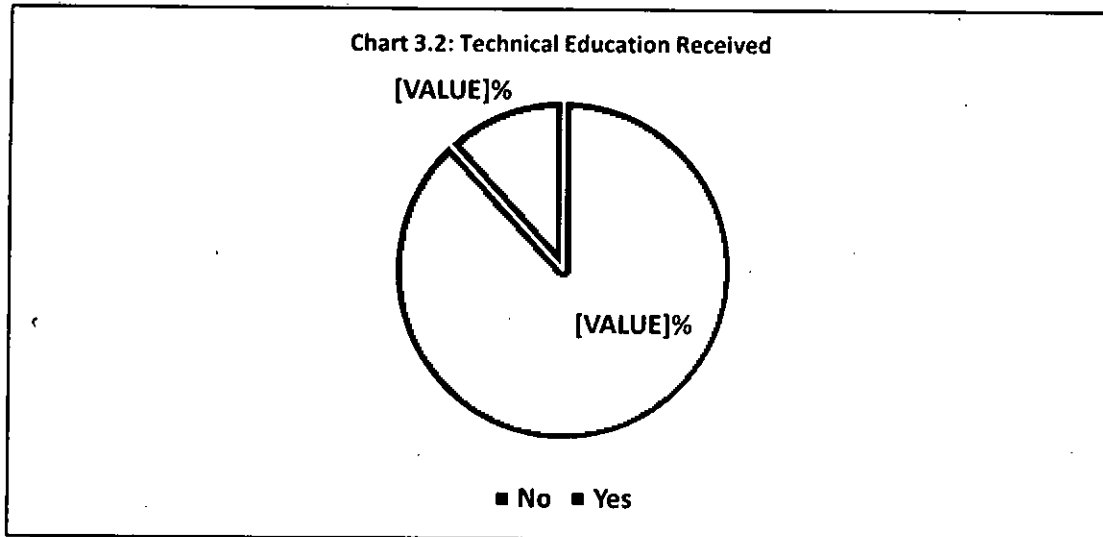
The owners of sampled cold storages were analysed as per their education profile, and it was found that one-third (33%) were graduate, followed by nearly one-fourth (24%) post graduate, and nearly a fifth (17%) who attended higher secondary.





### 3.2.1.2 Technical Education Received by the Cold Storage Owner

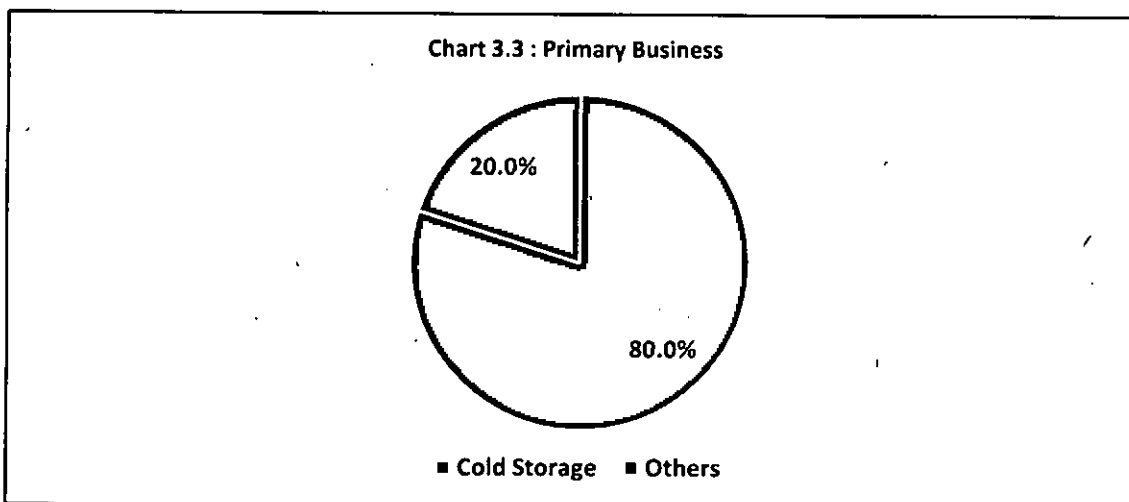
The cold storage owners were enquired if they had any technical education related to cold storage operation. It was found that majority of the cold storage owners (88%) did not have any education related to the operation of cold storage. In all, of the 42 sampled cold storages, 5 cold storage owners had technical education related to cold storage operation, while 37 did not.



### 3.2.1.3 Cold Storage Owner having other business

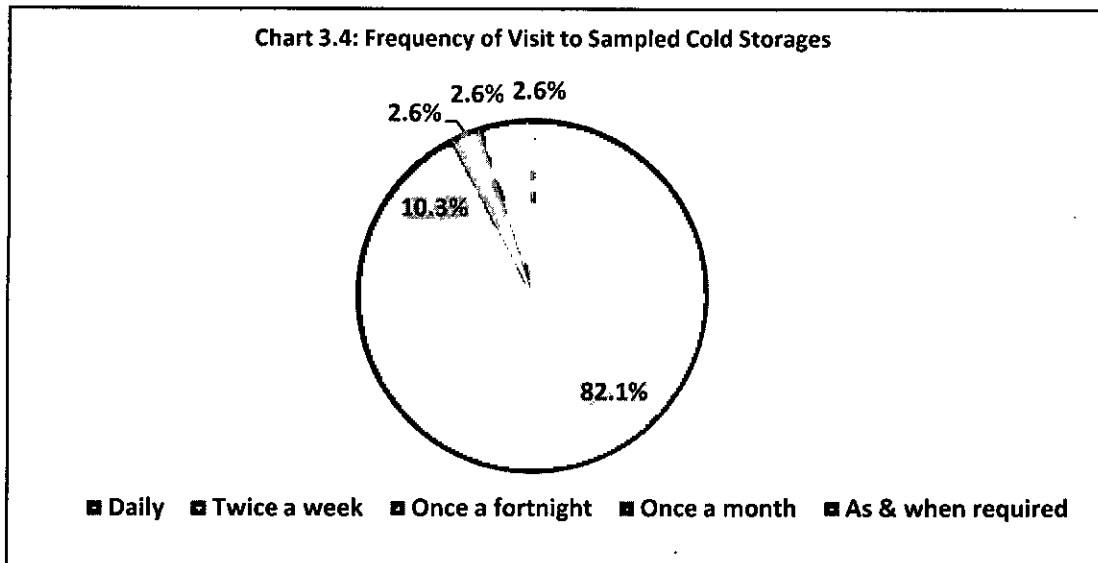
It was found during the study that more than half (56%) of the cold storage owners had other businesses along with cold storages.

However, as can be seen from the pie chart below, four-fifth (80%) of the sampled cold storage owners with other business responded as having Cold storage as their primary business.



#### 3.2.1.4 Frequency of Visit to Cold Storages

The owners of the sampled cold storages were enquired about the frequency of their visit to the cold storage. It was found that an overwhelming majority (82%) visited the cold storage as and when required, while 10% visited twice a week. The same has been shown ahead in the pie chart.

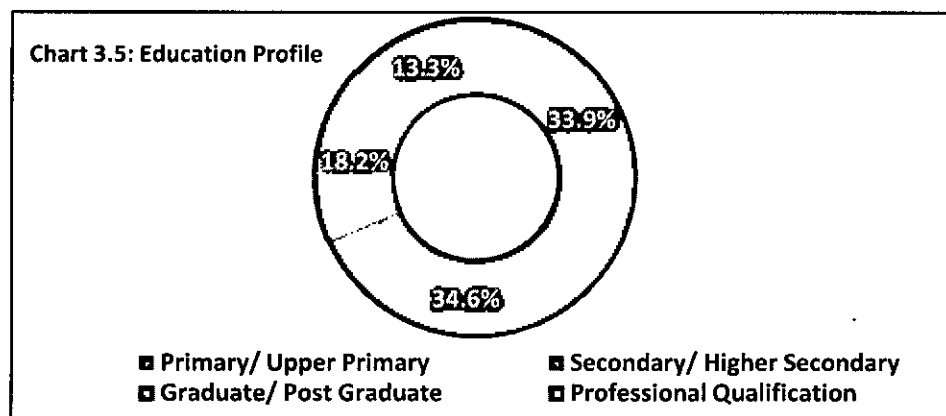


#### 3.2.2 Profile of User Farmers

The profile of user farmers of cold storages was classified as per their educational status, social category, economic category and land holding. Each category has been discussed below-

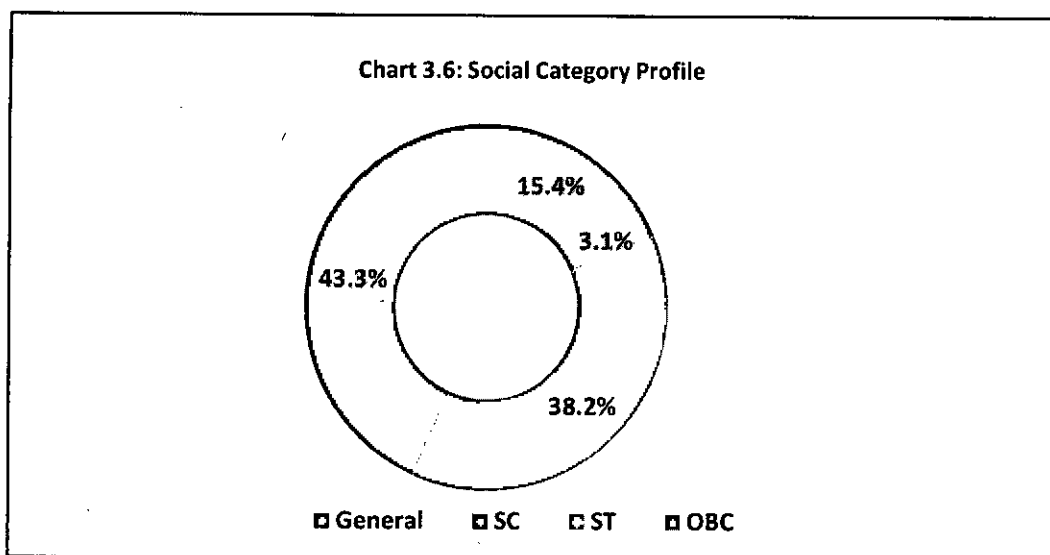
##### 3.2.2.1 Education Profile

During the survey, it was found that majority of the user farmers (69%) were primary/upper primary or secondary/higher secondary level educated. While nearly one-fifth (18%) were graduate or post graduate, 13% were either illiterate or literate but with no formal education. However, a minor 0.7% were professionally qualified.



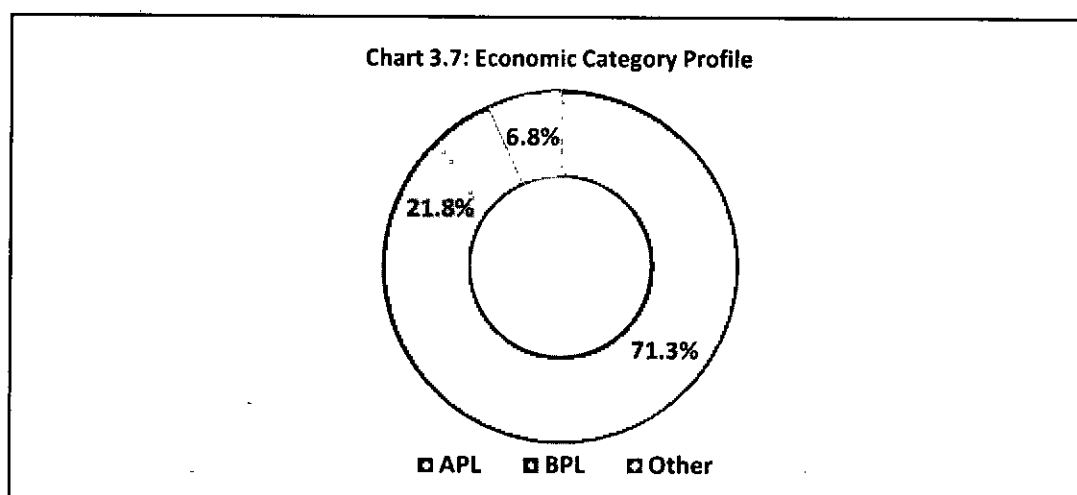
### 3.2.2.2 Social Category

The user farmers of cold storage were enquired about their social category profiles, as in General, SC, ST, OBC, to ensure that all categories of the society are getting opportunity to use the facilities and benefits provided by the cold storages. It was found that there were two-fifth (43%) users from OBC category, followed by nearly another two-fifth (38%) ST, and 15% General. SC were in considerably minor proportion (3%).



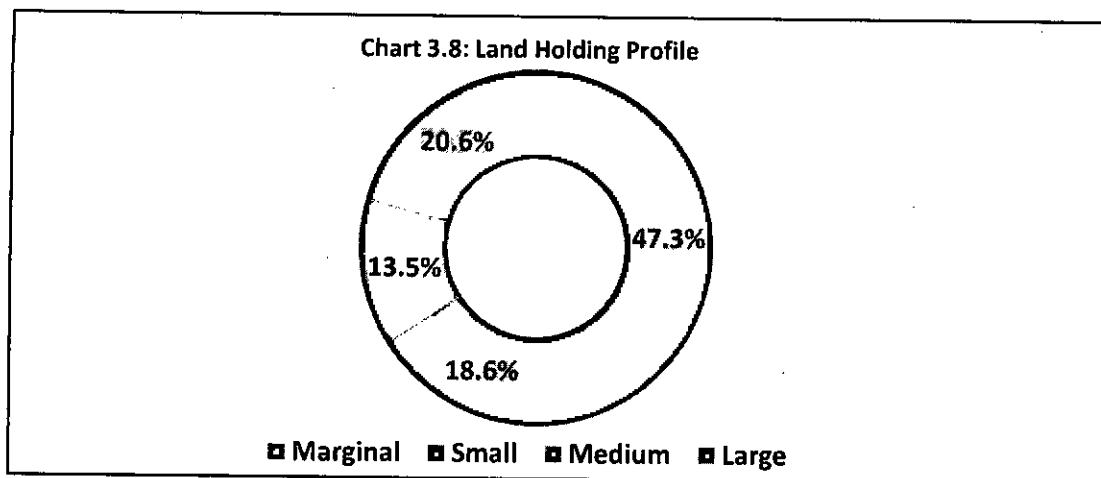
### 3.2.2.3 Economic Category

The user farmers of cold storages were classified as per their economic profile, viz., APL or BPL. It was found that nearly four-fifth of the user farmers (71%) were APL, while a fifth (22%) were BPL. However, 7% were such as those who did not have the card to define their economic category.



### 3.2.2.4 Land Holding Profile

The user farmers were also classified as per their land holding profile, viz; Marginal, Small, Medium or Large farmers. It was found that almost half (47%) of the user farmers were Marginal farmers, while a fifth (21%) were large farmers. One-fifth (18%) of the user farmers were small farmers while 13% were medium farmers.

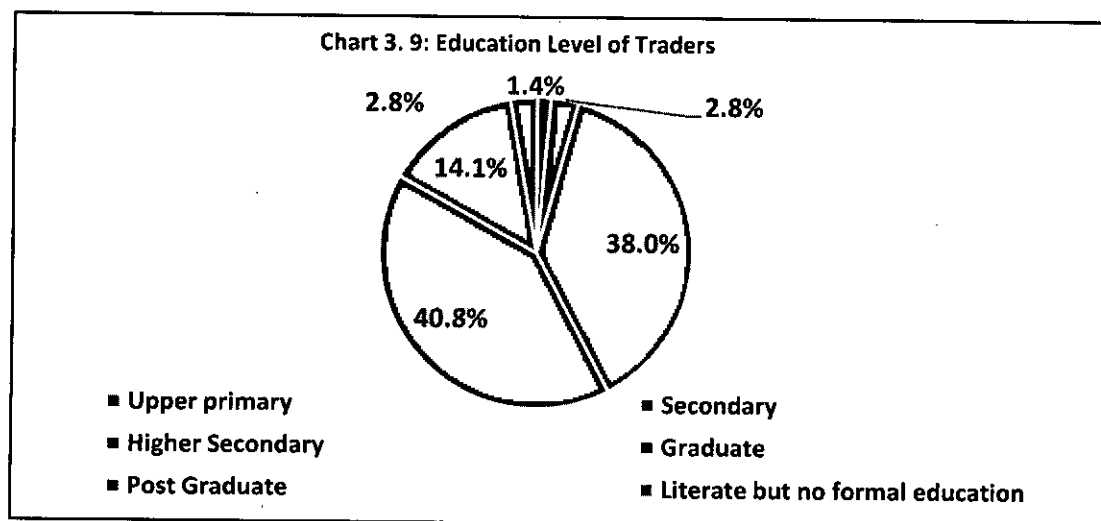


### 3.2.3 Profile of Traders

The following observations have been made from the primary data collection by surveying the user traders.

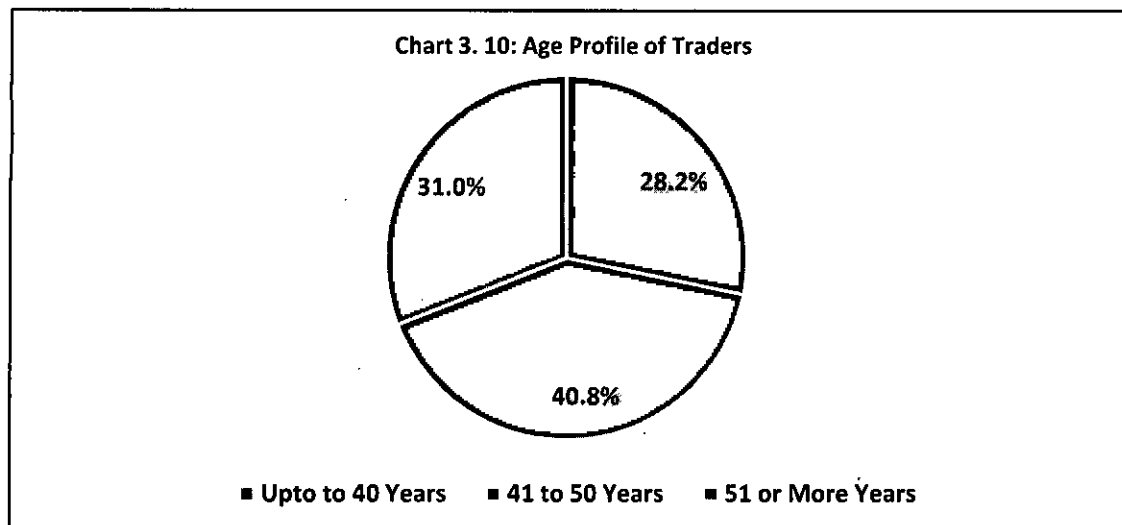
#### 3.2.3.1 Educational Profile

The traders educational profile is as detailed in the chart below. Almost four-fifth (78%) of the traders who utilize the cold storage facility were found to be having higher secondary education or above.



### 3.2.3.2 Age Profile

Majority of the traders were falling into the age group of 41 to 50 years (41%). Of the remaining, nearly one-third (31%) were 50 years or older and less than a third (28%) were below 40 years. The age profile of the traders is presented in chart 3.10 ahead:

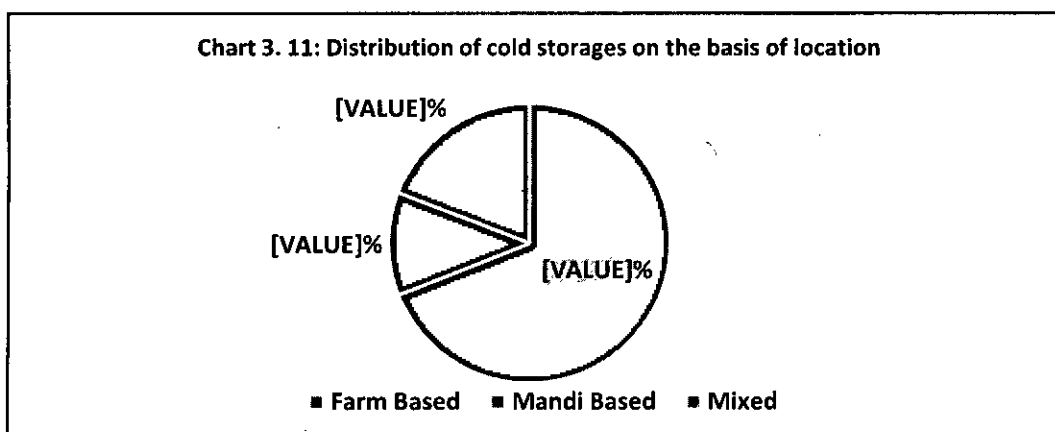


## 3.3 Profile of Cold Storage

Cold storages can be classified based on the basis of their location and service provided. As per the location of the cold storage, there are 2 kinds- Farm based and Mandi based. Based on the service provided, there are 2 kinds- Lease/Rent and Purchased base. All these kinds have been discussed below-

### 3.3.1 Distribution of Cold Storage by Location

For the purpose of the study, the cold storages were also classified as per their location, to analyze which segment of users are served more, the farmers or the traders. It was, however, found that majority (69%) of the cold storages were Farm based, i.e., catering to the farmers by being close to fields. One-tenth (12%) were found to be mandi based, while nearly one-fifth (19%) were found to be mixed type, i.e. catering services to both farmers and traders.

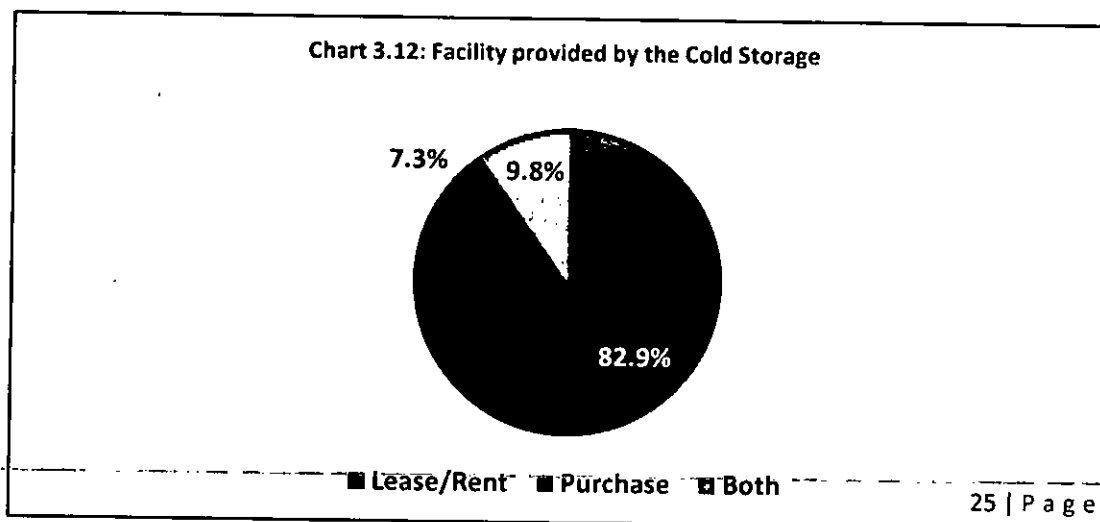


Following is the state-wise distribution of sampled cold storages on the basis of their location-

Table 3.2: State-wise distribution of cold storages on the basis of location				
Particulars	Number of Cold Storage	Farm based	Mandi based	Mixed
Overall	42	28	6	8
State-wise				
Andhra Pradesh	2	2		
Assam	2	2		
Chhattisgarh	2			2
Delhi	1		1	
Gujarat	1		1	
Haryana	3			3
Himachal Pradesh	1	1		
Jammu & Kashmir	1		1	
Jharkhand	1	1		
Karnataka	1	1		
Madhya Pradesh	2	2		
Maharashtra	3	3		
Odisha	1	1		
Punjab	1		1	
Rajasthan	1		1	
Tamil Nadu	2			2
Uttar Pradesh	15	14		1
Uttarakhand	1	1		
West Bengal	1		1	

### 3.3.2 Distribution of Cold Storage by Service Provided

Cold Storages provide two kinds of services basically, they either store the produce on lease/rent or they purchase the produce from the farmers/traders. Some cold storages, however, also provide both the services. In the 42 cold storages analyzed under the study, it was found that more than four-fifth (83%) of them stored produce on lease/rent, while 7% purchased the crops and 10% provided both the kinds of services.

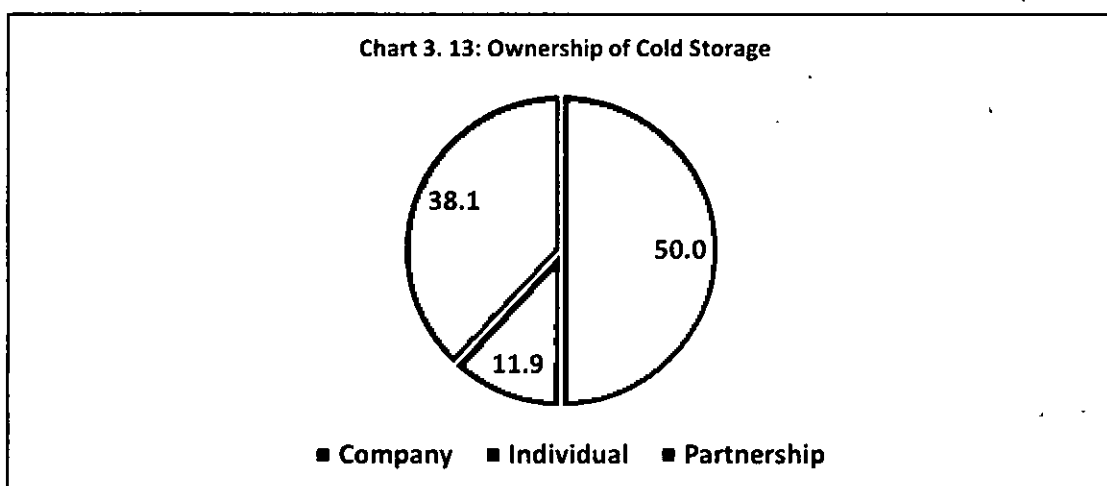


Following is the state-wise distribution of sample cold storages on the basis of facility provided by them-

Table 3.3: State-wise distribution of cold storages on the basis of facility provided				
Particulars	Number of Cold Storage	Lease/Rent	Purchase	Both
Overall	42	35	3	4
State				
Andhra Pradesh	2	1		1
Assam	2	2		
Chhattisgarh	2	2		
Delhi	1		1	
Gujarat	1			1
Haryana	3	2		1
Himachal Pradesh	1		1	
Jammu& Kashmir	1	1		
Jharkhand	1	1		
Karnataka	1	1		
Madhya Pradesh	2	2		
Maharashtra	3	3		
Odisha	1	1		
Punjab	1	1		
Rajasthan	1	1		
Tamil Nadu	2		1	1
Uttar Pradesh	15	15		
Uttarakhand	1	1		
West Bengal	1	1		

### 3.3.3 Ownership of Cold Storage

The constitution of cold storages could be either, Company, Partnership or Individual ownership. In the sampled cold storages, it was found that half (50%) were Company, followed by nearly two-fifth (38%) Partnership and the remaining (12%) were individually owned.

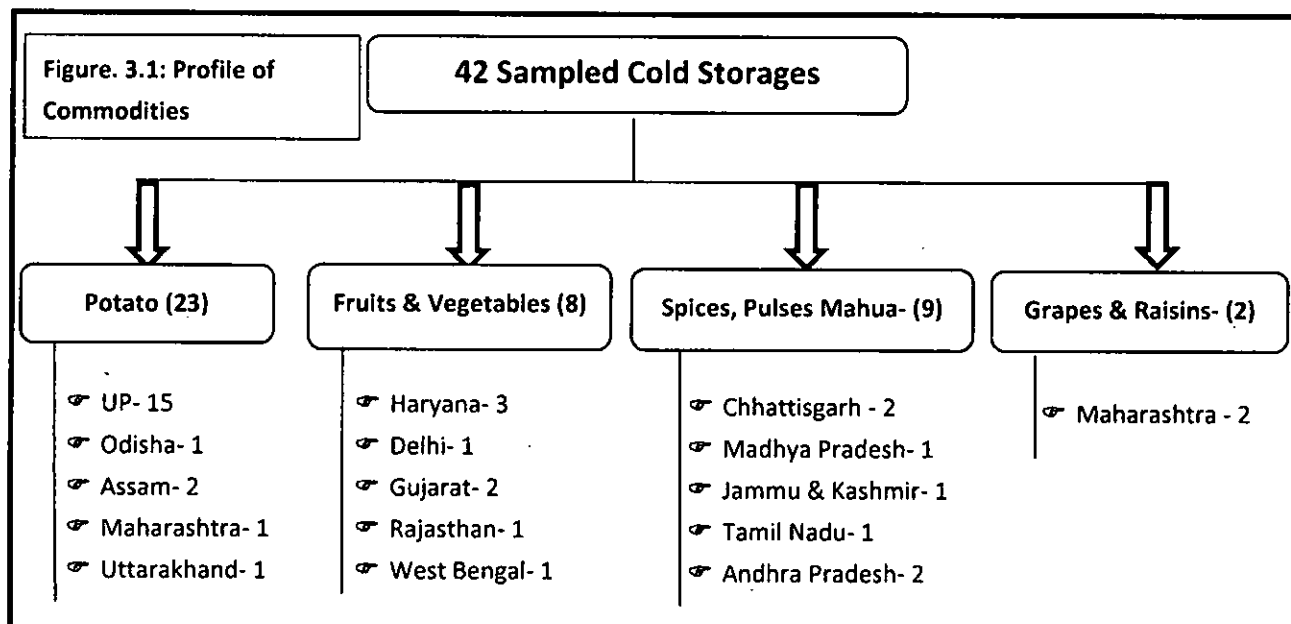


### 3.3.4 Registration with WDRA

None of the sampled Cold Storages were registered with WDRA.

### 3.4 Profile of Commodities

The commodities stored in the sampled cold storages were analyzed region- wise. The same has been charted below —



There were 44 sampled cold storages for the purpose of impact evaluation of Capital Subsidy Investment Scheme of NHB. However, out of these 44, 1 in Rajasthan (M/s Aravali Trade Vision Pvt Ltd) was found closed, while the owner of 1 in Punjab (Sakshi Fruit & Vegetable Cold Storage) refused to co-operate for the study. Hence, out of the 44, only 42 cold storages could be sampled under the impact evaluation study.

It was seen during the analysis that of the 42, more than half (55%) cold storages were potato-based, followed by more than one-fifth (21%) spices, pulses and mahua based cold storages, nearly one-fifth (19%) fruits and vegetable based cold storages, and 2% grapes and raisins based cold storages, understandably in Maharashtra.

The potato based cold storages were located in Uttar Pradesh, Odisha, Assam, Maharashtra, Madhya Pradesh, Uttarakhand, and Jharkhand. The spices, pulses and mahua based cold storages were located in Chhattisgarh, Madhya Pradesh, Jammu and Kashmir, Tamil Nadu, Andhra Pradesh and Karnataka. Fruits and vegetable based cold storages were located in Haryana, Delhi, Gujarat, Rajasthan, West Bengal and Himachal Pradesh. Lastly, the grapes and raisins based cold storages were located in Maharashtra.



### 3.5 Cold Storage Capacity Created

The capacity of cold storage created over the years 2012 to 2017 have been studied under two categories:

1. Those created between 2012 and 2014.
2. Those created between 2014 and 2017.

As already mentioned there are three types of cold storage facilities being installed under the ambit of NHB—

<b>Table 3.4: Number, types and capacity of cold storage facilities established over the years 2012-14 and 2014-17</b>				
<b>Year</b>	<b>Type</b>	<b>Number of Cold Storage</b>	<b>Total Capacity Created</b>	<b>Average Capacity</b>
2012-14	Type 1	142	733692	5167
	Type 2	5	10421	2084
	CA	6	11752	1959
	Total	153	755864	4940
2014-17	Type 1	129	699567	5423
	Type 2	11	34082	3098
	CA	16	56564	3771
	Total	156	798228	5117
Total	Type 1	271	1433259	5289
	Type 2	16	44503	2781
	CA	22	68316	3253
	Total	309	1554092	5029

*Source: NHB Website*

The total capacity created over the period of 2012-2017 was 15.5 lakh MT. It can be seen that out of a total of 309 units established under the scheme, 271 belonged to type 1. At the same time type 2 and CA accounted for a total of 38 units only. A slight increase in proportion of type 2 and CA can be seen during 2014-17. Type 1 cold storage is technically less advanced when compared to the other two. Understandably, its cost of installation is lower than the other two.

The flat rates of subsidy leads to establishment of cheaper cold storages. Also, to some extent the current cold storage networks can be assumed to be in the capacity development phase which is prior to the specialization phase which will happen once the network establishes and has enough preliminary capacity required. This may be noted as it may be utilized for the formulation of policy directives. Either, more impetus can be given to type 1 storage facilities which can help in achieving the basic capacity requirements easily, following the existing momentum of its establishment choice over the other types. Or preference can be given to the other types focusing on the specialization required for the future. The necessary changes in guidelines and norms will required to be made in accordance with the decision. Alternatively it can be left to the market to decide over the choice of

facility to be established. But it has to be made sure that the economy takes an informed decision. The details are provided in the table ahead —

<b>Table 3.5: Capacity of Cold Storages Established Under the Scheme Across States</b>			
<b>State</b>	<b>Number of Cold Storage</b>	<b>Total Capacity (MT)</b>	<b>Capacity as Percentage of Total</b>
Assam	7	46865	3.0%
AP	10	46926	3.0%
Chandigarh	1	246	0.0%
Chhattisgarh	8	44594	2.9%
Delhi	2*	800	0.1%
Gujarat	7	38079	2.5%
Haryana	36	155260	10.0%
HP	5	14724	0.9%
J&K	1	2730	0.2%
Jharkhand	1	4400	0.3%
Karnataka	3	17360	1.1%
Maharashtra	20	81642	5.3%
Meghalaya	1	5354	0.3%
MP	8	44971	2.9%
Odisha	1	9982	0.6%
Punjab	16	72130	4.6%
Rajasthan	14	60559	3.9%
Tamil Nadu	4	15572	1.0%
Tripura	2	8690	0.6%
UK	3	5744	0.4%
UP	154	866169	55.7%
WB	5	11295	0.7%
<b>Total</b>	<b>309</b>	<b>1554092</b>	<b>100.0%</b>

Source: NHB Website

*\*One of the two Cold Storages in Delhi was upgradation of existing facilities. Capacity addition was not made.*

The capacity created under the scheme was analysed state wise from 2012 to 2017. Uttar Pradesh was the State which achieved the highest capacity establishment owing to higher demand. It achieved a total of 866169 MT. This accounts to more than half (56%) the share of the total capacity established in the country. Among the other States Haryana, Maharashtra and Punjab fare better. Haryana achieved 10% of the total capacity established in the country, while Maharashtra and Punjab both achieved near to 5% of total capacity established.

An analysis of the various facets of costs and benefits incurred by following the scheme, the demand for various types and capacities of storage facilities and many other parameters will also act as inputs for policy directives. These are tried to be achieved in the following sections.

### 3.5.1 Capacity Utilization

The capacity utilization of cold storages varies from 50 to 100 percentage. Out of the 42 sample units, 18 cold storages recorded 100 percent capacity utilization. Of the remaining 28 cold storages, 17 recorded a utilization of 80 percent or less which is highly undesirable. The lowest utilization recorded was in Odisha and one unit in Maharashtra (50%). There were different reasons sighted for the underutilization of the facility, viz; crops being seasonal, lack of awareness among farmers of the benefits of using cold storage and even competition among cold storages.

Of the sampled cold storages, 18 were utilizing the full capacity- 9 belonged to Uttar Pradesh, while 1 each to Andhra Pradesh, Himachal Pradesh, Karnataka, Punjab, and Uttarakhand. There were 7 cold storages utilizing 81% to 90% of their capacity- 2 in Chhattisgarh and U.P. each, followed by 1 each in Haryana, Jammu and Kashmir, Jharkhand. However, there were 17 cold storages that were utilizing less than 81% of their capacity- 4 in Uttar Pradesh, followed by 2 each in Haryana, Madhya Pradesh and Tamil Nadu, and 1 each in Delhi, Gujarat, Maharashtra, Odisha, Rajasthan and West Bengal.

States	Number of Cold Storage	Capacity Full	81 to 99%	Less than 81%
Andhra Pradesh	2	1		1
Assam	2	2		
Chhattisgarh	2		2	
Delhi	1			1
Gujarat	1			1
Haryana	3		1	2
Himachal Pradesh	1	1		
Jammu & Kashmir	1		1	
Jharkhand	1		1	
Karnataka	1	1		
Madhya Pradesh	2			2
Maharashtra	3	2		1
Odisha	1			1
Punjab	1	1		
Rajasthan	1			1
Tamil Nadu	2			2
Uttar Pradesh	15	9	2	4
Uttarakhand	1	1		
West Bengal	1			1
<b>Total</b>	<b>42</b>	<b>18 (43%)</b>	<b>7(17%)</b>	<b>17(40%)</b>

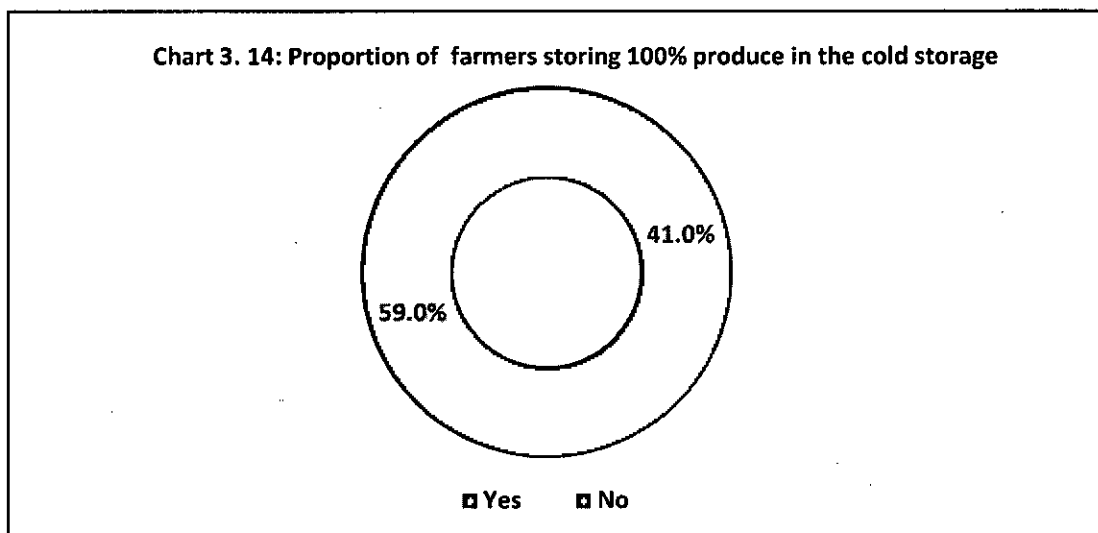
### 3.5.2 Reasons for Under-utilization

The cold storage owners were enquired about the reasons for under-utilization of their cold storages. It came to light that, in Uttar Pradesh, mostly potato is stored, which is seasonal in nature, while Punjab faced over saturation of cold storages. In West Bengal, however, lack of farmers/traders was cited as the reason for underutilization. Another reason quoted in Haryana, was that as cold storages have now come up in Himachal Pradesh and Jammu & Kashmir, the traders/farmers have stopped using the facility in Haryana.

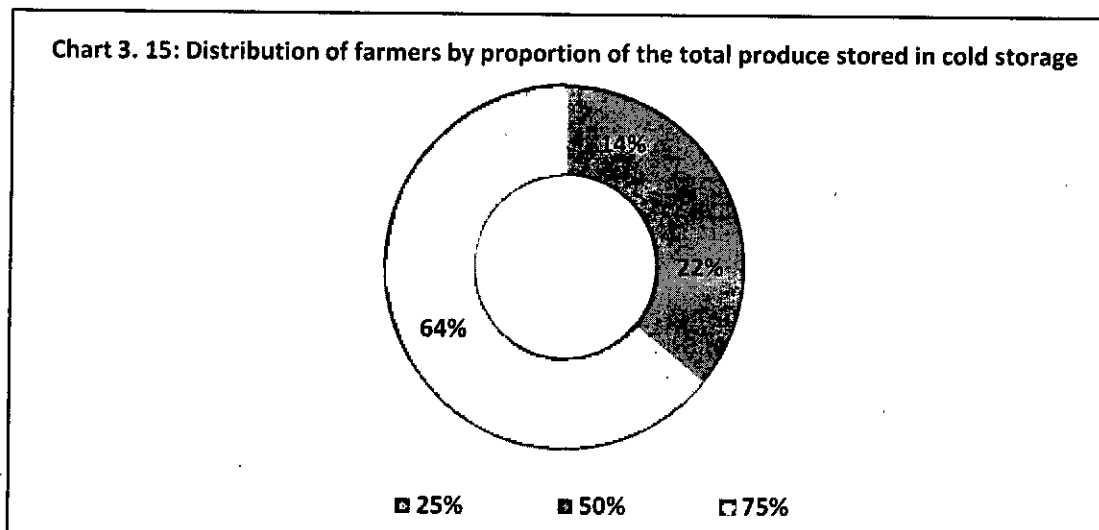
Lack of crop and dependability on season were quoted as reasons for under-utilization by half (50%) of the sampled cold storage owners. The other minor reasons included lack of awareness in people about cold storages (8% of the respondents- Rajasthan and Haryana), lack of traders and farmers (13% respondents- Tamil Nadu and West Bengal) etc.

### 3.5.3 Pattern of Storage

During the study, the user farmers were also asked about their pattern of cold storage utilization. It was found that nearly two-fifth (41%) of the user farmers of sampled cold storages stored their entire produce in the cold storage. The same has been shown in the table given in chart 3.14 —



Further, the user farmers were enquired what proportion of their produce they stored in cold storage, if they did not store the entire produce (59% of the respondents of the sampled cold storages). It was found that almost two-third (64%) of the farmers stored up to three-fourth (75%) of their horticulture produce, while slightly more than one-fifth (22%) stored half of their produce, followed by 14% storing only one-fourth of their produce. Refer chart 3.15 ahead—



#### 3.5.4 Reasons for Less Storage

The reasons for non-storage of entire produce lies to a great extent, in the fact that most of the farmers were small scale/marginal. Small scale farmers sell only part of their entire produce as they save the remaining for self-consumption. A large portion of these small farmers cannot wait for a better price as they are in an urgent need to earn money so that they can repay their debts, meet daily needs and reinvest in the agricultural works. Therefore such farmers cannot afford to utilize the full potential offered by cold storage networks.

### 3.6 Financial Aspects

Credit linked projects relating to Cold Storages including Controlled Atmosphere (CA) and their modernization are eligible for assistance under this scheme. Subsidy need not be credit linked for the institutions like Public Sector Units, Panchayats, cooperatives, registered societies/trust and public limited companies provided they can meet remaining share of the project cost out of their own resources. Such projects will have to be appraised by appraising agency approved by NHB.

The assistance is currently being given as subsidy at 35% of the capital cost of project in general areas and 50% in case of NE, Hilly & Scheduled Areas for a storage capacity above 5000MT up to 10000MT from NHB. For calculation of capacity, 3.4 cubic meters (cum.) (120 cubic feet (cft)) of chambers volume is considered equivalent to 1MT storage capacity.

#### 3.6.1 Cost Norms

The cost norms are frequently misconstrued to directly reflect the market price of the infrastructure components. The cost norms of the scheme are applied strategically for setting direction for specific interventions and relates only to the admissible items in a project. The subsidy scheme has sole

purpose to incentivize investment in key areas basis policy direction and is not a funding mechanism. In practice, the cost of a project will include non-admissible items like land and other equipment.

### 3.6.2 Capital Cost

The capital cost has two facets- 1) The cost reportedly incurred for establishment of cold storage and 2) The normative cost on which subsidy is calculated as per the prescribed norms. The reported capital cost incurred for 153 projects during 2012-14 was 72871 lakh rupees while the same for 156 projects during 2014-17 was 98290 lakh rupees. Further it can be seen that while 64% of the total costs have been realized through bank loans, 24 % have been met by subsidy provided (normative cost is usually less than reported cost). The effective utilization of funds has been tried to be captured through the 'Cost incurred per MT' capacity achieved. It can be observed that there has been an increase in the capital cost required to establish the same capacity over the years.

Year	No of Users	Total Cost (In Lakh)	Subsidy Amount (in Lakh)	Total Bank Loan (in Lakh)	Storage Capacity (MT)	Cost /MT (In Lakh)
2012-14	153	72871	16533	44148	755864	0.10
2014-17	156	98290	23756	64590	798228	0.12
Total	309	171160	40289	108738	1554092	0.11

*Source: NHB Website*

From the field survey it was found that the highest average capital cost was incurred by the sample cold storage in Himachal Pradesh (Rs. 2731 Lakh), which was CA type with advance technology. The installed capacity of the cold storage was 5250 MT, while its capacity utilization was 100%, it actually works as procurement unit for another cold storage situated at Delhi. Similarly, the lowest capital cost was incurred by the sample cold storage in Uttarakhand (Rs. 301 Lakh). The installed capacity of the cold storage was 4200 MT with 100% capacity utilization. The state wise data of average capital cost per metric ton has been given in the table —

State	Number of Cold Storage	Average Cost/ MT (in Rupees)
Haryana	2	20616
AP	2	11346
Assam	2	10748
Chhattisgarh	2	8188
Delhi	1	95872
Gujarat	1	45967
Haryana	1	35359
HP	1	90409
J&K	1	14650
Jharkhand	1	14809

Table 3.8: State wise Average Cost Incurred (per metric ton) to Establish Cold Storages		
State	Number of Cold Storage	Average Cost/ MT (in Rupees)
Karnataka	1	16220
Maharashtra	1	8486
Maharashtra	2	16864
MP	2	8459
Odisha	1	7513
Punjab	2	14841
Rajasthan	1	10036
Tamil Nadu	1	31964
UK	1	6972
UP	15	9767
WB	1	25071
<b>Total</b>	<b>42</b>	<b>17429</b>

### 3.6.2.1 Components of Capital Cost

The capital cost incurred to start a cold storage facility can be divided into various components. They are the cost of land, cost involved in procuring and installing plant and other equipment, expense on civil works involved, and other miscellaneous expenses. During the field survey detailed costs under the above mentioned components were enquired up on. The highest proportion of capital cost has been dedicated to plant and other equipment (38%). Civil works incurred came to a third (34%) of the cost. Cost of land constituted to nearly one-fifth (16%). Installation costs came up to 6% and the remaining 6% was constituted by miscellaneous expenses including land development expenses.

### 3.6.3 Recurring Cost

Recurring cost is the cost incurred repeatedly over a period of time in a year. In case of cold storages, recurring costs include electricity cost, fuel cost, maintenance cost, salary/wages (regular or contractual), Insurance, staff welfare, interest, depreciation, etc.

Electricity expenses is the single largest contributor (26%) to recurring costs. Another 4% is accounted for fuel expenses, thus making the total expense on energy to be nearly a third of the total recurring cost (30%). However, two-fifth (43%) of the total recurring cost is contributed by depreciation and interest. Interest accounts for one-fifth (20%) while depreciation forms 23% of the total annual recurring cost, which is about 12% of the capital spending on plants and equipment. Salary and wages of regular and contractual workers accounted for 8 % and 7% respectively. The annual maintenance comes to 7 % and the remaining expenditure is for miscellaneous activities.

### 3.6.4 Provision of Credit

It was seen in all the sampled cold storages that the facility of credit availability from the banks had helped in the establishment of cold storages. Further, the owners of sampled cold storages were asked about their opinion about loan application, and it was found that nearly two-third (66%) found

the loan application to be okay, while nearly one-fifth (17%) found it to be easy. However, 7% each found it to be extremely difficult.

At the same time the system of credit requires improvement in many aspects. Due to the time taken in releasing the credit the project often incur loss of money which could be avoided otherwise. There were many owners of the opinion that the documentation, verification and processing for loans must have been simpler. Some of the owners raised concern over the lack of an interest free period by which the establishment can get into full functioning. At present there is no cushion period which means that right from the first month after obtaining the loan the interest has to be paid. Any delay in subsidy, directly affect the viability of the project.

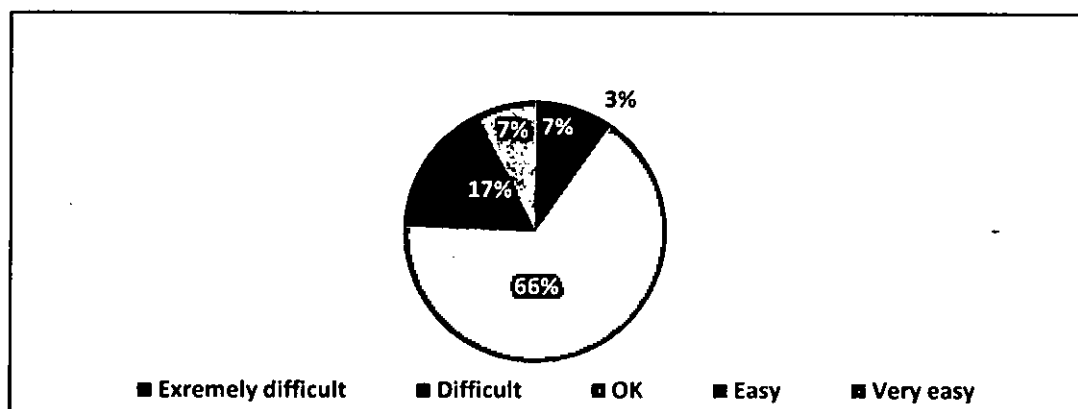
On analysing the total credit provided over the years it could be found that 64% of the total cost has been met from the bank credits provided. The detailed table is presented below—

Table 3.9: Contribution of Bank Loans Towards Cost of Projects				
Year	No of Users	Total Cost (In Lakh)	Total Bank Loan	
			(Rs. in Lakh)	Percentage
2012-14	153	72871	44148	60.6%
2014-17	156	98290	64590	65.7%
Total	309	171160	108738	63.5%

Source: NHB Website

### 3.6.5 Subsidy

While two-fifth (42%) of the cold storage owners were satisfied on the subsidy amount, almost three-fifth (58%) were not. Almost half (45%) of the owners believe that the subsidy amount should be at least 50%. There were instances in which the subsidy was delayed. While more than two-thirds (68%) of the owners were happy about the process involved in obtaining the subsidy, 32 % were not. Out of the total sample,nearly a fifth (17%) think that the process should be less lengthy. There were



some rare occurrences where the interest was mounting as the subsidy was being delayed. Such matters may be looked into on an urgent basis. An overwhelming majority of 93 % believe that the subsidy amount has helped in improving the financial viability of the project, while 7% think otherwise.



### 3.7 Technical Aspects

The various technical aspects related to cold storages and their comparison are covered in the following section.

#### 3.7.1 Insulating Materials Used, Comparison

Only 16 out of 42 Cold Storages (nearly two-fifth) were using polyurethane foam (PUF) as an insulating material. The remaining three-fifth (62%) of the cold storages were using EPS as the insulation material. Two of the cold storages either used 'brickwork and plastering' or thermocol for insulation which is less energy efficient. Therefore it can be seen that there is a significant scope for improvement in the material used.

#### Insulating Materials Used, Comparison

In most of the cold storages the insulating material used is either PUF or EPS. The following section gives a comparison between these materials in terms of R-Value, Density, Fire and Moisture resistance. A cost comparison in terms of the annual energy costs incurred is also presented.

#### Comparison of PUF and EPS

PUF is a new product with roughly 35 years of testing. Expanded Polystyrene has been used for approximately 50 years. Polyurethane has been developed to alleviate the shortfalls of EPS.

#### R- Value

PUF is the most efficient manmade insulation in the world. Polyurethane can be found in most refrigerators, freezers, and in some high end personal coolers. When per inch of insulation is calculated, PUF has no equal. Polystyrene has a R-value as high as R-5 and as low as R-2 per inch. On the other hand Polyurethane has an R-Value as high as R-8 and as low as R-7 / Inch. PUF materials are suitable for temperature range between -200°C to +110°C. PIR Slabs are suitable for use between -200°C to +145°C. It has low thermal conductivity value of maximum 0.021 w/mk at 10°C. It is not easily ignitable and has negligible water permeability. The Cold storages in the sample using EPS had a Thermal conductivity (at +10 degcel) of 0.033-0.036 watts per meter-kelvin. At the same time those using PUF had a thermal conductivity of 0.021-0.025 watts per meter-kelvin only. The following is a simplified example of energy savings while using PUF over EPS.

The following assumptions have been made just to understand saving in terms of money —

Storage capacity 6000 MT. Size 32m (L) x 32m (W) x 18m (H)

Table 3.10: Comparison Between Conventional and PUF Panel System in Energy Consumption	
Conventional System	Modern PUF Panel System
WALL - Brick wall 225mm (9"), Cement 12mm both side, EPS 100mm, Aluminium foil 0.05mm	WALL - PUF Panel 80mm

CEILING- EPS 100mm, RCC slab at roof. FLOOR- EPS 60mm, after tar felting and finish with concrete PCC (75mm).	CEILING – PUF Panel 100mm FLOOR – As in case of conventional system
Thermal conductivity of EPS 0.036 W / mK.	Thermal conductivity of PUF 0.023 W / mK.
For ambient temperature of 40 °C and operation at 6 °C, thermal transmission values: Q wall and Ceiling = 12.24 W/m <sup>2</sup> Q Floor = 9.06W/m <sup>2</sup>	For ambient temperature of 40°C and operation at 6 °C, thermal transmission values: Q wall and Ceiling = 9.78 W/m <sup>2</sup> Q Floor = 7.82 W/m <sup>2</sup>
For total area of wall, ceiling and floor are 1152m <sup>2</sup> , 1024m <sup>2</sup> , 1024m <sup>2</sup> respectively	For total area of wall, ceiling and floor are 1152m <sup>2</sup> , 1024m <sup>2</sup> , 1024m <sup>2</sup> respectively,
<b>Q (Total) = 35.91 KW</b>	<b>Q (Total) = 29.28 KW</b>
<i>*Source: coolsway.com</i>	

Saving by putting modern PUF technology is  $35.91 - 29.28 = 6.63$  KW at 100% efficiency. If plant runs for 24 hours, units saved will be  $6.63 \times 24 = 159$  Units. Assuming cost of a unit of electricity is Rs 6.00, saving per day =  $159 \times 6 = \text{Rs } 954$ , saving in month =  $954 \times 30 = \text{Rs } 28641$  implying an annual savings of more than Rs. 30 lakh (Saving in a year =  $28641 \times 12 = \text{Rs } 343699$ ).

#### Moisture Resistance

Moisture resistance is a very important factor. Moisture causes mildew, mold and once panels become saturated it causes problems with efficiency. Polyurethane has the lowest moisture Permeability ratings of any product manufactured; Polyurethane is number one in the building industry today.

- Polyurethane's permeance rating is 1.2.
- EPS permeance rating is 2.0 to 5.0.

In the working environment Polystyrene absorbs water more readily than does Polyurethane resulting in lowered efficiency over the life Span of the Product.

#### Fire Resistance

Polyurethane is better defined as a thermal-set plastic, which means this product will not melt at temperatures below 1000 degrees. Expanded Polystyrene on the other hand will soften at 180 degrees and it will melt at 240 degrees.

#### Density

Density determines the strength of a product

- The density of EPS is 1 lb.
- The density of Polyurethane is 2.2lb.

The PUF panels used in the sample cold storages had a density of 40 Kg/cubic meter, while the EPS material used had a density of 15-18 Kg/cubic meter.

Thus in all comparisons it can be seen that PUF is a better material than EPS. Please refer **Annexure 1** for detailed list of cold storages and the material of insulation used by each of them.

### 3.7.2 Type of Refrigeration System and Refrigerant

Almost a quarter (26%) of the cold storages used overfeed system with reciprocating compressors while another quarter (28%) used direct expansion of system. Gravity feed system was used by nearly another quarter (24%), while the remaining used miscellaneous methods.

Nearly four-fifth (79%) of the cold storages used ammonia as refrigerant. Slightly more than a tenth (12%) of the cold storages used Freon as the refrigerant.

### 3.7.3 Type of Condenser

Almost four-fifth (78%) of the sample used atmospheric condenser and slightly more than a tenth (14 %) used air cooling for cooling while the remaining resorted to shell and tube mechanism.

### 3.7.4 Type of cooling coil

Majority (95%) resorted to ceiling suspended type of cooling coil while the remaining used floor mounted systems.

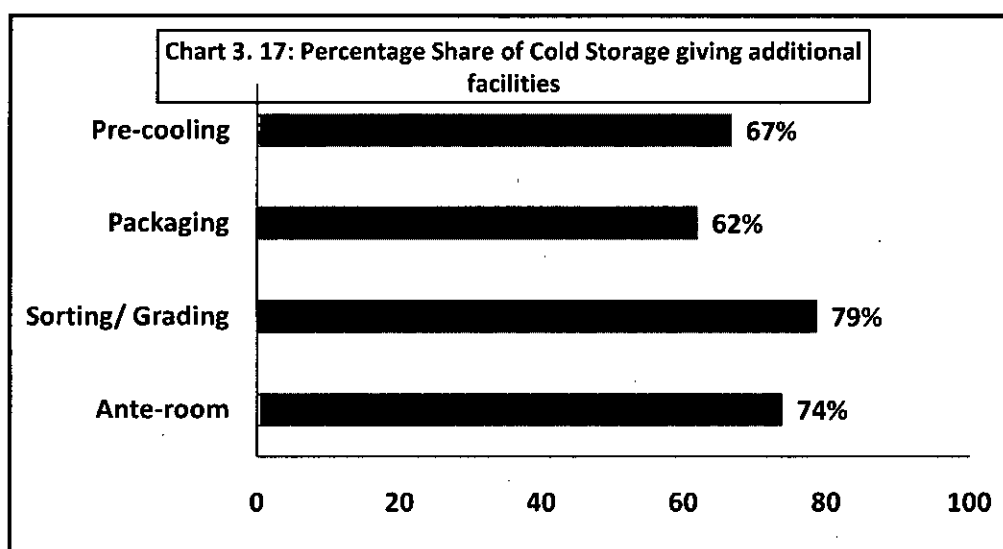
### 3.7.5 Lighting

All the cold storages use CFL lighting to conserve energy. There were 3 cold storages which confirmed to IP 65 standard fittings.

A detailed list of all sample cold storages and their complete technical specifications are given in **Annexure 1**.

## 3.8 Service Delivery

Out of the 42 sample cold storages 36 (86%), have employed a mechanical engineer. This is quite encouraging as it helps in the proper maintenance of cold storage and good service delivery to customers. Most of the cold storages provide enabling services which helps in optimum utilization of the facility. Some of the facilities provided by the cold storages and the percentage of cold storages providing those services are shown in the chart ahead—



### **3.8.1 Energy**

All the cold storages utilize power from the supplies through grid. All except two cold storages have a generator facility available as backup in case of power failure. Out of the 42 samples surveyed 22 have satisfactory power supply of 22-24 hours per day. In the states of Odisha, Jharkhand, Uttar Pradesh and Assam the power supply is very poor that often the total hours of daily supply is as low as 14 hours. There are cold storages in these states which use generators for up to 8 hours per day. This is a serious hindrance for achieving financial viability of the entire chain including cold storages, farmers and traders.

### **3.8.2 Commodity Handling, Grading and Sorting**

Less than one-third (30%) of the cold storage facilities have a conveyor mechanism for handling the commodities. Also less than two-fifth (40%) of the facilities have any kind of lifting mechanism. Of the 42 sample cold storages 22 (52%) adopted manual means of commodity handling. Four other cold storages had forklifts in place and 3 others had conveyor belts for handling the material. This means that most of the facilities depend on manual labor for meeting the basic needs of handling commodities. This may lead to contamination and lesser efficiency.

Only half 42 cold storages (52%) had any Grading, sorting, washing and packing line in place. All of them were manual. While nearly one-third (33 %) had no mechanism in place for grading and sorting, two cold storages had automatic grading and sorting facilities in place and one had a semiautomatic facility.

### **3.8.3 Extent of Automation**

Automation is yet to make its mark in the cold storages sampled. Only one cold storage (in Punjab) among 42 reported that it is fully automated. One other cold storage (in Madhya Pradesh) has got a Program Logic Controller enabled control of systems. Three of the cold storages reported to follow the NHB guidelines. In total 8 out of 42 cold storages use automation at least up to an extent. There is tremendous scope of improvement in this regard.

The cold storage in Delhi and Haryana have facility to send auto generated SMS to the users on the temperature maintained for their commodity stored. This enhances the transparency and accountability of the facility and also brings in confidence among the farmers and traders.

### **3.8.4 Weigh Bridge**

All the facilities surveyed had a weighing mechanism in place. But, there is no standardized timeline adopted for calibration. There are facilities which reported that they do the calibration either once in a year or as and when required. There are facilities undertaking calibration activity once in every 3 or 6 months. Some facilities never undertake calibration of their machines. On the other extreme are

those few facilities which have fully automated calibration facilities. In short it can be stated that there is no specific standard timeline followed by the facilities for calibration. It should be made sure that the weighing machines are calibrated as per some specific standards and norms and should be certified on a timely basis.

Despite the lack of frequent calibration of the weighing systems both the farmers and traders are happy about the weights recorded. This is a recognition of the good practice followed by the cold storages. However, it is highly desirable that the faith and good regard be kept by undertaking proper precautions as loss of calibration over regular use is a generally observed phenomenon. There is a need for a guideline which prescribes the frequency of calibrations. A certification mechanism to check the accuracy of the system at regular intervals may be established.

### **3.8.5 Insurance**

Stocks are essential part of day today business activities. Due to intrinsic nature of Potatoes, it needs specific attention in storage. Certain policies need to be established to provide protection against deterioration, contamination or putrefaction (rotting) of perishable stock as a result of the unexpected rise in temperature brought about by the accidental failure or breakdown of the refrigeration plant. Existence of Machinery Breakdown insurance is prerequisite.

More than 25 % of the cold storages admitted that there are occurrences of loss of the produce stored due to various reasons. At the same time almost all the cold storages does not charge any insurance on the produce of farmers. This may be considered as a policy directive to ensure that the stored commodities are insured which can help in reducing losses incurred.

## **3.9 Impact Assessment**

One of the objectives of the study being, to conduct impact analysis of Cold Storage scheme with respect to reduction in glut conditions and distress sale during peak harvest etc., and analysis of benefit to growers, reduction in post-harvest losses and other benefits like salvation of glut situation, meeting market demand in off season etc.; it was imperative to do the impact assessment of the scheme. The scheme was assessed in terms of additional storage capacity, effect on income of user, effect on glut condition/ distress sale, and reduction in post-harvest losses.

The analysis has been covered under the following respective heads —

### **3.9.1 Effect on Income**

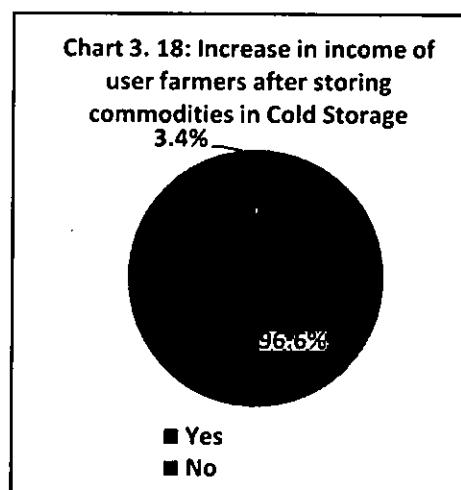
There has been a significant difference in the income levels of both the users of the cold storages, viz; farmers and traders. This has been captured in the following sections.

The user farmers were asked if they had an increase in their income after storing their commodities in the cold storages. It was found that out of 291 user farmers, 97% affirmed to have had an increase in their income. Only 10 farmers (5 of 9 in Assam, 1 of the 20 in M.P., 1 of 6 in Odisha, and 3 of 162

in U.P.) denied having an increase in their income after storing their commodities in cold storage. The proportion is depicted in the chart given ahead —

All the traders interviewed were of the opinion that they have got an increase in income due to the use of cold storage. The average annual increase in income as reported by the traders after starting to utilize cold storages is 36%.

The increase in income due to use of cold storage in different States for different crops have been captured in the tables presented ahead.



### Andhra Pradesh

In Andhra Pradesh it was found that Black Gram, Dry chili, Paddy and Jowar were stored in the cold storages. The average profit reported for all the crops came to be higher than 25%. The minimum profit percentage was for Black Gram which came out to be 18%. At the same time paddy gave a profit of 50% while stored in cold storage. The table ahead presents the details—

Table 3.11.A.Effect on Income in Andhra Pradesh			
Particulars	Average Profit (in percent)	Min Profit (in percent)	Max Profit (in percent)
Black Gram	27.5	18.0	40.0
Dry chili	30.1	28.8	31.3
Jowar	34.9	34.9	34.9
Paddy	39.5	20.8	50.0

### Chhattisgarh

In Chhattisgarh, the major crops utilizing the facility of cold storage were Amchar, Gram, Horse Gram, Jaggery, Malma and Tamarind. The minimum profit reported was by farmers storing Amchar, who received 10% profit by utilizing cold storage. At the same time, farmers trading in Horse Gram could receive profit as high as 55%. See the table ahead for details on the profit as reported by farmers in Chhattisgarh.

Table 3.11.B.Effect on Income in Chhattisgarh			
Particulars	Average Profit (in percent)	Min Profit (in percent)	Max Profit (in percent)
Amchar	10.4	10.4	10.4
Gram (Chana)	16.1	16.1	16.1
Horse gram	54.8	54.8	54.8
Jaggery	16.4	16.4	16.4

Malma	22.5	22.5	22.5
Tamarind	13.1	13.1	13.1

#### Gujarat

Farmers and Traders in Gujarat State utilize cold storage facility to store Apple, Ginger, Onion and Potato. The farmers utilizing cold storages reported to gain profits in every crop they stored. The average profits ranged from as high 121% (apple) to as low as 15% (Ginger).

Table 3.11.C.Effect on Income in Gujarat			
Particulars	Average Profit (in percent)	Min Profit (in percent)	Max Profit (in percent)
Apple	121.4	121.4	121.4
Ginger	15.3	15.3	15.3
Onion	80.0	80.0	80.0
Potato	122.5	122.5	122.5

#### Haryana

In Haryana, cold storages were used by traders to store Apple and Mango and by farmers who cultivated Mango, Masor and Meten. The average profits varied from 128 % on the higher side (Masoor) to 18% on the lower side (dried pea). The following table presents the details.

Table 3.11.D.Effect on Income in Haryana			
Particulars	Average Profit (in percent)	Min Profit (in percent)	Max Profit (in percent)
Apple	90.7	90.7	90.7
Mango	58.0	58.0	58.0
Masoor Dal (Red Lentils)	128.0	128.0	128.0
Pea (dried)	17.5	17.5	17.5

#### Jharkhand

In Jharkhand Potatoes was the only crop utilizing cold storage facility (from sample). The farmers interviewed noted by using cold storage facility, that 12 % was the least profit gained, while it could go up to 100%.

Table 3.11.E.Effect on Income in Jharkhand			
Particulars	Average Profit (in percent)	Min Profit (in percent)	Max Profit (in percent)
Potato	35.3	12.5	100.0

#### Karnataka

The traders and farmers in Karnataka used cold storage facilities to store Apple, Bengal Gram, Coriander Seeds and Dry Chilly to gain average profits as high as 33% (for apple). The average minimum profit turned out to be for coriander seeds.

Table 3.11.F.Effect on Income inKarnataka			
Particulars	Average Profit (in percent)	Min Profit (in percent)	Max Profit (in percent)
Apple	33.1	27.0	38.0
Bengal Gram	24.7	24.7	24.7
Coriander Seed	21.8	16.6	29.2
Dry chilly	29.2	18.7	45.0

#### Madhya Pradesh

In Madhya Pradesh, Chilly and Potato were the crops stored by farmers. They reported an average profit of 76% for Potatoes and 44% for Chilly.

Table 3.11.G.Effect on Income in Madhya Pradesh			
Particulars	Average Profit (in percent)	Min Profit (in percent)	Max Profit (in percent)
Chilly	43.5	41.4	55.7
Potato	75.7	30.0	97.5

#### Maharashtra

In Maharashtra Grapes and Raisins are the major produce stored in cold storages. They also reported profits by utilizing the cold storage facilities as shown in table below.

Table 3.11.H.Effect on Income in Maharashtra			
Particulars	Average Profit (in percent)	Min Profit (in percent)	Max Profit (in percent)
Grapes	99.9	16.7	195.0
Raisins	52.3	34.9	66.8

#### Odisha

It can be seen that utilization of cold storages in Odisha gave only 15% average profits for the Potato farmers which is comparatively lesser than other States.

Table 3.11.I.Effect on Income in Odisha			
Particulars	Average Profit (in percent)	Min Profit (in percent)	Max Profit (in percent)
Potato	14.8	10.8	18.6

#### Punjab

In Punjab 19% average profits were obtained by farmers who stored Potatoes.

Table 3.11.J.Effect on Income in Punjab			
Particulars	Average Profit (in percent)	Min Profit (in percent)	Max Profit (in percent)



Potato	18.8	18.8	18.8
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#### Rajasthan

The Rajasthan traders utilizing Cold Storages for storing Apple, Grapes and Oranges received highest average profit on Orange (92%), followed by Apple (62%) and Grapes (27%).

Table 3.11.K.Effect on Income in Rajasthan			
Particulars	Average Profit (in percent)	Min Profit (in percent)	Max Profit (in percent)
Apple	62.1	50.0	71.0
Grapes	26.7	18.3	33.3
Orange	92.2	90.9	95.1

#### Tamil Nadu

The cold storages were used to store Apple, Chilly and Pulses in Tamil Nadu. All the commodities gave a profit more than 20%.

Table 3.11.L.Effect on Income in Tamil Nadu			
Particulars	Average Profit (in percent)	Min Profit (in percent)	Max Profit (in percent)
Apple	33.3	33.2	33.5
Chilly	22.2	22.2	22.2
Pulses	22.2	22.2	22.2

#### Uttar Pradesh

In Uttar Pradesh, Potatoes were the only crop (within sample) to be stored in Cold storages. It gained a profit of 65%.

Table 3.11.M.Effect on Income in Uttar Pradesh			
Particulars	Average Profit (in percent)	Min Profit (in percent)	Max Profit (in percent)
Potato	65.1	65.1	65.1

#### Uttarakhand

In Uttarakhand storing Potatoes gave an average profit of 74%. The maximum percentage of profit is 100 % and minimum is 74%.

Table 3.11.N.Effect on Income in Uttarakhand			
Particulars	Average Profit (in percent)	Min Profit (in percent)	Max Profit (in percent)
Potato	74.4	36.4	100.0

## West Bengal

In West Bengal Cold Storages are used to store Apple, Beetroot, Cauliflower, Carrot, Dates, Flower, Mango, Marigold, Orange, Tomato and Potato. The maximum, minimum and average profits are discussed in the table ahead.

Table 3.11.O.Effect on Income in West Bengal			
Particulars	Average Profit (in percent)	Min Profit (in percent)	Max Profit (in percent)
Apple	62.8	40.0	92.5
Beetroot	35.0	35.0	35.0
Cauliflower	45.6	42.5	48.8
Carrot	37.5	35.0	40.0
Dates	40.0	40.0	40.0
Flower	54.9	48.8	61.0
Mango	28.4	28.3	28.5
Marigold	41.6	41.6	41.6
Orange	38.2	33.0	43.3
Potato	35.7	35.7	35.7
Tomato	45.0	45.0	45.0
vegetable	48.0	48.0	48.0

## Jammu & Kashmir

Cold storages are utilized for the storage of a variety of crops in Jammu & Kashmir. They include Ahar Dal, Ajwain (Carom Seeds), Chilly, Gram (Chana), Jeera (cumin), Potato, Pulses, Rajma, Tamarind and Walnut. The maximum, minimum and average profits are discussed in the table ahead.

Table 3.11.P.Effect on Income in Jammu & Kashmir			
Particulars	Average Profit (in percent)	Min Profit (in percent)	Max Profit (in percent)
Ahar Dal	18.8	18.8	18.8
Ajwain (Carom Seeds)	16.6	16.6	16.6
Chhola	25.0	25.0	25.0
Chilly	36.0	22.2	50.0
Gram (Chana)	25.0	25.0	25.0
Jeera (cumin)	36.0	36.0	36.0
Potato	50.0	50.0	50.0
Pulses	41.8	37.2	50.0
Rajma	22.5	22.5	22.5
Tamarind	21.4	21.4	21.4
Walnut	33.3	33.3	33.3

## Himachal Pradesh

The farmers storing Apple in Himachal Pradesh reported a profit of 94% while utilizing cold storages.

Table 3.11.Q.Effect on Income in Himachal Pradesh			
Particulars	Average Profit (in percent)	Min Profit (in percent)	Max Profit (in percent)
Apple	94.0	94.0	94.0

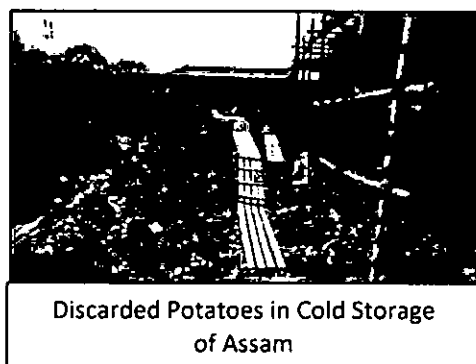
## Assam

Flowers and Potatoes were stored in Assam. The profits obtained are as listed in the table ahead.

Table 3.11.R.Effect on Income in Assam			
Particulars	Average Profit (in percent)	Min Profit (in percent)	Max Profit (in percent)
Flower	43.3	20.0	70.0
Potato	12.5	12.5	12.5

### 3.9.2 Effect on Glut Condition/distress sale

The user farmers were asked if they had an increase in their income after storing their produce in the cold storage. Most of them noted that the income increased after they started utilizing cold storage for their commodities. This can be taken as an inference to say that there has been a positive change in addressing the glut condition through the use of cold storage facilities. However, the cold storages, traders and farmers all reported a loss due to fall in potato



prices in 2017. This indicates that potato was available in the market in plenty and the producers could not control its supply even with existing capacity of cold storages. The study team witnessed the situation during field visit to the Cold Storage facility in Assam.

### 3.9.3 Reduction in post-harvest losses

There has been a reduction in post-harvest losses after resorting to the use of cold storage facilities. This can be inferred from the majority (97%) of farmer responses stating that their profits have increased after the use of cold storage.

### 3.9.4 Loss in commodities during storage

It is to be noted that nearly one-third (32%) of the farmers were of the opinion that they suffered loss of a part of their commodities even while storing under the cold storage facilities. This is in close conformation to the loss reported by cold storage owners (21%). Among the traders four-fifth (82%)

were of the opinion that they suffered loss of a part of their commodity even while storing in cold storage.

The owners were enquired to find out the losses happened to the produce stored in cold storages according to the time period of storage. When the commodities were stored up to 3 months, only one cold storage reported loss of commodity by more than 20%. One each reported that the loss was in the range of 1-5% and 6-10%.

When the storage period was 3 to 6 months, one cold storage reported a loss of commodity in the range 1-5% and one cold storage reported that the loss is between 11 and 20 %. When the commodities were stored for more than 6 months, one each reported that the loss were between 1 and 5%, 6 and 10% and more than 20%.

### **3.9.5 Safety of Commodities Stored**

Majority (62%) of the farmers were of the opinion that the safe keeping of their commodities in cold storage is not compromised. However, a minor proportion(2%) of them think that advanced technology should be used for the safe keep of the commodities.

## **3.10 Vendors Views on Scheme**

During the presentation of top line findings, it was suggested to interview a few of the equipment vendors to know their views about the scheme. Out of the total 8 vendors contacted 5 vendors were ready to provide necessary time and information for the purpose of the Study under progress. The responses received from these 5 sampled vendors fell into either of the following categories, viz; 1. Insulation and 2. Refrigeration and Automation. The relevant information received are presented under the corresponding heads ahead.

### **3.10.1 Insulation**

Thermocol/EPS and PUF the major insulation materials which are available for use in cold storages. Although usage of PUF for insulation have many benefits over thermocol/EPS, most of the cold storage owners prefer to use thermocol due to cost benefits involved. For example, cost of thermocol comes to Rs.200 per Square meter while that for PUF is Rs.900. Thus, for a cold storage with a capacity of 5000 MT, using thermocol can save the owner around 35 lakh rupees while compared to using PUF. This forces the owner to oversee the advantages of using PUF such as higher energy efficiency which can get reflected in a reduction in the recurring costs like electricity charges, incurred during the life time of the cold storage. Since there is no incentive for using the better energy efficient material in the form of an enhanced subsidy, the owners are left with no choice but to use the inferior material and thus add to the energy woes of the country. The material used for construction of cold storages also have an impact in the total cost. Therefore the owners prefer not to use steel for construction, which again has many advantages over the other materials. But by not preferring steel they miss the chance of utilizing the cold storage for the storage of produce like

tomato, thereby limiting the facility for storage of only one produce; potato. This limits the capacity utilization percentage of the cold storages affecting the revenues.

### 3.10.2 Refrigeration and Automation

The vendors were critical about the use of advanced technology in refrigeration control. The lack of incentives provided for using better technology has been hindering the process of updating to new and better technologies. For example the cold storage owners prefer not to use the systems with Variable Frequency Drive which helps in reducing electricity consumption in A.C motors significantly. It was also pointed out that energy wheel/ heat recovery wheel which helps in maintaining the moisture content of fruits, is rarely used in cold storages. The efforts for promoting automation of the cold storage systems are also limited due to lack of incentives as mentioned in the previous section.

All the vendors were of the opinion that the subsidy provided for the cold storages should not be at one single flat rate. Instead, a dynamic system should be introduced whereby the subsidy amount will vary according to the materials, equipment and other technology used. Dynamic subsidy can be seen as a good tool to incentivize the establishment of an advanced and energy efficient cold storage network.

### 3.11 View of Officials on Scheme

The officials were interviewed to find out the details regarding the scheme implementation, perception about its success rate and to gain insights about the thoughts of officials on various other factors. Insights obtained from such in-depth-interviews are presented ahead.

#### 3.11.1 Areas which have achieved Saturation of Cold Storage

There are very few regions in the country where the cold storage capacities have reached saturation point. Parts of Agra, Meerut and Kanpur in Uttar Pradesh and a few areas of Punjab and Haryana have reached saturation levels.

#### 3.11.2 Areas which hold Potential for New Facilities

The State officials were enquired about the areas which hold potential for new cold storage facilities. The officer in Himachal Pradesh had observed that the capacity established is 35000 to 40000 MT whereas there is a potential for around 100000 MT as the demand from Apple growers alone comes to this amount. The following districts were identified by officials as holding potential for new Cold Storage facilities —

Table 3.12: Areas with Potential for New Cold Storage Facility	
State	Districts viable for Cold Storage
Andhra Pradesh	Guntur and Prakasam
Chhattisgarh	Rajnandgaon, Rajpur, and Sarguja(JaspurAmbikapur)

Gujrat	SabarKantha, BanasKantha and Mahesana
Haryana	Sonipath, Kurukshetra and Ambala
Himachal Pradesh	Shimla, Kinnaur, Kullu and Mandi
Jammu Kashmir	Srinagar In PalwamaDist
Karnataka	Bijapur, Banglore, Bellary, Haven and Raichur
Maharashtra	Nagpur, Nashik, Akola, Amravati, Mumbai, Pune, Sangoli and Gondra
Punjab	Jalandhar, Hoshiyarpur and Ludhiyana
Tamil Nadu	Dindigul, Krishnagiri and Salem
Telangana	Hyderabad
Uttar Pradesh	Agra
Uttarakhand	Almora and Nainital

### 3.12 Way ahead

Most of the cold storage facilities are optimistic about their future. Many of the facilities acknowledge the need for increased capacity. They also have goals to install fully automatic plants in future. All these are indications of the financial viability and existing opportunities in the sector at majority of places. There exists optimism among the cold storage owners that the sector is going to be in a good state in the future. Thus indicates that the cold storage facilities are well received by the users. Therefore, it can be assumed that there has been a spread of knowledge on the advantages of using the cold storage facilities among the users. Though the cold storage industry is confident of the way forward, there are certain areas of concern which needs to be addressed. They are to be given due importance since these are issues relating the reduction of losses, empowering of user farmers and traders and also which will help improving the industry as a whole —

#### 3.12.1 Policy Interventions suggested

The following interventions have been suggested which will help improve the cold storage network's infrastructure quality and ensure better accountability. This is essential for the progress of the sector as a whole —

- a) Insurance coverage of crops stored in cold storages to be made mandatory.
- b) Proper calibration of weighing machines, following specified norms should be encouraged. A certification mechanism to check the accuracy of the system at regular intervals may be established.
- c) Policy interventions are required to improve the automation of facilities. This may be achieved by including it as a mandatory component for availing an enhanced subsidy (the amount may be decided as found suitable enough for encouragement).
- d) Since it is found that there is a positive sentiment existing among the farmers and traders for the establishment of new facilities, the same may be utilized by encouraging more investors

to establish cold storages, by increasing the total amount allocated for the subsidy scheme by incentivizing the use of latest technology.

- e) There are many cold storage facilities which are established outside the subsidy scheme. They may be encouraged to improve up on their infrastructural facilities by publicizing the lateral subsidy inclusion scheme whereby the facility may avail subsidy against loans for the improvement/ upgradation proposed. This is vital as the lion's share of facilities offer basic facilities only.

### 3.12.2 Suggestions Received

There were many suggestions which came up during the interviews with owners and beneficiaries of cold storage. The owners were keen to solve the financial issues arising out of the scheme. At the same time farmers and traders were interested in getting better facilities from cold storages. The major and important suggestions obtained during the field survey are recorded below—

#### Owners

Various suggestions given by Cold storage owners have been classified according to their nature and are described as follows:

**Subsidy:** Majority of the cold storage owners (79%) were of the opinion that subsidy should be raised at least up to 50% of the total cost. There were 17 % of the respondents who alleged that they did not get the subsidy amount until the day of interview. A major part of respondents wanted to make the entire process to provide subsidy easier. The need to synchronize the release of bank loan and subsidy was also emphasized by many Cold Storage owners.

**Loan:** Most of the owners wanted to make the loan available at a lower interest rate or no interest rate at all. Some suggested that instead of providing a subsidy amount the government may provide them with an interest free loan. There were opinions that the bail/collateral security on credit may be reduced. Also, the documentation process required for obtaining the loan may be simplified. Some owners were of the opinion that the loan may be made available at a faster rate. Another major opinion which came up was that there should be at least an interest free year/period after which the repayment may begin. This may help in getting the firm established and also may solve the problems arising out of non-synchronization of loan and subsidy release.

#### Farmers

Farmers had suggestions on different matters including the machinery, storage facilities and accessibility. These are noted below.

**Machinery:** Some farmers were of the opinion that the cold storages should have better technology as per the modern times (Maharashtra). Better loading and unloading facilities were demanded by farmers in Andhra Pradesh.

**Storage:** There were suggestions that the storage facility should have provisions for storing the produce of different farmers in different chambers. Also it was suggested that different kinds of produce should be separately stored. The need for chambers of different size was emphasized in cold storages of Andhra Pradesh and Odisha.

**Capacity:** Farmers from various States had the opinion that capacity should be progressively increased or new cold storages may be established (34% of sample).

### **Traders**

The suggestions given by traders on improving the facilities of cold storage are noted below:

**Capacity:** Of the total sample 31 % traders were of the opinion that there should be enhancement of cold storage capacity.

**Availability of Labour and handling of goods:** Almost 23 % of the total respondents wanted to have more labourers/loading facility available at the cold storage so that there is better and faster handling of commodities.

**Storage:** A large number of traders were of the opinion that there should be separate facilities/chambers available for different traders and for different commodities. It may be noted that the same was suggested by a large number of farmers too. There were also suggestions that better grading facilities be made available for the goods at the cold storage.



## Chapter 4

# Nursery Accreditation

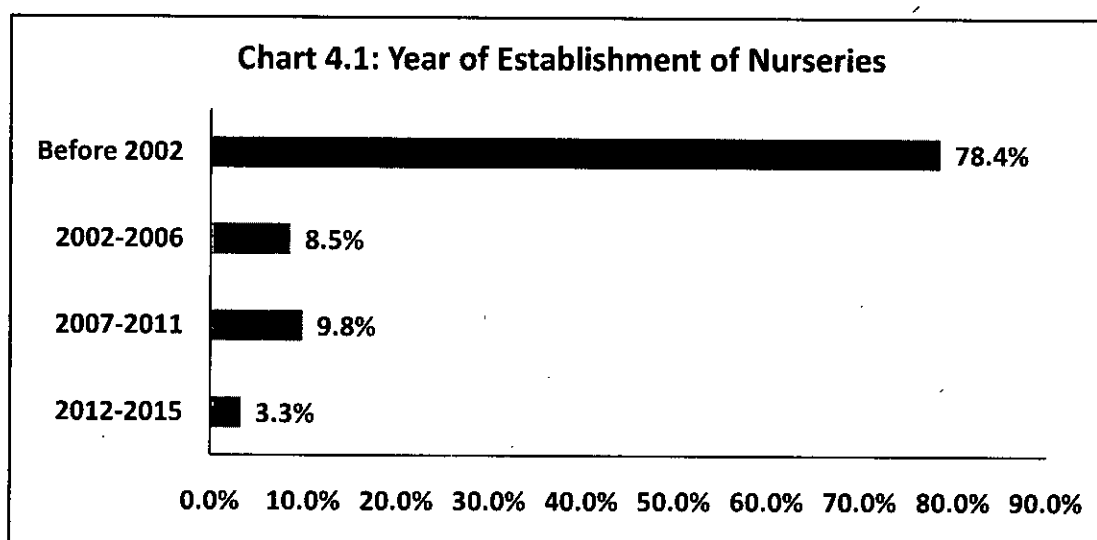
In the current chapter, an attempt has been made to analyze the working of nurseries along with the profile of nursery, nursery owners, and user farmers. It also discusses the process of accreditation and impact assessment of accreditation, i.e., benefits of using quality planting materials in terms of increase in yield, increase in income, and improvement in crop quality among other benefits.

### 4.1 Profile of Nursery

The profile of sampled nurseries are analyzed in detail in the following section. The analysis has covered establishment year, year of accreditation, rating, Capacity, and number of users.

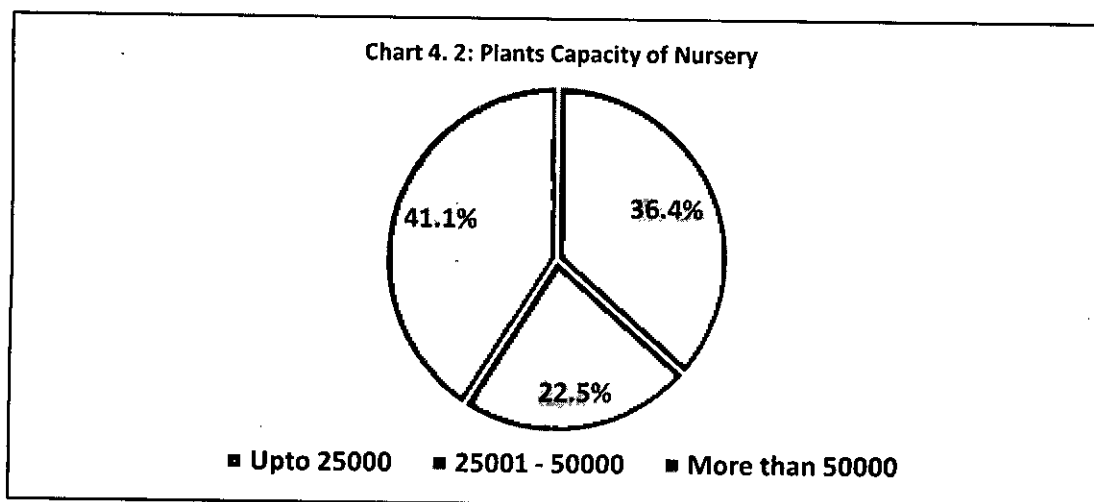
#### 4.1.1 Year of Establishment

Out of the total 160 nurseries sampled, almost four-fifth (78%) were established before 2002. This means that the respondents can give us a clear picture of the existing scenario of nurseries, the problems to be addressed, and solutions suggested. See following chart for detailed information.



#### 4.1.2 Capacity

The capacity data regarding capacity of nursery have been presented under three categories, viz; a) Plants; b) Mother Plants and c) Root stocks —

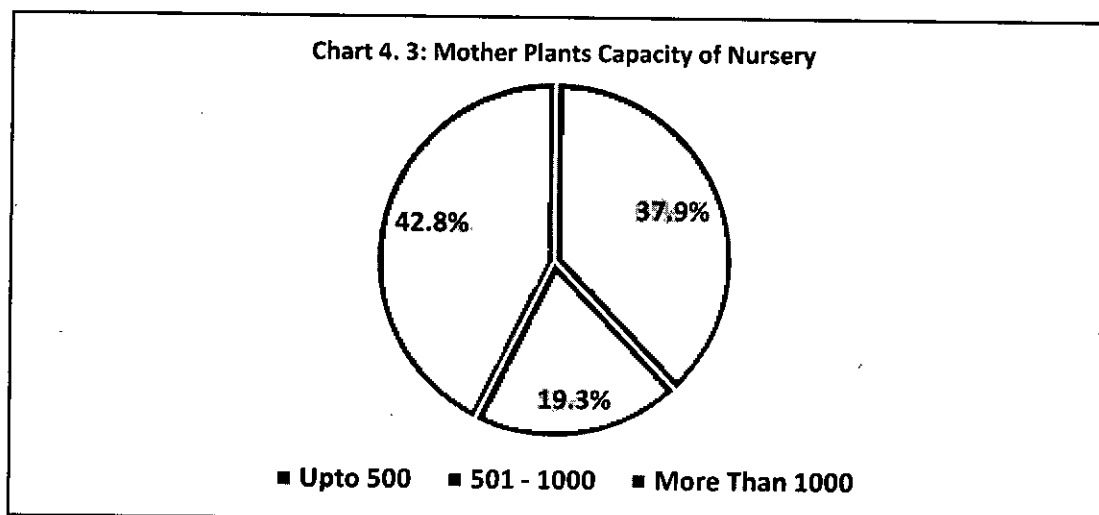


#### Plants: Number and Variety

Two-fifth(41%) of the sampled nurseries have plant capacities more than 50000. At the same time a considerable proportion (36%) of the sample nurseries have plants less than or equal to 25000. The details are presented in chart ahead

#### Mother Plants

A Mother plant is a plant grown for the purpose of taking cuttings or offsets in order to grow more quantity of the same plant. The following chart shows the proportion of nurseries having varying number of Mother Plants. It can be seen that the majority of the sample nurseries (43%) fall into the highest category by number.



There are a variety of plants made available through the nurseries which were covered as part of the study (Please see Annexure 3 for photo gallery of sample nurseries). Mango is seen as the single largest plant variety propagated throughout the country with the exception of most of the North Eastern States and Punjab. The other fruit plants which are widely produced through the nurseries are Guava, different varieties of Orange and Apple (Northern States). The single largest number of

mother plants produced in the nurseries Jammu & Kashmir and Himachal Pradesh are of Apple whereas that in Punjab and Haryana are of Kinnow. Pears, Mango, Cherry and Peach also are found to be promoted by nurseries of Jammu & Kashmir and Himachal Pradesh. In Uttarakhand, Apple is the mostly grown plant variety, followed by Mango, Litchi and Peach. The methods of propagation, mostly preferred in these States vary. If it is Veneer grafting and air layering in Himachal Pradesh, in Jammu & Kashmir it is Budding.

In the Eastern part including Bihar, Chhattisgarh, Jharkhand, West Bengal and Odisha, Mango is propagated through all sampled nurseries. Guava and Litchi are also propagated in most of the nurseries, though less in number. The other plants in this region are Sapota, Cashew and variants of lemon.

In the North Eastern States, Orange and its hybrid variants are grown predominantly in all Nurseries. Other plants include Guava, Mango, Papaya, Litchi and Cashew. Air layering is the mostly used method of propagation. In the central States of Madhya Pradesh, Rajasthan and Uttar Pradesh Mango is the single largest plant variety propagated through all the nurseries sampled, but one. Anola and Guava are also propagated in most of the nurseries. Litchi, Bel and Citrus plants are grown in these nurseries. In Rajasthan

Olive plants are largely produced in one sample nursery. Veneer grafting is the most used method for propagation, though budding and layering are also used.

In the western States including Gujarat and Maharashtra, Mango is the mostly produced plant variant. Orange and its variants also find a considerable number of plant production in the region. Sapota, Guava, Jamun, Pomegranate, and Cashew are also propagated through these nurseries. Veneer grafting and Budding are the mostly used methods for propagation of plants.

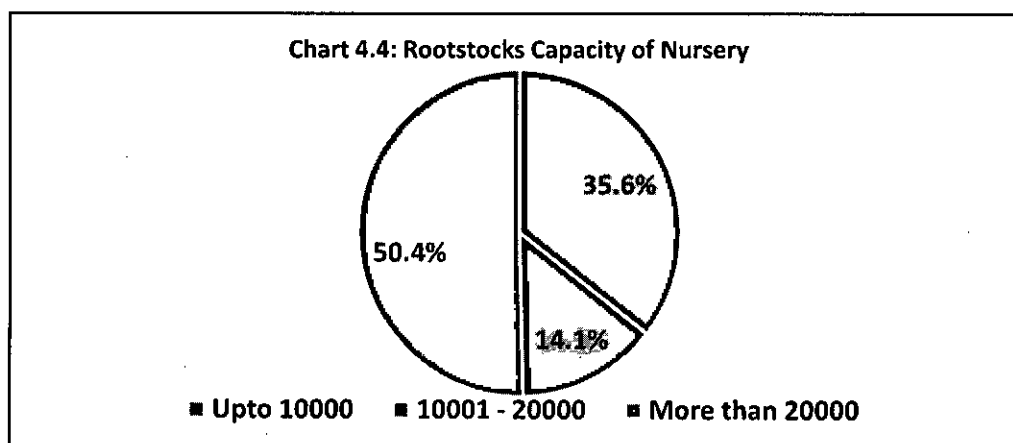
In South Indian States also Mango is found to be the most produced plant variety in nurseries. Coconut, Guava, Sapota, Cashew and Spices including Arecanut and turmeric are also promoted through the nurseries here. Veneer grafting and Inarching are the most used methods of propagation.

A detailed list showing the number of mother plants of different nurseries, their variety, methods of propagation adopted by nurseries and age of mother plant is given in **Annexure 2**. The gradings of individual nurseries are also given in the tables.

#### **Root stocks**

A rootstock is part of a plant, often an underground part, from which new above-ground growth can be produced. It can refer to a rhizome or underground stem.

One half of the sampled nurseries (50%) had a root stock capacity of more than 20000. At the same time more than a third (36%) had a capacity of up to 10000. The classification is presented in figure below —

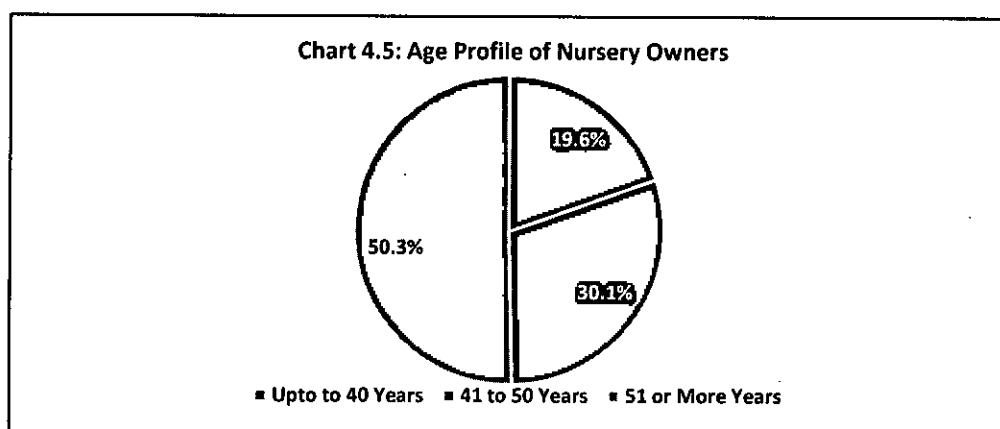


## 4.2 Profile of Nursery Owners

For the purpose of the study, the profile of the nursery owners was analyzed. The age profile, Social Category, Education including technical education related to nursery operation and management have been presented in the following section.

### 4.2.1 Age Profile

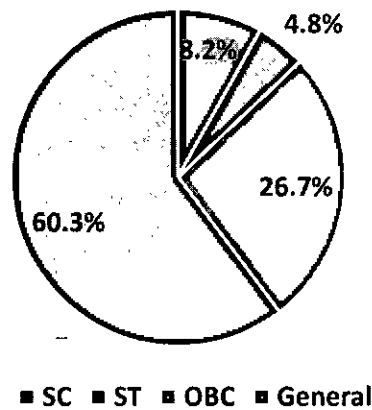
The age profile of the nursery owners has been studied under three categories, viz; those aged up to 40 years, between 40 and 50 years and above 50 years. More than half of the sample owners belong to the above 50 age category. The detailed chart is presented ahead —



### 4.2.2 Social Category

Three-fifth (60%) of the nursery farm owners in the sample belonged to the general category. More than a quarter (27%) further belonged to OBC. The participation rate of SC and ST communities together was capped at just over one-tenth —

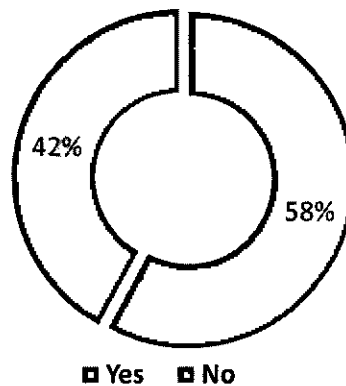
Chart 4.6: Social Category Of the Respondent



#### 4.2.3 Technical Education

During the study, it was found that the proportion of nursery owners with technical education (58%) was higher than the proportion of owners with no technical education (42%). The same has been presented in chart ahead—

Chart 4.7: Received Nursery Related Technical Education



#### 4.2.4 Training for Nursery Management

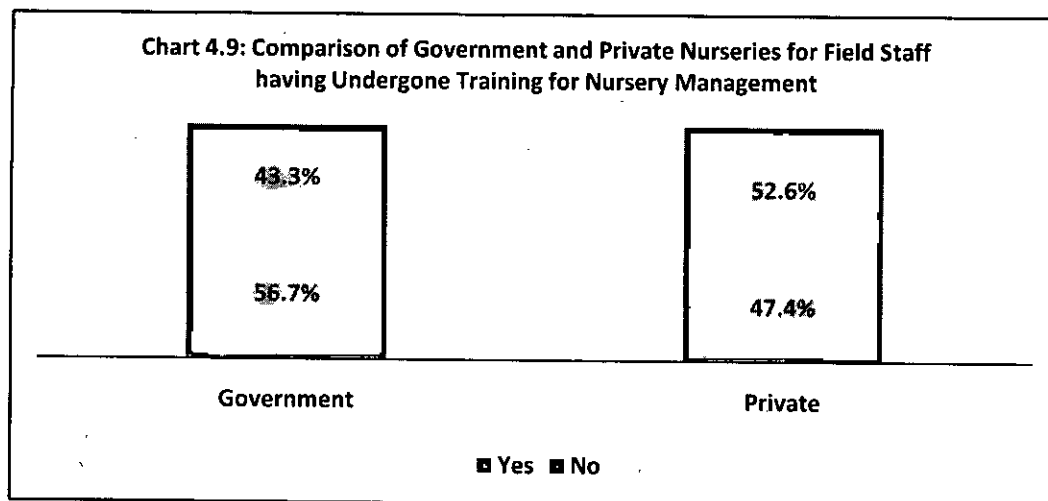
More than half (52%) of the sampled nursery owners had undergone training for management of nursery, while a closer proportion (48%) of the sampled nursery owners were operating the nursery

Chart 4.8: Received Training for Nursery Management

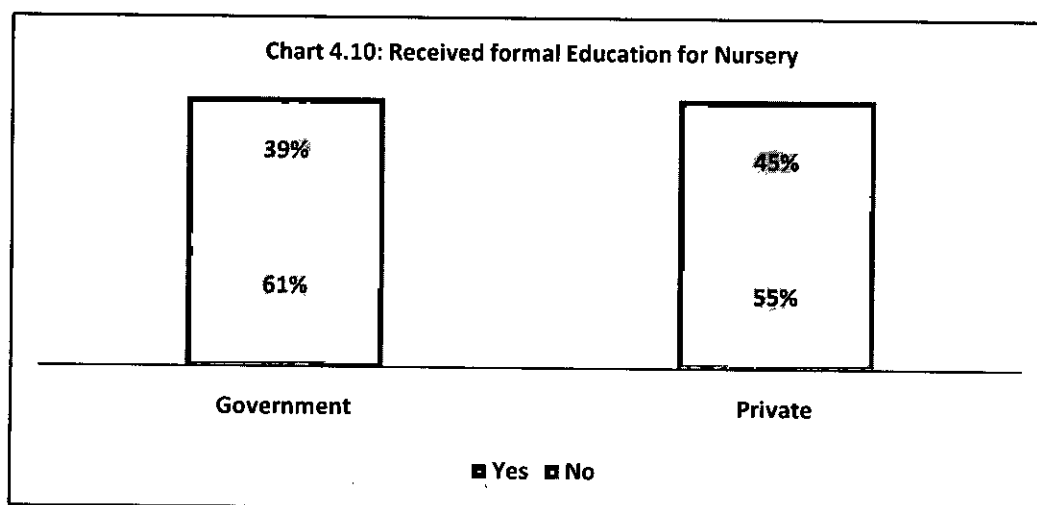


without any training for management —

While three-fifth (57%) of the government nurseries had trained field staff in nursery management only a half (47%) of private nurseries had.



While three-fifth (61%) of the government field nursery staff have received formal education related to nurseries, only 55% of Private staff have similar education. This may well be the reasons why Government nurseries are better rated than their private counterparts. This is represented in chart ahead—



#### 4.2.5 Involvement in other Employment

Among the respondents three-fourth were having only nursery as the source of income. The remaining had other income means too. Among those respondents who had an alternative income (25%), only a fifth considered Nursery as a secondary income. This suggests that the sample would give a much clear picture from the side of the nursery owners on various parameters.

### 4.3 Processes Followed

The NHB State officials and members of Accreditation Committee (preferably chairman) were interviewed to know about the shortcomings/ restraints faced in the accreditation process. All the officials except those in Jammu & Kashmir and Chhattisgarh mentioned that the accreditation process followed was good. In Jammu & Kashmir, officials of appraisal committee mentioned the field visits were not easy as often the nurseries were located in remote areas with less connectivity, also, the land records were not available, which posed yet another problem in accreditation process. In Chhattisgarh, the officials noted that there was a lack of co-ordination between officials of the State Agricultural University, KrishiVikasKendras and State Authorities, it needed to be improved for timely inspection of proposed nurseries for accreditation. The different processes followed in the accreditation are discussed ahead —

#### 4.3.1 Accreditation & Grading of Nurseries

**Scope:** The scope of the scheme is to establish a network of quality nurseries across the country for the purpose of propagation and distribution of quality planting material of specified horticulture crops. The recognition shall be accorded to the nurseries for:

- a) Production of quality planting material of one or more specified crops by adopting Good Nursery management Practices,
- b) Nursery Premise only where sale of specified quality planting material of recognized source are being carried out by creating necessary infrastructure facilities and proper record keeping.

#### Objectives of Accreditation/Grading Process

The objectives of the nursery accreditation system are as follows:

1. To ensure availability of quality planting material which is a prerequisite to the success of horticulture development initiatives.
2. To ensure the availability of disease free and healthy planting material of the perennial fruit crops.
3. To ensure the national level network of quality horticulture nurseries.
4. To adopt good nursery practices in a comprehensive manner.

### Accreditation Process:

The Nursery seeking NHB Recognition shall apply in Form- I to NHB HQ at Gurgaon. Each such application shall be accompanied by layout of Nursery showing location of infrastructure components and land utilization plan, details of technically qualified staff in the nursery, major farm machineries and operational manual prepared by nursery for selection and maintenance of mother plants, process followed for production of planting material and management of inventory of planting material. The Nursery shall submit details regarding source of Mother Plants used for propagation of horticulture plants in prescribed form (FORM- 1) and shall also maintain a register for sale of horticulture plants. The application form duly completed along with necessary enclosures shall be submitted to NHB, Head Office at Gurgaon. Each application will be considered by NHB based on criteria specified for recognition of nursery. The recognition of nursery by NHB shall generally be considered product wise/aspect wise as required. On receipt of the application for recognition, assessment would be done by agency identified by NHB with the help of a Technical Committee. Agency shall submit its assessment report to NHB along with recommendations. On the basis of the assessment report NHB shall decide whether to register the nursery with or without up-gradation. The decision of NHB shall be conveyed to the concerned nursery. In case of accreditation, the period of validity of recognition with other terms and condition shall be indicated. In case of any deficiency, the nursery shall be given time frame for compliance; failing which, the application shall be rejected. In case of requirement, additional assessment visits may be undertaken.

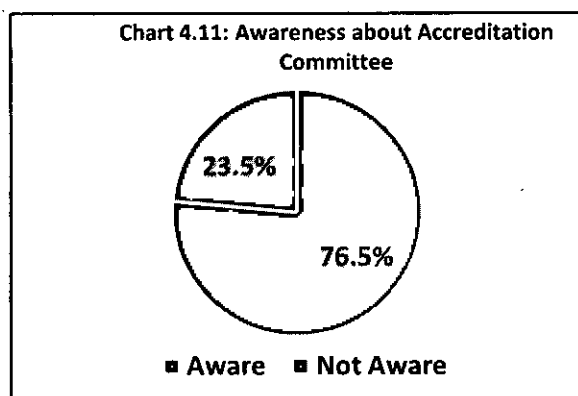
As per the NHB website out of the total 2652 accreditation proposals received only 1598 were accredited (60%). Among the accredited nurseries the majority (72%) could receive a 1 star rating only. There are 103 (4%) applications pending with the NHB among which Madhya Pradesh has the maximum share (51 nurseries).

#### 4.3.1.1 Knowledge of Accreditation Process

About three-fourth of the sampled respondents claimed to be aware about the accreditation committee —

##### Grading/Rating

A system of Graded Certification based on continuous evaluation of source of parent material, propagation in disease free condition by adoption of technically prescribed method, adoption of Good Nursery Management Practices, Reliable record keeping and training of staff. Each parameter will be critically examined by assessment team as per laid down criteria. Following grading shall be provided:





Outstanding - ★★★★★

Excellent - ★★★★

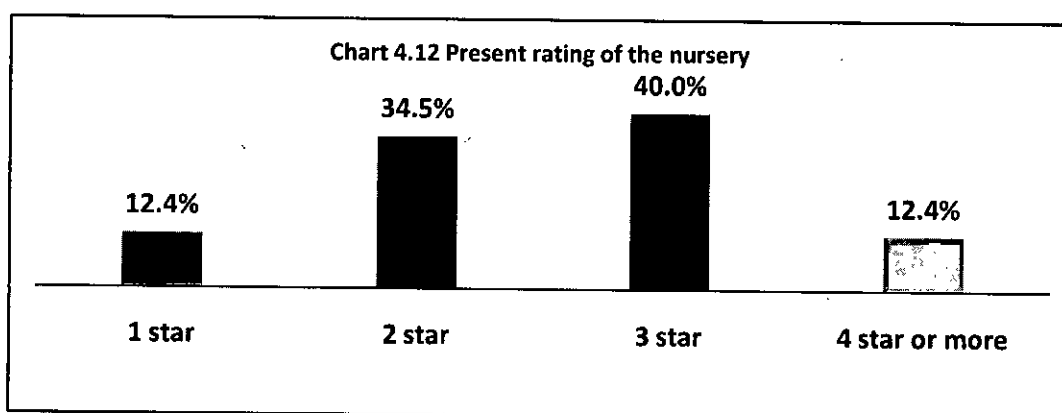
Very Good - ★★★

Good - ★★

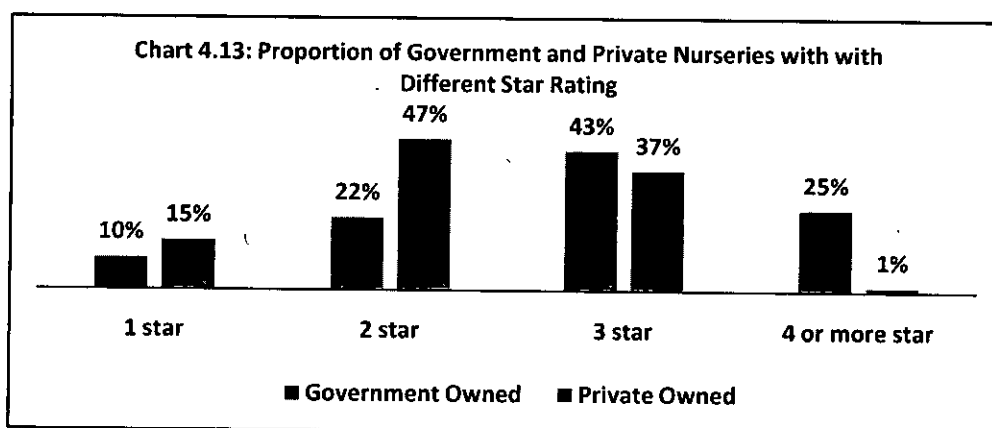
Satisfactory - ★

#### 4.3.1.2 Classification According to Rating

According to the ratings given to nurseries, nurseries with all possible ratings were included in the sample. The graph given ahead represents the percentage of nurseries belonging to various levels of rating. Two-fifth (40%) of the nurseries surveyed had a 3 star rating. Further a third (34%) of the sampled nurseries had 2 star rating. One tenth (12%) of nurseries had a single star rating only. Another one tenth (12%) of the nurseries had 4 star rating or higher. This indicates that there is a huge potential for improvement in the quality of service provided by nurseries. Please refer chart ahead for details—

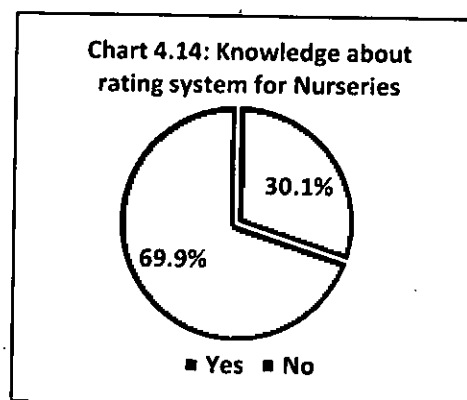


Further, it can be seen that government nurseries fare better than the private nurseries. While nearly two-thirds (62%) of the private nurseries are 2 or less starred, only one-third (32%) of the government nurseries are so. One-fourth (25%) of the Government nurseries have 4 star rating or above. At the same time only 1% of the private nurseries fall in to the highest category. Refer chart for details—



#### 4.3.1.3 Knowledge of farmers about Rating of Nursery

Among the interviewed farmers only one-third (30%) were aware about the existence of a rating system for nurseries. Therefore nurseries as well as farmers will not be able to gain an advantage of the rating system, without proper dissemination of knowledge on the matter. The owners too raised this issue since they are not able to gain any advantage over the unrated nurseries due to the lack of awareness among the farmers. This has been represented in the chart alongside.

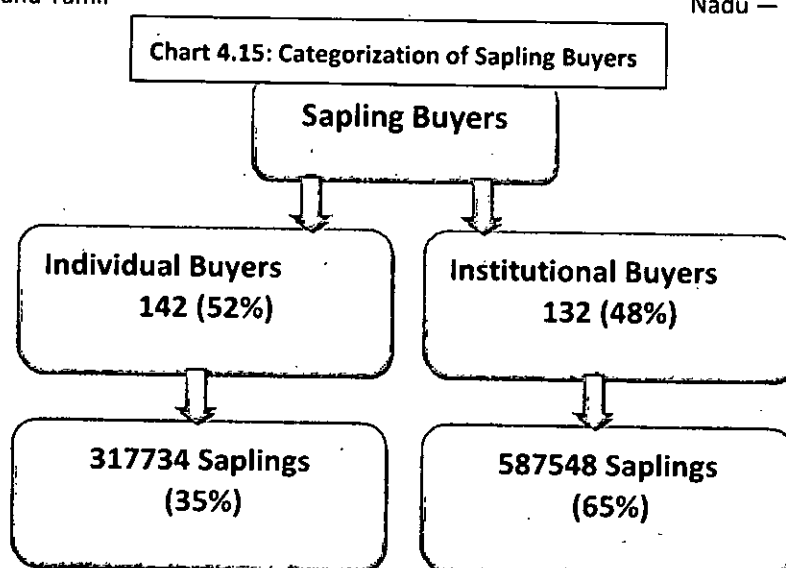


#### 4.4 Profile of Users

The users who buy the plants from nurseries can be classified into two categories, viz; a. Institutional Buyers and b. Individual Buyers. From the survey it was found that the proportion of individual buyers were higher than institutional buyers. While the proportion of individual buyers were nearly 52% that of institutional buyers were only near 48%. When it comes to the number of plants purchased it can be seen that nearly two-third (65%) of the plants were purchased by institutional buyers whereas the individual buyers purchased only around one-third (35%) of the total plants sold.

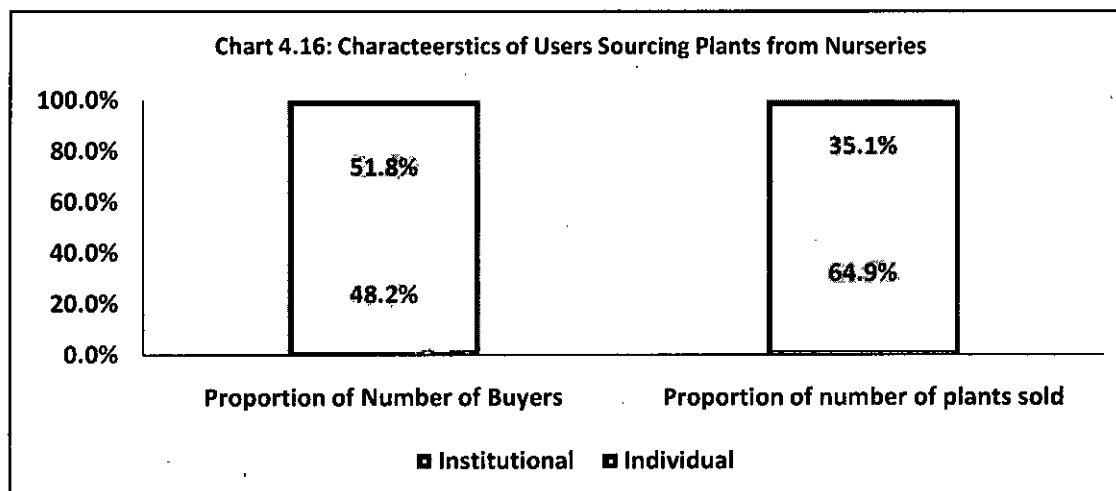
The total sales of plants were 9.05 lakhs of which 5.87 lakhs were sold in to institutional buyers and the remaining 3.17 lakhs were sold to individual buyers. In Odisha alone, nearly 3.4 lakh plants were sold to institutional buyers. Similarly around one lakh plants were sold to institutional buyers both in Karnataka and Tamil

Nadu —



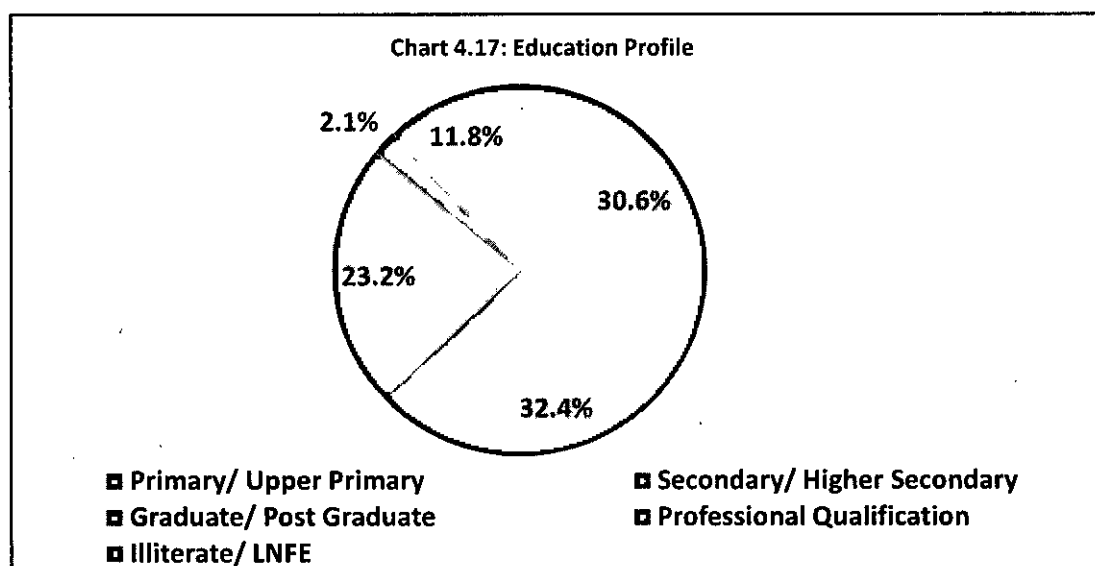
#### 4.4.1 Profile of User Farmers

The profile of user farmers of sampled nurseries was analyzed according to their educational status, social category, economic category and land holding. The different classifications which arise out of this has been discussed ahead:



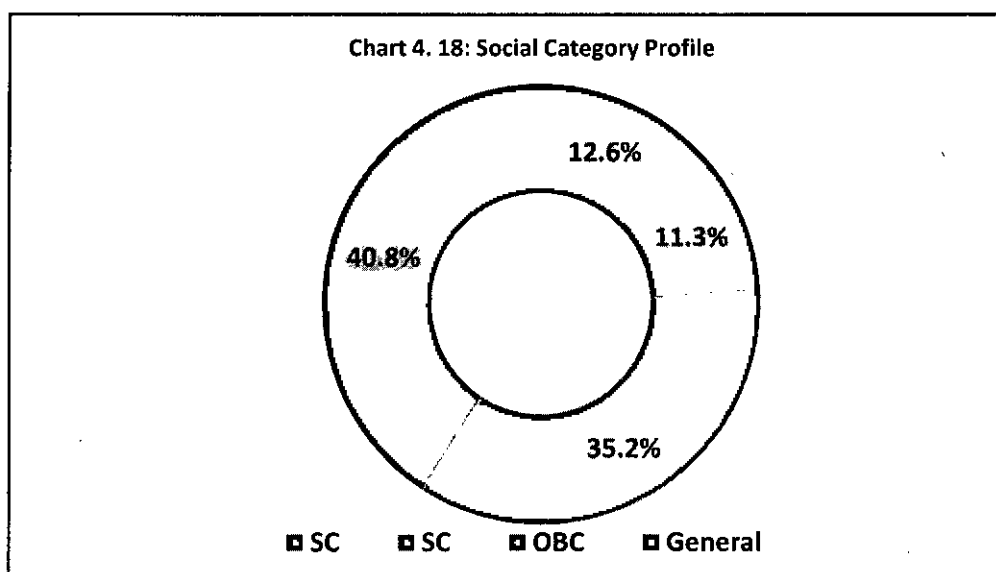
##### 4.4.1.1 Education Profile

During the survey, it was found that nearly two-third of the user farmers (63%) belong to the class of education up to higher secondary-level. While nearly one-fourth (23%) were graduates or post graduates, 12% belonged to either of the categories; 'illiterate' or 'literate but with no formal education'. Please refer chart ahead for the details—



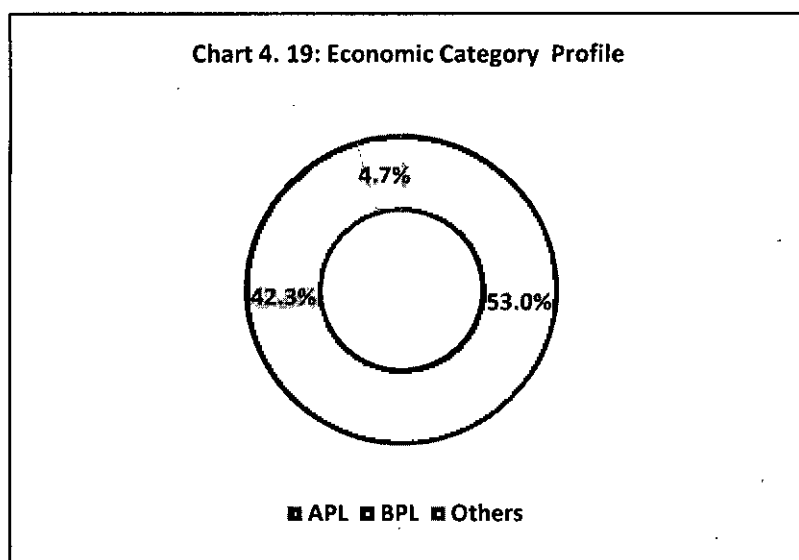
#### 4.4.1.2 Social Category Profile

It was found that two-fifth (40%) of the user farmers were of General category, followed by nearly one-third (35%) OBC, 13% SC and 11% ST. The detailed chart is provided ahead —



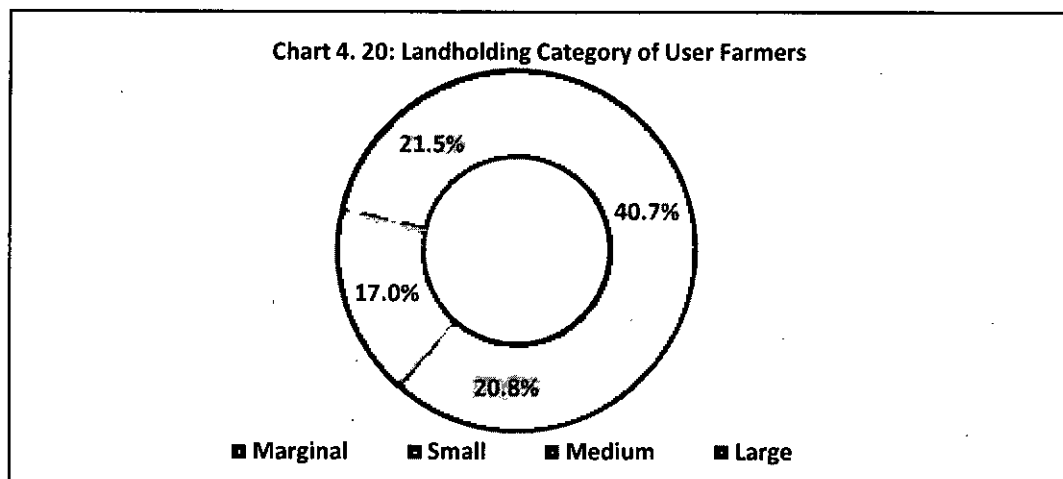
#### 4.4.1.3 Economic Profile

The user farmers of sampled nurseries were classified as per their economic profile, viz., APL or BPL. It was found that more than half (53%) were APL, while nearly two-fifth (42%) were BPL. However, 5% were such as those who did not have the card to define their economic category. Such cases are marked as 'others' as depicted in chart ahead —



#### 4.4.1.4 Land Holding Profile

The user farmers are classified according to their land holding profile, viz., Marginal, Small, Medium or Large. It was found that two-fifth (41%) were Marginal farmers, followed by one-fifth (21%) large farmers, another one-fifth (21%) small farmers and 17% medium farmers as shown in chart ahead —

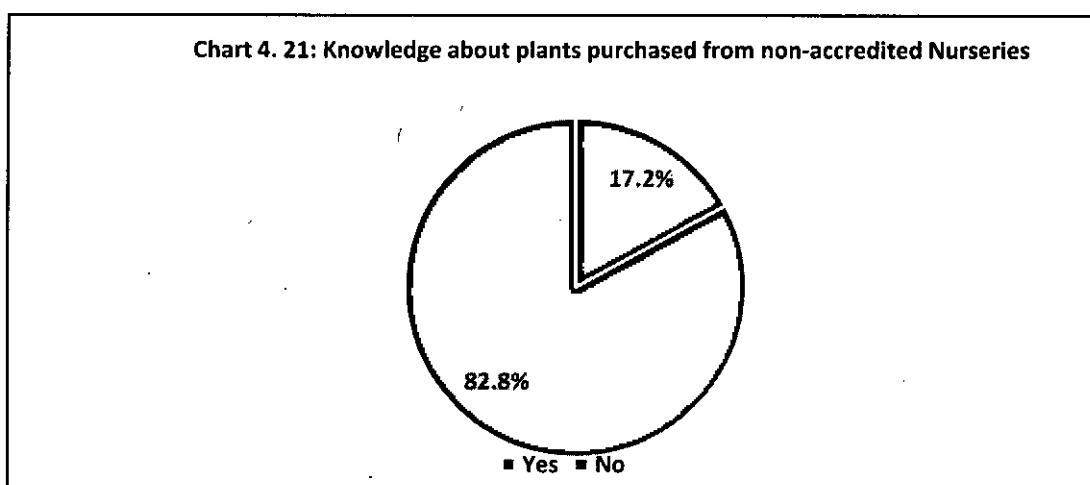


### 4.5 Impact Evaluation

The impact evaluation seeks to gain insights on the effects on farming practices, yield and overall profit for farmers and nursery owners, besides evaluating the overall impact and success of the scheme.

#### 4.5.1 Limitations

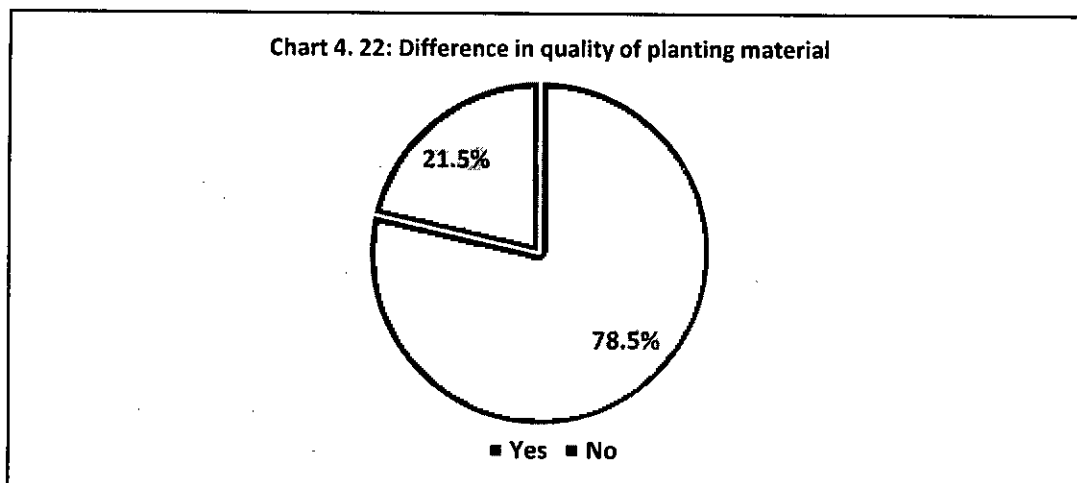
There were many limitations for bringing out the intended results of the study due to various reasons. In many cases the farmers were yet to start harvesting fruits as the plants were too young to bear any. In other cases where fruition had happened, the farmers did not have any previous experience for themselves or in their knowledge, in using plants from other nurseries. Only 275 (17%) of the sample had any such experience and knowledge as depicted in chart ahead as shown in the chart—



For the purpose of impact assessment these 275 farmers have been considered for analysis —

#### 4.5.2 Variation in Quality of Planting Material

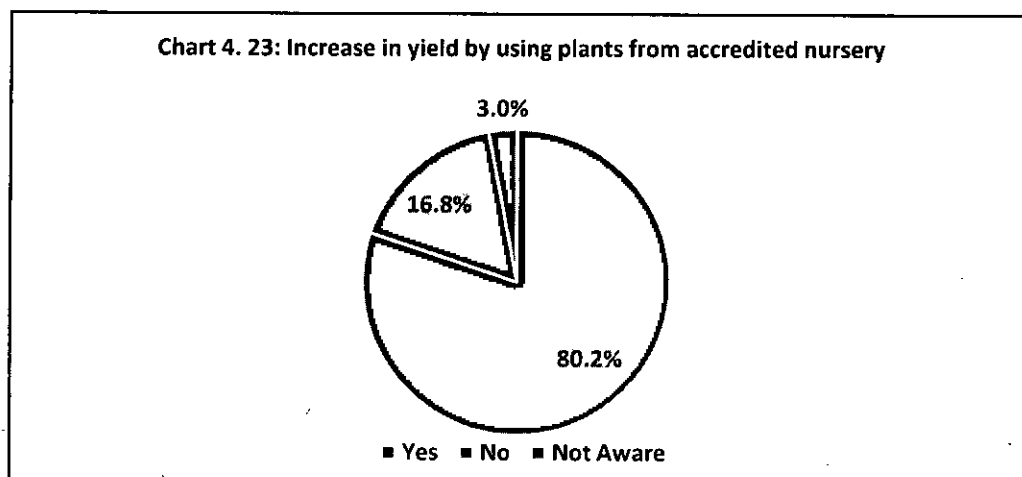
Among the farmers who had any previous experience (or knowledge) in using plants from sources other than accredited nurseries (see section 4.4) nearly four-fifth (78%) observed that there is a difference in the quality of planting material sourced from nurseries when compared to other sources as depicted in chart ahead —



At the State level, all the farmers who responded from Haryana, Punjab, Chhattisgarh, Uttarakhand and Rajasthan felt there is change in the quality of plants from accredited nurseries and other sources. At the same time the farmers in States like Sikkim, Tamil Nadu and Andhra Pradesh had more than 50% of the farmers who did not think that there is a quality difference between plants from accredited nurseries and others. In Sikkim the dissatisfaction was as high as 80%.

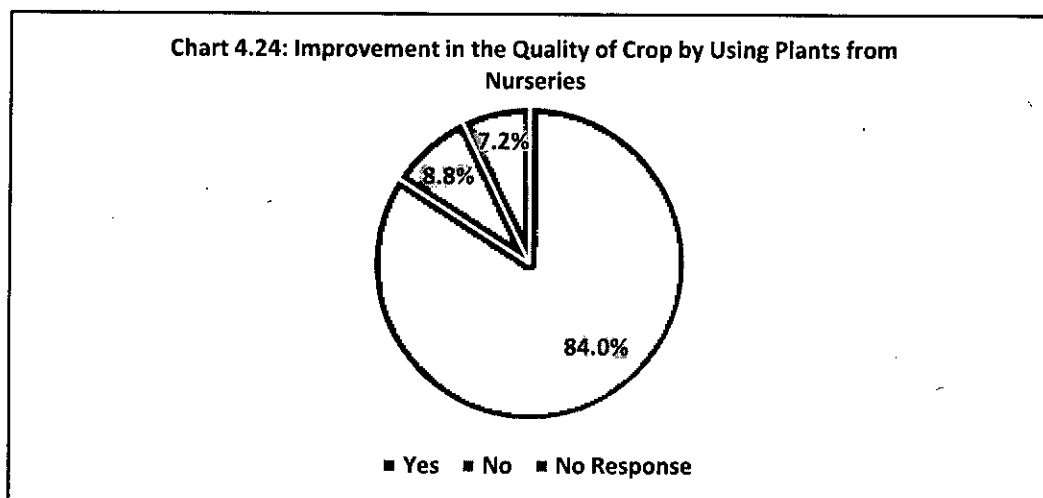
#### 4.5.3 Increase in yield by using plants from accredited nursery

The increase in yield when compared to plants from non-accredited nursery was reported by four-fifth (82%) of the farmers who had the knowledge or experience in using plants from non-accredited nurseries. At the same time nearly one-fifth (17%) farmers reported otherwise. A small proportion (3%) of the sample were unaware of it as shown in chart ahead —.



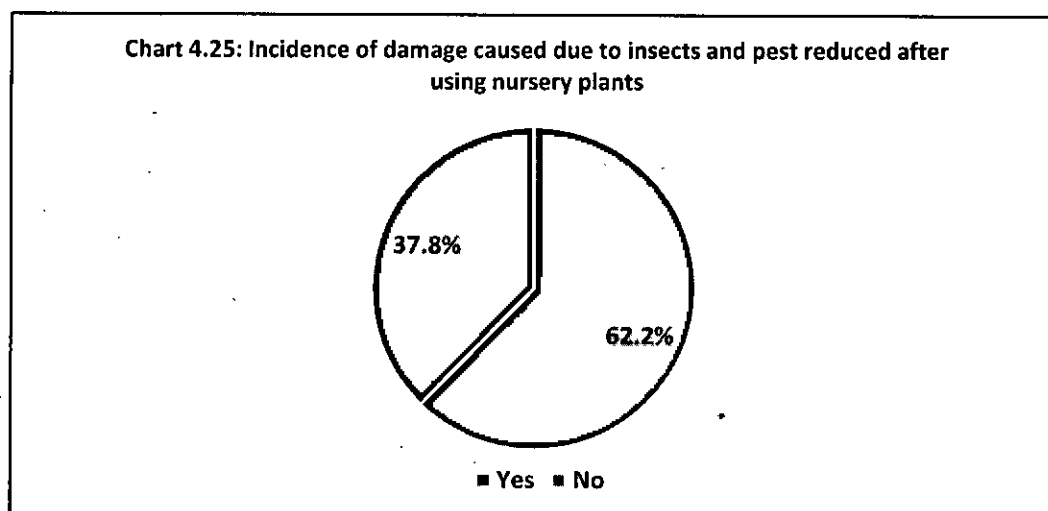
#### 4.5.4 Improvement in the Quality of Crop

More than a four-fifth (84%) of the respondent farmers told they had an increase in the quality of their crop by using plants from nurseries. Of the remaining, 9% observed that there was no increase in quality of their crop and 7% did not respond as given in chart ahead —

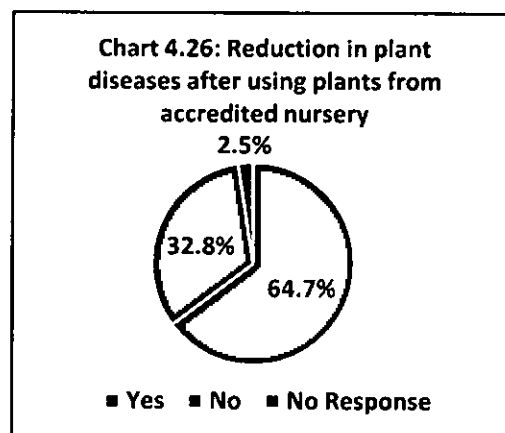


#### 4.5.5 Effect on damage caused due to pest, insects and diseases

There was a mixed response from the farmers when enquired about the pest and insect resistance offered by the plants from nurseries. While more than half (62%) of the respondents thought that there is better resistance of the plants from nurseries towards insects and pests, the remaining (38%) thought not. The same has been depicted in chart ahead —



While the State level detail is considered, it can be seen that the farmers of Maharashtra and Telangana thought that the incidence of damage due to insects and pests had reduced. At the same time in the States like Kerala, Chhattisgarh, Tamil Nadu, Madhya Pradesh, Himachal Pradesh, Uttarakhand and Andhra Pradesh more than half of the respondents thought that there was no significant reduction in pest and insect attack.

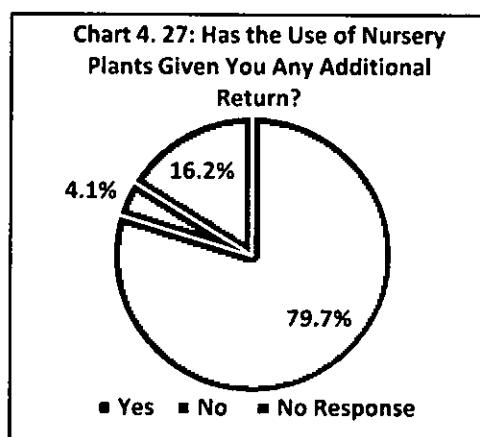


On enquiring about the reduction in plant diseases after using plants from accredited nurseries, almost two-thirds (65%) of the sample reported that there has been a decrease in plants diseases while nearly one-third (33%) reported otherwise. The remaining did not respond. Among those who answered affirmatively, 9% added that Government nurseries provided better plants than the private one.

While all farmers in Maharashtra, Bihar, Jharkhand, Assam, Mizoram and Nagaland had the opinion that there is a reduction in plant diseases after using the plants from accredited nurseries, more than half of the respondents in Tamil Nadu, Uttar Pradesh, Uttarakhand, Himachal Pradesh, Kerala and Chhattisgarh thought otherwise.

#### 4.5.6 Additional Return from Crop

Comparing with conventional agriculture, the plants from nurseries gave additional income to four-fifth (80%) of the sampled farmers. Only 4% of the farmers reported that the profit has not risen after using the plants from nurseries. Please refer chart presented alongside.



The State wise increase in income has been studied by comparing the income levels while using plants from nurseries in comparison with the conventional plant usage. The following table details out the state wise maximum, minimum and average profit after using plants from nurseries—

Sl. No.	State	Max	Min	Average
1	Andhra Pradesh	300.0	5.0	81.3
2	Assam	100.0	100.0	100.0
3	Bihar	263.6	100.0	198.8
4	Chhattisgarh	400.0	31.3	147.5



Table 4.1: Profit (in Percentage) for Farmers after using plants from Nursery				
Sl. No.	State	Max	Min	Average
5	Gujarat	400.0	50.0	147.9
6	Haryana	203.5	14.2	69.3
7	Himachal Pradesh	663.6	25.0	178.8
8	Jammu & Kashmir	200.0	16.6	54.5
9	Jharkhand	108.9	56.9	25.3
10	Karnataka	150.0	24.0	47.6
11	Madhya Pradesh	127.0	25.0	63.1
12	Maharashtra	110.0	31.9	62.6
13	Mizoram	253.7	66.7	188.0
14	Nagaland	106.6	75.0	85.5
15	Odisha	82.4	21.6	57.0
16	Punjab	389.1	7.9	97.9
17	Rajasthan	192.0	8.8	61.3
18	Sikkim	100.0	15.0	48.6
19	Tamil Nadu	200.0	36.6	81.8
20	Telangana	166.6	16.6	75.4
21	Tripura	400.0	100.0	275.0
22	Uttar Pradesh	400.0	7.0	132.7
23	Uttarakhand	525.0	22.4	168.4
24	West Bengal	128.0	25.0	51.7

It can be seen from the table that there has been a maximum profit of more than 600% recorded in Himachal Pradesh (663.6%). There has been a pronounced increase in income in all the States. On an average farmers in all States except Jharkhand and Karnataka have reported a profit of more than 50%. In short it can be concluded that there has been an increase in the profit of farmers after using plants from nurseries.

#### 4.6.1 Suggestions from Nursery Owners

The owners had an opinion that the time taken for accreditation process is more (one-fifth). Therefore they wanted to reduce the same. The present accreditation period is for two years. Some farmers had the opinion to increase this to 5 years (10%). Owners also wanted timely frequent visits to guide them in various matters related to the functioning of nursery (3.5%). Since the benefits of accreditation do not reach the nurseries which are accredited, the owners thought that the Government should run an awareness drive of accreditation to enlighten farmers (9.8%). Owners had the suggestion that plants supplied by Government should be sourced from accredited nurseries. Some owners wanted the guideline in regional language. Some owners pointed out that since the accreditation process is online this may act as a hindrance for nurseries to get accredited in rural areas. Owners wanted the Government to give training to them.

#### **4.6.2 Suggestions from User Farmers**

The farmers had an opinion that there should be a forum, where nursery functionaries and farmers can interact for better output from their farms. At some places farmers suggested to have saplings with matching local conditions for proper growth of plants, indicating nurseries also grow plants different than the plants grown in an area. There was a suggestion that help should be provided in insurance of plants bought from accredited nurseries. There should be provision of arranging exhibition of fruit and vegetable plants in events like KisanMela for spreading information of varieties available and advantage of purchasing from accredited nurseries. The user farmers of Satyam Nursery, district Sitamarhi, vociferously demanded that purchase of saplings from Nepal should be banned.

## **Chapter 5**

# **Key Findings and Recommendations**

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The key findings of the study, after the extensive field work and data analysis undertaken during the study period, are hereby presented. The findings and suggestions of the Impact Evaluation Study of NHB Schemes are presented in two sections as follows. First, the findings and suggestions related to “Capital Investment Subsidy Scheme for Construction/ expansion/ modernization of Cold Storage and Storages for Horticulture products” are presented followed by the findings and suggestions on scheme for “Accreditation and Rating of fruit plant Nurseries”.

## **5.1 Key Findings**

### **5.1.1 Cold Storage Capital Subsidy Scheme**

The evaluation was carried across the country with a sample size of 42 Cold Storages for a total of 309 Cold Storages established between 2012-13 and 2016-17. To capture the essence of the real situation and to find out the intrinsic details on the impact of the scheme, field visits were conducted to each of the sample cold storage and in-depth-interviews were conducted with different stake holders including Owners, User farmers and trades and Cold Storage Vendors. The findings are presented in the section ahead.

The key findings of the study which can help in policy formulation are —

13. It was found that most of the cold storages were of Type 1 category. Nearly 88% of the cold storages were of type 1, while 5% were of type 2 and 7% were type CA. The reasons for establishing more number of type 1 cold storage compared to other types were related to the higher costs involved in installation of Types 2 and 3.
14. It was found that the cold storages lag behind in modernization and automation. Only half of 42 cold storages (52%) had any Grading, sorting, washing and packing line in place. All of them were manual. While nearly one-third (33 %) had no mechanism in place for grading and sorting, two cold storages had automatic grading and sorting facilities in place and one had a semiautomatic facility.
15. The key factor riding the choice of cold storage’s specification by investors, is the amount of capital cost to be invested. This has led to the establishment of cold storages with just the basic facilities only.
16. The highest proportion of capital cost has been dedicated to the establishment of plant and other equipment (38%). Therefore it can be noted that this is the primary reason why cold storages of type 1 are chosen by investors over the other types. Civil works incurred a third of the costs (34%), while cost of land constituted to nearly one-fifth of the expenditure. The remaining cost included installation cost and land development costs.

17. It was observed that the fuel expenses came up to a third of the total recurring expenses (30%). Also for an installed capacity of 6000 MT, from various studies, it was found that in comparison with the cold storages having advanced insulation materials and technology, the conventional type 1 cold storages incur more than 3 lakh rupees per annum as additional charges on energy requirements. Therefore, conveniently overlooking the future energy expenses, so that the capital cost can be significantly reduced may turn out to affect the financial viability of the cold storages during the operation phase.
18. The cold storages lack in the use of advanced technology and materials. Only two-fifth (42%) of the cold storages have used PUF as the insulation material, while the remaining have chosen the inferior material, thermocol/EPS. The PUF is a material developed to overcome the limitations of EPS. PUF is better in terms of R-Value, Density and moisture and fire resistance. But it costs more than EPS. Similarly, it can be seen that nearly four-fifth (79%) of the cold storages have preferred using ammonia as the refrigerant instead of Freon. Therefore, it can be noted that capital cost reduction is the largest factor which determines the selection of material and technology. Though a capital cost escalation can be avoided by using low grade materials and technology (including the use of cheaper materials for insulation), this can lead to cost escalation during operational phase.
19. There is underutilization of capacity in the existing cold storages at most of the places. The capacity utilization of cold storages varies from 50% to 100%. Out of the 42 sample units, 18 cold storages recorded 100% capacity utilization. Of the remaining 24 cold storages, 17 recorded a utilization of 80% or less, which is undesirable. Summarizing, we find that while slightly more than two-fifth of the cold storages reported full utilization of capacity, the remaining reported underutilization.

One among the major reasons for underutilization is the seasonal nature of crops being stored as most of the cold storages can cater to single commodity only. Different commodities require different temperature conditions, which cannot be provided with the basic technology available with most of the cold storages, resulting in poor capacity utilization and low financial viability. Similarly lack of awareness among farmers of the benefits of using cold storage also constituted one among the reasons for underutilization. There were only two-fifth of the farmers utilizing cold storages to store their entire produce.
20. There is dissatisfaction with cold storage promoters regarding the amount of subsidy provided. In some cases, the subsidy amount was often released after a considerable time lag. This puts the burden of interest over subsidy amount on investors. Such bottlenecks in provision of subsidy needs to be addressed.
21. Cold storages does not provide any insurance coverage to the crops stored.
22. There has been a significant difference in the income levels of both the users of the cold storages, viz; farmers and traders. All the traders and 97% of the farmers reported an increase in income after starting use cold storages.

23. Saturation Levels have been reached in parts of Agra, Meerut and Kanpur of Uttar Pradesh State and certain parts of Punjab as per the State officials. No other area in the country have been reported as saturated.
24. Potential areas for new cold storages have been identified in the States of Andhra Pradesh, Chhattisgarh, Gujarat, Haryana, Himachal Pradesh, Jammu Kashmir, Karnataka, Maharashtra, Punjab, Tamil Nadu, Telangana, Uttar Pradesh and Uttarakhand. The same have been mentioned in section 3.10.2.

### **5.1.2 Scheme for Accreditation and Rating of fruit plant Nurseries**

The evaluation of NHB scheme to accredit and rate fruit plant nurseries was carried out through the field visit and detailed study of 160 nurseries and their users across the Country. In-depth interviews were conducted with various stakeholders. The findings from both secondary and primary data analysis are presented ahead —

6. The proportion of nurseries belonging to higher rating is less (4 star and above only 12%).
7. Awareness about the accreditation process is very less among the user farmers. Only less than one-third (30%) were aware about the existence of a rating system for nurseries. This will act as a hindrance to achieve the objectives of Nursery accreditation scheme.
8. Only 275 farmers (17%) had experience or knowledge of using planting material from both accredited and non-accredited nurseries.
9. The farmers who had experience of using plants from both accredited and unaccredited nurseries, clearly affirmed the positive effect created by accredited nurseries in terms of increase in yield, improvement in the quality of crop, reduction in plant diseases and attack by pests and insects.

Nearly four-fifth (78%) of them observed that there is a difference in the quality of planting material sourced from nurseries when compared to other sources. The increase in yield when compared to plants from non-accredited nurseries was reported by four-fifth (82%) of the farmers with previous experience or knowledge in using plants from other sources. More than a four-fifth (84%) of the farmers told they had an increase in the quality of their crop by using plants from nurseries. Further, nearly two-third (62%) of the farmers had observed a reduction in damage caused due to insects and pests after starting to use plants from accredited nurseries and almost two-thirds (65%) reported that there has been a decrease in plants diseases.

Therefore, it can be observed that the nursery accreditation scheme has started to create a positive impact on the horticulture sector.

10. The nursery owners preferred to get trained and guided by government agencies throughout the accreditation process and afterwards.

## **5.2 Recommendations**

### **5.2.1 Cold Storage Capital Subsidy Scheme**

7. Improve the dynamic nature of subsidy by introducing various packages for different levels of technology and automation included in each cold storage. This should ensure that there is a proportionate increase in the subsidy amount available for subsequent levels of sophistication/modernization included by cold storages.
8. There may be a gestation period given before the starting of loan repayment. This can help in improving the financial viability of the project.
9. Dissemination of knowledge among the investors about the advantages of using modern materials and technology while establishing cold storage is the need of the hour. This can help in reducing the operation cost to a large extent and thereby make the cold storages more financially viable. This part is not only vital to achieve success of the proposed dynamic subsidy scheme but will also facilitate savings of crucial electricity energy. The provision in the existing scheme for modernization of cold storages must also be utilized to a larger extent.
10. The cold storage facilities established outside the subsidy scheme must be encouraged to improve up on their infrastructural facilities by publicizing the lateral subsidy inclusion scheme whereby the facility may avail subsidy against loans for the improvement/upgradation proposed. This is vital as the lion's share of facilities offer basic facilities only.
11. Provisions should be made to make subsidy available for Cold storages with less than 5000 MT, especially, in Hilly Areas due to their peculiar topography. The terrain makes it difficult for cold storages to serve large catchment areas.
12. Insurance schemes for the produce stored in cold storage may be introduced at nominal rates and must be made mandatory for all cold storages.

### **5.2.2 Scheme for Accreditation and Rating of fruit plant Nurseries**

7. A quality improvement program should be introduced as part of the scheme which will help the nurseries to improve their rating on a continuing program.
8. As part of the above mentioned program continuous training and assistance should be given to nurseries for improving the operation, management and overall quality provided by nurseries.
9. Focus should be given on creating awareness among farmers about the merits of using plants from accredited nurseries.
10. There should be arrangement of exhibition of varieties of fruit trees during the events like KisanMela, where advantage of use of planting material from accredited nurseries may be disseminated.

11. There was a wide spread demand for increasing the period of accreditation from 3 years to 5 years.
12. The user farmers suggested to have a forum, where nursery functionaries may interact with farmers for knowledge transfer to improve the output from their orchards.

**\* \* \* \* \***

## **Annexure -I: List of Cold Storage with Technical Details**



## List of Cold Storage with Technical Details

1	Name of cold storage	SN Sharma Cold Storage, Firozabad, U.P.
2	Type of Company	Partnership Firm
3	Present activity in brief	Preservation of Potatoes & other Agricultural Produce
4	Total capacity	5030.70 MT
5	Type of Construction	---
a	Type of external walls of Cold Chambers	Bricks work
b	Type of Internal/Partition walls	Bricks work
c	Type of Roof/Ceiling	4" RCC Slab
d	Type of Internal structure/Racks	Wooden Rack
e	Type of Mezzanine grafting	Wood
f	Type of Lighting fixtures in cold Chambers	CFL Lighting Fixtures
g	Type of Lighting fixtures in Process and Other areas	CFL Lighting Fixtures
6	Insulation and Vapour barriers	---
i	External Wall	---
a	Type of Material (EPS /Metal Skin/PUF/Composite Pannels/XPS/PUR/Others)	Glass Wool
b	Relevant IS code	IS-661 : 2000
c	Density	27 Kg. /M <sup>3</sup>
d	Thermal conductivity at +10 deg cel	0.033
ii	Internal	---
a	Type of Material (EPS /Metal Skin/PUF/Composite Pannels/XPS/PUR/Others)	Glass Wool
b	Relevant IS code	IS 661 : 2000
c	Density	27 Kg. /M <sup>3</sup>
d	Thermal conductivity at +10 deg cel	0.033
iii	Ceiling/Roof	---
a	Type of Material (EPS /Metal Skin/PUF/Composite Pannels)	Glass Wool
b	Relevant IS code	IS 661 : 2000
c	Density	27 Kg. /M <sup>3</sup>
d	Thermal conductivity at +10 deg cel	0.033
iv	Floor	---
a	Type of Material (EPS /Metal Skin/PUF/Composite Pannels)	EPS
b	Relevant IS code	---

c	Density	18 Kg./M <sup>3</sup>
d	Thermal conductivity at +10 deg cel	0.036
7	Material Handling	---
a	Material Handling procedures and equipments	Manual
b	Cap of Electric elevator	N/A
	Rating of motor	---
c	Any other device	---
8	Grading, sorting, washing and packing line	---
a	Process line	N/A
b	Total connected load	N/A
9	Cooling system	---
a	Type of refrigerant	Ammonia
b	Type of system	Overfeed
c	Type of compressor	Reciprocating
d	Type of condenser	Atmospheric
e	Type of cooling coil	Ceiling suspended
10	Compressor detail	---
a1	Compressor make & model	454XL
b1	Compressor RPM	930
c1	Refrigeration capacity	243.59
a2	Compressor make & model	454XL
b2	Compressor RPM	930
c2	Refrigeration capacity	200.42

1	Name of cold storage	Kusum Cold Storage Pvt Ltd, Etah, U.P.
2	Type of Company	Pvt. Ltd. Company
3	Present activity in brief	Preservation of Potato and other agricultural produce
4	Total capacity of chamber	672.60 MT
5	Type of Construction	---
a	Type of external walls of Cold Chambers	As per technical standard
b	Type of Internal/Partition walls	As per technical standard
c	Type of Roof/Ceiling	4" RCC Slab
d	Type of Internal structure/Racks	Wooden Rack
e	Type of Mezzanine grafting	Wooden grafting
f	Type of Lighting fixtures in cold Chambers	CFL Lighting Fixtures
g	Type of Lighting fixtures in Process and Other areas	CFL Lighting Fixtures
6	Insulation and Vapour barriers	---
i	External	---
a	Type of Material	150 mm in two layers of 75 mm each
b	Relevant IS code	IS-4671
c	Density	15
d	Thermal conductivity at +10 deg cel	0.036
ii	Internal	---
a	Type of Material	Partition 75 mm single layers each
b	Relevant IS code	IS-4671
c	Density	15
d	Thermal conductivity at +10 deg cel	0.036
iii	Ceiling/Roof	---
a	Type of Material	150 mm in two layers of 75 mm each
b	Relevant IS code	IS-4671
c	Density	15
d	Thermal conductivity at +10 deg cel	0.036
iv	Floor	---
a	Type of Material	125 mm in two layer of 75 mm and 50 mm
b	Relevant IS code	IS-4671
c	Density	15
d	Thermal conductivity at +10 deg cel	0.036
7	Material Handling	---
a	Material Handling procedures and equipments	Manual
b	Cap of Electric elevator	N/A
	Rating of motor	---

c	Any other device	---
8	Grading, sorting, washing and packing line	---
a	Process line	N/A
b	Total connected load	N/A
9	Cooling system	---
a	Type of refrigerant	Ammonia
b	Type of system	Overfeed
c	Type of compressor	Reciprocating
d	Type of condenser	Atmospheric
e	Type of cooling coil	Ceiling suspended
10	Compressor detail	---
a1	Compressor make & model	456 XL
b1	Compressor RPM	860
c1	Refrigeration capacity	338.01
a2	Compressor make & model	456 XL
b2	Compressor RPM	860
c2	Refrigeration capacity	277.64

1	Name of cold storage	Shri Hiramani Cold Storage Pvt Ltd, Mathura, U.P.
2	Type of Company	Pvt. Ltd. Company
3	Present activity in brief	Preservation of Potatoes & Other Agricultural Produce
4	Total capacity of chamber	6904.60 MT
5	Type of Construction	---
a	Type of external walls of Cold Chambers	As per technical standards
b	Type of Internal/Partition walls	As per technical standards
c	Type of Roof/Ceiling	4" RCC slab
d	Type of Internal structure/Racks	wooden racks
e	Type of Mezzanine grafting	wooden batten
f	Type of Lighting fixtures in cold Chambers	CFL Lighting Fixtures
g	Type of Lighting fixtures in Process and Other areas	CFL Lighting Fixtures
6	Insulation and Vapour barriers	---
i	External	---
a	Type of Material	150 mm in two layers of 75mm each
b	Relevant IS code	IS-4671
c	Density	15
d	Thermal conductivity at +10 deg cel	0.036
ii	Internal	---
a	Type of Material	Partition 75 mm single layer each
b	Relevant IS code	IS-4671
c	Density	15
d	Thermal conductivity at +10 deg cel	0.036
iii	Ceiling/Roof	---
a	Type of Material	150mm in two layers of 75 mm each
b	Relevant IS code	IS-4671
c	Density	15
d	Thermal conductivity at +10 deg cel	0.036
iv	Floor	---
a	Type of Material	125 mm in two layers of 75 mm and 50 mm
b	Relevant IS code	IS-4671
c	Density	15
d	Thermal conductivity at +10 deg cel	0.036
7	Material Handling	---
a	Material Handling procedures and equipments	Manual

b	Cap of Electric elevator	N/A
	Rating of motor	---
c	Any other device	---
8	Grading, sorting, washing and packing line	---
a	Process line	Manual
b	Total connected load	N/A
9	Cooling system	---
a	Type of refrigerant	Ammonia
b	Type of system	Overfeed
c	Type of compressor	Reciprocating
d	Type of condenser	Atmospheric
e	Type of cooling coil	Ceiling suspended
10	Compressor detail	---
a1	Compressor make & model	456XL
b1	Compressor RPM	860
c1	Refrigeration capacity	338.01
a2	Compressor make & model	456XL
b2	Compressor RPM	860
c2	Refrigeration capacity	277.64
a3	Compressor make & model	454XL
b3	Compressor RPM	950
c3	Refrigeration capacity	248.85
a4	Compressor make & model	454XL
b4	Compressor RPM	950
c4	Refrigeration capacity	204.63

1	Name of cold storage	Sumitra Devi Nand Kumar Sheetgrah Pvt Ltd, Hathras, U.P.
2	Type of Company	Pvt. Ltd.
3	Present activity in brief	Farmers and producing agriculture produce
4	Total capacity of chamber	5825.48 MT
5	Type of Construction	---
a	Type of external walls of Cold Chambers	345mm bricks wall with cement plaster
b	Type of Internal/Partition walls	230mm bricks wall with cement plaster
c	Type of Roof/Ceiling	RCC slab with proper water proofing and reflector colour paints
d	Type of Internal structure/Racks	RCC Columns and Beams
e	Type of Mezzanine grafting	Wooden Racks
f	Type of Lighting fixtures in cold Chambers	CFL Lighting in cold storage with central switch outside of the chamber
g	Type of Lighting fixtures in Process and Other areas	CFL Lighting Fixtures
6	Insulation and Vapour barriers	---
i	External	---
a	Type of Material	EPS 150mm in 2 layers of 75mm each
b	Relevant IS code	IS-4671
c	Density	15 kg /M <sup>3</sup>
d	Thermal conductivity at +10 deg cel	0.036
ii	Internal	---
a	Type of Material	Partition 75mm single layer each
b	Relevant IS code	IS-4671
c	Density	15 kg /M <sup>3</sup>
d	Thermal conductivity at +10 deg cel	0.036
iii	Ceiling/Roof	---
a	Type of Material	EPS 150mm in 2 layers of 75mm each
b	Relevant IS code	IS-4671
c	Density	15 kg /M <sup>3</sup>
d	Thermal conductivity at +10 deg cel	0.036
iv	Floor	---
a	Type of Material	EPS 150mm in 2 layers of 75mm each
b	Relevant IS code	IS-4671
c	Density	15 kg /M <sup>3</sup>
d	Thermal conductivity at +10 deg cel	0.036
7	Material Handling	---

a	Material Handling procedures and equipments	Manual
b	Cap of Electric elevator	N/A
	Rating of motor	---
c	Any other device	N/A
8	Grading, sorting, washing and packing line	---
a	Process line	Manual after uploading of potatoes from farmers transport the same shall be sorted out/graded/pack numberd manually
b	Total connected load	N/A
9	Cooling system	---
a	Type of refrigerant	Ammonia
b	Type of system	Overfeed
c	Type of compressor	Reciprocating
d	Type of condenser	Atmospheric
e	Type of cooling coil	Ceiling suspended
10	Compressor detail	---
a1	Compressor make & model	454XL
b1	Compressor RPM	950
c1	Refrigeration capacity	248.80
a2	Compressor make & model	454XL
b2	Compressor RPM	950
c2	Refrigeration capacity	204.63
a3	Compressor make & model	MX400
b3	Compressor RPM	880
c3	Refrigeration capacity	318.00
a4	Compressor make & model	MX400
b4	Compressor RPM	880
c4	Refrigeration capacity	318.00



1	Name of cold storage	M/S Baba Inder Ice & Cold Storage, Mathura, U.P.
2	Type of Company	Registered partnership Firm
3	Present activity in brief	Preservation of Potatoes, Fruits & other vegetables
4	Total capacity of chamber	6201 MT
5	Type of Construction	---
a	Type of external walls of Cold Chambers	Cemented
b	Type of Internal/Partition walls	Cemented
c	Type of Roof/Ceiling	RCC
d	Type of Internal structure/Racks	Wooden Racks
e	Type of Mezzanine grafting	---
f	Type of Lighting fixtures in cold Chambers	---
g	Type of Lighting fixtures in Process and Other areas	---
6	Insulation and Vapour barriers	---
i	External	---
a	Type of Material	EPS
b	Relevant IS code	IS 4671
c	Density	18 Kg
d	Thermal conductivity at +10 deg cel	0.033
ii	Internal	---
a	Type of Material	EPS
b	Relevant IS code	IS 4671
c	Density	18 Kg
d	Thermal conductivity at +10 deg cel	0.033
iii	Ceiling/Roof	---
a	Type of Material	EPS
b	Relevant IS code	IS 4671
c	Density	18 Kg
d	Thermal conductivity at +10 deg cel	0.033
iv	Floor	---
a	Type of Material	EPS
b	Relevant IS code	IS 4671
c	Density	18 Kg
d	Thermal conductivity at +10 deg cel	0.033
7	Material Handling	---
a	Material Handling procedures and equipments	Manual
b	Cap of Electric elevator	---

	Rating of motor	
c	Any other device	---
8	Grading, sorting, washing and packing line	---
a	Process line	Manual
b	Total connected load	---
9	Cooling system	---
a	Type of refrigerant	Ammonia
b	Type of system	Direct EXP
c	Type of compressor	Reciprocating
d	Type of condenser	Cell & Tube
e	Type of cooling coil	Ceiling suspended
10	Compressor detail	---
a1	Compressor make & model	KC 4
b1	Compressor RPM	750
c1	Refrigeration capacity	274.00
a2	Compressor make & model	KC 4
b2	Compressor RPM	750
c2	Refrigeration capacity	347.00

1	Name of cold storage	P.R.R. Ice & Cold Storage Pvt Ltd, Hathras, U.P.
2	Type of Company	Pvt. Ltd.
3	Present activity in brief	Storing Potao
4	Total capacity of chamber	2912.74 MT
5	Type of Construction	---
a	Type of external walls of Cold Chambers	345mm bricks walls with cement plaster
b	Type of Internal/Partition walls	230mm bricks walls with cement plaster
c	Type of Roof/Ceiling	RCC Slabs with proper water proofing and reflector colour paints
d	Type of Internal structure/Racks	RCC columns and beams
e	Type of Mezzanine grafting	Wooden Racks
f	Type of Lighting fixtures in cold Chambers	CFL Lighting in Cold Storage with Central Switch outside the chambers
g	Type of Lighting fixtures in Process and Other areas	CFL Lighting and Fixtures
6	Insulation and Vapour barriers	---
i	External	---
a	Type of Material	EPS 150 mm in 2 layers of 75mm each
b	Relevant IS code	IS-4671
c	Density	15 Kg. /M <sup>3</sup>
d	Thermal conductivity at +10 deg cel	0.036
ii	Internal	---
a	Type of Material	Partition 75mm single layer each
b	Relevant IS code	IS-4671
c	Density	15 Kg. /M <sup>3</sup>
d	Thermal conductivity at +10 deg cel	0.036
iii	Ceiling/Roof	---
a	Type of Material	EPS 150 mm in 2 layers of 75mm each
b	Relevant IS code	IS-4671
c	Density	15 Kg. /M <sup>3</sup>
d	Thermal conductivity at +10 deg cel	0.036
iv	Floor	---
a	Type of Material	EPS 125 mm in 2 layers of 75mm and 50mm each
b	Relevant IS code	IS-4671
c	Density	15 Kg. /M <sup>3</sup>
d	Thermal conductivity at +10 deg cel	0.036
7	Material Handling	---

a	Material Handling procedures and equipments	Manual
b	Cap of Electric elevator	N/A
	Rating of motor	N/A
c	Any other device	N/A
8	Grading, sorting, washing and packing line	---
a	Process line	Manual
b	Total connected load	N/A
9	Cooling system	---
a	Type of refrigerant	Ammonia
b	Type of system	Overfeed
c	Type of compressor	Reciprocating
d	Type of condenser	Atmospheric
e	Type of cooling coil	Ceiling suspended
10	Compressor detail	---
a1	Compressor make & model	Frick vilter 452 XL
b1	Compressor RPM	960
c1	Refrigeration capacity	125.65
a2	Compressor make & model	Frick vilter 452 XL
b2	Compressor RPM	960
c2	Refrigeration capacity	103.19

1	Name of cold storage	M/S Ramddot Ice and cold storage Pvt Ltd, Agra U.P.
2	Type of Company	Pvt. Ltd.
3	Present activity in brief	Preservation of Potatoes, Onion, Garlik and other vegetables
4	Total capacity of chamber	7000 MT
5	Type of Construction	---
a	Type of external walls of Cold Chambers	240mm bricks wall with sand cement plaster
b	Type of Internal/Partition walls	240 mm brick wall with sand cement plaster
c	Type of Roof/Ceiling	RCC slab with pre coated GS sheet cover and drainage forrain water
d	Type of Internal structure/Racks	Rack made of wood mounted on wood block
e	Type of Mezzanine grafting	---
f	Type of Lighting fixtures in cold Chambers	---
g	Type of Lighting fixtures in Process and Other areas	Solar operated units
6	Insulation and Vapour barriers	---
i	External	---
a	Type of Material	Bricks and plaster
b	Relevant IS code	IS-661-13202
c	Density	15 Kg.
d	Thermal conductivity at +10 deg cel	0.023
ii	Internal	---
a	Type of Material	Plaster + Thermocole
b	Relevant IS code	IS-661-13202
c	Density	15 Kg.
d	Thermal conductivity at +10 deg cel	0.023
iii	Ceiling/Roof	---
a	Type of Material	RCC + Thermocole
b	Relevant IS code	IS-661 13202
c	Density	15 Kg.
d	Thermal conductivity at +10 deg cel	0.023
iv	Floor	---
a	Type of Material	PCC + Thermocole
b	Relevant IS code	IS-661 13202
c	Density	15 Kg.
d	Thermal conductivity at +10 deg cel	0.023
7	Material Handling	---

a	Material Handling procedures and equipments	Manual
b	Cap of Electric elevator	N/A
	Rating of motor	---
c	Any other device	---
8	Grading, sorting, washing and packing line	---
a	Process line	Manual
b	Total connected load	---
9	Cooling system	---
a	Type of refrigerant	Ammonia
b	Type of system	Direct Exp.
c	Type of compressor	Reciprocating
d	Type of condenser	Atmospheric
e	Type of cooling coil	Ceiling suspended
10	Compressor detail	---
a1	Compressor make & model	Kirloskar KC-6
b1	Compressor RPM	650
c1	Refrigeration capacity	491 , 416
a2	Compressor make & model	Kirloskar KC -4
b2	Compressor RPM	650
c2	Refrigeration capacity	328, 277

1	Name of cold storage	Singh Ice & Preservations Pvt Ltd, Unnao, U.P.
2	Type of Company	Pvt. Ltd.
3	Present activity in brief	Cold Storage
4	Total capacity of chamber	5000 MT
5	Type of Construction	---
a	Type of external walls of Cold Chambers	230mm bricks wall with sand cement plaster
b	Type of Internal/Partition walls	230mm bricks wall with sand cement plaster
c	Type of Roof/Ceiling	RCC slab with water proofing
d	Type of Internal structure/Racks	RCC columns and beams frame
e	Type of Mezzanine grafting	Wooden batten grating, using flats over RCC beams
f	Type of Lighting fixtures in cold Chambers	Energy efficient CFL
g	Type of Lighting fixtures in Process and Other areas	Energy efficient CFL
6	Insulation and Vapour barriers	---
i	External	---
a	Type of Material	EPS Thermocole
b	Relevant IS code	IS-4671
c	Density	18 kg M <sup>3</sup>
d	Thermal conductivity at +10 deg cel	0.036
ii	Internal	---
a	Type of Material	EPS Thermocole
b	Relevant IS code	IS-4671
c	Density	18 kg M <sup>3</sup>
d	Thermal conductivity at +10 deg cel	0.036
iii	Ceiling/Roof	---
a	Type of Material	EPS Thermocole
b	Relevant IS code	IS-4671
c	Density	18 kg M <sup>3</sup>
d	Thermal conductivity at +10 deg cel	0.036
iv	Floor	---
a	Type of Material	EPS Thermocole
b	Relevant IS code	IS-4671
c	Density	18 kg M <sup>3</sup>
d	Thermal conductivity at +10 deg cel	0.036
7	Material Handling	---
a	Material Handling procedures and equipments	Manual

b	Cap of Electric elevator	N/A
	Rating of motor	---
c	Any other device	N/A
8	Grading, sorting, washing and packing line	---
a	Process line	Manual
b	Total connected load	N/A
9	Cooling system	---
a	Type of refrigerant	Ammonia
b	Type of system	Gravity Feed
c	Type of compressor	Reciprocating
d	Type of condenser	Atmospheric
e	Type of cooling coil	Floor mounted fined coil unit
10	Compressor detail	---
a1	Compressor make & model	Cylinder of 160mm bore and 110mm stroke (Make Kirloskar Model KC - 4)
b1	Compressor RPM	800
c1	Refrigeration capacity	405.8
a2	Compressor make & model	Cylinder of 160mm bore and 110mm stroke (Make Kirloskar Model KC - 3)
b2	Compressor RPM	800
c2	Refrigeration capacity	304.4
a3	Compressor make & model	Cylinder of 160mm bore and 110mm stroke (Make Kirloskar Model KC - 2)
b3	Compressor RPM	800
c3	Refrigeration capacity	202.9



1	Name of cold storage	M/S Samridhi Cold Storage Pvt Ltd, Farukhabad, U.P.
2	Type of Company	Pvt. Ltd. Company
3	Present activity in brief	Preservation of Potatoes and other agricultural produce
4	Total capacity of chamber	7161 MT
5	Type of Construction	---
a	Type of external walls of Cold Chambers	345 mm bricks walls & with cement plaster
b	Type of Internal/Partition walls	230 mm bricks walls & with cement plaster
c	Type of Roof/Ceiling	4" RCC Slab
d	Type of Internal structure/Racks	RCC Columns
e	Type of Mezzanine grafting	Wooden Batten
f	Type of Lighting fixtures in cold Chambers	CFL Lighting and fixtures
g	Type of Lighting fixtures in Process and Other areas	CFL Lighting and fixtures
6	Insulation and Vapour barriers	---
i	External	---
a	Type of Material	150mm in 2 layers of 75mm each
b	Relevant IS code	IS-4671-1984
c	Density	24
d	Thermal conductivity at +10 deg cel	0.036
ii	Internal	---
a	Type of Material	Glass wool
b	Relevant IS code	IS-8183
c	Density	32
d	Thermal conductivity at +10 deg cel	0.030
iii	Ceiling/Roof	---
a	Type of Material	Glass wool
b	Relevant IS code	IS-8183
c	Density	32
d	Thermal conductivity at +10 deg cel	0.030
iv	Floor	---
a	Type of Material	125mm in 2 layers of 75 & 50 mm
b	Relevant IS code	IS-4671-1984
c	Density	24
d	Thermal conductivity at +10 deg cel	0.036
7	Material Handling	---
a	Material Handling procedures and	Manual

	equipments	
b	Cap of Electric elevator	N/A
	Rating of motor	---
c	Any other device	N/A
8	Grading, sorting, washing and packing line	---
a	Process line	Manual
b	Total connected load	N/A
9	Cooling system	---
a	Type of refrigerant	Ammonia
b	Type of system	Direct Exp
c	Type of compressor	Reciprocating
d	Type of condenser	Atmospheric
e	Type of cooling coil	Ceiling suspended
10	Compressor detail	---
a1	Compressor make & model	Kirloskar KC - 3
b1	Compressor RPM	750
c1	Refrigeration capacity	283
a2	Compressor make & model	Kirloskar KC - 3
b2	Compressor RPM	750
c2	Refrigeration capacity	283
a3	Compressor make & model	Kirloskar KC - 4
b3	Compressor RPM	750
c3	Refrigeration capacity	378

1	Name of cold storage	Shikhar Integrated Cold Chain Pvt Ltd, Hathras, U.P.
2	Type of Company	Pvt. Ltd.
3	Present activity in brief	Cold Storage - Potatoes
4	Total capacity of chamber	3200 MT
5	Type of Construction	---
a	Type of external walls of Cold Chambers	Metal Clad sandwiched puff panels 120 mm thick
b	Type of Internal/Partition walls	Metal Clad sandwiched puff panels 100 mm thick
c	Type of Roof/Ceiling	Metal Clad sandwiched puff panels 120 mm thick
d	Type of flooring for Forklift/Stacker movement	Covering insulation with tar felt and laying 100 mm thick trimix cover it.
e	Type of Gas tightening/Sealing methodology to maintain minimum gas tightness requirements as per ISO code 6949:1988(E)	Gas Tight coating application using silicon sealing compound with imported paint and fiber resin to ensure gas tightness. The storage will be tested to withstand a pressure of 15 mm WG for 24 hours
f	Type of Lighting fixtures in cold Chambers	CFL with vapour proof casing
g	Type of Lighting fixtures in Process and Other areas	CFL and LEDs
6	Insulation and Vapour barriers	---
i	External	---
a	Type of Material	Metal skin puff composite pannels
b	Relevant IS code	IS-12436
c	Density	40+/-2 kg/M <sup>3</sup>
d	Thermal conductivity at +10 deg cel	.023W/m K
ii	Internal	---
a	Type of Material	Metal skin puff composite pannels
b	Relevant IS code	IS-12436
c	Density	40+/-2 kg/M <sup>3</sup>
d	Thermal conductivity at +10 deg cel	.023W/m K
iii	Ceiling/Roof	---
a	Type of Material	Metal skin puff composite pannels
b	Relevant IS code	IS-12436
c	Density	40+/-2 kg/M <sup>3</sup>
d	Thermal conductivity at +10 deg cel	.023W/m K
iv	Floor	EPS Slab
a	Type of Material	Metal skin puff composite pannels
b	Relevant IS code	IS-12436
c	Density	18 + /-1 Kg/M <sup>3</sup>

d	Thermal conductivity at +10 deg cel	.036 W/mK
7	Material Handling	---
a	Material Handling procedures and equipments	Stackers and Fork Lift
b	Any other device	---
8	Grading, sorting, washing and packing line	---
a	Process line	Initially Manual only
b	Total connected load	N/A
9	Cooling system	---
a	Type of refrigerant	Ammonia
b	Type of system	Flooded Chiller/PHE and Pumped Glycol as secondary refrigerant
c	Type of compressor	Reciprocating
d	Type of condenser	Evaporative
e	Type of cooling coil	Ceiling suspended
10	Compressor detail	---
a1	Compressor make & model	Kirloskar KCX-4 (Loading)
b1	Compressor RPM	373
c1	Refrigeration capacity	207.43 KW
a2	Compressor make & model	Kirloskar KCX-4 (Loading)
b2	Compressor RPM	425
c2	Refrigeration capacity	118.35 KW

1	Name of cold storage	Rahul Cold Storage & Ice Factory, Bareilly, U.P.
2	Type of Company	Partnership
3	Present activity in brief	Land and site Development
4	Total capacity of chamber	5604 MT
5	Type of Construction	---
a	Type of external walls of Cold Chambers	230 mm Brick wall with sand-cement plaster
b	Type of Internal/Partition walls	230 mm Brick wall with sand-cement plaster
c	Type of Roof/Ceiling	RCC slab with water proofing
d	Type of Internal structure/Racks	RCC columns and beams Frame
e	Type of Mezzanine grafting	Wooden batten grating using flats over RCC beams
f	Type of Lighting fixtures in cold Chambers	Energy efficient LED
g	Type of Lighting fixtures in Process and Other areas	Energy efficient LED
6	Insulation and Vapour barriers	---
i	External	---
a	Type of Material	EPS (Thermacolde)
b	Relevant IS code	IS-4671
c	Density	18 (kg/m <sup>3</sup> )
d	Thermal conductivity at +10 deg cel	0.036
ii	Internal	---
a	Type of Material	EPS (Thermacolde)
b	Relevant IS code	IS-4671
c	Density	18 (kg/m <sup>3</sup> )
d	Thermal conductivity at +10 deg cel	0.036
iii	Ceiling/Roof	---
a	Type of Material	EPS (Thermacolde)
b	Relevant IS code	IS-4671
c	Density	18 (kg/m <sup>3</sup> )
d	Thermal conductivity at +10 deg cel	0.036
iv	Floor	---
a	Type of Material	EPS (Thermacolde)
b	Relevant IS code	IS-4671
c	Density	18 (kg/m <sup>3</sup> )
d	Thermal conductivity at +10 deg cel	0.036
7	Material Handling	---
a	Material Handling procedures and equipments	Semi-automatic belt type conveyor

b	Cap of Electric elevator	600 Beg per hours, 7 kw. The energy load due to conveyor @ 10 hr per day will be = $(7 \times 10) / 24 = 2.92$ kw
	Rating of motor	---
c	Any other device	---
8	Grading, sorting, washing and packing line	---
a	Process line	Manual
b	Total connected load	N/A
9	Cooling system	---
a	Type of refrigerant	Ammonia
b	Type of system	Gravity Feet
c	Type of compressor	Reciprocating
d	Type of condenser	Atmospheric
e	Type of cooling coil	Ceiling suspended
10	Compressor detail	---
a1	Compressor make & model	4 cylinder of 160 mm bore & 110mm stroke (Make-Kirlosker/Metalex Model kc-4/mx-4)
b1	Compressor RPM	800 RPM
c1	Refrigeration capacity	413 (393.9) - 345.9
a2	Compressor make & model	3 cylinder of 160 mm bore & 110mm stroke (Make-Kirlosker/Metalex Model kc-3/mx-3)
b2	Compressor RPM	750 RPM
c2	Refrigeration capacity	290.4 243.2(216.2)
a3	Compressor make & model	2 cylinder of 160 mm bore & 110mm stroke (Make-Kirlosker/Metalex Model kc-2/mx-2)
b3	Compressor RPM	750 RPM
c3	Refrigeration capacity	193.6 162.1

1	Name of cold storage	M/S Madhav Cold Storage, Agra, U.P.
2	Type of Company	Partnership Firm
3	Present activity in brief	Preservation of Potatoes & Other agricultural Produce.
4	Total capacity of chamber	5379MT
5	Type of Construction	---
a	Type of external walls of Cold Chambers	Brick wall with sand-cement plaster
b	Type of Internal/Partition walls	Brick wall with sand-cement plaster
c	Type of Roof/Ceiling	4" RCC slab
d	Type of Internal structure/Racks	RCC Columns
e	Type of Mezzanine grafting	Wooden Battern
f	Type of Lighting fixtures in cold Chambers	CFL lighting fixtures
g	Type of Lighting fixtures in Process and Other areas	CFL lighting fixtures
6	Insulation and Vapour barriers	---
i	External	---
a	Type of Material	150mm in two layers of 75 mm each
b	Relevant IS code	IS-4671
c	Density	15
d	Thermal conductivity at +10 deg cel	0.036
ii	Internal	---
a	Type of Material	Partition 75mm single layer each
b	Relevant IS code	IS-4671
c	Density	15
d	Thermal conductivity at +10 deg cel	0.036
iii	Ceiling/Roof	---
a	Type of Material	150mm in two layers of 75 mm each
b	Relevant IS code	IS-4671
c	Density	15
d	Thermal conductivity at +10 deg cel	0.036
iv	Floor	---
a	Type of Material	120mm in two layers of 75 mm & 50 mm
b	Relevant IS code	IS-4671
c	Density	15
d	Thermal conductivity at +10 deg cel	0.036
7	Material Handling	---
a	Material Handling procedures and equipments	Manual
b	Cap of Electric elevator	N/A

	Rating of motor	---
c	Any other device	N/A
8	Grading, sorting, washing and packing line	---
a	Process line	Manual
b	Total connected load	N/A
9	Cooling system	---
a	Type of refrigerant	Freon
b	Type of system	Direct Exp.
c	Type of compressor	Reciprocating
d	Type of condenser	Shell & Ube
e	Type of cooling coil	Ceiling suspended
10	Compressor detail	---
a1	Compressor make & model	Carrier 06 EM 799, Tatal No. 5
b1	Compressor RPM	1450
c1	Refrigeration capacity	86/431 KW



1	Name of cold storage	M/S Saifi Cold Storage, Moradabad, U.P.
2	Type of Company	Partnership
3	Present activity in brief	Raft Foundation are complet & column & brick wall work upto G. Floor L VL
4	Total capacity of chamber	6204 MT
5	Type of Construction	---
a	Type of external walls of Cold Chambers	Brick wall with sand cement Plaster
b	Type of Internal/Partition walls	Brick wall with sand cement Plaster
c	Type of Roof/Ceiling	4" RCC slab with water proofing
d	Type of Internal structure/Racks	RCC Columns & Beams
e	Type of Mezzanine grafting	Treated wooden battens
f	Type of Lighting fixtures in cold Chambers	CFL / TL
g	Type of Lighting fixtures in Process and Other areas	TL/Natural light
6	Insulation and Vapour barriers	---
i	External	---
a	Type of Material	150mm. EPS
b	Relevant IS code	IS 12436
c	Density	18 Kg/cm2
d	Thermal conductivity at +10 deg cel	0.032
ii	Internal	---
a	Type of Material	75mm EPS
b	Relevant IS code	IS 12436
c	Density	18 Kg/cm2
d	Thermal conductivity at +10 deg cel	0.032
iii	Ceiling/Roof	---
a	Type of Material	150mm. EPS
b	Relevant IS code	IS 12436
c	Density	18 Kg/cm2
d	Thermal conductivity at +10 deg cel	0.032
iv	Floor	---
a	Type of Material	125mm. EPS
b	Relevant IS code	IS 12436
c	Density	18 Kg/cm2
d	Thermal conductivity at +10 deg cel	0.032
7	Material Handling	---
a	Material Handling procedures and equipments	Manual
b	Cap of Electric elevator	N/A

	Rating of motor	---
c	Any other device	N/A
8	Grading, sorting, washing and packing line	---
a	Process line	N/A
b	Total connected load	N/A
9	Cooling system	---
a	Type of refrigerant	Ammonia
b	Type of system	Gravity Feed
c	Type of compressor	Reciprocating
d	Type of condenser	Atmospheric
e	Type of cooling coil	Ceiling suspended
10	Compressor detail	---
a1	Compressor make & model	Kirloskar/Equivalent KC-4
b1	Compressor RPM	850
c1	Refrigeration capacity	440
a2	Compressor make & model	Kirloskar/Equivalent KC-3
b2	Compressor RPM	750
c2	Refrigeration capacity	290
a3	Compressor make & model	Kirloskar/Equivalent KC-2
b3	Compressor RPM	750
c3	Refrigeration capacity	194

1	Name of cold storage	M/S Turki Cold Storage General Mill, Sambhal, U.P.
2	Type of Company	Proprietorship/Partnership
3	Present activity in brief	---
4	Total capacity of chamber	5332.67 Ton
5	Type of Construction	---
a	Type of external walls of Cold Chambers	230 mm brick wall with sand-cement plaster
b	Type of Internal/Partition walls	230 mm brick wall with sand-cement plaster
c	Type of Roof/Ceiling	RCC Slab with Water Proofing
d	Type of Internal structure/Racks	RCC Colmns and beams frame structure
e	Type of Mezzanine grafting	---
f	Type of Lighting fixtures in cold Chambers	Energy Efficient CFL
g	Type of Lighting fixtures in Process and Other areas	Energy Efficient CFL
6	Insulation and Vapour barriers	---
i	External	---
a	Type of Material	EPS
b	Relevant IS code	IS-4671
c	Density	16kg/m3
d	Thermal conductivity at +10 deg cel	0.036
ii	Internal	---
a	Type of Material	EPS
b	Relevant IS code	IS-4671
c	Density	16kg/m3
d	Thermal conductivity at +10 deg cel	0.036
iii	Ceiling/Roof	---
a	Type of Material	EPS
b	Relevant IS code	IS-4671
c	Density	16kg/m3
d	Thermal conductivity at +10 deg cel	0.036
iv	Floor	---
a	Type of Material	EPS
b	Relevant IS code	IS 4671
c	Density	16kg/m3
d	Thermal conductivity at +10 deg cel	0.036
7	Material Handling	---
a	Material Handling procedures and equipments	Slant type conveyor (Nos.)
b	Cap of Electric elevator	60.0 KW

	Rating of motor	---
c	Any other device	N/A
8	Grading, sorting, washing and packing line	
a	Process line	
b	Total connected load	
9	Cooling system	---
a	Type of refrigerant	Ammonia
b	Type of system	Gravity Feed
c	Type of compressor	Reciprocating
d	Type of condenser	Atmospheric
e	Type of cooling coil	Ceiling Suspended/Wall mounted finned coil units
10	Compressor detail	---
a1	Compressor make & model	Kirloskar (Model-KC-3) Two
b1	Compressor RPM	750
c1	Refrigeration capacity	283.18 and 228.86
a2	Compressor make & model	Kirloskar (Model-KC-3)
b2	Compressor RPM	880
c2	Refrigeration capacity	332.27, 281.23

1	Name of cold storage	M/S Ali Cold Storage & Factory, Badaun, U.P.
2	Type of Company	Partnership
3	Present activity in brief	Preservation of Potatoes & other Agriculture Produce
4	Total capacity of chamber	6555 MT
5	Type of Construction	---
a	Type of external walls of Cold Chambers	Bricks wall with cement plaster
b	Type of Internal/Partition walls	Bricks wall with cement plaster
c	Type of Roof/Ceiling	100mm thick RCC slab
d	Type of Internal structure/Racks	Bricks wall with cement plaster
e	Type of Mezzanine grafting	---
f	Type of Lighting fixtures in cold Chambers	Energy Efficient CFL with IP-65 Grade Fitting
g	Type of Lighting fixtures in Process and Other areas	Energy Efficient CFL with IP-65 Grade Fitting
6	Insulation and Vapour barriers	---
i	External	---
a	Type of Material	Expanded Polystyrene (EPS)
b	Relevant IS code	IS 4671
c	Density	
d	Thermal conductivity at +10 deg cel	0.036
ii	Internal	---
a	Type of Material	Expanded Polystyrene (EPS)
b	Relevant IS code	IS 4671
c	Density	
d	Thermal conductivity at +10 deg cel	0.036
iii	Ceiling/Roof	---
a	Type of Material	Expanded Polystyrene (EPS)
b	Relevant IS code	IS 4671
c	Density	
d	Thermal conductivity at +10 deg cel	0.036
iv	Floor	---
a	Type of Material	Expanded Polystyrene (EPS)
b	Relevant IS code	IS 4671
c	Density	
d	Thermal conductivity at +10 deg cel	0.036
7	Material Handling	---
a	Material Handling procedures and equipments	N/A
b	Cap of Electric elevator	N/A

	Rating of motor	N/A
c	Any other device	N/A
8	Grading, sorting, washing and packing line	
a	Process line	
b	Total connected load	---
9	Cooling system	---
a	Type of refrigerant	Ammonia
b	Type of system	Gravity Feed
c	Type of compressor	Reciprocating
d	Type of condenser	Atmospheric
e	Type of cooling coil	Ceiling Suspended/Wall-mounted finned coil units
10	Compressor detail	---
a1	Compressor make & model	Kirloskar (Model - KXC-3) Two
b1	Compressor RPM	825
c1	Refrigeration capacity	298.00
a2	Compressor make & model	Kirloskar (Model - KXC-4)
b2	Compressor RPM	875
c2	Refrigeration capacity	355.00

1	Name of cold storage	S.K. Logistics, New Delhi
2	Type of Company	Partnership
3	Present activity in brief	This is a new firm and a new project, but the partnersh of the firm have 15-20 years of experience in building and operating cold chain successfully.
4	Total capacity of chamber	2000 MT
5	Type of Construction	---
a	Type of external walls of Cold Chambers	Outside envelope of 40mm PUF panels, inside brick mortar wall and inside 12 mm PUF panels
b	Type of Internal/Partition walls	PUF panels
c	Type of Roof/Ceiling	PUF panels below RCC
d	Type of Internal structure/Racks	Pallets on floor
e	Type of Mezzanine grafting	Pallets on floor
f	Type of Lighting fixtures in cold Chambers	CFL sealed
g	Type of Lighting fixtures in Process and Other areas	CFL sealed
6	Insulation and Vapour barriers	---
i	External	---
a	Type of Material	PUF Panels
b	Relevant IS code	---
c	Density	40+/-2
d	Thermal conductivity at +10 deg cel	0.018
ii	Internal	---
a	Type of Material	PUF Panels
b	Relevant IS code	---
c	Density	40+/-2
d	Thermal conductivity at +10 deg cel	0.018
iii	Ceiling/Roof	---
a	Type of Material	PUF Panels
b	Relevant IS code	---
c	Density	40+/-2
d	Thermal conductivity at +10 deg cel	0.018

iv	Floor	---
a	Type of Material	PUF and PCC
b	Relevant IS code	---
c	Density	40+/-2
d	Thermal conductivity at +10 deg cel	0.018
7	Material Handling	---
a	Material Handling procedures and equipments	Semi automatic, with Goods elevator and may be conveyor
b	Cap of Electric elevator	10HP
	Rating of motor	---
c	Any other device	As per requirement
8	Grading, sorting, washing and packing line	---
a	Process line	N/A
b	Total connected load	N/A
9	Cooling system	---
a	Type of refrigerant	Freon
b	Type of system	Direct Exp for Freon
c	Type of compressor	Screw Open Type
d	Type of condenser	Air Cooled
e	Type of cooling coil	Ceiling suspended
10	Compressor detail	---
a1	Compressor make & model	Bitzer (Three)
b1	Compressor RPM	2980
c1	Refrigeration capacity	62 Kw



1	Name of cold storage	<b>M/S Harshana Ice &amp; Cold Storage Pvt Ltd, Sonipat Haryana</b>
2	Type of Company	Pvt. Ltd.
3	Present activity in brief	1. Fruit Business Since 1977 2. Cold Chain & Service Provider Since 2000
4	Total capacity of chamber	700 MT
5	Type of Construction	---
a	Type of external walls of Cold Chambers	100 mm Puf Panel
b	Type of Internal/Partition walls	100 mm Puf Panel
c	Type of Roof/Ceiling	100 mm Puf Panel
d	Type of flooring for Forklift/Stacker movement	Trimix
e	Type of Gas tightening/Sealing methodology to maintain minimum gas tightness requirements as per ISO code 6949:1988(E)	Viniflex Coating Electrometric coating used for gas tightening of the CA rooms.
f	Type of Lighting fixtures in cold Chambers	CFL / Vapour Proof Light Fixtures
g	Type of Lighting fixtures in Process and Other areas	CFL / Fluorescent day light tube
6	Insulation and Vapour barriers	---
i	External	---
a	Type of Material	PUF Panels
b	Relevant IS code	IS 12436/BS-5608
c	Density	40 kg/M <sup>3</sup>
d	Thermal conductivity at +10 deg cel	0.021
ii	Internal	---
a	Type of Material	PUF Panels
b	Relevant IS code	IS 12436/BS-5608
c	Density	40 kg/M <sup>3</sup>
d	Thermal conductivity at +10 deg cel	0.021
iii	Ceiling/Roof	---
a	Type of Material	PUF Panels
b	Relevant IS code	IS 12436/BS-5608
c	Density	40 kg/M <sup>3</sup>
d	Thermal conductivity at +10 deg cel	0.021
iv	Floor	---
a	Type of Material	EPS
b	Relevant IS code	IS 4671-1984
c	Density	24 kg/M <sup>3</sup>
d	Thermal conductivity at +10 deg cel	0.033
7	Material Handling	---

a	Material Handling procedures and equipments	Forklift
b	Any other device	Pallet Jacks
8	Grading, sorting, washing and packing line	---
a	Process line	The grading packing line & plastic crates are being planned as a separate project
b	Total connected load	Not Applicable
9	Cooling system	---
a	Type of refrigerant	NH3
b	Type of system	Glycol Recirculation System
c	Type of compressor	Screw Compressor
d	Type of condenser	S/T Condenser
e	Type of cooling coil	Ceiling Suspended
10	Compressor detail	---
a1	Compressor make & model	Bitzer (one)
b1	Compressor RPM	2900
c1	Refrigeration capacity	194 kw
a2	Compressor make & model	Bitzer (one)
b2	Compressor RPM	2900
c2	Refrigeration capacity	194 kw

1	Name of cold storage	Lawrence Agro Storage Pvt Ltd, Sonipat, Haryana
2	Type of Company	Pvt. Ltd.
3	Present activity in brief	Agricultural Produce
4	Total capacity of chamber	650 MT
5	Type of Construction	---
a	Type of external walls of Cold Chambers	230 mm thick Brick Wall & EPS
b	Type of Internal/Partition walls	75 mm thick EPS
c	Type of Roof/Ceiling	150 mm thick EPS
d	Type of Internal structure/Racks	230 mm RCC structure
e	Type of Mezzanine grafting	Wooden
f	Type of Lighting fixtures in cold Chambers	Vapor Proof Lighting Fixtures
g	Type of Lighting fixtures in Process and Other areas	Vapor Proof & Normal /Standard Lighting Fixtures
6	Insulation and Vapour barriers	---
i	External	---
a	Type of Material	EPS
b	Relevant IS code	IS 4671-1984
c	Density	18 kg/M3
d	Thermal conductivity at +10 deg cel	0.036 K
ii	Internal	---
a	Type of Material	EPS
b	Relevant IS code	IS 4671-1984
c	Density	18 kg/M3
d	Thermal conductivity at +10 deg cel	0.036 K
iii	Ceiling/Roof	---
a	Type of Material	EPS
b	Relevant IS code	IS 4671-1984
c	Density	18 kg/M3
d	Thermal conductivity at +10 deg cel	0.036 K
iv	Floor	---
a	Type of Material	EPS
b	Relevant IS code	IS 4671-1984
c	Density	18 kg/M3
d	Thermal conductivity at +10 deg cel	0.036 K
7	Material Handling	---
a	Material Handling procedures and equipments	Manual
b	Any other device	---
8	Grading, sorting, washing and packing line	---

a	Process line	Manual
b	Total connected load	N/A
9	Cooling system	---
a	Type of refrigerant	Others (Eco Friendly R-404a)
b	Type of system	Direct Exp.
c	Type of compressor	Scroll
d	Type of condenser	other (Air cooled)
e	Type of cooling coil	Ceiling Suspended (for Cold Stores)
10	Compressor detail	---
a1	Compressor make & model	Emerson (zx 076E) Danfoss (One)
b1	Compressor RPM	2950
c1	Refrigeration capacity	17.65 kw, 15.57 kw

1	Name of cold storage	M/S Jubin Cold Storage Pvt Ltd, Sonipat Haryana
2	Type of Company	Pvt. Ltd.
3	Present activity in brief	Cold Storage - Fruit and other agriculture produce
4	Total capacity of chamber	2112 MT
5	Type of Construction	---
a	Type of external walls of Cold Chambers	120 mm PUF Panel
b	Type of Internal/Partition walls	100 mm PUF Panel
c	Type of Roof/Ceiling	120 mm PUF Panel
d	Type of flooring for Forklift/Stacker movement	Trimix flooring Vacuum Dewatered Flooring Suitable for CA Store
e	Type of Gas tightening/Sealing methodology to maintain minimum gas tightness requirements as per ISO code 6949:1988(E)	Viniflex Coating with fibre mat, Electrometric Coating used for Gas tightening of the CA rooms.
f	Type of Lighting fixtures in cold Chambers	CFL / Vapour Proof Light Fixtures
g	Type of Lighting fixtures in Process and Other areas	CFL / Fluorescent Day Light Fixtures
6	Insulation and Vapour barriers	---
i	External	---
a	Type of Material	PUF Panels
b	Relevant IS code	IS 12436 / BS - 5608
c	Density	40 kg/m <sup>3</sup>
d	Thermal conductivity at +10 deg cel	0.021
ii	Internal	---
a	Type of Material	PUF Panels
b	Relevant IS code	IS 12436 / BS - 5608
c	Density	40 kg/m <sup>3</sup>
d	Thermal conductivity at +10 deg cel	0.021
iii	Ceiling/Roof	---
a	Type of Material	PUF Panels
b	Relevant IS code	IS 12436 / BS - 5608
c	Density	40 kg/m <sup>3</sup>
d	Thermal conductivity at +10 deg cel	0.021
iv	Floor	---
a	Type of Material	EPS
b	Relevant IS code	IS 4671-1984
c	Density	24 kg/m <sup>3</sup>
d	Thermal conductivity at +10 deg cel	0.033

7	Material Handling	---
a	Material Handling procedures and equipments	Forklift
b	Any other device	Pallet Jack
8	Grading, sorting, washing and packing line	---
a	Process line	Manual
b	Total connected load	---
9	Cooling system	---
a	Type of refrigerant	Ammonia (Primary) & Glycol (Secondary)
b	Type of system	Glycol Recirculation system
c	Type of compressor	Screw Compressor
d	Type of condenser	Evaporative Condenser
e	Type of cooling coil	Ceiling suspended
10	Compressor detail	---
a1	Compressor make & model	Bitzer Screw Compressor Model - OSK - 7471
b1	Compressor RPM	2900
c1	Refrigeration capacity	256, 219
a2	Compressor make & model	Bitzer Screw Compressor Model - OSK - 7471
b2	Compressor RPM	2900
c2	Refrigeration capacity	256, 219

1	Name of cold storage	Dev Bhumi Cold Chain Ltd, Shimla, Himanchal
2	Type of Company	Pvt. Ltd.
3	Present activity in brief	Integrated Cold Chain company, buying product at farm gate and carrying it through best technology to reduce wastage & effect value addition
4	Total capacity of chamber	1842 MT
5	Type of Construction	---
a	Type of external walls of Cold Chambers	100 mm PUF Panels
b	Type of Internal/Partition walls	100 mm PUF Panels
c	Type of Roof/Ceiling	100 mm PUF Panels
d	Type of Internal structure/Racks	---
e	Type of Mezzanine grafting	---
f	Type of Lighting fixtures in cold Chambers	CFL / Vapour Proof Light Fixtures
g	Type of Lighting fixtures in Process and Other areas	CFL / Fluorescent Day Light Fixtures
6	Insulation and Vapour barriers	---
i	External	---
a	Type of Material	PUF Panels
b	Relevant IS code	IS 12436 / BS - 5608
c	Density	40 Kg /m3
d	Thermal conductivity at +10 deg cel	0.023
ii	Internal	---
a	Type of Material	PUF Panels
b	Relevant IS code	IS 12436 / BS - 5608
c	Density	40 Kg /m3
d	Thermal conductivity at +10 deg cel	0.023
iii	Ceiling/Roof	---
a	Type of Material	PUF Panels
b	Relevant IS code	IS 12436 / BS - 5608
c	Density	40 Kg /m3
d	Thermal conductivity at +10 deg cel	0.023

iv	Floor	Nil
a	Type of Material	---
b	Relevant IS code	---
c	Density	---
d	Thermal conductivity at +10 deg cel	---
7	Material Handling	
a	Material Handling procedures and equipments	2 Nos. Reach Stacker / Fork Lift
		4 Nos. Hand Pallet Jack
		3 Nos. Freight Elevators
		1 Nos. Hoist
b	Any other device	---
8	Grading, sorting, washing and packing line	---
a	Process line	Grading, Sorting, Washing Waxing Packing Line Semi Automated Capacity : 5 MT/hr
b	Total connected load	65 Kw
9	Cooling system	---
a	Type of refrigerant	Ammonia
b	Type of system	Glycol Recirculation System
c	Type of compressor	Screw
d	Type of condenser	Air Cooled Condenser
e	Type of cooling coil	Ceiling Suspended
10	Compressor detail	---
a1	Compressor make & model	Bitzer - OSK - 7471
b1	Compressor RPM	2900
c1	Refrigeration capacity	256 , 219
a2	Compressor make & model	Bitzer - OSK - 7471
b2	Compressor RPM	2900
c2	Refrigeration capacity	256 , 219



1	Name of cold storage	ESS EMM GEE Ice Factory & Cold Storage, Jammu & Kashmir
2	Type of Company	Partnership
3	Present activity in brief	Cold Storage -Fruit and agriculture produce
4	Total capacity of chamber	3000 MT
5	Type of Construction	---
a	Type of external walls of Cold Chambers	Brick & masonry
b	Type of Internal/Partition walls	Brick & masonry
c	Type of Roof/Ceiling	MS trusses with Asbestos sheet
d	Type of Internal structure/Racks	Steel & wooden racks
e	Type of Mezzanine grafting	Steel & Wood
f	Type of Lighting fixtures in cold Chambers	CFL
g	Type of Lighting fixtures in Process and Other areas	CFL
6	Insulation and Vapour barriers	---
i	External	---
a	Type of Material	EPS
b	Relevant IS code	IS 4671
c	Density	16 to 18 m <sup>3</sup>
d	Thermal conductivity at +10 deg cel	34/31
ii	Internal	---
a	Type of Material	EPS
b	Relevant IS code	IS 4671
c	Density	16 to 18 m <sup>3</sup>
d	Thermal conductivity at +10 deg cel	34/31
iii	Ceiling/Roof	---
a	Type of Material	EPS
b	Relevant IS code	IS 4671
c	Density	16 to 18 m <sup>3</sup>
d	Thermal conductivity at +10 deg cel	34/31
iv	Floor	---
a	Type of Material	EPS
b	Relevant IS code	IS 4671
c	Density	16 to 18 m <sup>3</sup>
d	Thermal conductivity at +10 deg cel	34/31
7	Material Handling	---
a	Material Handling procedures and equipments	Manually
b	Cap of Electric elevator	N/A

	Rating of motor	---
c	Any other device	N/A
8	Grading, sorting, washing and packing line	---
a	Process line	Manual
b	Total connected load	---
9	Cooling system	---
a	Type of refrigerant	Ammonia
b	Type of system	Gravity Feed System
c	Type of compressor	Reciprocating
d	Type of condenser	Atmospheric
e	Type of cooling coil	Floor Mounted
10	Compressor detail	---
a1	Compressor make & model	KC4
b1	Compressor RPM	750
c1	Refrigeration capacity	263 (k w)
a2	Compressor make & model	KC3
b2	Compressor RPM	750
c2	Refrigeration capacity	263 (k w)

1	Name of cold storage	Sakshi Fruit and Vegetable Cold Storage, Amritsar, Punjab
2	Type of Company	Partnership
3	Present activity in brief	Cold Storage CS-I Type
4	Total capacity of chamber	5160 MT
5	Type of Construction	---
a	Type of external walls of Cold Chambers	Brick Walls
b	Type of Internal/Partition walls	Brick Walls
c	Type of Roof/Ceiling	Steel
d	Type of Internal structure/Racks	Steel
e	Type of Mezzanine grafting	Wooden
f	Type of Lighting fixtures in cold Chambers	CFL
g	Type of Lighting fixtures in Process and Other areas	CFL
6	Insulation and Vapour barriers	---
i	External	---
a	Type of Material	EPS
b	Relevant IS code	IS 13205
c	Density	32 (kg/m3)
d	Thermal conductivity at +10 deg cel	0.023
ii	Internal	---
a	Type of Material	EPS
b	Relevant IS code	IS 4671
c	Density	15 (kg/m3)
d	Thermal conductivity at +10 deg cel	0.036
iii	Ceiling/Roof	---
a	Type of Material	XPS
b	Relevant IS code	---
c	Density	30 (kg/m3)
d	Thermal conductivity at +10 deg cel	0.025
iv	Floor	---
a	Type of Material	---
b	Relevant IS code	---
c	Density	35 (kg/m3)
d	Thermal conductivity at +10 deg cel	---
7	Material Handling	---
a	Material Handling procedures and equipments	Manual
b	Cap of Electric elevator	N/A

	Rating of motor	---
c	Any other device	---
8	Grading, sorting, washing and packing line	---
a	Process line	N/A
b	Total connected load	---
9	Cooling system	---
a	Type of refrigerant	Ammonia
b	Type of system	Liquid Overfeed
c	Type of compressor	1
d	Type of condenser	Atmospheric
e	Type of cooling coil	Finned type
10	Compressor detail	0
a1	Compressor make & model	Kirloskar KC-3 Two
b1	Compressor RPM	600/950
c1	Refrigeration capacity	453.10/320.90

1	Name of cold storage	M/S Ajeet Enterprises, Sangrur, Punjab
2	Type of Company	Enterprises
3	Present activity in brief	Cold Storage
4	Total capacity of chamber	5100 MT
5	Type of Construction	---
a	Type of external walls of Cold Chambers	PUF
b	Type of Internal/Partition walls	PUF
c	Type of Roof/Ceiling	Toughened Colour Coated Galvalume Sheet of 0.5 mm Tct of material Ppaz /Ceiling-Puf
d	Type of Internal structure/Racks	Rigid Frame, Multispan
e	Type of Mezzanine grafting	N/A
f	Type of Lighting fixtures in cold Chambers	Twin CFL
g	Type of Lighting fixtures in Process and Other areas	CFL
6	Insulation and Vapour barriers	---
i	External	---
a	Type of Material	Metal Skin PUF Compo site Panels
b	Relevant IS code	IS-661
c	Density	40+/-2
d	Thermal conductivity at +10 deg cel	<0.02 K cal/sq.m.hr. °C
ii	Internal	---
a	Type of Material	Metal Skin PUF Compo site Panels
b	Relevant IS code	IS-661
c	Density	40+/-2
d	Thermal conductivity at +10 deg cel	<0.02 K cal/sq.m.hr. °C
iii	Ceiling/Roof	---
a	Type of Material	Metal Skin PUF Compo site Panels
b	Relevant IS code	IS-661
c	Density	40+/-2
d	Thermal conductivity at +10 deg cel	<0.02 K cal/sq.m.hr. °C
iv	Floor	---
a	Type of Material	EPS/PUF
b	Relevant IS code	IS-661
c	Density	16/40+/-2

d	Thermal conductivity at +10 deg cel	<0.02 K cal/sq.m.hr. °C
7	Material Handling	---
a	Material Handling procedures and equipments	Material Handling Equipments - Pre grader, hopper, inspection conveyer, roller conveyer space finder & pickup scooter
b	Cap of Electric elevator	Included Below
	Rating of motor	---
c	Any other device	---
8	Grading, sorting, washing and packing line	---
a	Process line	Grading/sorting line
b	Total connected load	40 KW
9	Cooling system	---
a	Type of refrigerant	Freon
b	Type of system	Direct Exp
c	Type of compressor	Reciprocating
d	Type of condenser	Shell & Tube
e	Type of cooling coil	Ceiling suspended
10	Compressor detail	
a1	Compressor make & model	Bitzer 6FE - 50 Y
b1	Compressor RPM	1450
c1	Refrigeration capacity	146.1 KW

1	Name of cold storage	M/S Annapurna Cold Storage & Ice factory, Udham Singh Nagar, Uttarkhand
2	Type of Company	Proprietorship
3	Present activity in brief	Agriculture
4	Total capacity of chamber	4435 MT
5	Type of Construction	---
a	Type of external walls of Cold Chambers	345 mm Brick Walls with Cement Plaster
b	Type of Internal/Partition walls	230 mm Brick Walls with Cement Plaster
c	Type of Roof/Ceiling	4" RCC Slab
d	Type of Internal structure/Racks	RCC Columns
e	Type of Mezzanine grafting	Wooden Batten
f	Type of Lighting fixtures in cold Chambers	CFL Lighting Fixtures
g	Type of Lighting fixtures in Process and Other areas	CFL Lighting Fixtures
6	Insulation and Vapour barriers	---
i	External	---
a	Type of Material	150 mm in tow layers of 75 mm each
b	Relevant IS code	IS - 4671
c	Density	15
d	Thermal conductivity at +10-deg cel	0.036
ii	Internal	---
a	Type of Material	Partition 75 mm single layer each
b	Relevant IS code	IS - 4671
c	Density	15
d	Thermal conductivity at +10 deg cel	0.036
iii	Ceiling/Roof	---
a	Type of Material	150 mm in two layers of 75mm each
b	Relevant IS code	IS - 4671
c	Density	15
d	Thermal conductivity at +10 deg cel	0.036
iv	Floor	---
a	Type of Material	125 mm in two layers of 75mm & 50mm.
b	Relevant IS code	IS - 4671
c	Density	15
d	Thermal conductivity at +10 deg cel	0.036
7	Material Handling	---
a	Material Handling procedures and	Manual

	equipments	
b	Cap of Electric elevator	N/A
	Rating of motor	---
c	Any other device	N/A
8	Grading, sorting, washing and packing line	---
a	Process line	Manual
b	Total connected load	N/A
9	Cooling system	---
a	Type of refrigerant	Ammonia
b	Type of system	Overfeed
c	Type of compressor	Reciprocating
d	Type of condenser	Atmospheric
e	Type of cooling coil	Ceiling suspended
10	Compressor detail	---
a1	Compressor make & model	"ICE HILL" MAX-4
b1	Compressor RPM	750
c1	Refrigeration capacity	378
a2	Compressor make & model	"ICE HILL" MAX-4
b2	Compressor RPM	750
c2	Refrigeration capacity	320



1	Name of cold storage	StoreEx Solutions Pvt Ltd. , Mehsana, Gujrat
2	Type of Company	Pvt. Ltd.
3	Present activity in brief	The Directors are farmers and industrialist engaged in various Agri business and industrial business and industrial business activities
4	Total capacity of chamber	---
5	Type of Construction	---
a	Type of external walls of Cold Chambers	Brick Wall (Up to plingth level) + fire retardant PUF panel
b	Type of Internal/Partition walls	Fire retardant PUF panel
c	Type of Roof/Ceiling	Fire retardant PUF panel
d	Type of Internal structure/Racks	Concrete + VDE
e	Type of Mezzanine grafting	---
f	Type of Lighting fixtures in cold Chambers	Moisture Proof /CFL/LED base
g	Type of Lighting fixtures in Process and Other areas	Moisture Proof /CFL/LED base
6	Insulation and Vapour barriers	---
i	External	---
a	Type of Material	PUF
b	Relevant IS code	IS 13205
c	Density	40 Kg $\pm$ 2
d	Thermal conductivity at +10 deg cel	0.023
ii	Internal	---
a	Type of Material	PUF
b	Relevant IS code	IS 1471
c	Density	40 Kg $\pm$ 2
d	Thermal conductivity at +10 deg cel	0.036
iii	Ceiling/Roof	---
a	Type of Material	PUF
b	Relevant IS code	IS 4671
c	Density	32 Kg $\pm$ 2
d	Thermal conductivity at +10 deg cel	0.025
iv	Floor	---

a	Type of Material	PUF
b	Relevant IS code	IS 4671
c	Density	32 Kg for XPS
d	Thermal conductivity at +10 deg cel	0.025
7	Material Handling	---
a	Material Handling procedures and equipments	Reach Truck - Battery operated, Hydraulic pallet lifter
b	Cap of Electric elevator	---
	Rating of motor	---
c	Any other device	---
8	Grading, sorting, washing and packing line	Semi Automated
a	Process line	10 ton per Capacity
b	Total connected load	25 kw
9	Cooling system	---
a	Type of refrigerant	Ammonia
b	Type of system	Secondary Brine System
c	Type of compressor	Reciprocating
d	Type of condenser	Shell & Tube Type
e	Type of cooling coil	Ceiling suspended
10	Compressor detail	---
a1	Compressor make & model	Mycom 8L (Three)
b1	Compressor RPM	1450
c1	Refrigeration capacity	654.6

1	Name of cold storage	Aravali Trade Vision Pvt. Ltd., Jaipur, Rajasthan
2	Type of Company	---
3	Present activity in brief	Preservation of Potatoes, Fruits and other Agricultural Produce
4	Total capacity of chamber	5978.76 MT
5	Type of Construction	---
a	Type of external walls of Cold Chambers	As per Technical standards
b	Type of Internal/Partition walls	As per Technical standards
c	Type of Roof/Ceiling	4" RCC slab
d	Type of Internal structure/Racks	Wooden Racks
e	Type of Mezzanine grafting	Wooden Batten
f	Type of Lighting fixtures in cold Chambers	CFL Lighting Fixtures
g	Type of Lighting fixtures in Process and Other areas	CFL Lighting Fixtures
6	Insulation and Vapour barriers	---
i	External	---
a	Type of Material	150 mm in two layers of 75 mm each
b	Relevant IS code	IS-4671
c	Density	15
d	Thermal conductivity at +10 deg cel	0.036
ii	Internal	---
a	Type of Material	Partition 75 mm single
b	Relevant IS code	IS-4671
c	Density	15
d	Thermal conductivity at +10 deg cel	0.036
iii	Ceiling/Roof	---
a	Type of Material	150 mm in two layers of 75 mm each
b	Relevant IS code	IS-4671
c	Density	15
d	Thermal conductivity at +10 deg cel	0.036
iv	Floor	---
a	Type of Material	125 mm in two layers of 75 mm & 50 mm
b	Relevant IS code	IS-4671
c	Density	15
d	Thermal conductivity at +10 deg cel	0.036
7	Material Handling	---
a	Material Handling procedures and equipments	Manual
b	Cap of Electric elevator	N/A

	Rating of motor	---
c	Any other device	---
8	Grading, sorting, washing and packing line	---
a	Process line	Manual
b	Total connected load	---
9	Cooling system	---
a	Type of refrigerant	Ammonia
b	Type of system	Gravity Feed
c	Type of compressor	Reciprocating
d	Type of condenser	Evaporative
e	Type of cooling coil	Ceiling suspended
10	Compressor detail	---
a1	Compressor make & model	Metalex MX-300
b1	Compressor RPM	750
c1	Refrigeration capacity	276.75
a2	Compressor make & model	Metalex MX-300
b2	Compressor RPM	750
c2	Refrigeration capacity	276.75
a3	Compressor make & model	Metalex MX-300
b3	Compressor RPM	750
c3	Refrigeration capacity	233.26

1	Name of cold storage	Narsh Cold Storage and Warehousing, Sangli, Maharashtra
2	Type of Company	Partnership Firm
3	Present activity in brief	Multi Chamber & Multi Product Cold Storage with mechanical handling of stored agriculture produce with cleaning, grading, sorting & packaging activity
4	Total capacity of chamber	4971 MT
5	Type of Construction	---
a	Type of external walls of Cold Chambers	PUF Panels
b	Type of Internal/Partition walls	PUF Panels
c	Type of Roof/Ceiling	PUF Panels
d	Type of Internal structure/Racks	MS.columns and Beams
e	Type of Mezzanine grafting	Wooden grating of sufficient strength & treated for termites
f	Type of Lighting fixtures in cold Chambers	CFL Lighting in Cold Storage with central switch outside the chamber
g	Type of Lighting fixtures in Process and Other areas	CFL Lighting and Fixture
6	Insulation and Vapour barriers	---
i	External	---
a	Type of Material	PUF Panels 100 MM
b	Relevant IS code	IS-11239
c	Density	$40 \pm 2 \text{ Kg/M}^3$
d	Thermal conductivity at +10 deg cel	0.023
ii	Internal	---
a	Type of Material	PUF Panels 80 MM
b	Relevant IS code	IS-11239
c	Density	$40 \pm 2 \text{ Kg/M}^3$
d	Thermal conductivity at +10 deg cel	0.023
iii	Ceiling/Roof	---
a	Type of Material	PUF Panels 100 MM
b	Relevant IS code	IS-11239
c	Density	$40 \pm 2 \text{ Kg/M}^3$

d	Thermal conductivity at +10 deg cel	0.023
iv	Floor	---
a	Type of Material	PUF Panels 100 MM
b	Relevant IS code	IS-11239
c	Density	20± 2 Kg/M <sup>3</sup>
d	Thermal conductivity at +10 deg cel	0.036
7	Material Handling	---
a	Material Handling procedures and equipments	Manual
b	Cap of Electric elevator	3 KW.
	Rating of motor	---
c	Any other device	N/A
8	Grading, sorting, washing and packing line	---
a	Process line	Manual After Unloading of Raisin & Turmeric from farmers transport, th same shall be sorted out/graded/packed manually
b	Total connected load	5 KW
9	Cooling system	---
a	Type of refrigerant	Ammonia
b	Type of system	Gravity Feed
c	Type of compressor	Reciprocating
d	Type of condenser	Evaporative
e	Type of cooling coil	Ceiling suspended
10	Compressor detail	---
a1	Compressor make & model	KC-2
b1	Compressor RPM	750
c1	Refrigeration capacity	155 KW.
a2	Compressor make & model	KC-2
b2	Compressor RPM	700
c2	Refrigeration capacity	233 KW
a3	Compressor make & model	KC-3 Standby
b3	Compressor RPM	700
c3	Refrigeration capacity	233 KW

1	Name of cold storage	<b>M/s Asati Cold, Gondia, Maharastra</b>
2	Type of Company	Proprietorship Firm
3	Present activity in brief	Business for Potates, Ber tamarind, Mango, powder, Fruit etc.
4	Total capacity of chamber	5250 MT
5	Type of Construction	---
a	Type of external walls of Cold Chambers	100mm PUF Panel
b	Type of Internal/Partition walls	50 mm PUF Panel
c	Type of Roof/Ceiling	100 PUF Panel
d	Type of Internal structure/Racks	Steel Racks Structure
e	Type of Mezzanine grafting	Steel Racks Structure
f	Type of Lighting fixtures in cold Chambers	CFL Lamp open PVC Pipe Wiring
g	Type of Lighting fixtures in Process and Other areas	CFL Lamp & T5 Tube light PVC Pipe wiring
6	Insulation and Vapour barriers	---
i	External	---
a	Type of Material	100 MM
b	Relevant IS code	IS 661
c	Density	40 Kg
d	Thermal conductivity at +10 deg cel	k=0.022 W/mk
ii	Internal	---
a	Type of Material	50 MM
b	Relevant IS code	IS 661
c	Density	40 Kg
d	Thermal conductivity at +10 deg cel	k=0.024 W/mk
iii	Ceiling/Roof	---
a	Type of Material	100 MM
b	Relevant IS code	IS 661
c	Density	40 Kg
d	Thermal conductivity at +10 deg cel	k=0.022 W/mk
iv	Floor	---
a	Type of Material	100 MM
b	Relevant IS code	IS 661
c	Density	40 Kg
d	Thermal conductivity at +10 deg cel	k=0.022 W/mk
7	Material Handling	---
a	Material Handling procedures and equipments	Reach Truck, Standard hydraulic Pallet Truck and Pallet
b	Cap of Electric elevator	No Required

	Rating of motor	
c	Any other device	---
8	Grading, sorting, washing and packing line	---
a	Process line	Hand Operate System
b	Total connected load	2 Kw
9	Cooling system	---
a	Type of refrigerant	Ammonia
b	Type of system	Direct Exp
c	Type of compressor	Reciprocating
d	Type of condenser	Evaporative
e	Type of cooling coil	Ceiling suspended
10	Compressor detail	---
a1	Compressor make & model	VILTER 454 XL (Three)
b1	Compressor RPM	850
c1	Refrigeration capacity	234.85 KW



1	Name of cold storage	Sai Pooja Agrotech Cold Storage, Nasik, Maharashtra
2	Type of Company	Partnership
3	Present activity in brief	Managing & Operating Multi Chamber & Multi Product Cold Storage with Mechanical Handling of Stored Agriculture Produce with cleaning. Grading sorting & packaging activity Commission agent of agri products.
4	Total capacity of chamber	3766 MT
5	Type of Construction	---
a	Type of external walls of Cold Chambers	PUF Panels
b	Type of Internal/Partition walls	PUF Panels
c	Type of Roof/Ceiling	PUF Panels
d	Type of Internal structure/Racks	MS. Columns and Beams
e	Type of Mezzanine grafting	Wooden grating of sufficient strength & treated for termites
f	Type of Lighting fixtures in cold Chambers	CFL/Led Lighting in Cold Storage with central switch outside the chamber
g	Type of Lighting fixtures in Process and Other areas	T. L. Lighting and Fixture
6	Insulation and Vapour barriers	---
i	External	---
a	Type of Material	PUF Panels 100 MM
b	Relevant IS code	IS-11239
c	Density	$40 \pm 2 \text{ Kg/M}^3$
d	Thermal conductivity at +10 deg cel	0.023
ii	Internal	---
a	Type of Material	PUF Panels 80 MM
b	Relevant IS code	IS-11239
c	Density	$40 \pm 2 \text{ Kg/M}^3$
d	Thermal conductivity at +10 deg cel	0.023
iii	Ceiling/Roof	---
a	Type of Material	PUF Panels 100 MM

b	Relevant IS code	IS-11239
c	Density	40± 2 Kg/M <sup>3</sup>
d	Thermal conductivity at +10 deg cel	0.023
iv	Floor	---
a	Type of Material	PUF HD 80 MM For ground floor & perimeter insulation of 80mm EPS for 1st Floor
b	Relevant IS code	IS-11239
c	Density	40± 2 Kg/M <sup>3</sup>
d	Thermal conductivity at +10 deg cel	0.023
7	Material Handling	---
a	Material Handling procedures and equipments	Manual
b	Cap of Electric elevator	3 KW. (For hoist.)
	Rating of motor	
c	Any other device	N/A
8	Grading, sorting, washing and packing line	---
a	Process line	Manul, after Unloading of grapes/equivalent from farmers transport. The same shall be sorted out/graded/packed manually.
b	Total connected load	5 KW.
9	Cooling system	---
a	Type of refrigerant	HFC for pre cooling & high RH CS/Ammonia For upper floor cold stores
b	Type of system	Dx. System for pre cooling & high RH CS & gravity feed for upper floor cold stores.
c	Type of compressor	Semi hermetic for pre cooling & high RH CS/Open reciprocating for upper floor CS
d	Type of condenser	Air Cooled./Water Cooled.
e	Type of cooling coil	Ceiling suspended
10	Compressor detail	---
a1	Compressor make & model	KC-3:1 stand by
b1	Compressor RPM	750
c1	Refrigeration capacity	233 KW.
a2	Compressor make & model	Bock-S-7HGX-5/Equivalent

b2	Compressor RPM	---
c2	Refrigeration capacity	22 KW.
a3	Compressor make & model	Bock-S-7HGX-4/Equivalent
b3	Compressor RPM	---
c3	Refrigeration capacity	27.32 KW.

1	Name of cold storage	Kamrupa Thanda Ghar Pvt. Ltd., Kamroop, Assam
2	Type of Company	Company Ltd. By Shares
3	Present activity in brief	Cold Storage
4	Total capacity of chamber	12218 MT
5	Type of Construction	---
a	Type of external walls of Cold Chambers	250 mm thick brick wall with plaster and insulation
b	Type of Internal/Partition walls	125 mm thick brick wall with plaster and insulation
c	Type of Roof/Ceiling	Reinforced Cement Concrete Slab with roof treatment and ceiling with insulation and plaster
d	Type of Internal structure/Racks	RCC framed structure (Beam, Columns in Grids) with Timber/Bamboo framed Racks
e	Type of Mezzanine grafting	Timber framed Challies (Gratings)
f	Type of Lighting fixtures in cold Chambers	Tube lights/bulbs with standard illumination
g	Type of Lighting fixtures in Process and Other areas	Tube lights/bulbs with standard illumination
6	Insulation and Vapour barriers	---
i	External	---
a	Type of Material (Type of material EPS /Metal Skin PUF Composite Panels/XPS/PUR, Others)	EPS
b	Relevant IS code	IS-4671
c	Density	16
d	Thermal conductivity at +10 deg cel	0.036
ii	Internal	---
a	Type of Material (Type of material EPS /Metal Skin PUF Composite Panels/XPS/PUR, Others)	EPS
b	Relevant IS code	IS-4671
c	Density	16
d	Thermal conductivity at +10 deg cel	0.036
iii	Ceiling/Roof	---
a	Type of Material (Type of material EPS /Metal Skin PUF Composite Panels/XPS/PUR, Others)	EPS
b	Relevant IS code	IS-4671
c	Density	16
d	Thermal conductivity at +10 deg cel	0.036
iv	Floor	---

a	Type of Material (Type of material EPS /Metal Skin PUF Composite Panels/XPS/PUR, Others)	EPS
b	Relevant IS code	IS-4671
c	Density	16
d	Thermal conductivity at +10 deg cel	0.036
7	Material Handling	---
a	Material Handling procedures and equipments	Manual/Semi Automated
b	Cap of Electric elevator	7.5 KW
	Rating of motor	---
c	Any other device	Convayer
8	Grading, sorting, washing and packing line	---
a	Process line	No
b	Total connected load	No
9	Cooling system	---
a	Type of refrigerator	Ammonia
b	Type of system	Overfeed
c	Type of compressor	Reciprocating
d	Type of condenser	Atmospheric
e	Type of cooling coil	Ceiling suspended
10	Compressor detail	---
a1	Compressor make & model	Frick Vilter 458 XL
b1	Compressor RPM	1000
c1	Refrigeration capacity	534.22
a2	Compressor make & model	Frick Vilter 458 XL
b2	Compressor RPM	1000
c2	Refrigeration capacity	436.99
a3	Compressor make & model	Frick Vilter 456 XL
b3	Compressor RPM	1070
c3	Refrigeration capacity	428.92
a4	Compressor make & model	Frick Vilter 456 XL
b4	Compressor RPM	1070
c4	Refrigeration capacity	350.64
a5	Compressor make & model	Frick Vilter 456 XL
b5	Compressor RPM	1070
c5	Refrigeration capacity	428.92
a6	Compressor make & model	Frick Vilter 456 XL
b6	Compressor RPM	1070
b6	Refrigeration capacity	350.64

1	Name of cold storage	M/s Krishna Cold Storage, North Guwahati, Kamroop, Assam
2	Type of Company	Partnership
3	Present activity in brief	Cold Storage for Storing of horticultural produces and seed potatoes
4	Total capacity of chamber	6000 MT
5	Type of Construction	---
a	Type of external walls of Cold Chambers	250 mm thick Brick Wall with RCC Beam and Column
b	Type of Internal/Partition walls	250 mm thick Brick Wall with RCC Beam and Column
c	Type of Roof/Ceiling	125 mm thick RCC concrete as per IS 875 standard
d	Type of Internal structure/Racks	RCC Column & Beam
e	Type of Mezzanine grafting	RCC Beam with Wooden & Bamboo Challi Rafter
f	Type of Lighting fixtures in cold Chambers	CFL Lamp Lighting & Tube lights
g	Type of Lighting fixtures in Process and Other areas	CFL Lamp Lighting & Tube lights
6	Insulation and Vapour barriers	
i	External	---
a	Type of Material	EPS
b	Relevant IS code	IS 661
c	Density	16
d	Thermal conductivity at +10 deg cel	0.028
ii	Internal	---
a	Type of Material	EPS
b	Relevant IS code	2000
c	Density	16
d	Thermal conductivity at +10 deg cel	© mtr
iii	Ceiling/Roof	---
a	Type of Material	EPS
b	Relevant IS code	---
c	Density	16
d	Thermal conductivity at +10 deg cel	thickness
iv	Floor	---
a	Type of Material	EPS
b	Relevant IS code	---
c	Density	16
d	Thermal conductivity at +10 deg cel	---

7	Material Handling	---
a	Material Handling procedures and equipments	Conveyor Sprocket type fitted with 10.0 HP Motor-1 No.
b	Cap of Electric elevator	7.5 kw
	Rating of motor	
c	Any other device	---
8	Grading, sorting, washing and packing line	---
a	Process line	Not applicable
b	Total connected load	---
9	Cooling system	---
a	Type of refrigerant	Ammonia
b	Type of system	Overfeed
c	Type of compressor	Reciprocating
d	Type of condenser	Atmospheric
e	Type of cooling coil	Ceiling suspended
10	Compressor detail	---
a1	Compressor make & model	KCX-3 (Two)
b1	Compressor RPM	950
c1	Refrigeration capacity	410, 280
a2	Compressor make & model	KCX-2 (one)
b2	Compressor RPM	900
c2	Refrigeration capacity	225, 170

1	Name of cold storage	NSR Farm Fresh, Dindigul, Tamilnadu
2	Type of Company	Pvt. Ltd.
3	Present activity in brief	Briefed In Application Form
4	Total capacity of chamber	8.450 MT
5	Type of Construction	---
a	Type of external walls of Cold Chambers	Pre Fabricated sandwiched PUF panel 120 mm Thick
b	Type of Internal/Partition walls	Pre Fabricated sandwiched PUF panel 100 mm Thick
c	Type of Roof/Ceiling	
d	Type of Flooring for forklift/stacker movement	100mm PUF plus vapour barrier above PCC Flooring finished with RCC/VDF
e	Type of Internal structure/Racks	
f	Type of Mezzanine grafting	
g	Type of Lighting fixtures in cold Chambers	Weather Proof Light Fittings, IP 65 degree of protection.
h	Type of Lighting fixtures in Process and Other areas	Weather Proof Light Fittings, IP 65 degree of protection.
6	Insulation and Vapour barriers	---
i	External	---
a	Type of Material	PUF Composite Panels
b	Relevant IS code	IS 12436
c	Density	40+/- 2
d	Thermal conductivity at +10 deg cel	0.021
ii	Internal	---
a	Type of Material	PUF Composite Panels
b	Relevant IS code	IS 12436
c	Density	40+/- 2
d	Thermal conductivity at +10 deg cel	0.021
iii	Ceiling/Roof	---
a	Type of Material	PUF Composite Panels
b	Relevant IS code	IS 12436
c	Density	40+/- 2
d	Thermal conductivity at +10 deg cel	0.021
iv	Floor	---
a	Type of Material	PUF Composite Panels



b	Relevant IS code	IS 12436
c	Density	40+/- 2
d	Thermal conductivity at +10 deg cel	0.021
7	Material Handling	---
a	Material Handling procedures and equipments	Forklifts with lift height of 7.5m and weight of 1200 kg at that height will be used for lifting and positioning the bulk bins
b	Cap of Electric elevator	---
	Rating of motor	---
c	Any other device	Battery operators Stackers and Pallet truck to be used for lower height
8	Grading, sorting, washing and packing line	---
a	Process line	Automatic sorting, grading & waxing line with 5MT/Hr.
b	Total connected load	28 KW
9	Cooling system	---
a	Type of refrigerant	Freon
b	Type of system	Direct Exp
c	Type of compressor	Reciprocating
d	Type of condenser	Aircooled
e	Type of cooling coil	Ceiling suspended
10	Compressor detail	---
a1	Compressor make & model	---
b1	Compressor RPM	---
c1	Refrigeration capacity	---
a2	Compressor make & model	---
b2	Compressor RPM	---
c2	Refrigeration capacity	---

1	Name of cold storage	M/s Adiraj Cold Storage, Ranchi, Jharkhand
2	Type of Company	Partnership Firm
3	Present activity in brief	Cold Storage/Modified Storage/Frozen Food Storage
4	Total capacity of chamber	3266 MT (based on Potato capacity)
5	Type of Construction	---
a	Type of external walls of Cold Chambers	250 mm brick wall with PUF insulation
b	Type of Internal/Partition walls	---
c	Type of Roof/Ceiling	---
d	Type of Internal structure/Racks	---
e	Type of Mezzanine grafting	---
f	Type of Lighting fixtures in cold Chambers	---
g	Type of Lighting fixtures in Process and Other areas	---
6	Insulation and Vapour barriers	---
i	External	150mm PUF insulation with A1 Foil of 50 microns as barrier
a	Type of Material	---
b	Relevant IS code	---
c	Density	---
d	Thermal conductivity at +10 deg cel	---
ii	Internal	---
a	Type of Material	---
b	Relevant IS code	---
c	Density	---
d	Thermal conductivity at +10 deg cel	---
iii	Ceiling/Roof	---

a	Type of Material	---
b	Relevant IS code	---
c	Density	---
d	Thermal conductivity at +10 deg cel	---
iv	Floor	---
a	Type of Material	---
b	Relevant IS code	---
c	Density	---
d	Thermal conductivity at +10 deg cel	---
7	Material Handling	Manual
a	Material Handling procedures and equipments	---
b	Cap of Electric elevator	---
	Rating of motor	---
c	Any other device	---
8	Grading, sorting, washing and packing line	Manual
a	Process line	---
b	Total connected load	---
9	Cooling system	---
a	Type of refrigerant	Three compress each having cooling capacity of 153.6 KW and Three more compress each having cooling capacity of 233.19 KW against the maximum the maximum demand of heat load of 538.3 KW which is not seems justified. Similarly 17 cooling coils having total cooling capacity of 725.68 KW is proposed against the maximum demand of heat load of 538.3 KW which is again not seems justified.
b	Type of system	---
c	Type of compressor	---
d	Type of condenser	---
e	Type of cooling coil	---
10	Compressor detail	---
a1	Compressor make & model	KC3 175 HP
b1	Compressor	85

	RPM/AMP	
c1	Refrigeration capacity	---
a2	Compressor make & model	KC 3/60 HP
b2	Compressor RPM/AMP	60
c2	Refrigeration capacity	---
a3	Compressor make & model	KC 31/60 HP
b3	Compressor RPM/AMP	58
c3	Refrigeration capacity	---
a4	Compressor make & model	KC 21/40 HP
b4	Compressor RPM/AMP	42
c4	Refrigeration capacity	---

1	Name of cold storage	M/s Shree Radhey Intrlogistics India Ltd., Raipur Chattisgarh
2	Type of Company	Pvt. Ltd. Company
3	Present activity in brief	Cold Storage under CS type -2 (a)
4	Total capacity of chamber	6240 MT
5	Type of Construction	---
a	Type of external walls of Cold Chambers	PUF Pnael 120 mm
b	Type of Internal/Partition walls	PUF Pnael 120 mm
c	Type of Roof/Ceiling	PUF Pnael 120 mm
d	Type of Internal structure/Racks	XPS 125 mm
e	Type of Mezzanine grafting	---
f	Type of Lighting fixtures in cold Chambers	---
g	Type of Lighting fixtures in Process and Other areas	---
6	Insulation and Vapour barriers	---
i	External	Pre Engineering Building of 100 mm Composite PUF panel and 0.5 mm pre-coated GI sheet with vapour barrier
a	Type of Material	---
b	Relevant IS code	---
c	Density	---
d	Thermal conductivity at +10 deg cel	---
ii	Internal	---
a	Type of Material	---
b	Relevant IS code	---
c	Density	---
d	Thermal conductivity at +10 deg cel	---
iii	Ceiling/Roof	---
a	Type of Material	---
b	Relevant IS code	---
c	Density	---
d	Thermal conductivity at +10 deg cel	---
iv	Floor	---
a	Type of Material	---

b	Relevant IS code	---
c	Density	---
d	Thermal conductivity at +10 deg cel	---
7	Material Handling	---
a	Material Handling procedures and equipments	Manual
b	Cap of Electric elevator	---
	Rating of motor	---
c	Any other device	---
8	Grading, sorting, washing and packing line	Manual arrangement
a	Process line	---
b	Total connected load	---
9	Cooling system	---
a	Type of refrigerant	Ammonia refrigeration system with over feed system with compressor, Cooling coil and condenser is proposed
b	Type of system	---
c	Type of compressor	---
d	Type of condenser	---
e	Type of cooling coil	---
10	Compressor detail	---
a1	Compressor make & model	450XL 450XL 450XL
b1	Compressor RPM	970
c1	Refrigeration capacity	189.98 KW/UNIT
a2	Compressor make & model	450XL 450XL 450XL
b2	Compressor RPM	---
c2	Refrigeration capacity	160 KW/UNIT

1	Name of cold storage	M/s Anika Food & Beverages, Raipur, Chattisgarh
2	Type of Company	Proprietary Firm
3	Present activity in brief	Cold Storage under CS type-2
4	Total capacity of chamber	5987.37
5	Type of Construction	---
a	Type of external walls of Cold Chambers	PUF Panel 120 mm
b	Type of Internal/Partition walls	PUF Panel 1250 mm
c	Type of Roof/Ceiling	PUF Panel 120 mm
d	Type of Internal structure/Racks	XPS 125 mm
e	Type of Mezzanine grafting	---
f	Type of Lighting fixtures in cold Chambers	---
g	Type of Lighting fixtures in Process and Other areas	---
6	Insulation and Vapour barriers	Composite PUF panel of 120 and 100 mm with metal sheet as vapour barrier
i	External	---
a	Type of Material	---
b	Relevant IS code	---
c	Density	---
d	Thermal conductivity at +10 deg cel	---
ii	Internal	---
a	Type of Material	---
b	Relevant IS code	---
c	Density	---
d	Thermal conductivity at +10 deg cel	---
iii	Ceiling/Roof	---
a	Type of Material	---
b	Relevant IS code	---
c	Density	---
d	Thermal conductivity at +10 deg cel	---
iv	Floor	---
a	Type of Material	---
b	Relevant IS code	---
c	Density	---
d	Thermal conductivity at +10 deg cel	---
7	Material Handling	---
a	Material Handling procedures and	Manual

	equipments	
b	Cap of Electric elevator	---
	Rating of motor	---
c	Any other device	---
8	Grading, sorting, washing and packing line	---
a	Process line	Manual
b	Total connected load	---
9	Cooling system	---
a	Type of refrigerant	Ammonia
b	Type of system	Over feed with compressor, condenser and cooling coil
c	Type of compressor	---
d	Type of condenser	---
e	Type of cooling coil	---
10	Compressor detail	---
a1	Compressor make & model Kirlosker	Kirlosker KC 3
b1	Compressor RPM	1000
c1	Refrigeration capacity@ $\pm 2/38$ Deg C.	361 KW
a2	Compressor make & model Kirlosker	Kirlosker KC 3
b2	Compressor RPM	1000
c2	Refrigeration capacity @ $\pm 2/38$ Deg C.	361 KW
a3	Compressor make & model Kirlosker	Kirlosker KC 3
b3	Compressor RPM	1000
c3	Refrigeration capacity @ $\pm 2/38$ Deg C.	361 KW



1	Name of cold storage	R. S. Cold & ware houses, Shajapur, Madhya Pradesh
2	Type of Company	Partnership Firm
3	Present activity in brief	Cold Storage (i.e. type-1)
4	Total capacity of chamber	5800 MT
5	Type of Construction	---
a	Type of external walls of Cold Chambers	RBC
b	Type of Internal/Partition walls	PUF Sandwiched metal skin panel.
c	Type of Roof/Ceiling	Steel structured profitted sheet roofing
d	Type of Internal structure/Racks	PUF Sandwiched metal skin panel.
e	Type of Mezzanine grafting	Hard wood challies
f	Type of Lighting fixtures in cold Chambers	---
g	Type of Lighting fixtures in Process and Other areas	---
6	Insulation and Vapour barriers	---
i	External	120mm thick
a	Type of Material	EPS (3 layersx40thk)
b	Relevant IS code	15 for EPS 1.75 for PUF
c	Density	15 for EPS 1.75 for PUF
d	Thermal conductivity at +10 deg cel	---
ii	Internal	80mm thick
a	Type of Material	PUF (1 Layer)
b	Relevant IS code	---
c	Density	15 for EPS & 1.75 for PUF
d	Thermal conductivity at +10 deg cel	---
iii	Ceiling/Roof	150mm thk
a	Type of Material	PUFP (1 Layer)
b	Relevant IS code	---
c	Density	15 for EPS & 1.75 for PUF
d	Thermal conductivity at +10 deg cel	---
iv	Floor	80mm thick
a	Type of Material	EPS (2 layersx40thick)
b	Relevant IS code	---
c	Density	---
d	Thermal conductivity at +10 deg cel	---
7	Material Handling	---
a	Material Handling procedures and equipments	Semi automatic 1000/ 3.7KW
b	Cap of Electric elevator	---

	Rating of motor	---
c	Any other device	---
8	Grading, sorting, washing and packing line	---
a	Process line	Manual
b	Total connected load	---
9	Cooling system	---
a	Type of refrigerant	Ammonia
b	Type of system	Flooded
c	Type of compressor	Reciprocating
d	Type of condenser	Atmospheric
e	Type of cooling coil	Ceiling suspended
10	Compressor detail	---
a1	Compressor make & model	Kirlosker KC-3 (Three)
b1	Compressor RPM	750
c1	Refrigeration capacity	28.3 KW At 2/35 °C
a2	Compressor make & model	KC-3
b2	Compressor RPM	750
c2	Refrigeration capacity	239.69 KW at -2/35°C
a3	Compressor make & model	KC-3
b3	Compressor RPM	750
c3	Refrigeration capacity	225 KW

1	Name of cold storage	Mis Kaveri Cold Storage, Khandwa, Madhya Pradesh
2	Type of Company	Partnership Firm
3	Present activity in brief	Type multi Chamber CS with Mezzanine floor
4	Total capacity of chamber	9862 MT
5	Type of Construction	---
a	Type of external walls of Cold Chambers	100 MM PUF Pannel
b	Type of Internal/Partition walls	100 MM PUF Pannel
c	Type of Roof/Ceiling	100 MM PUF Pannel
d	Type of Internal structure/Racks	Steel Column and beams
e	Type of Mezzanine grafting	Wooden Batten Grating
f	Type of Lighting fixtures in cold Chambers	---
g	Type of Lighting fixtures in Process and Other areas	---
6	Insulation and Vapour barriers	---
i	External	---
a	Type of Material	PUF thickness 100mm
b	Relevant IS code	---
c	Density	40 kg cumt
d	Thermal conductivity at +10 deg cel	---
ii	Internal	---
a	Type of Material	PUF 100 mm
b	Relevant IS code	---
c	Density	40 kg cumt
d	Thermal conductivity at +10 deg cel	---
iii	Ceiling/Roof	---
a	Type of Material	PUF 100 mm 1 Layer
b	Relevant IS code	---
c	Density	40 kg cumt
d	Thermal conductivity at +10 deg cel	---
iv	Floor	---
a	Type of Material	PUF 100 mm 2 Layers of 50 + 50m.
b	Relevant IS code	---
c	Density	40 kg cumt
d	Thermal conductivity at +10 deg cel	---
7	Material Handling	---
a	Material Handling procedures and equipments	Manual
b	Cap of Electric elevator	---

	Rating of motor	---
c	Any other device	---
8	Grading, sorting, washing and packing line	---
a	Process line	Manual
b	Total connected load	---
9	Cooling system	---
a	Type of refrigerant	Ammonia
b	Type of system	Direct expansion
c	Type of compressor	Reciprocating
d	Type of condenser	Atmospheric
e	Type of cooling coil	Ceiling suspended
10	Compressor detail	---
a1	Compressor make & model	Mycon /Kirlosker Equivalnet-3 Nos. (2 Wat+1 SB)
b1	Compressor RPM	1280
c1	Refrigeration capacity	75 KW. - 327 KW at (-) 2.5°C /136 °C

1	Name of cold storage	M/s Chakadola Shital Bhandar, Cuttack, Odisha
2	Type of Company	Partnership Firm
3	Present activity in brief	Cold Storage
4	Total capacity of chamber	9982.37 MT
5	Type of Construction	Bricks wall with RCC Beam and column and with wooden grating
a	Type of external walls of Cold Chambers	
b	Type of Internal/Partition walls	
c	Type of Roof/Ceiling	
d	Type of Internal structure/Racks	
e	Type of Mezzanine grafting	
f	Type of Lighting fixtures in cold Chambers	
g	Type of Lighting fixtures in Process and Other areas	
6	Insulation and Vapour barriers	EPS as thermal insulation material metal sheet as vapour barrier and metal coated sheet for cladding
i	External	
a	Type of Material	
b	Relevant IS code	
c	Density	
d	Thermal conductivity at +10 deg cel	---
ii	Internal	
a	Type of Material	
b	Relevant IS code	
c	Density	
d	Thermal conductivity at +10 deg cel	---
iii	Ceiling/Roof	
a	Type of Material	
b	Relevant IS code	
c	Density	
d	Thermal conductivity at +10 deg cel	---
iv	Floor	
a	Type of Material	
b	Relevant IS code	
c	Density	
d	Thermal conductivity at +10 deg	

	cel	
7	Material Handling	Manual arrangement
a	Material Handling procedures and equipments	
b	Cap of Electric elevator	
	Rating of motor	
c	Any other device	
8	Grading, sorting, washing and packing line	Manual arrangement
a	Process line	
b	Total connected load	
9	Cooling System	---
a	Type of refrigerant	Ammonia
b	Type of system	Gravity feed
c	Type of compressor	---
d	Type of condenser	Air Cooled Condenser
e	Type of cooling coil	---
10	Compressor detail	---
a1	Compressor make & model	Kirlosker KC-3
b1	Compressor RPM	850
c1	Refrigeration capacity	264 KW
a2	Compressor make & model	KC-4
b2	Compressor RPM	950
c2	Refrigeration capacity	465 KW
a3	Compressor make & model	Accessal SMC - 128
b3	Compressor RPM	850
c3	Refrigeration capacity	580 KW
a4	Compressor make & model	Kirlosker KC-4
b4	Compressor RPM	---
c4	Refrigeration capacity	---

1	Name of cold storage	M/s Suryadeep Multi Porpose Cold Storage, District, Hubli, West Bengal
2	Type of Company	Partnership Firm
3	Present activity in brief	Cold Storage
4	Total capacity of chamber	3820 MT
5	Type of Construction	Bricks wall with PUF panel of 100mm
a	Type of external walls of Cold Chambers	---
b	Type of Internal/Partition walls	---
c	Type of Roof/Ceiling	---
d	Type of Internal structure/Racks	---
e	Type of Mezzanine grafting	---
f	Type of Lighting fixtures in cold Chambers	---
g	Type of Lighting fixtures in Process and Other areas	---
6	Insulation and Vapour barriers	---
i	External	PUF as thermal insulation for external wall , Internal
a	Type of Material	Wall, Roof and Floor
b	Relevant IS code	---
c	Density	---
d	Thermal conductivity at +10 deg cel	---
ii	Internal	Alumuium foil as vapour barries and GI sheet as cladding
a	Type of Material	---
b	Relevant IS code	---
c	Density	---
d	Thermal conductivity at +10 deg cel	---
iii	Ceiling/Roof	
a	Type of Material	---
b	Relevant IS code	---
c	Density	---
d	Thermal conductivity at +10 deg cel	---
iv	Floor	
a	Type of Material	---
b	Relevant IS code	---
c	Density	---
d	Thermal conductivity at +10 deg cel	---

7	Material Handling	Hand pallet truck
a	Material Handling procedures and equipments	---
b	Cap of Electric elevator	---
	Rating of motor	---
c	Any other device	---
8	Grading, sorting, washing and packing line	Manual arrangement
a	Process line	---
b	Total connected load	---
9	Cooling system	Freon based gravity feed system with compressor cooling coil and air cool condenser
a	Type of refrigerant	---
b	Type of system	---
c	Type of compressor	---
d	Type of condenser	---
e	Type of cooling coil	---
10	Compressor detail	---
a1	Compressor make & model	Blue Star RUAH
b1	Compressor RPM	3000
c1	Refrigeration capacity	---
a2	Compressor make & model	Blue Star RUAH-05-8012 & HG-34/E/380
b2	Compressor RPM	---
c2	Refrigeration capacity	---
a3	Compressor make & model	HG35E/380
b3	Compressor RPM	3000
c3	Refrigeration capacity	75000 BTW/Hrs. to 145000 VTW/Hrs.



1	Name of cold storage	Vani Venketeswara Cold Storage, Kurnool (Andhra Pradesh)
2	Type of Company	Partnership Firm
3	Present activity in brief	Cold Storage (CS Type)
4	Total capacity of chamber	5499 MT
5	Type of Construction	Bricks wall with wooden mezzaine floor and EPS as thermal insulation
a	Type of external walls of Cold Chambers	---
b	Type of Internal/Partition walls	---
c	Type of Roof/Ceiling	---
d	Type of Internal structure/Racks	---
e	Type of Mezzanine grafting	---
f	Type of Lighting fixtures in cold Chambers	---
g	Type of Lighting fixtures in Process and Other areas	---
6	Insulation and Vapour barriers	EPS as thermal insulation and 0.5mm sheet for vapour barrier. FRP/GP Sheet for cladding
i	External	---
a	Type of Material	---
b	Relevant IS code	---
c	Density	---
d	Thermal conductivity at +10 deg cel	---
ii	Internal	---
a	Type of Material	---
b	Relevant IS code	---
c	Density	---
d	Thermal conductivity at +10 deg cel	---
iii	Ceiling/Roof	---
a	Type of Material	---
b	Relevant IS code	---
c	Density	---
d	Thermal conductivity at +10 deg cel	---
iv	Floor	---
a	Type of Material	---
b	Relevant IS code	---
c	Density	---
d	Thermal conductivity at +10 deg cel	---

7	Material Handling	Manual
a	Material Handling procedures and equipments	---
b	Cap of Electric elevator	---
	Rating of motor	---
c	Any other device	---
8	Grading, sorting, washing and packing line	Manual
a	Process line	---
b	Total connected load	---
9	Cooling system	---
a	Type of refrigerant	Ammonia
b	Type of system	Gravity Feed
c	Type of compressor	Compressor cooling coil and condenser
d	Type of condenser	---
e	Type of cooling coil	---
10	Compressor detail	---
a1	Compressor make & model	MEFLASE/300
b1	Compressor RPM	1000
c1	Refrigeration capacity	---
a2	Compressor make & model	450 XL 162 XL
b2	Compressor RPM	750
c2	Refrigeration capacity	---
a3	Compressor make & model	450XL 162 XL
b3	Compressor RPM	750
c3	Refrigeration capacity	---

1	Name of cold storage	M/s Kamali Cold Storage Pvt Ltd. Prakaram (Andhra Pradesh)
2	Type of Company	Pvt. Ltd. Company
3	Present activity in brief	Cold Storage
4	Total capacity of chamber	4897.383MT
5	Type of Construction	---
a	Type of external walls of Cold Chambers	300mm bricks wall with sand cement plaster
b	Type of Internal/Partition walls	230mm bricks wall with sand cement plaster
c	Type of Roof/Ceiling	180mm RCC roof
d	Type of Internal structure/Racks	RCC coloums and beams
e	Type of Mezzanine grafting	wooden batten grading
f	Type of Lighting fixtures in cold Chambers	---
g	Type of Lighting fixtures in Process and Other areas	---
6	Insulation and Vapour barriers	---
i	External	150mm EPS for external wall
a	Type of Material	---
b	Relevant IS code	---
c	Density	20 KG M <sup>3</sup>
d	Thermal conductivity at +10 deg cel	---
ii	Internal	---
a	Type of Material	80mm EPS
b	Relevant IS code	---
c	Density	20 KG M <sup>3</sup>
d	Thermal conductivity at +10 deg cel	---
iii	Ceiling/Roof	---
a	Type of Material	150mm EPS for ceiling
b	Relevant IS code	---
c	Density	---
d	Thermal conductivity at +10 deg cel	---
iv	Floor	---
a	Type of Material	125mm EPS
b	Relevant IS code	---

c	Density	---
d	Thermal conductivity at +10 deg cel	---
7	Material Handling	Received in unloading area in trucks and kept in ante room for 24 Hrs and stored in chambers manually with lift support
a	Material Handling procedures and equipments	---
b	Cap of Electric elevator	---
	Rating of motor	---
c	Any other device	---
8	Grading, sorting, washing and packing line	---
a	Process line	Unloading area ante room manual storing total connected load 140 kg
b	Total connected load	---
9	Cooling system	---
a	Type of refrigerant	Ammonia
b	Type of system	Direct expansion
c	Type of compressor	Reciprocating
d	Type of condenser	Atmospheric
e	Type of cooling coil	Floor mounted
10	Compressor detail	---
a1	Compressor make & model	SRA-300
b1	Compressor RPM	850
c1	Refrigeration capacity	---
a2	Compressor make & model	SRA-200
b2	Compressor RPM	650
c2	Refrigeration capacity	---
a3	Compressor make & model	SRA - 300
b3	Compressor RPM	750
c3	Refrigeration capacity	---

1	Name of cold storage	M/s Runwal Agritech, Bijapur, Karnataka
2	Type of Company	partnership firm
3	Present activity in brief	Cold Storage
4	Total capacity of chamber	3760.28MT
5	Type of Construction	---
a	Type of external walls of Cold Chambers	PUF Panel
b	Type of Internal/Partition walls	PUF Panel
c	Type of Roof/Ceiling	PUF Panel
d	Type of Internal structure/Racks	Rack Steel
e	Type of Mezzanine grafting	MS square tubes
f	Type of Lighting fixtures in cold Chambers	---
g	Type of Lighting fixtures in Process and Other areas	---
6	Insulation and Vapour barriers	---
i	External	---
a	Type of Material	PUF metal skin 0.5mm
b	Relevant IS code	180 GSM of Zinc. Thickness not mentioned
c	Density	40+2kg M3
d	Thermal conductivity at +10 deg cel	0.020 /MK
ii	Internal	---
a	Type of Material	0.5 mm colour coated polyster hotdip galvanized 80mm thick /
b	Relevant IS code	
c	Density	---
d	Thermal conductivity at +10 deg cel	---
iii	Ceiling/Roof	---
a	Type of Material	0.5 mm colour coated polyster hotdip galvanized 80mm thick
b	Relevant IS code	---
c	Density	---
d	Thermal conductivity at +10 °C	---
iv	Floor	---
a	Type of Material	0.5 mm color coated polyster hotdip galvanized 100mm thick
b	Relevant IS code	---
c	Density	40-2kg M <sup>3</sup>
d	Thermal conductivity at +10 °C	0.020 /MK

7	Material Handling	---
a	Material Handling procedures and equipments	Palex
b	Cap of Electric elevator	4 Kw
	Rating of motor	---
c	Any other device	---
8	Grading, sorting, washing and packing line	---
a	Process line	---
b	Total connected load	---
9	Cooling system	---
a	Type of refrigerant	Ammonia
b	Type of system	Pump Circulation
c	Type of compressor	Screw
d	Type of condenser	Evaporative
e	Type of cooling coil	forced draft (Ceiling suspended)
10	Compressor detail	---
a1	Compressor make & model	Bitzer make (two)
b1	Compressor RPM	2950 RPM
c1	Refrigeration capacity	143.2 KW at (5/40 °C)
a2	Compressor make & model	Bitzer make (two)
b2	Compressor RPM	2950 RPM
c2	Refrigeration capacity	175.3 KW at 0/40 °C)

1	Name of cold storage	M/s N S Rathinam & Sons Pvt. Ltd., Thadicombu, Dindgul, Tamilnadu
2	Type of Company	Pvt. Ltd.
3	Present activity in brief	Cold Storage
4	Total capacity of chamber	8450MT
5	Type of Construction	---
a	Type of external walls of Cold Chambers	Pre fabricated sandwiched PUF panel 120mm thick
b	Type of Internal/Partition walls	Pre fabricated sandwiched PUF panel 100mm thick
c	Type of Roof/Ceiling	Pre fabricated sandwiched PUF panel 120mm thick
d	Type of Internal structure/Racks	100mm PUF + Vapour barriers above PCC flooring finished with RCC/VDF
e	Type of Mezzanine grafting	---
f	Type of Lighting fixtures in cold Chambers	Weather proof light fitting IP 65 degree of protection
g	Type of Lighting fixtures in Process and Other areas	Weather proof light fitting IP 65 degree of protection
6	Insulation and Vapour barriers	---
i	External	---
a	Type of Material	PUF composite panels
b	Relevant IS code	IS 12436
c	Density	40+-2 kg m3
d	Thermal conductivity at +10 deg cel	0.021 W/mK
ii	Internal	---
a	Type of Material	PUF composite panels
b	Relevant IS code	IS 12436
c	Density	40+-2 kg m3
d	Thermal conductivity at +10 deg cel	0.021 W/mK
iii	Ceiling/Roof	---
a	Type of Material	PUF composite panels
b	Relevant IS code	IS 12436
c	Density	40+-2 kg m3
d	Thermal conductivity at +10 deg cel	0.021 W/mK
iv	Floor	---
a	Type of Material	PUF composite panels

b	Relevant IS code	IS 12436
c	Density	40+2 kg m <sup>3</sup>
d	Thermal conductivity at +10 deg cel	0.021 W/mK
7	Material Handling	---
a	Material Handling procedures and equipments	Forklifts with lift height of 7.5m and weight of 1200 kg at that height will be used for lifting and positioning th bulk bins
b	Cap of Electric elevator	---
	Rating of motor	---
c	Any other device	Battery Operators Stackers and Pallet truck to be used for lower height
8	Grading, sorting, washing and packing line	---
a	Process line	Automatic, sorting, grading & waxing line with 5MT/Hr
b	Total connected load	28 Kw
9	Cooling system	---
a	Type of refrigerant	Freon
b	Type of system	Direct EXP
c	Type of compressor	Reciprocating
d	Type of condenser	Aircooled
e	Type of cooling coil	Ceiling suspended
10	Compressor detail	---
a1	Compressor make & model	Voltage 4922.2 Y40P (16)
b1	Compressor RPM	1450
c1	Refrigeration capacity	± 2/38 Deg. C
a2	Compressor make & model	Control by High & Low pressure
b2	Compressor RPM	1450
c2	Refrigeration capacity	± 2/38 Deg. C



**Annexure -II : List of Nurseries Covered  
with Details**

## Annexure-II

## List of Nurseries Covered with Details

State	S. No	Name of Nursery	Details of Mother Plant										Method of Propagation	N. Rating	Remarks
			Fruit 1	No.	Fruit 2	No.	Fruit 3	No.	Fruit 4	No.	Fruit 5	No.			
Jammu & Kashmir	1	CITH, K.D. Farm, Old Field, Rangreth, Srinagar	Apple	120	Almond Walnut	80, 130	Cherry	63	Peach	48	Apricot Pulam	40 24	Budding	4	20-25 Year
	2	Lone Nursery	Apple	1100									Budding	2	15-20 Year
	3	Govt. Fruit Plant Nursery	Apple	1200	Pear	300	Walnut	390					Budding	2	16-20 Year
	4	Fruit Plant Nursery, Harwan	Apple	1210	Apricot	40	Cherry	302	Pulan	80	Walnut	40	By Budding	2	5-20 Year
	5	Gularoo Fruit Plant Nursery	Apple	1000	Walnut	300	Apricot	100	Pear	100			Budding	2	15-19 Year
	6	Moghal e Azam	Apple	75									Budding	2	15-20 Year
	7	Intergrated Multi Crop Nursery, Vijaypur	Mango	185	Guava	260	Anola	31	Litchi	12	Pears Peach	9 27	Budding, Veneer, Inarching, Air Layering	2	10-40 Year

8	Ramzan Nursery	Apple	125									Budding	2	16-20 Year
9	Hilal Nurseries	Apple	90	Pears	50	Plum	10					Budding	2	15-20 Year
10	Manzoor Nursery	Apple	35	Pears	15							Budding	2	8-12 Year
11	A. R. Nurseries	Apple	102	Pears	50	Plum	10					Budding	3	15-20 Year
12	Reshi Nurseries	Apple	350	Pears	50							Budding	2	6-20 Year
13	Nazir Nurseries	Apple	100	Pears	45	Plum	15					Budding	2	15-20 Year 5-8 Year
14	New Sri Laxmi Nursery	Mango	50	Guava	20	Litchi	15	Pomegranate	15			Veneer, Budding, Inarching	2	20 Year
15	Green Field Nursery	Mango	50	Anola	20	Citrus	75					Veneer Grafting, Budding, Seed	2	7-10 Year
16	Dar Nursery	Apple	50	Pears	30	Apricot	20					Budding	2	15-20 Year
17	Parray Nursery	Apple	100									By Budding	2	12 Year

	18	Ketriteng Nursery	Apple	900	Cherry	100							Budding	2	15- Year
	19	Mughal e Azam Nursery	Apple	780									Budding	2	20 Year
	20	Fruit Plant Nursery, Chogal	Apple	298	Pears	297	Plum	70	Kiwi	148			Budding	2	12-15 Year
	21	Classic Nurseries	Apple	100									Budding	2	10-15 Year
	22	Falak Nursery	Apple	500	Pulam	280	Apricot	130					Budding	2	15-20 Year
	23	Hi-tech Mother fruit plant nursery (SKUAST-kasmir)	Apple	1200	Pears	300	Cherry	50	Peach	50	Walnut	200	Budding	1	10-20 Year
	24	Bakhtawar Seeds & Plants	Apple	75									Budding	3	7-8 Year
	25	Fiyaz Nurseries	Apple	120									Budding	2	6-15 Year

State Wise List of Nurseries Covered and Details															
State	S. No	Name of Nursery	Details of Mother Plant										Method of Propagation	N. Rating	Remarks
			Fruit 1	No.	Fruit 2	No.	Fruit 3	No.	Fruit 4	No.	Fruit 5	No.			
Himachal Pradesh	1	Shipra Nursery	Apple	510	Pomegranate	90							Budding	3	5-6 Year
	2	Fruit Nursey, Regional Horticulture Research Station	Apple	2000	Chery	300							Budding	4	42 Year
	3	Deptt. Of Horticulture Nursery	Apple	210	Peach	1185	Apricot	560	Litchi	210	Pea Nut, Guava	450,150	Budding, Air layering, Inarching	4	4-14 Year
	4	Fruit Nursery, Dept of Fruit Science	Apple	330	Stone Fruit	120							Budding	4	35-40 Year
	5	Fruit Nursey, Regional Horticultural Research Station	Mango	420	Citrus	1200	Litchi	182	Guava	120			Veneer Grafting, Air Layering	3	32 Year
	6	Parmar University, Dhaulakuan	Mango	390	Citrus	800	Litchi	180	Guava	120			Veneer Grafting, Air Layering	3	40-42 Year

	7	Nursery Of PCDO, Kwagdhar	Apple	150	Peach	800							Budding	3	45 Year
	8	Janta Nursery	Mango	6000	Litchi	90	Guava	200	Anola	10	Kinnow	80	Veneer Grafting, Air Layering	3	10-30 Year,5- 10 Year,5-10 Year
	9	Mehta Nursery	Apple	615	Pear	200							Grafting, Budding	3	4-5 Year, A5- 20 Year
	10	Matiyaik Nursery	Apple	200									Budding	3	6-8 Year
	11	Fruit Nursery RHRS Mashobra	Apple	48	Stone Fruit	150	Tempert Fruit	900					Budding	3	16-20 Year
	12	Progeny Cum Demonstration Orchards Bajaura	Apple	700	Pear	400	Cheery	56					Budding	4	38 Year
	13	Fruit Nursey Regional Horticultural Research Stat.	Apple	70	Apricot	220	Orange	230	Peach, Kiwi	200	Walnut Pecan Nut	10 25	Budding, Seed	3	8-40 Year
	14	Regional Horticultural Research Sub- station, Tabo	Apple	150	Pear	80	Apricot	60	Cheery	60			Budding	3	40 Year

State Wise List of Nurseries Covered and Details															
State	S. No	Name of Nursery	Details of Mother Plant										Method of Propagation	Rating	Remarks
			Fruit 1	No.	Fruit 2	No.	Fruit 3	No.	Fruit 4	No.	Fruit 5	No.			
Haryana	26	Govt. Garden & Nursery,	Mango	274	Sapota	115	Litchi	35					Veneer Grafting, Air layering, Budding	3	20-39 Year
	27	Centre of Excellence for fruits	Kinnow	264	Citrus	84	Pine Apple	90	Mango	84			Air Layering, Mount Layering, Grafting	4	3-6 Year
Punjab	28	Fruit Plan nursery, Department of Horticulture	Citrus	188	Pear	172	Guava	220	Plum	112			Seeds, Inarching, Budding	4	3-8 Year
	29	Shankar Nursery	Kinnow	90	Citrus	80							Layering, Seed, Budding	3	4 Year
	30	Manjit Fruit Nursery	Kinnow	141	Sapota	12	Lemon	30	Jack Fruit	10	Malta	12	Air layering, Cutting	3	80- Year
	31	Parmjit Nursery	Lemon	15	Kinnow	150							Air layering, Cutting	3	60- Year
	32	PAU. Regional Research Station,	Kinnow	100	Sweet Orange	10	Grape Fruit	10	Lemon	10	Ber, Guava	10	Air layering, Seed, Budding	3	
Uttarakhand	33	Nirmal Nursery	Mango	116	Guava	27	Pomegr anate	133	Litchi	15			Veneer Grafting, Seed, Air layering	2	3-35 Year
	34	Rajkiya Paudhshala, Kaladhungi	Mango	139	Litchi	128							Veneer/Croft Grafting, Air layering	2	25-27 Year 9-60 Year

	35	Usha Nursery	Apple	180									Budding	2	16-17 Year
	36	Rukmani Nursery	Apple	230	Apricot	55	Kiwi	17	Peach	14			Budding, Seed	2	15-20 Year
	37	Narayani Nakshatra Paudhshala	Apple	139	Peach	60	Apricot	20					Budding	2	13-15 Year
	38	Govt. Garden Magra	Apple	940	Pear	1311	Peach	10	Walnut	42			Budding	2	20-20 Year



State Wise List of Nurseries Covered and Details															
State	S. No	Name of Nursery	Details of Mother Plant										Method of Propagation	N. Rating	Remarks
			Fruit 1	No.	Fruit 2	No.	Fruit 3	No.	Fruit 4	No.	Fruit 5	No.			
Madhya Pradesh	1	Government Polo Garden Pachmarhi	Mango	1508									Veneer Grafting	3	10-15 Year
	2	Government Garden Matkuli	Mango	2016									Veneer Grafting	3	
	3	Shaskiya Udhan Ropani, Jamuniya	Mango	700	Guava	130	Anola	200	Citrus	560	Pomegranate	200	Grafting, Gootee Seeds Poly Bags	2	5 Year
	4	Shri Guru Kripa Model Nursery	Mango	160	Guava	200	Orange	400	Sweet Citrus	300			Veneer Grafting, Budding, Air Layering	2	9-10 Year
	5	Majitha Floriculture Nursery	Mango	150	Guava	1175	Pomegranate	215	Orange	500	Anola	550	Grafting Gootee Seed, Cutting, Budding	3	9-10 Year
Rajasthan	6	Horticulture Nursery, KVK, Banswara	Mango	550	Aonla	142	Guava	775	Sapota	30			Layering, Grafting, Budding	4	6-26 Year
	7	Nursery of Centre of Excellence, Rajasthan	Olive	6362									Cutting	3	8-9 Year

Uttar Pradesh	8	Central Institute for Sub- tropical Horticulture	Mango	2000	Anola	96	Guava	1800	Bel	55			Veneer, Budding Inarching	4	3-12year 15year
	9	Central Nursery, Govt. Garden	Mango	196	Anola	15	Guava	29	Bel	4	Litchi	55	Veneer Budding Inarching	3	35 Year,17 Year,31 Year
	10	AdarshPaudhshala	Mango	90	Anola	15	Guava	40	Litchi	70			Veneer Grafting, Airlayering Budding, Inarching	4	10 Year,20 Year,44 Year,22 Year
	11	Rajkiya Nursery, Banjaria	Mango	103	Anola	48	Guava	74			Bel	29	Grafting Layering,Budding Inarching	3	35 Year,17 Year,22 Year
	12	Central Nursery, Govt. Garden	Mango	80					Litchi	220	Peach	300	Veneer Grafting, Air Layering, Budding		35 Year, 22 Year, 17 Year
	13	Govt. Nursery GomtaBagh	Mango	60	Anola	62	Citrus	290	Guava	100			Cleft/Veneer Layering, Budding	3	20-25 Year Ago, 10 -15 Year, 20-25 Year Ago
	14	Govt. Nursery Polytechnic	Mango		Anola	35	Bel	4	Guava	100	Citrus	290	Veneer Grafting, Budding, Inarching	3	15-18 Year
	15	Rajkiya Santati Udyan, Malihabad	Mango	330	Guava	67	Anola	10					Veneer Grafting, Seed, Budding	3	15 Year,12 Year

	16	Govt. Nursery, Company Bagh	Mango	151	Litchi	15	Anola	17	Guava	50			Veneer, Air Layering, Budding	3	25 Year, 10 Year, 15 Year
	17	Govt. Nursery, KhusrooBagh	Mango	295	Guav a	662	Anola	78					Veneer Grafting, Budding, Inarching	3	30-40 Year
	18	Green Avadh Nursery	Mango	160	Guav a	300	Citrus	275					Veneer Grafting, Inarching, Seed	2	12-15 Year

State Wise List of Nurseries Covered and Details															
State	S. No	Name of Nursery	Details of Mother Plant										Method of Propagation	N. Rating	Remarks
			Fruit 1	No.	Fruit 2	No.	Fruit 3	No	Fruit 4	No	Fruit 5	No			
Bihar	1	Grow More FoodNursery	Mango	603 5	Litchi	135 0	Guava	55 0					Veneer Grafting, Air Layering, Inarching	2	15-20 Year
	2	Panday Nursery	Mango	575	Litchi	150							Veneer Grafting, Air Layering	2	15-20 Year, 7 Year
	3	Satyam Nursery	Mango	176 6	Litchi	152	Guava	12					Grafting, Gootee/ Air layering, Inarching	2	30-15 Year, 8-12 Year
	4	AdarshPaudhshala	Mango	600	Litchi	15	Guava						Veneer Grafting, Air Layering	3	10-12 Year
Chhattis garh	5	Govt. Horticulture Nursery, Kunjara, Lailunga	Mango	200	Guava	70	Litchi	35	Lemon	80			Veneer/Croft Grafting, Inarching, Air Layering	3	18-20 Year

	6	Govt. Horticulture Nursery, Asna, Dogaghat	Mango	204	Guava	46	Cashew nut	84	Anola	75	Cheeku	25	Croft Grafting, Inarching, Budding	3	15-19 Year
	7	Govt. Horticulture Nursery, Semara	Mango	247	Guava	224	Lemon	120					Veneer & Croft Grafting, Seed	3	34 Year
	8	Govt. Garden, Lalpur	Mango	816	Litchi	45	Guava	49					Veneer & Croft Grafting, Inarching, Air Layering	3	25-30 Year
Jharkhand	9	Phal Udyog Nursery	Mango	1580	Litchi	130	Guava	930	Lemon	120			Veneer & Croft Grafting, Inarching, Air Layering	3	20-25 Year
Odisha	10	MaaTarini Nursery	Mango	415	Guava	30	Lime/ Lemon	90					Veneer Grafting, Inarching, Air Layering	3	8-11 Year
	11	Tulasi Nursery	Mango	2600									Veneer/Croft Grafting	3	8- Year
	12	Malati nursery	Mango	1200									Veneer	2	8-9 Year
	13	Kuanr Farm, Keonjhar	Mango	3704									Veneer	2	20- Year
	14	Trupty Orchards	Mango	2994	Cashew Nut	5196							Veneer Seed	3	5-18 Year

West Bengal	15	Mahima Nursery	Mango	300								Veneer	2	14- Year
	16	Jena Udyan Nursery	Mango	400								Veneer Grafting	2	6-9 Year
	17	Labanyagarh Farm	Mango	667								Veneer Grafting	2	8-10 Year
	18	Kajamba Nursery	Mango	660	Cashew	600						Veneer & Seed	2	9-10 Year
	19	Fruit Nursery,Sambalpur	Mango	183								Veneer Grafting & Croft Grafting	3	7- Year
	20	Hara Priya Nursery	Mango	900 0								Veneer Grafting	3	8-10 Year
	21	Amit Bikram Model Nursery.	Mango	210 4								Veneer Grafting	3	5-6 Year
	22	Shakti Nursery	Mango	635			Lemon	60				Veneer, Seed	3	11-14 Year
	23	Asiana Nursery	Mango	184 8	Guava	101	Lime	70 0				Veneer, Inarching, Air Layering, Seed	3	6-13 Year
West Bengal	24	New Nadia Nursery	Mango	304	Guava	195	Litchi	41	Lime	25		Veneer, Inarching, Air Layering, Seed	3	7-14 Year

	25	Purnima Nursery	Mango	310	Guava	200	Litchi	200	Sapota	30	Lime	100	Veneer, Inarching, Air Layering, Seed	2	15-30 Year
	26	Madhabi Nursery	Mango	200	Guava	50	Litchi	120	Lemon	200			Veneer, Inarching, Air Layering, Seed	2	12-20 Year
	27	National Nursery & Agri Farm	Mango	900	Guava	1300	Litchi	300	Lemon	200	Sweet Orange	100	Veneer, Air layering, Inarching, Seed	3	8-12 Year
	28	New Deshpran Nursery & Agricultural Farm	Mango	1400	Guava	800	Lemon	700	Litchi	200	Sapota	200	Veneer Grafting	3	7-14 Year
	29	Asiatic Horticultural Farm	Mango	150	Guava	100	Sapota	100					Veneer Grafting, Inarching	2	5-15 Year
	30	Deb Narayan Garden	Mango	100	Guava	50	Pears	25	Wood Apple	25			Veneer Grafting	2	5-15 Year

State Wise List of Nurseries Covered and Details															
State	S. No	Name of Nursery	Details of Mother Plant										Method of Propagation	N. Rating	Remarks
			Fruit 1	No.	Fruit 2	No.	Fruit 3	No.	Fruit 4	No.	Fruit 5	No.			
Madhya Pradesh	1	Government Polo Garden Pachmarhi	Mango	1508									Veneer Grafting	3	10-15 Year
	2	Government Garden Matkuli	Mango	2016									Veneer Grafting	3	
	3	ShaskiyaUdhanRopani, Jamuniya	Mango	700	Guava	130	Anola	200	Citrus	560	Pomegranate	200	Grafting, Gootee Seeds Poly Bags	2	5 Year
	4	Shri Guru Kripa Model Nursery	Mango	160	Guava	200	Orange	400	Sweet Citrus	300			Veneer Grafting, Budding, Air Layering	2	9-10 Year
	5	Majitha Floriculture Nursery	Mango	150	Guava	1175	Pomegranate	215	Orange	500	Anola	550	Grafting Gootee Seed, Cutting, Budding	3	9-10 Year
Rajasthan	6	HorticultureNursery, KVK, Banswara	Mango	550	Aonla	142	Guava	775	Sapota	30			Layering, Grafting, Budding	4	6-26 Year
	7	Nursery of Centre of Excellence, Rajasthan	Olive	6362									Cutting	3	8-9 Year

Uttar Pradesh	8	Central Institute for Sub- tropical Horticulture	Mango	2000	Anola	96	Guava	1800	Bel	55			Veneer, Budding Inarching	4	3-12year 15year
	9	Central Nursery, Govt. Garden	Mango	196	Anola	15	Guava	29	Bel	4	Litchi	55	Veneer Budding Inarching	3	35 Year,17 Year,31 Year
	10	AdarshPaudhshala	Mango	90	Anola	15	Guava	40	Litchi	70			Veneer Grafting, Air layering Budding, Inarching	4	10 Year,20 Year,44 Year,22 Year
	11	Rajkiya Nursery, Banjaria	Mango	103	Anola	48	Guava	74			Bel	29	Grafting Layering, Budding Inarching	3	35 Year,17 Year,22 Year
	12	Central Nursery, Govt. Garden	Mango	80					Litchi	220	Peach	300	Veneer Grafting, Air Layering, Budding		35 Year, 22 Year, 17 Year
	13	Govt. Nursery GomtaBagh	Mango	60	Anola	62	Citrus	290	Guava	100			Cleft/Veneer Layering, Budding	3	20-25 Year Ago, 10 - 15 Year, 20-25 Year Ago
	14	Govt. Nursery Polytechnic	Mango		Anola	35	Bel	4	Guava	100	Citrus	290	Veneer Grafting, Budding, Inarching	3	15-18 Year
	15	RajkiyaSantatiUdyan, Malihabad	Mango	330	Guava	67	Anola	10					Veneer Grafting, Seed, Budding	3	15 Year,12 Year



	16	Govt. Nursery, Company Bagh	Mango	151	Litchi	15	Anola	17	Guava	50			Veneer, Air Layering, Budding	3	25 Year, 10 Year, 15 Year
	17	Govt. Nursery, KhusrooBagh	Mango	295	Guava	662	Anola	78					Veneer Grafting, Budding, Inarching	3	30-40 Year
	18	Green Avadh Nursery	Mango	160	Guava	300	Citrus	275					Veneer Grafting, Inarching, Seed	2	12-15 Year

State Wise List of Nurseries Covered and Details															
State	S. N o	Name of Nursery	Details of Mother Plant										Method of Propagati on	N. Ratin g	Remarks
			Fruit 1	No.	Fruit 2	No.	Fruit 3	No.	Fruit 4	No.	Fruit 5	No.			
Gujarat	1	Model Nursery, Department of Horticulture	Mango	1000	Guava	70	Anola	30	Sapota	15	Custard Apple	30	Veneer Budding Inarching	3	7 Year
	2	Lal, Sakkar, Madhadi, Jambuvadi, Khengarvavnur	Mango	60	Jack Fruit	201							Veneer Budding	3	15-20 Year
	3	GulabVadi And Nursery	Mango	400									Veneer Grafting	2	20-25 Year
	4	Govt. Nursery, Una	Mango	1192	Sapota	119 6							Veneer Budding	2	5-36 Year
	5	Nilmadhav Nursery Farm	Mango	400									Veneer Grafting	2	10-12 Year
	6	Kurphali Farm Nursery	Mango	400									Veneer Grafting	2	12- Year

	7	KrishiVigyan Kendra, Ambheti	Mango	470								Veneer Grafting	2	8-9 Year	
	8	Aknj Farm & Nursery	Mango	1050								Veneer Grafting	2	7-8 Year	
	9	Model Nursery, Regional Horticulture Research St.	Mango	2886	Sapota	465						Veneer Grafting, Budding	3	3-28 Year	
	10	ShakbhajiVikasYojna	Mango	208								Veneer	2		
	11	Sangar Farm & Nursery	Guava	900	Coconut	11	Sapota	30	Ber				Inarching, Seed, Budding	2	2-3 Year
	12	Shree Ashapura Nursery	Mango	110	Pomegranate	47	Sapota	250					Veneer, Budding	3	7-15 Year
Maharashtra	13	Fruit Nursery, Department of Horticulture	Mango	1736	Sapota	995	Pomegranate	1052	Guava	1854	Custard Apple	89	Veneer, Inarching, Seed Budding	4	25-23 Year
	14	Regional Fruit Research Station, Vengurle	Mango	1050	Sapota	120	Cashew Nut	560	Coconut	2000			Veneer Grafting Seed Air layering	4	15-20 Year
	15	Fruit Plant Nursery, Dept. of Horticulture	Mango	1736	Cashew Nut	800	Anola	60	Jamun	25	Coconut Guava	250154	Inarching, Grafting, Budding	4	
	16	Central Experiment Station, Wakawali	Mango	930	Cashew Nut	450							Veneer, Seed	4	20-25 Year
	17	NRCC Nursery	Mandarin	250	Sweet Orange	150							Budding	5	2-3 Year

18	Govt. Nursery Tidangi	Mango	43	Custard Apple	300	Orange	170					Veneer, Budding	2	15-18 Year
19	Govt. Nursery, Dhiwarwadi	Mandarin	278	Sweet Orange	200							Budding	2	22 Year
20	Govt. Nursery, Susundri	Mango	85	Guava	200	Orange	800					Veneer, Inarching, Budding	2	16-18 Year
21	Horticulture Section, College of Agriculture	Citrus	600									Budding / Seed	3	20-22 Year
22	Pawan Nursery	Mandarin	300			Sweet Orange	170					Budding	2	12-15 Year
23	Manoj Nursery	Mandarin	150									Budding	2	10-14 Year
24	Vansri Nursery, Sawata Chowk	Mandarin	150									Budding	2	16-18 Year
25	Taluka Fruit Nursery, Chakur	Mango	60									Veneer	1	6 Year
26	Krishiraj Nursery	Orange	150					Sweet Orange	600			Budding	2	5 Year
27	Adarsh Nursery	Pomegran ate	1000									Budding	2	6 Year
28	Taluka Fruit Nursery, RajuriNavgan	Mango	253	Chiku	112	Guava	989					Inarching, Veneer Budding	3	18-33 Year

	29	K. V. K. Baramati	Mango	529	Pomegranate	560	Guava	72					Croft, Grafting, Budding, Air Layering	4	5 Year
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State Wise List of Nurseries Covered and Details															
State	S. No	Name of Nursery	Details of Mother Plant										Method of Propagation	N. Rating	Remarks
			Fruit 1	No.	Fruit 2	No.	Fruit 3	No.	Fruit 4	No.	Fruit 5	No.			
Andhra Pradesh	1	Horticulture Farm, Tirupati	Mango	413	Lime	150							Veneer, Seed	2	7 - Year
	2	Horticulture Farm, Panagal	Mango	489									Graft/Veneer	3	12- Year
	3	Govt. Model Nursery, Raghavrajapuram	Sweet Orange	930	Lemon	100							Budding, Seed	2	7 - Year
	4	Hrs, Coconut Nursery, Ambajipeta	Coconut	680	Guava	30							Veneer Grafting, Inarching	4	20-30 Year
	5	Samalkota Fruit Crops Nursery	Mango	1463									Veneer Grafting	2	5- Year
Karnataka	6	Indian Institute Of Horticultural Research	Mango	800	Guava	575	Sapota	230	Custard Apple	450			Veneer Grafting, Inarching	4	8-10 YEAR 5-8 YEAR 6-10 YEAR

	7	Yashaswini Nursery												4	
	8	Sri Sai Nursery	Mango	40	Sapota	74	Guava	31	Anola	10	COCON UT	10	Veneer Grafting, Inarching	3	4-12 YEAR
	9	Scientific Nursery	Mango	200	Guava	250	Citrus	300	Other's		Cocon ut		Veneer Grafting, Seed	3	7-15 Year
	10	Deptt. Of Horti., GKVK University Of Agri. Sciences	-											3	
	11	Cpcri, Research Station Vittal	Coconu t										Seed	4	Establish 29-01- 2010
	12	Directorate Of Cashew Research DCR Nursery Kemminj	Cashew	409									Seed	4	7-8 YEAR
	13	Directorate Of Cashew Research DCR Exptl Station												4	
	14	Shiva Nursery Garden	Mango	610 0	Sapota	500	Guava	300	Cashew nut	600			Veneer Grafting, Inarching	3	8-27 Year
	15	Horti. Research Station, Tidagundi	Coconu t	400 0	Areca nut	100 0	Cocoa	100 0					Seed, Budding	3	12-15 Year
Kerala	16	Indian Institute Of Spice Research	Ginger	NA	Turmer ic	NA							Rhizome	4	15-40 YEAR

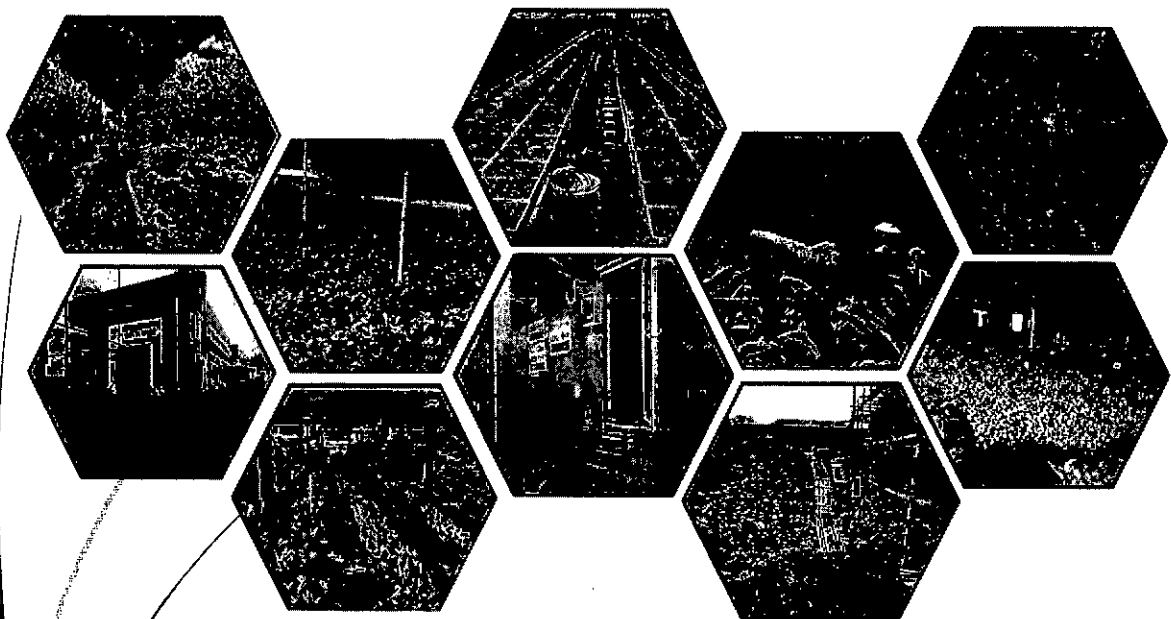
	17	Cpcri, Kasargod	Coconut	862								Seed	4	15-40 Year	
Tamil Nadu	18	A. Kamraj Nursery Garden	Mango	1000	Coconut	3000	Pine Apple	1500			Sapota	1500	Veneer, Seed, Sucker	4	12-15 Year
	19	The Yendal Farm Nursery	Mango	750	Anola	2500	Jack Fruit	125	Jamun	75	Guava		Veneer Grafting, Inarching, Seed	3	15-21 Year
	20	State Coconut Nursery And Horticulture Office	Coconut	5000									Seed	2	12-15 YEAR
	21	B. Chithan Nursery Garden	Mango	8300									Veneer Grafting, Inarching, Seed	2	5- Year
	22	Sri Balaji Nursery	Mango	601	Guava	616	Sapota	614	Coconut	1006			Croft Grafting, Air Layering	2	35 Year
	23	Venkateswara Nursery Garden	Mango	14000									Veneer And Cleft Grafting	3	
	24	PalaveeiNurseriKishangarh	Mango	250									Veneer Grafting	3	10-12 Year
Telangana	25	Asra Nursery	Mango	400									Veneer Grafting		7-10 Year

## **Annexure -III : Photo Gallery**

## Annexure-3

# Photo Gallery

Field Visits: Nurseries and Cold Storages





## Uttar Pradesh Nurseries



AdarshPaudhshala, Allahabad



KendriyaPaudhshalaBasti



AdarshPaudhshala-Basti



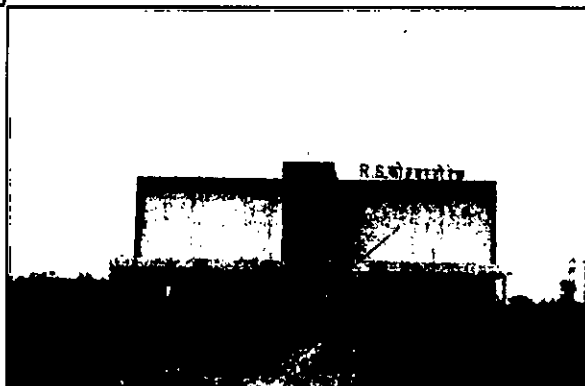
Govt. Nusery Polytechnic- Jaunpur

## Uttar Pradesh Cold Storages

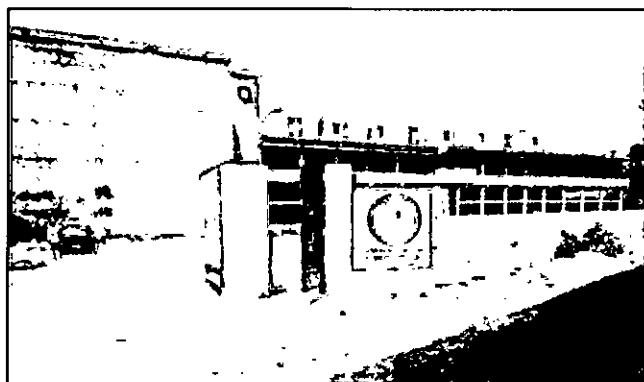


Samriddhi CS Farrukhabad

RS Coldstorage



SNSharma CS Ferozabad



Sumitradevi CS Aligarh

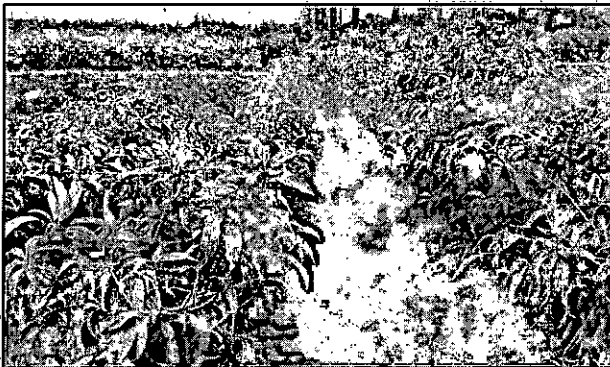


## Tamil Nadu Nurseries



Yendal Farm Nursery-Dindigul

Modern Horticulture-Erode



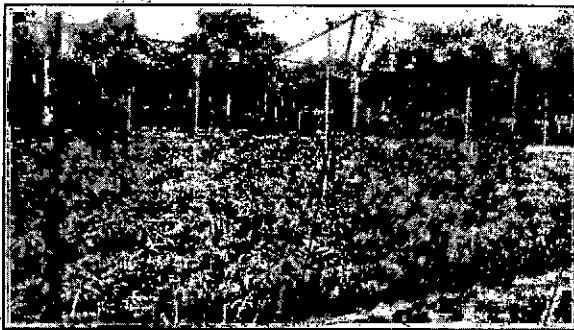
ChintanNusery-Krishnagiri

## Odisha Nurseries



Labanyagarh Nursery-Gajapati

Fruit Nursery-Sambalpur



Malati Nursery-Dhenkanal

Asiana Nursery-Cuttack



## Odisha Nurseries and Cold Storage



MaaTarini Nursery-Jajpur

Kuanr Nursery-Keonjhar



Tulasi Nursery-Sonepur

Ckadoda cold store

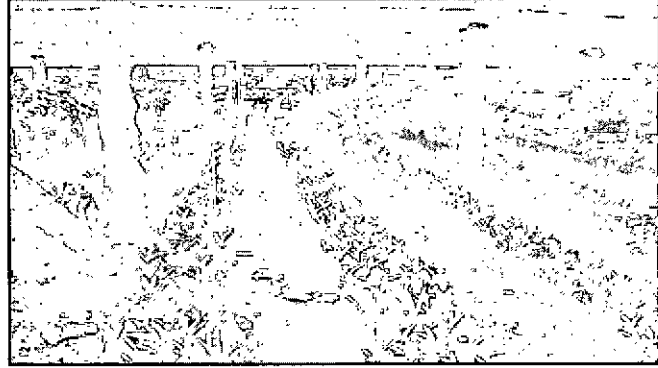


## Karnataka Nurseries and Cold Storage

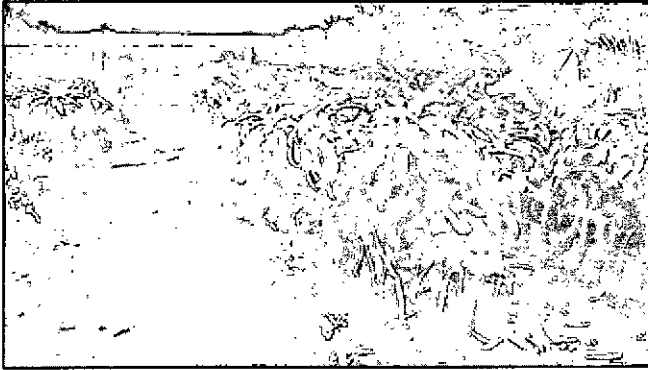


Shiva Nursery-Kolar

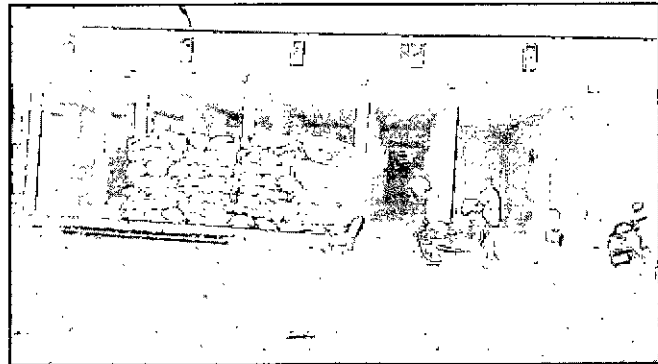
IIHR Nursery-Banglore



DCR KemminjNusery-Dakshin Kannada



Arunodaya Cold Storage



## Madhya Pradesh Cold Storage and Nurseries



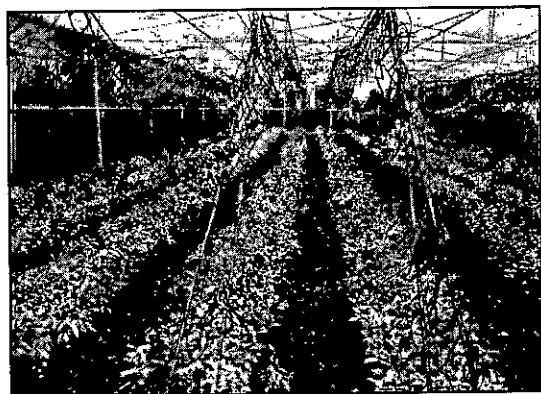
Kaveri CS-Khargaon-MP

Govt. Garden-1-Hoshangabad

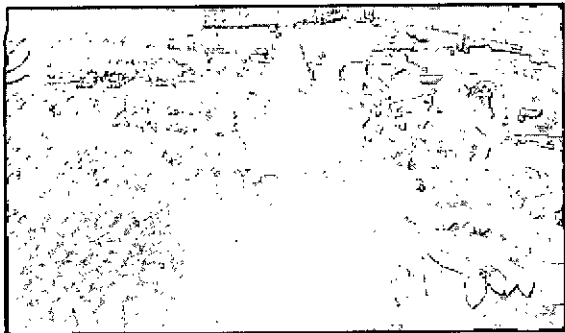


Govt. Garden-2-Hoshangabad

NRCC Nursery, Nagpur



Kerala Nurseries



Kerala Nursery



Kerala Nursery



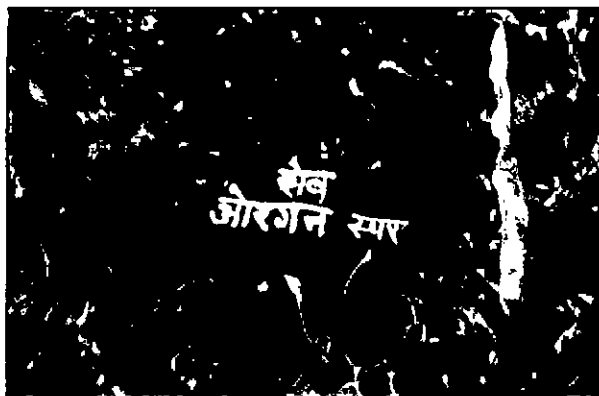
Kerala Nursery



Kerala Nursery



## Uttarakhand Nurseries



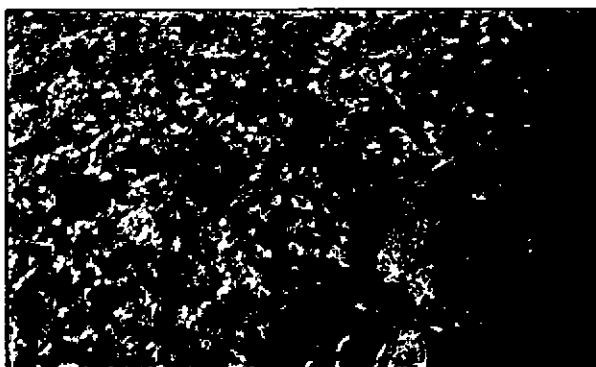
Rukmini Nursery-Tehri

Gomta Bag-New Tehri



NakshatraPaudhshala-Tehri

Govt. Nursery-Magra



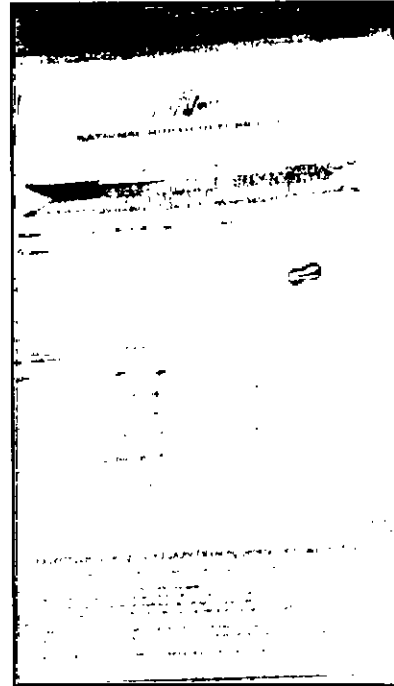
## Haryana&Gujarat Nurseries



Use of Drip Irrigation, Centre of Excellence-Sirsa-Haryana



AnandAgri University-Anand, Gujarat



KrishiVigyan Kendra, Ambheti, Gujarat

Kinnow Mother Plant, Centre of Excellence-Sirsa-Haryana

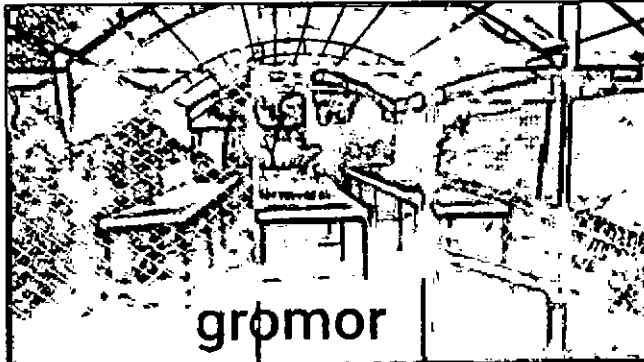
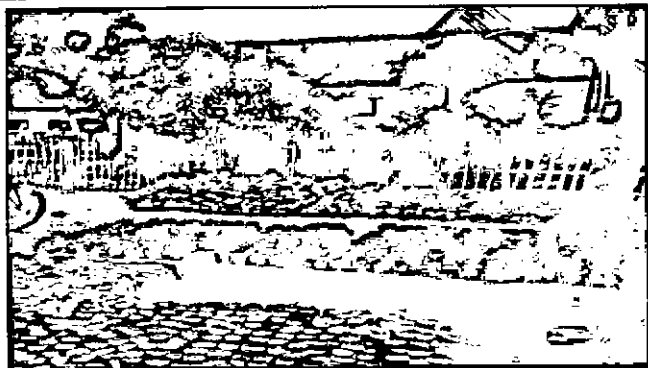


## Bihar Nurseries



Satyam Nursery-Sitamarhi

Pandey Nursery-Sitamarhi



Gromor Nursery-1-Purnea

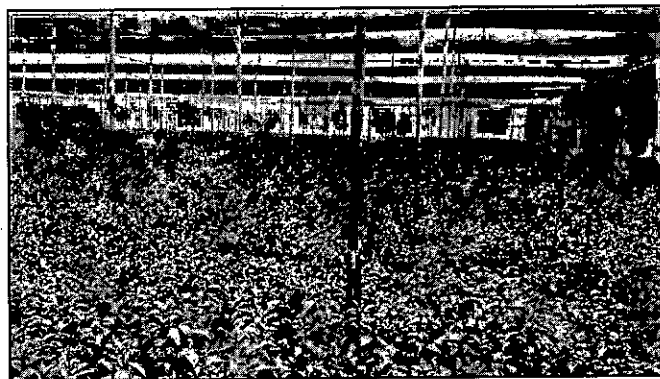
Gromor Nursery-2-Purnea



## Punjab Nurseries



Regional Research Station, Abohar



Shankar Nursery, Punjab



Cold Storage, Sangur, Punjab

## Andhra Pradesh Nurseries



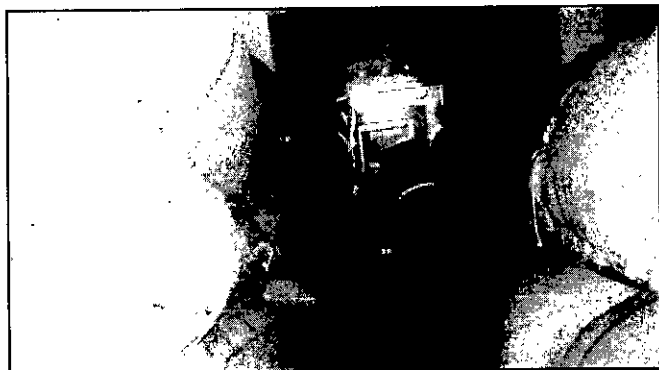
Govt. Model Nursery-Kadapa

HRS Coconut Nursery-East Godawari



Samalkota Nursery-East Godawari

Cold Storage District-Nandyal,



## West Bengal Nurseries and Cold Storage



New Nadia Nursery

Deb Narayan\_ Garden

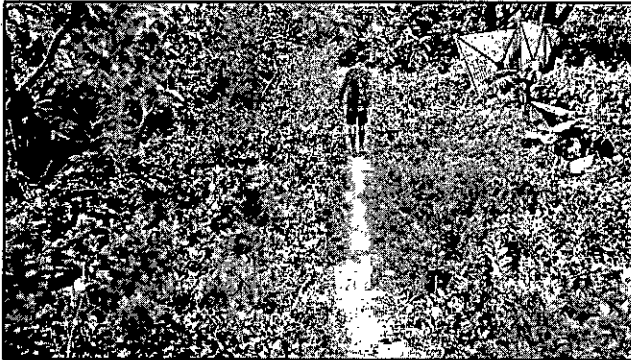


Madhabi Nursery

Surya Deep Multipurpose Cold Storage,



## Chhattisgarh Nurseries and Cold Storage



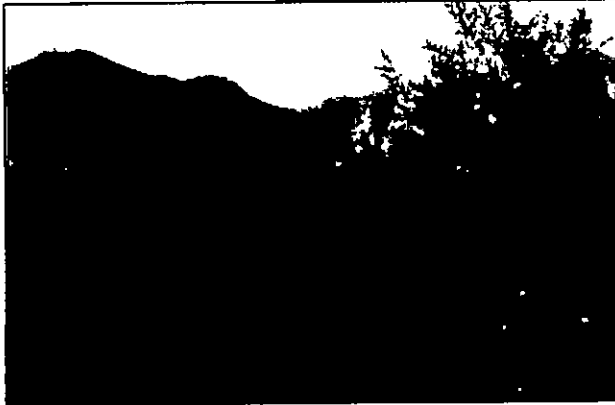
Lalpur, Chhattisgarh

Jagadapur, Bastar, Chhattisgarh



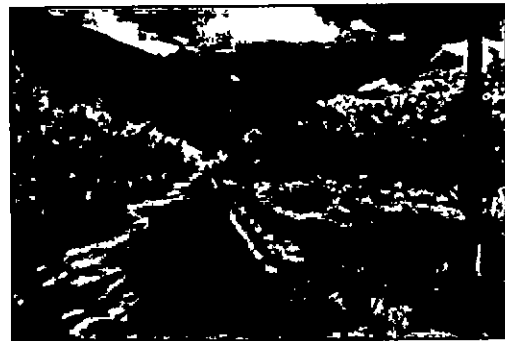
Anika Cold Storage, Chhattisgarh

## Himachal Pradesh Nurseries



Shipra Nursery, Vill-Tharass, Post-Huria,  
District-Kullu, Himachal Pradesh

Tabo Nursery



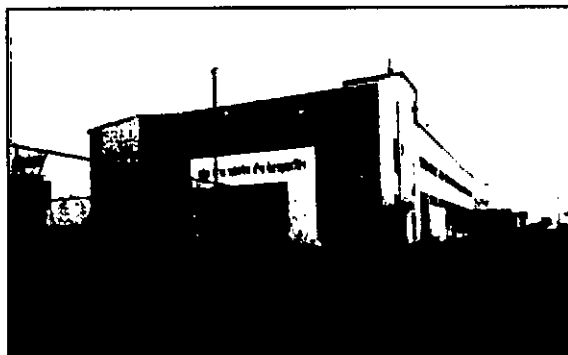
Fruit Nursery Regional Horticultural  
Research station (Vill-Sharbo, ReckongPeo,  
District-Kinnaur

Fruit Nursery, Regional Horti. Reserach  
Station (Vill-Bajaura (jhiri), District-Kullu





## Maharashtra, Cold Storage and Nurseries



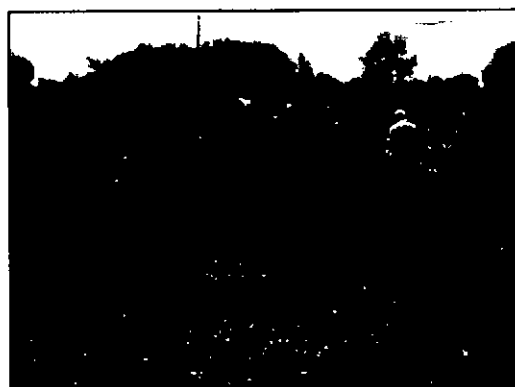
Naresh Cold Storage, Sangli

Centre of Excellence for Citrus, Nagpur



NRCC Nursery, Nagpur

Asra Nursery



## Jammu & Kashmir Nurseries



Department of Horticulture, Srinagar

Greenfield Nursery, Dumana, Jammu

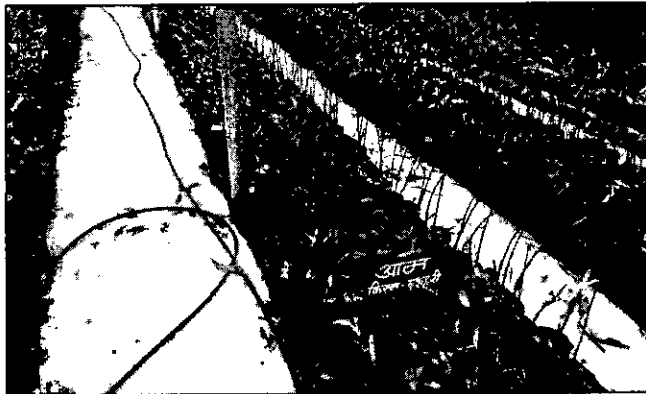


Hilal Nursery, Jammu

Government food plant Nursery, Chimnchak

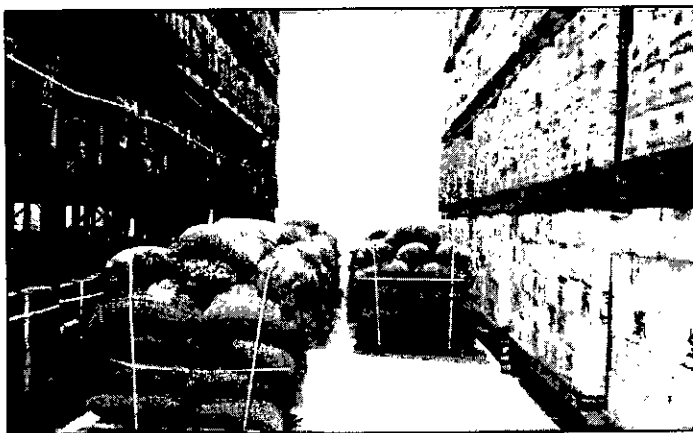


## Jharkhand and Mizoram Nurseries and Cold Storage



Phal Udyog Nursery Jharkhand

Evergreen Nursery, Mizoram



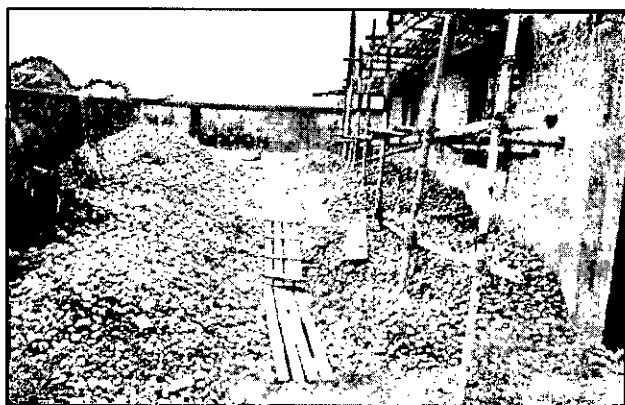
Cold Storage, Jharkhand

## Assam Cold Storage and Nurseries



Cold Storage-Kamrup,

Citrus Research Station Nursery



Wasted Potatoes in Cold Storage-Kamrup,