

MASTERPLAN FOR COLD STORAGE REQUIREMENTS IN KERALA

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PREFACE

Cold storages form the most important element for proper storage and distribution of wide variety of perishables, especially fruits and vegetables. According to a rough estimate 25% of fruits and vegetables worth crores of rupees are spoiled every year for want of adequate post harvest technologies including cold storages. It is therefore necessary that cold storages are to be constructed in major producing as well as consuming centers.

Kerala is considered as a consumer state as it imports almost all fruits and vegetables from neighbouring states. The annual growth rate in the area of food grain is negative in the state. Since there is no cultivation of generally cold stored items like apple, potato, oranges, chilly, tamarind etc. in the state, the growth of cold storages for horticultural items is very slow. Even after the announcement of capital linked subsidy scheme by the Ministry of Agriculture, Govt. of India, there is not much development in the field.

Almost 95% of the cold storages in the state are for the storage of marine products and for the captive use of exporters. Even though there is not much production, considering the huge arrivals of fruits and vegetables in the markets across the state, there is a need to construct cold storages in the major cities of the state. Considering the fact that Kerala imports most of the vegetables and fruits from outside states, on a daily basis, cold chain system may be the ideal solution for Kerala.

Before establishing a cold storage, the first thing an entrepreneur has to do is to identify the locality of the cold storage. The cold storages are to be established in areas where there is potential. Considering the increasing operational cost, viability of the cold storage is an important thing to be studied before constructing it.

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The Govt. of India may not be responsible for any of the views expressed in this report.

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I.INTRODUCTION

Cold storage plays an important role in the preservation of perishables especially fruits and vegetables. It helps in scientific preservation of perishables, stabilizes prices by regulating marketing period and supplies. It also helps the primary producer from distress sale and encourages farmers to produce more. In view of the fall in prices of fruits and vegetables immediately after harvest and to avoid spoilage of fruits and vegetables worth crores of rupees, it has become necessary to create cold storage facility in the producing as well as consuming centers to take care of the existing and projected production of fruits and vegetables.

The most obvious losses after harvest are caused by mechanical injury, decay and aging. Losses in moisture, vitamins, sugars and starches are less obvious, but they adversely affect quality and nutrition. Rough handling and holding at undesirably high temperature or too low temperature increase losses. Such losses can be substantially reduced by adopting the recommended cold storage practices.

1.1 Product quality and suitability

Maximum storage life can be obtained only by storage of high quality commodities soon after harvest. Different lots of fruits and vegetables may vary greatly in their storage behavior. Storage potential may be influenced by variety, climate, soil and cultural conditions, maturity and handling practices. When products are transported from a distance, grown under unfavorable conditions, or are deteriorated, appropriate storage allowance should be made.

Fresh fruits and vegetables intended for storage should be as free as possible from skin breaks, bruises and decay. Bruises other mechanical damage not only detract from the appearance of product and allow entrance of decay organisms. Much more decay will develop on bruised areas of apples than on non-bruised areas. Mechanical damage may also increase moisture loss by as much as 400 %. The amount of incipient decay infection, which influences storage potential of grapes and apples, can be predicted by forecasting of decay early in storage period. Only lots with good storage potential should be held for late season marketing.

Varieties of fruits and vegetables vary substantially in their adaptability to refrigerated storage. Some varieties keep very well in storage

for long periods while other varieties can be kept only short storage times. Further more the storage temperature and humidity required may be quite different from one variety to another. Refrigerated storage life of apples of different varieties may vary from a few weeks to 6 to 7 months.

1.2 Maturity and harvest.

Maturity of fruits and vegetables at the time of harvest is directly related to the refrigerated storage life and quality of the product. Almost invariably, for any given product there is a maturity which will prove to be best suited for refrigerated storage. Under-mature product will not ripen or develop good quality during or following refrigerated storage.

1.3 Harvesting method.

The trend in harvesting is towards more mechanization. In most cases some product bruising is incurred in mechanical harvesting. This damage can materially reduce the refrigerated storage life and quality of the product. Careful examination of the raw material should be made prior to placing in refrigerated storage to determine the extent of bruising or other damage. If excessive damage is present the owner of the product as well as the cold storage owner should be aware of the problem.

1.4 Transportation

Losses from deterioration during distribution must be minimized. As in storage, these losses are affected by temperature, moisture, diseases and mechanical damage. Gradual aging and deterioration are continuous after harvest. So movement into storage or to market should be prompt with careful handling. Time in transit may represent a large portion of the post harvest life of the most perishable commodities. Many different kinds of refrigeration are available during transportation. Use of mechanically refrigerated truck and rail transportation has expanded greatly. It takes a great deal of training and experience to transport perishable fruits and vegetables properly. Drivers and other responsible should know the refrigeration requirements of the commodities hauled.

1.5 Pre-cooling

Pre-cooling of product prior to refrigerated storage is strongly recommended since rapid removal of field heat and cooling the product to the storage temperature before placing it in the refrigerated storage will substantially increase the storage life. Since deterioration occurs much more rapidly at warm than at low temperature, the more quickly field heat is removed after harvest, the longer produce can be maintained in good marketable condition in storage.

1.6 Storage requirements and causes of deterioration

Storage requirements for specific fruits and vegetables are so varied that no generalization can be made. Annexure-v presents the recommended storage requirements for various fruits and vegetables.

All fresh fruits and vegetables are alive and remain so during storage and marketing and even for some time after they are no longer in marketing condition. Being alive they respire using stored chemical constituents, primarily sugars and oxygen from air to produce carbon dioxide and energy (heat). The reactions are extremely complex. The environment in which harvested produce is placed may greatly influence not only its rate of inspiration but also other changes and products formed in related chemical reactions. In fruits these changes are described as ripening. In many fruits such as bananas and apples the process of ripening is required to develop the maximum edible quality. However if ripening process continues further, deterioration changes occurs. Refrigeration is by far the greatest factor in delaying and controlling the ripening process.

In addition to deterioration after harvest by chemical changes within the product, two other forms of deterioration are important during storage and marketing, namely desiccation and disease caused by microorganisms. Regardless of the kind of deterioration, its rate is greatly influenced by temperature. Deterioration of fruits and vegetables by their process or by microorganisms is reduced as temperature is lowered, so that the marketable life span may be perceptibly extended.

The third important factor of deterioration namely, desiccation of water loss results in shriveling of produces and is strictly a physical factor related to the evaporative potential of air. To avoid desiccation of water loss, the relative humidity is to be maintained at desired level.

II. COLD STORAGE REQUIREMENTS IN KERALA

Kerala is considered as a consumer state and it imports most of the fruits and vegetables from the neighbouring states. The agricultural production in Kerala is reducing day by day, due to rapid urbanization and also due to high labour cost. Rubber, coconut, paddy, pepper, cardamom, tea etc are the main cultivation in the state. The production of Horticultural items including fruits and vegetables in the state is very poor. The annual growth rate in the area of food grain is negative in the state as compared to the positive growth rate in the neighbouring states.

As regards cold storages in the state, almost 95% of them are for storage of marine products. These cold storages are not available for rent and used for the captive use of exporters. Kerala exported Rs.1000 crores worth marine products last year out of the total export of 6500 crores from India. New cold storages are constructed by the exporters depending upon the export demand. There are very few cold storages for horticultural commodities and the development of such cold storages in the state is slow. In spite of the fact that a number of agencies like HORTICORP, VEFCO etc, are engaged in the promotion of fruits and vegetables in the state, the production is very poor as compared to the demand. Banana and pineapple are the main fruits produced in the state. As regards vegetables bitter gourd, long beans, snake gourd etc are some of them cultivated in Kerala. None of the vegetables or fruits cultivated in Kerala is stored in cold storages.

The reasons for slow development of horticultural cold storages in the state are:

1. Kerala is one of the thickly populated states in the country. In spite of very good irrigation facilities and abundant rain, the annual growth rate in the area of food grain is negative in the state.
2. Fruits and vegetables are brought to the markets on a daily basis from the neighbouring states. As seen from the tables, the average arrivals of Kerala items in the market are negligible as compared to the average out of state arrivals.
3. Due to high labour cost in the state, traders find bringing things from outside is cheaper. Rapid urbanization and high

land cost are also factors affecting the slow growth of the industry.

4. Production of fruits and vegetables in the state is very poor and the arrivals in the markets are based and on the demand. The generally cold stored items like potato, apples, oranges, chilly etc are not cultivated in the state.
5. There is no concession for cold storage industry in the state. Considering the fact that almost 60% of the operating expense for a cold storage is electricity bill, some sort of concession to the electricity tariff for horticultural based cold storages may be provided by the state govt. as done by the neighbouring states.
6. The traders/consumers are not aware about the benefit of cold storages in preserving perishables.
7. Consumers prefer to buy fresh items to cold stored one. Since cold stored items are also costlier, as compared to the outside items, only a small percentage of consumers prefer to buy such items.

Even though there is not much production of fruits and vegetables in the state, considering the huge arrival of vegetables and fruits in the markets across the states, there is a need to construct cold storages in the main cities to take care of the demand, fluctuation in price, spoilage etc.

The storage and post storage life of most of the fresh fruits and vegetables are short. Storage of such items is risky and needs more care and attention. Cold chain system is the best way to handle such highly perishable items. However an average consumer is more concerned about the cost of the items than the quality. A cold stored item will definitely costlier than the outside item but the quality will be superior. Cold stored items are to be sold through air-conditioned super bazaars as the post storage life of most of these items is very short. Even if 10% of the consumers are going for the cold storage items, there is a need to construct cold storages in major cities in Kerala. Cold storages are required for items like potato, apples, oranges, tamarind, chilly etc. having long cold storage life.

Items like cabbage, tomato and other fresh fruits and vegetables can also be stored in cold storages, if scientific storage practices are followed. These items can be brought from producing states and stored here for distribution during off-season. For Kerala cold chain system is the best option. Whenever there is a strike or Harthal in the state, the arrivals from outside state are affected and the prices of vegetables and fruits shoot up. If cold storages are available in the state, such fluctuations in prices can be reduced.

III. OBJECTIVE

The objective of the report is to assess the district wise requirement of cold storages for the next 3-5 years, by taking into account the production of various perishables, arrivals from outside, existing availability of cold storages and its utilization, potential, future requirements etc.

IV. METHODOLOGY

To assess the requirement of cold storages (district-wise), information were collected from cold storages, traders, farmers, State Horticultural/Agricultural departments, Nabard, VEFCO, Horticorp, Economics and Statistics, Market Committees and other agencies connected with the subject. For the purpose of assessing the arrivals only important markets were selected. The information collected from different agencies has been compiled to arrive at a tentative assessment for the future requirement of cold storages in each district. The assessment is however tentative and requires to be reassessed on a yearly basis, as the production, consumption, demand etc. vary every year.

V. DISTRICT-WISE REQUIREMENTS OF COLD STORAGEES.

V-I. ERNAKULAM

Ernakulam is the commercial capital of Kerala. It has major ports and international airport. Most of the exports and imports in Kerala are taking place through the ports in Ernakulam. There are number fish cold storages in the district owned by the marine products exporters. More than 50% of the cold storages in the state are located in Ernakulam. These cold storages are of deep freeze type (-20C) and used by the exporters for their captive use. Marine products worth crores of rupees are being exported from these cold storages every year. However there is no cold storage in the district for horticultural commodities. Ernakulam being the biggest city in Kerala, there is a need to construct cold storages for perishable horticultural crops also. Even though highly perishable fruits and vegetables are not generally stored in cold storages, items like potato, chilly, apples, oranges etc. can be brought from neighbouring states and stored here, for distribution in the city. In Kerala, harthals, bandh, transport strike etc. are very common and the consumers suffer due non arrival of vegetables fruits etc. from neighbouring states. In the absence of cold storages in the state, the prices of all commodities go up in such occasions. At present traders are storing items in the neighbouring states and bring here during off season. In cities like Ernakulam where the demand is high, cold storages can play a vital role in controlling the fluctuations in prices. Cold storages also help the availability of all fruits and vegetables round the year.

Even though the production of vegetables and fruits in the district is poor, there is huge arrival in the markets. The total area under cultivation for vegetables and fruits in the district is 9863 hectares and 29317 hectares respectively. This is very low as compared to the neighbouring states. The details of arrivals in the markets in respect of important perishable items in the district are given below.

Sl.No	Name of commodity	Average Kerala arrivals (T)*	Average out of state arrivals(T)*
1	carrot	506	3389
2	Banana	8445	25075
3	Brinjal	00	3124
4	Tomato	00	10210
5	Cualiflower	00	1447
6	potato	327	7783
7	cabbage	562	8315
10	beans	00	710

*Combined arrivals in Ernakulam, Aluva and Perumbavur markets

Source:Vegetable and Fruit Promotion Council of Keralam

List of cold storages in the district is given below.

S NO	NAME AND ADDRESS OF THE COLD STORAGE	CAPACITY (MT)	ITEMS STORED	SECTOR
1	K.K.Raghavan & Co., Nambianpuram, P.B.No.851, Palluruthy, Kochi - 6	75	MARINE PRODUCTS	Pvt
2	K.E.Kesavan & Sons, P.B.No. 322, Kochangadi, Kochi - 682 002	60	MARINE PRODUCTS	Pvt
3	Seastar Industries, XVIII/8, Palluruthy Road, Kochi - 682 005.	25	MARINE PRODUCTS	Pvt
4	The Kerala State Co.Op. Federation for Fisheries Devt. Ice & Freezing Plant Kochi - 682 005	600	Milk PRODUCTS	Co-op
5	Island Seafoods Private Limited, Island Club House, P.B.No. 580, Willingdon Island, Kochi - 682 003. (closed)	200	MARINE PRODUCTS	Pvt
6	Fanci Foods, P.B.No. 314, XII Main Road, Kochi - 682 002.	200	MARINE PRODUCTS	Pvt
7	Meat Products of India Ltd., Edayar, Kothattukulam - 682 662.	125	Meat	pub
8	M.K.Fisheries, P.B.No. 932, Palluruthy, Kochi - 682 006.	100	MARINE PRODUCTS	Pvt
9	Raymon Foods Pvt. Ltd., Cheriyakadavu, kannamaly, Kochi	50	MARINE PRODUCTS	Pvt
10	Kreen Foods Private Ltd., XXVII / 2250 Kodavanthra, Kochi - 682 000.	10	ICE-CREAM	Pvt
11	Ernakulam Regional Co-operative Milk Producers' Chion Ltd., No. E-150 (D), Ernakulam Diary,, P.B.No. 33, Tripunithura - 682 301.	250	MILK PRODUCTS	Co-op
12	Baley Marine Exports, XVIII, Pallichal Road, Near Parry Junction, Kochi - 682 005.	400	MARINE PRODUCTS	Pvt
13	Amison Foods Pvt. Ltd., Karthika Building, Thoppumpady, Kochi - 682 005.	75	MARINE PRODUCTS	Pvt
14	Abad Fisheries, Kochi, Unit III), Abad Buildings, Kochangadi, Kochi - 682 002.	150	MARINE PRODUCTS	Pvt
15	National Sea Foods Company, 14/367-B, Verma Co-Extension Road, Kochi - 682 005.	100	MARINE PRODUCTS	Pvt
16	Peevee`s Enterprises, P.B.No. 914, Eda Kochi, Kochi - 682 006.	60	MARINE PRODUCTS	Pvt
17	Paragon industries Thoppumpady, Kochi - 682 005.	100	MARINE PRODUCTS	Pvt
18	Bell Foods (Marine Division) Pallichal Road, Kochi - 682 005.	150	MARINE PRODUCTS	Pvt
19	Island Sea Foods, P.B.No. 580, Willingdon Island, Kochi - 682 003. (closed)	200	MARINE PRODUCTS	Pvt
20	Amalgam Foods Limited (Zamoron Division) Admn. Office, Nima House, IV Main Road, Willingdon Island, Kochi - 682 003.	50	MARINE PRODUCTS	Pvt
21	Amalgam Food Ltd., Admn. Office, Nima House, IV Main Road, Willingdon Island, Kochi - 682 003.	75	MARINE PRODUCTS	Pvt
22	Gold Farm Foods (P) Ltd., 12 / 1396, Eda Cochin, Cochin - 682 006.	75	MARINE PRODUCTS	Pvt

S NO	NAME AND ADDRESS OF THE COLD STORAGE	CAPACITY (MT)	ITEMS STORED	SECTOR
23	Abad exports P Ltd, Ind.Estate, Aroor.	1000	MARINE PRODUCTS	Pvt
24	K.E.K.Industries, VII / 405, Kochangadi, Kochi - 682 002. (closed)	50	MARINE PRODUCTS	Pvt
25	Integrated Fisheries Project, P.B.No. 1801, Kochi - 682 016	125	MARINE PRODUCTS	pub
26	Choice Canning Company, Choice House, M.G.Road, Kochi - 682 015.	100	MARINE PRODUCTS	Pvt
27	Sithara Marine Products, P.B.No. 98, Palluruthy, Kochi - 682 006.	40	MARINE PRODUCTS	Pvt
28	Abad Fisheries, Abad Buildings, Kochangadi, Kochi - 682 002.	110	MARINE PRODUCTS	Pvt
29	Aamir Ice & Cold Storage, Eda Cochi, Cochin - 682 006	150	MARINE PRODUCTS	Pvt
30	The Universal Trades Corporation, SUI Centre, IX/ 313, Cheriakadava, Kochi - 682 008.	100	MARINE PRODUCTS	pvt
31	Indian Sea Foos Industries, Sea Pride Building, Kchangadi, Kochi - 682 002 (closed)	75	MARINE PRODUCTS	Pvt
32	'XL' Sea Foods, Karuvelipady, Kochi - 682 005. .	30	MARINE PRODUCTS	Pvt
33	The New India Maritime Agencies (P) Ltd.,Nima Ware House, G.V.Ayyar Road, W.Island, Kochi - 682 003.	300	MARINE PRODUCTS	Pvt
34	Indo - Marine Agencies (Kerala (P) Ltd.,)Packers & Exporters of Canned & Frozen sea fiids, P.B.No.825,Kochi - 682 005. (closed)	75	MARINE PRODUCTS	Pvt
35	Abad Fisheries, Abad Buildings, P.B.No. 313, Kochi - 682 002.	75	MARINE PRODUCTS	Pvt
36	Chemmeens (Regd) , Kochangadi, Kochi - 682 005. (closed)	50	MARINE PRODUCTS	Pvt
37	Binny Limited, XXIV / 1517, Bristaon Road, West Island, P.B.No. 553, Kochi - 682 003.	600	MARINE PRODUCTS	Pvt
38	Elite Sea Foods, Anchorage Building, No.9 Palliyil Lane, Kochi - 682 016	60	MARINE PRODUCTS	Pvt
39	Karthika Fisheries P.B.No 879 Amrut complex, Thoppumpady, Kochi-682 005	50	MARINE PRODUCTS	Pvt
40	Elenjikal Exports Pvt. Ltd., 18/1348, Palluruthy, Cochin - 682 006. (closed)	200	MARINE PRODUCTS	Pvt
41	Tri-Marine Foods Pvt. Ltd., O - Jaisam Tea Building, Willington Island, Kochi - 682 008.	100	MARINE PRODUCTS	Pvt
42	India Sea Foods (Regd.) P.B.No. 818, Cochin - 682 005.	75	MARINE PRODUCTS	Pvt
43	The Canning Industries Cochin Ltd., Edakochi XXII / 1182, Kochi - 682 006.	100	MARINE PRODUCTS	Pvt
44	Emireat Seafoods P Ltd, Plot. No.9,Fisheries Harbour, Cochin-5	100	MARINE PRODUCTS	Pvt
45	Sait Exports, 13-645, Masjid Complex, Kochangadi	100	MARINE	Pvt

S NO	NAME AND ADDRESS OF THE COLD STORAGE	CAPACITY (MT)	ITEMS STORED	SECTOR
	Road, Cochin - 682 009. (closed)		PRODUCTS	
46	Samrat Middle East Export (P) Ltd., 18/ 75, Parry Junction, Thoppumpady, Kochi - 682 08.	150	MARINE PRODUCTS	Pvt
47	Nava Exports (India) Pvt. Ltd., XIII / 842, Karuvelipady, Cochin - 682 005.	50	MARINE PRODUCTS	Pvt
48	Master Marine Foods Pvt. Ltd., XVIII / 273, Nadakadavu Road, Cochin - 682 006.	100	MARINE PRODUCTS	Pvt
49	Paragon Sea Foods, P.B.No. 817, Thoppumpady, Cochin.	250	MARINE PRODUCTS	Pvt
50	Raymon Foods Pvt. Ltd., Cheriya Kadavu, Kannamaly, Cochin - 682 008.	500	MARINE PRODUCTS	Pvt
51	Baracka Overseas Traders, Palluruthy nada, Kochi - 682 006.	50	MARINE PRODUCTS	Pvt
52	Abad Exports Pvt. Ltd., 7 /455, Bay Pride Building, Jew Town Road, Cochin - 682 002.	3000	MARINE PRODUCTS	Pvt
53	Blue Bay Fisheries Pvt. Ltd., 7 / 411, Kochangady Road, Kochi - 682 002. (closed)	125	MARINE PRODUCTS	Pvt
54	Bhatsons aquatic products CC XVI/1368-C, Bhat memorial building, Thoppumpady, Kochi-682 005	250	MARINE PRODUCTS	Pvt
55	Lakshmi Marine Products, XVIII / 72, Parry Junction, Kochi - 682 009.	125	MARINE PRODUCTS	Pvt
56	Padinjathalackal Plantations P Ltd, Cochin-5	125	MARINE PRODUCTS	Pvt
57	Rubia sea foods 20 / 550 Nambiarapuram road, Pallurthy, COCHIN - 682 006	60	MARINE PRODUCTS	Pvt
58	Kay- Kay exports Ravivarma mandir, T.D. Road, Kochi-682 035	200	MARINE PRODUCTS	Pvt
59	Lansea foods ltd, 10/434, Cherakadavu, Kannamaly, Kochi-8	150	MARINE PRODUCTS	Pvt
60	Mangala sea foods P.B. No. 816, Thoppumpady, Kochi-682 005	125	MARINE PRODUCTS	Pvt
61	Abad fisheries, 19/2055A, Nambiarapuram road, Cochin -6	100	MARINE PRODUCTS	Pvt
62	Upasana Exports XXII/1377, edacochin Cochin-6	200	MARINE PRODUCTS	Pvt
63	India seafoods Kannamally Cochin-682008	45	MARINE PRODUCTS	Pvt
64	Abad Exim Pvt Ltd P.B. No.313, Cochin 2 CS at Kakkanad	330	MARINE PRODUCTS	Pvt
65	Freeze Engineering Industries P Ltd Fishing Harbour Thoppumpady. Ernakulam	150	MARINE PRODUCTS	Pvt
66	Prime Fisheries P LTd, 13/711, Kochangadi, Kochi-5	400	MARINE PRODUCTS	Pvt
67	VTJ Marine, Kannamaly road Ernakulam	300	MARINE PRODUCTS	Pvt
68	Gro Enterprises West of Cochin Fisheries harbour, Ernakulam	400	MARINE PRODUCTS	Pvt

S NO	NAME AND ADDRESS OF THE COLD STORAGE	CAPACITY (MT)	ITEMS STORED	SECTOR
69	Coromandel Fisheries, P.B.No. 920 Nadakadavu Road, Kochi - 682 006.	100	MARINE PRODUCTS	Pvt
70	Roshan foods P Ltd, Industrial Area Aroor	250	MARINE PRODUCTS	Pvt
71	Koyas Refrigeration, Packers and Exports of Frozen Meal & Sea Foods, 23 / 1777, Binny Road, P.B.No.931, Kochi - 682 006.	70	Meat,Fish	Pvt
72	Rejini Ice & Cold Storage Thoppumpady, Kochi - 6. (closed)	100	MARINE PRODUCTS	Pvt
73	Olattupurath Industries, Thopumpadi,Kochi-- 682 005	75	MARINE PRODUCTS	Pvt
74	Paragon Sea Foods, Thopumpady, P.B.No. 817 Kochi - 5	50	MARINE PRODUCTS	Pvt
75	Fibrite Fisheries, XVIII / 395, Palluruthy, Kochi - 682 006.	50	MARINE PRODUCTS	Pvt
76	Toyo Sea Foods, P.B.No.369, Kochangadi, Kochi - 682 002 (closed)	75	MARINE PRODUCTS	Pvt
77	The Marine Products Export Development Authority, Bristow Road W. Island, Kochi - 682 003.(closed)	900	MARINE PRODUCTS	pub
78	Karthika Marine Industries (P) Ltd., XVI 1207, Palluycothy Road, Thoppumpady, Kochi - 682 005.	100	MARINE PRODUCTS	Pvt
79	M/S Geo Sea Foods, P.B.No. 906, Thoppumpady, Kochi - 682 006.	125	MARINE PRODUCTS	Pvt
80	Nina`s Limited, 5th Cross Road, Wellington Island, Kochi - 682 003.	600	MARINE PRODUCTS	Pvt
81	Ruby Marine Products, Palluruthy, Kochi - 682 005. (closed)	100	MARINE PRODUCTS	Pvt
82	M/S Nas Fisheries (P) Ltd., Eda Kochi, Kochi - 682 006.	200	MARINE PRODUCTS	Pvt
83	Kaveri Meat Export Co. Ltd., Kattiparambu, Kannamaly - P.O, Kochi - 682 008.	100	MEAT PRODUCTS	Pvt
84	Upasana Exoports, XXII / 1372, Eda Kochi, Kochi - 682 006.	100	MARINE PRODUCTS	Pvt
85	Tri - Tee Sea Food Company, King Bridge, W.I, Kochi - 3.	150	MARINE PRODUCTS	Pvt
86	Innovative Marine exports Ltd, Amaalgam house, XXIV/1604, Bristow	800	MARINE PRODUCTS	Pvt
87	Baby Marine International, XVIII / 46-51, Thoppumpady, Palluruthy, Kochi - 682 005.	350	MARINE PRODUCTS	Pvt
88	King Fisheries Ltd. ,Wellington island Cochin-682 003	500	MARINE PRODUCTS	Pvt

It may be seen from the arrival chart that the arrivals of vegetables and fruits in the district from Kerala is negligible as compared to the out of state arrivals. Most of these items are brought from the neighbouring states by wholesale traders and distributed to the small traders, according to their demand. Items going to small markets in the city are not accounted.

In Ernakulam district there are two agricultural wholesale markets, one in Marad, and another in Muvattupuzha, The other markets in the district are in Aluva, Perumbavoor, Broadway etc. The markets in Marad and Muvattupuzha had been constructed with the EEC aid and have provisions for wholesale as well as retail sales with number of shops. The market in Marad is in closer to Ernakulam city and is the biggest in the state. It has 46 acres of land with provisions for further expansion. Vegetables and fruits and brought here by wholesale traders from other districts as well as neighbouring states. Considering the fact that Ernakulam is the biggest city in the state, this market may be the ideal location for construction of cold storages. Even though there is no need to store highly perishable vegetables and fruits, other items having long storage life like, potato, apple, oranges, dry chilly, tamarind etc. can be stored in cold storages here. However, there is no production of these items in the state and everything has to be brought from outside the state. Cold storages can also be constructed for fruits and vegetables meant for export purpose.

Three cold storages for storage horticultural items are under construction in and around the city. They are in Alwaye, Kolanchery and Aroor. The cold storage at Aroor is of 5000MT capacity and will be the biggest in the state, once completed. So there is gradual improvement in the cold storage capacity in the state. As far as Ernakulam is concerned there is potential for more cold storages. Almost 98% of the cold storages in the district are for marine products, owned by the exporters.

Considering the fact that Ernakulam is the fastest growing city in Kerala and also the main trading center, about **10000 tones of cold storage may be required in the district for storage of horticultural commodities.** The ideal locations are Marad and Muvattupuzha markets, where space is available for cold storage. The farmers and traders will be benefited, if cold storages are available in the market. The Ministry of Agriculture, Govt. of India through National Horticultural Board is giving subsidy for construction of cold

storages. This facility may be availed by the public/private sector for creation of more cold storages in the state. As regards fish cold storages, the requirement depends on the export demand.

V-2. THIRUVANANTHAPURAM

The details of arrivals of important perishables in the market is given below

Sl.No	Name of commodity	Average Kerala arrivals (T)*	Average out of state arrivals (T)*
1	carrot	00	431
2	Banana	738	1474
3	Beet root	00	412
4	Tomato	00	1209
5	Brinjal	00	721
6	potato	00	830
7	cabbage	00	1135

* Arrival at Chalai market

Source: Vegetable and fruit promotion council of Keralam.

It may be seen from the table that the arrival of fruits and vegetables in the market is very good. There is however no cold storage in the district for fruits and vegetables. Being the capital city there is good potential for such cold storage here. Considering the fact that there is an international airport in the city, there is good potential for export and import of perishables. Vegetables and fruits can be also be brought from Madurai, Trichy etc. and stored here. There is a cold storage at the international airport for the benefit of exporters.

There are a few cold storages in the district for storage of fish as per the list below.

S NO	NAME AND ADDRESS OF THE COLD STORAGE	CAPACITY (MT)	ITEMS STORED
1	Euro marine products P ltd, Puthenthope, Vettuthura PO, Trivandrum	300	MARINE PRODUCTS
2	Abad Enterprises Ltd, Vizhinjam, Trivandrum	120	MARINE PRODUCTS
3	Govt Ice& cold storage, Deptt of fisheries Madai, Trivandrum. (closed)	75	MARINE PRODUCTS
4	Kerala State Industrial Enterprises Ltd, Cotton Hill, Trivandrum-695 014. (CS at Airport)	150	MULTIPURPOSE
5	Aancy Marine and farm products Exporters P ltd, Pozhiyur, Trivandrum	100	MARINE PRODUCTS

All the cold storages are used for storage of fish items, except the one in the airport, constructed for the benefit of exporters.

Considering the fact that there is no cold storage for vegetables in the district, cold storage capacity of about 5000MT may be required in the district. The cold storage can be constructed in the wholesale market at Anayara, which is the ideal location, taking into account the closeness to highway, availability of space etc. Since there is an international airport at Trivandrum, there is potential for export/import of fruits and vegetables and the cold storage facility can be utilized for this purpose.

V-3.KOLLAM

Kollan is also one of the main export center for marine products after Ernakulam and Allapppy. There are number of fish cold storages in Sakthikulangara, the main fishing harbour. However no cold storage is available for storage of vegetables. The details of arrivals of fruits and vegetables in the main market are given below.

Sl.No	Name of commodity	Average Kerala arrivals (T)*	Average out of state arrival (T)*
1	carrot	00	850
2	Banana	90	10950
3	cauliflower	00	240
4	Tomato	00	2240
5	potato	00	1311
6	cabbage	00	1233
7	Brinjal	00	734

*Arrival at Kollam market

Source: Vegetable and Fruit promotion council of Keralam.

The list of cold storages in the district is given below

S NO	NAME AND ADDRESS OF THE COLD STORAGE	CAPACITY (MT)	ITEMS STORED	SECTOR
1	Fine sea products, sakthikulangara, Quilon	50	MARINE PRODUCTS	Pvt
2	Mariyalayam seafood exports P ltd, Sakthikulangara, Quilon	50	MARINE PRODUCTS	Pvt
3	MalabarArabian Fisheries Ltd Mamachanthuruth Neendakara Kollam	125	MARINE PRODUCTS	Pvt
4	Brony Fisheries, Sakthi Kulangara, Kollam - 691 581.	50	MARINE PRODUCTS	Pvt
5	Poyilakada Fisheries Ltd., P.B.No. 41, Parameswarnagar, Kollam - 691 001.	660	MARINE PRODUCTS	Pvt
6	Esmario Export Enterprises, Kavanad P.O Kollam.	150	MARINE PRODUCTS	Pvt
7	General Sea Foods Pvt. Ltd., M.C.9,	100	MARINE	Pvt

S NO	NAME AND ADDRESS OF THE COLD STORAGE	CAPACITY (MT)	ITEMS STORED	SECTOR
	Mandakkal West, Kollam - 1		PRODUCTS	
8	Oceanic Fisheries Ltd, Sakthikalangara P.O Kollam - 691 581.	340	MARINE PRODUCTS	Pvt
9	Arun Ice & Cold Storage, Lake View, Sakthikulangara, Quilon - 691 581	50	MARINE PRODUCTS	Pvt
10	King Fisheries Ltd., Exporters of Quality Sea Foods, Neendakara P.O, Chavara, Quilon.	125	MARINE PRODUCTS	Pvt
11	Indian Aquatic products Sakthikulangara, Quilon	90	MARINE PRODUCTS	Pvt
12	Oceanic Fisheries (India) Ltd., Sakthikalangara, Kollam - 691 581	150	MARINE PRODUCTS	Pvt
13	Deep sea products Sakthikualangara, Quilon- 691 581	125	MARINE PRODUCTS	Pvt
14	Kings Marine Products, Uliyakovil, Kollam - 691 019	175	MARINE PRODUCTS	Pvt
15	Capithan exporting Co Sakthikulangara, KOLLAM	60	MARINE PRODUCTS	Pvt
16	Poyllakada Fisheries Ltd., P.B.No. 41, Parameswar Nagar, Kollam - 691 001.	50	MARINE PRODUCTS	Pvt

As there is no cold storage in the district for fruits and vegetables, one cold storage of 2000 MT capacity may be required in the district capital Kollam. Vegetables and fruits can be easily brought here from Madurai, Odamchatram etc. in Tamil Nadu.

V-4. KOTTAYAM

Kottayam is one of the important cities and business centers in Kerala. Rubber is one of the main items produced in the district. There is no cold storage in the district. Traders are bringing vegetables, fruits etc. from the neighbouring states on a daily basis.

The arrival of important items in the district is given below. **Considering the arrival of items in the market one cold storage of about 2000MT may be required in the district, to be located nearby Kottayam city.**

Sl.No	Name of commodity	Average Kerala arrivals (T)*	Average out of state arrivals (T)*
1	carrot	00	998
2	Banana	2171	4018
3	Cauliflower	00	171
4	Tomato	00	1201
5	potato	00	2053
6	cabbage	00	1932
7	Beet root	00	188
*Arrival at Kottayam market Source: Vegetable and Fruit Promotion Council of Keralam			

V-5.PALGHAT

The details of arrivals of fruits and vegetables in the main market are given below.

Sl.No	Name of commodity	Average Kerala arrivals (T)*	Average out of state arrival (T)*
1	carrot	00	371
2	Banana	7190	6579
3	tamarind	NA	NA
4	Tomato	00	3017
6	potato	00	2311
7	cabbage	00	1014

* Arrival at Palghat market

Source: Vegetable and fruit promotion council of Keralam.

Palghat district is in the border of Tamil Nadu and Coimbatore city is only 40 kms from Palghat town. Vegetables, Fruits and other food items from Tamil Nadu, Karnataka and other states are brought to Kerala via Palghat. Being the border district and closer to Coimbatore, Palghat has good potential for cold storage. The first multipurpose cold storage in the state was constructed in Palghat during 1997. It has a capacity of 3000MT and owned by a private company. Except mango, banana and tamarind, production of other perishables in the district is poor. Items like potato, oranges, apples, tamarind, dates etc. are brought from the neighbouring states and stored in the cold storages here. There is also one small cold storage in the district owned by HORTICORP.

Considering the fact that Palghat is closer to Tamil Nadu and Karnataka, there is good potential for cold storage. The existing cold storage is fully utilized. So, additional **cold storage capacity of 5000MT may be required in the district.** Items brought from neighbouring states can be stored in the cold storages here and distributed to other parts of the states.

V-6. TRICHUR DISTRICT

Trichur is considered as the cultural capital of Kerala, located at the center part of Kerala. It is an important commercial city in Kerala. As seen from the arrivals in the markets, there is very good arrivals in the market from outside the state. Except banana, the arrivals of Kerala vegetables and fruits in the market are negligible, as per the table below.

There is no cold storage in the district for storage of vegetables and fruits. **Considering the very good arrivals in the market cold storage capacity of about 3000 MT may be required in the district. Taking into account the huge arrivals of banana, there is a need to construct one banana ripening room also in the district.**

Sl.No	Name of commodity	Average Kerala arrivals (T)*	Average out of state arrivals (T)*
1	carrot	00	1015
2	Banana	12869	30574
3	Beet root	00	1082
4	Tomato	00	12120
5	Brinjal	00	1685
6	potato	00	3152
7	cabbage	00	8535
8	cauliflower	00	572
*Arrival at Trichur market Source: Vegetable and Fruit Promotion Council of Keralam			

The list of cold storages in the district is given below.

1	Safa Enterprises, Light House Junction, Azhikode PO, Trichur Dist	150	MARINE PRODUCTS	Pvt
2	Trichur Regional Co.op Milk Producers' Union Ltd., Trissur Dairy, Ramavarmapuram, Trissur - 680 631	100	MILK PRODUCTS	Co-op
3	The Deputy Director of Fisheries, Government sample Cold Storage, Municipal Office Road, Trichur.	20	MARINE PRODUCTS	pub
4	Deputy Director of Fisheries, Trishur, Government Ice Cold Storage Plant, Chavakkad - 680 506	75	MARINE PRODUCTS	pub

V-7. KOZHIKODE

Kozikode is one of the main cities in the northern Kerala. The details of arrivals of main perishable items in the market are given below.

Sl.NO	Name of commodity	Average kerala arrivals (T)*	Average out of state arrivals(T)*
1	Potato	00	1392
2	Cabbage	00	2459
3	Tomato	00	7227
4	Beet root	00	783
5	Carrot	00	817
6	Brinjal	00	628
7	cauliflower	00	247
8	Banana	1762	4922

*Arrival at Kozhikode market

Source: Vegetable and fruit promotion council of Keralam

There are only two cold storages in the district as given below.

S NO	NAME AND ADDRESS OF THE COLD STORAGE	CAPACITY (MT)	ITEMS STORED
1	Baby Marine Exports, P.B.No. 901, West Hill, Calicut - 673 005.	125	MARINE PRODUCTS
2	Uni Royal Marine Exports Ltd., 11/19 Vengulam P.O, Kozhikode - 673 303.	350	MARINE PRODUCTS

Both these cold storages are for storage of marine products and there is no cold storage for perishable horticultural items in the district. Kozhikode is the main city in Northern Kerala having airport and port facility. The neighbouring Wynad district is a hilly district and has to depend on Kozhikode for most of the items. So, cold storage capacity of at least **3000MT** may be required in the district. Since airport and port facilities are available cold storage can be used for export/import of perishables.

V-8. ALLAPPUZHA

Allappuzha is also one of the coastal districts of Kerala. Fishing and Coir are the main industries in Allappuzha. Now-a-days, due to non availability of raw material, the coir industry is facing problem and most of the units have been closed down. Fishing is another important business in the district and a number of fish cold storages are located in the district, owned by the exporters. After Ernakulam, Allappuzha has the maximum number of cold storages for fish. Paddy is the main cultivation in the district and Kuttanad is the main paddy producing center in the state. Production of horticultural items is very poor and the details of arrivals of important commodities in the district are given below.

It may be observed from the table that except banana, the arrival of Kerala items in the market is negligible.

Sl.NO	Name of commodity	Average Kerala arrivals(T)*	Average out of state arrivals(T)*
1	Potato	00	2053
2	Cabbage	00	1932
3	Tomato	00	1201
4	Cauliflower	00	171
5	Carrot	00	998
6	Beet root	00	188
7	Banana	2171	4018
* Arrival at Allappuzha market Source: Vegetable and Fruit Promotion council of Kerala.			

The list of cold storages in the district is given below.

S NO	NAME AND ADDRESS OF THE COLD STORAGE	CAPACITY (MT)	ITEMS STORED	SECTOR
1	International Freeze fish exports AP 2/809 A, CIE,Aroor	125	MARINE PRODUCTS	Pvt
2	Geo aquatic products pvt Ltd Veluthuly Road Chandiroor Alleppey	400	MARINE PRODUCTS	Pvt
3	Snowman Frozen foods Ltd Ezhupunna Alleppey	650	MARINE PRODUCTS	Pvt
4	Torry Harris Seafoods Ltd, Chungom, Alleppy-688 010	250	MARINE PRODUCTS	Pvt
5	Fair exports India (pvt) ltd 11/686 , Industrial development area, AROOR - 688 534	250	MARINE PRODUCTS	Pvt
6	Sea fresh exports ltd, P.B No.9, Ind.Estate, Arooe-688 534	150	MARINE PRODUCTS	Pvt
7	Cochin Frozen Food Exports (P) Ltd., Aroor, Alleppey.	150	MARINE PRODUCTS	Pvt
8	Marine India exports P ltd, Ind.Estate, Aroor	230	MARINE PRODUCTS	Pvt
9	Femp exports (I) P ltd, Ind.Estate(chem), Aroor	100	MARINE PRODUCTS	Pvt
10	Pooppally Foods, P.B.No. 4613, Sea View, Alappuzha.	150	MARINE PRODUCTS	Pvt
11	Relish Custom Foods, Valanjavazhi, Allappuzha (closed)	100	MARINE PRODUCTS	Pvt
12	Accelerated Frozen Drying (Co) Ltd., EP / IV / 136, Ezhupunna P.O, Alleppey District.	100	MARINE PRODUCTS	Pvt
13	M / S Sreevas export enterprises Keltron road, AROOR	150	MARINE PRODUCTS	Pvt
14	Kerala Food Pacxkers North Oil Mills Co.p. XVI / 659 A, Vazhichery, Alleppey - 688 001.	150	MARINE PRODUCTS	pvt
15	Anand Exports X/300 (A), Chandiroor, Alleppey District.	60	MARINE PRODUCTS	Pvt
16	International Creative Foods, Industrial Estates, Aroor - 688 534.	250	MARINE PRODUCTS	Pvt
17	Star fish Exports AP V/420, Aroor-688 534 Alleppy	100	MARINE PRODUCTS	Pvt
18	Kerala Food Packers North Oil Mills Co. Ltd.,XVI 659 A, Vazicherry. Alleppey - 688 001	50	MARINE PRODUCTS	Pvt
19	Kaminee Sea Foods (P) Ltd., Industrial Estate Area, Aroor.	75	MARINE PRODUCTS	Pvt
20	Relish Foods, P.B.No. 20, Valanjavazhi, Alappuzha - 5.	40	MARINE PRODUCTS	Pvt
21	Front Line Exports Pvt. Ltd., Industrial Estate, Aroor.	100	MARINE PRODUCTS	Pvt
22	RF Exports, Eramalloor, Alappuzha, Kerala.	350	MARINE PRODUCTS	Pvt
23	Koluthara Exports Ltd., Keltron Road, Aroor –	300	MARINE	Pvt

S NO	NAME AND ADDRESS OF THE COLD STORAGE	CAPACITY (MT)	ITEMS STORED	SECTOR
	688534.		PRODUCTS	
24	Sea Pearl Enterprises, Chandiroor - 688 547 Alappuzha (dt)	100	MARINE PRODUCTS	Pvt
25	Standard Food Packers, Keltron Road, Aroor - 688 534	100	MARINE PRODUCTS	Pvt
26	International Creative Foods Ltd., Industrial Estate, Aroor - 688 534.	150	MARINE PRODUCTS	Pvt
27	Sea Pearl Industries, AP- 9/595, Chandiroor - 688 547	300	MARINE PRODUCTS	Pvt
28	Fish India International, Poochakkal, Shertalai - 688 526.	75	MARINE PRODUCTS	Pvt
29	Amalgam foods Ltd, Ezhupunna , arroor, Alleppy. (expn)	60	MARINE PRODUCTS	Pvt
30	Seasons Enterprises, Kommady Alleppey-7	100	MARINE PRODUCTS	Pvt
31	Marina Marine Exports, Thottappally, Alleppey, Kerala - 682 563.	50	MARINE PRODUCTS	Pvt
32	Inter seas Chandiroor, Alleppy	125	MARINE PRODUCTS	Pvt
33	Abad Fisheries, AGP/ W-II / 37A, Arroor post Alleppy	3050	MARINE PRODUCTS	Pvt
34	Kay kay exports, APX/114 A, NH 47,Arroor PO, Alleppy	750	MARINE PRODUCTS	Pvt
35	Kerala Co.op Milk Marketing Food. Ltd., Central Products Dairy, Punnapra, Alappuzha - 688 004	50	MILK PRODUCTS	co-op
36	Bharath Sea Foods, I.Q.F.Unit, P.B.No. 911, Palluruthy, Kochi.	100	MARINE PRODUCTS	Pvt
37	Rubian Exports, Rubian Company, Aroor - 688 534, Alapuzha Dt.	100	MARINE PRODUCTS	Pvt
38	Bharath Sea foods, Chandiroor - 688, Ext 7, Alleppey Dist, P.B.No. 911, Palluruthy, Kochi - 682 006.	100	MARINE PRODUCTS	Pvt
39	Premier Exports International, Chandiroor - 688 547 (closed)	125	MARINE PRODUCTS	Pvt
40	Premier Marine products, EP V/649-A, Eramalloor	250	MARINE PRODUCTS	Pvt

It may be observed from the list that there is no cold storage in the district for storage of horticultural perishable commodities. One cold storage of about 5000MT is under construction in Aroor. Even though Aroor falls under Alleppy district, it is nearer to Ernakulam city and this cold storage will meet the requirements of Ernakulam district. **Considering the arrivals of vegetables and fruits in the district, cold storage capacity of about 2000 MT may be required**

in the district. Some of the closed fish cold storages may be modified and used for the storage of horticultural items.

V-9.MALAPPURAM

The details of arrivals in Manjeri market of the district is given below.

Sl.No	Name of commodity	Average Kerala arrivals (T)*	Average out of state arrivals (T)*
1	carrot	00	3715
2	Banana	2955	7284
3	Brinjal	00	2776
4	Tomato	00	1711
5	potato	00	2133
6	cabbage	00	1711

*Arrivals at Manjeri market

Source: Vegetable and Fruit Promotion Council of Keralam

There is no cold storage in the district for storage of horticultural items. Even though there are good arrivals in the market, there is no need for a cold storage in the district as on today. If cold storages are available in the neighbouring districts of Palghat and Trichur the same can be used for this district as well.

V-10. KANNUR DISTRICT

Kannur is one of the northern districts in the state. It has many hilly areas. The arrivals in Thalassery market in the district is given below. There is no cold storage in the district. **Considering the arrivals in the markets, cold storage capacity of about 2000 MT may be required in the district to cater to the needs of northern districts.**

Sl.No	Name of commodity	Average Kerala arrivals (T)*	Average out of state arrivals (T)*
1	carrot	00	253
2	Banana	3030	9440
3	Beet root	00	289
4	Tomato	00	952
5	Brinjal	00	362
6	potato	00	959
7	cabbage	00	972
*Arrival at Thalassery market Source: Vegetable and Fruit Promotion Council of Keralam			

V-11. OTHER DISTRICTS

In districts like Pathanamthitta, Idukki, Wynad and Kasargode, even though there is good arrivals in the markets, construction of cold storages may not be viable at this stage. The facilities available in the nearby districts can be utilized by them.

VI. SUMMARY AND CONCLUSION

1. Kerala is one of the thickly populated states in India. Horticultural production in the state is very poor and it imports most of the fruits and vegetables from the neighbouring states.
2. The annual growth rate in the area of food grain is negative in the state as compared to positive growth rate in neighbouring states.
3. In case of vegetables and fruits, there is no marketable surplus and therefore the growth of cold storages for horticultural items in the state is very slow compared to other southern states. More over the generally cold stored items like potato, apple, oranges, tamarind, chilly etc are not cultivated in Kerala.
4. Almost 98% of the cold storages in the state are for storage of marine products operated by the exporters for their captive use.
5. Even though the production of fruits and vegetables in the state is poor the arrival of fruits and vegetables in the markets is very good. Fruits and vegetables are brought to the markets throughout the states on a daily basis. The arrivals are mainly from Coimbatore, Bangalore, Madurai, Tirunelveli, Odamchatram etc.
6. The traders are bringing fruits and vegetables according to the demand, to reduce the spoilage. In case of truck strike, harthal etc., which is very frequent in Kerala, the arrivals from outside states get affected. The prices of essential items increase on such occasions. If sufficient cold storages are available, this can be controlled to some extent.
7. Due to poor production, the growth of cold storages for fruits and vegetables in the state is very slow. However considering the huge arrival of fruits and vegetables in the markets across the state, there is a need for cold storages in major cities. Banana and pineapple are some of the main fruits produced in the state. The spoilage of bananas can be reduced by constructing ripening rooms. There is also good potential for export of fruits and vegetables.

8. Other reasons for slow development of cold storage industry are the high labour cost and trade union activities prevailing in the state.
9. The cold storages in the state can be linked through a cold chain. The fruits and vegetables from the neighbouring states can be brought through refrigerated trucks to the cold storages in major cities. The retail sales may be done through air-conditioned super bazaars, to avoid spoilage, as the post storage life of most of the fruits and vegetables is low.
10. There is a need to create awareness among the traders, farmers, consumers etc. regarding the benefit of cold storage in preserving fruits and vegetables.
11. Considering the fact that Kerala is a good producer of spices, cold storage facility may be used for storage of items like dry ginger, turmeric, cardamom etc. By storing in cold storages the storage life of most of the spices can be extended. Cold storage also helps in maintaining the quality of spices by preventing the attack of fungus, insects, bacteria etc. There is a need to experiment with other items also.
12. Due to the stringent quality control measures adopted by buyers, a number of fish cold storages in the state have been closed down. Efforts may be made to modify some of these cold storages to suit the storage requirements of fruits and vegetables. Some of the cold storages may be used for the benefit of fishermen for storing their fish for local sales.
13. Considering the fact that about 60% of the operational cost of a cold storage is on electricity, for the development of cold storages in the state, some sort of concession in electricity tariff may be provided to the cold storage industry by the state govt. Karnataka Govt. is giving a concession of Rs.1 per unit for horticultural cold storages. Tamil Nadu Govt. has also recently issued G O, giving concession in electricity tariff up to 3 lakhs per year, for horticultural based cold storages. Any concession in electricity tariff will help the development of cold storage industry in the state.

14. In order to reduce the operational cost of cold storages, prefabricated panels with rotary/screw compressors using advanced technologies may be used for new cold storages. This type of cold stores consumes less electricity as compared to conventional one.
15. The total requirement of cold storages in the state is about 34000 MT. It is better that all these cold storages form a cold chain and the procurement and distribution are done through refrigerated trucks. Since huge investment is required for a cold chain project, participation of private entrepreneurs, multinational companies etc. are necessary for the success of such projects.
16. There are 6 Agricultural Wholesale markets in the state constructed with EEC aid. They are
1. Anayara, Thiruvanthapuram
 2. Nedumangad, Thiruvanthapuram
 3. Marad, Ernakulam
 4. Muvattupuzha, Ernakulam
 5. Vengeri, Kozhikode.
 6. Sultan Bateri, Wayanad
- Cold storages may be constructed in all these markets which will help the farmers as well as traders.

VII.Cold Storage requirements for important fruits, vegetables and other perishables

VII-1 Apples

The recommended storage temperature for most of the varieties is 34 to 36 F and the approximate storage life is 4-6 months. It is unsafe to generalize on the storage life of apple varieties because much depends on harvest maturity, elapsed time temperature between harvest and storage, rate of cooling in storage etc. The best storage potential is usually found when the apples are mature, but have not attained their peak of respiration when harvested. However at the proper maturity, careful handling and prompt storage after harvest are conducive to long storage life.

Storage troubles of apples may be caused either by attack by microorganisms or by the fruits own physiological process. Scald, bitter pit, internal browning and brown core etc are the main storage disorders seen in apples. Scald first appears as traces of light mottling on the green surfaces of the fruit. Fruits harvested in the early mature stage are more susceptible than those harvested later. Ordinary scald affects only the skin, but in severe cases may extend into the flesh. Bitter pit is characterized by small sunken spots on the fruits surface. They are most prevalent near the blossom and although usually near the surface. They may be found deep in the flesh as well.

VII-2 Bananas

Bananas do not ripen on the plant in tropics; therefore the fruit is harvested green and at a stage of development which will allow it to be transported in refrigerated carriers or otherwise to the country of destination and arrive there still green. Another reason for cutting banana green is that the susceptibility of the fruit to handling damage is greatly increased as ripening advances.

VII. 2.1 Ripening

During ripening enzymatic changes take place in the pulp of the fruit. The pulp of the green banana contains about 20% starch. As ripening progresses the starch is converted into sugars, principally sucrose, dextrose

and laevulose. Color changes in the peel occur simultaneously with the pulp change and are also enzymatic.

Within certain limits the period require for ripening green fruit can be extended to meet the trade requirements. Under average conditions ripening cannot be accomplished in less than 3 or 4 days nor extended much beyond 8 to 10 days without resorting to drastic treatment harmful to the quality and salability of the fruit.

Especially important in controlling ripening is the change in the rate of heat generation as the ripening cycle progresses. The controlling factors in banana ripening are generally recognized to be temperature, humidity and ventilation.

VII. 2.2 Banana ripening rooms

Banana ripening rooms have construction requirements similar in basic principle to ordinary cold storage. Rooms must have adequate insulation, heating and cooling equipment, humidifying equipment, controls etc. It has been found that it is usually possible to load a larger amount of boxed fruits into a room than with stems.

VII. 2.3 Refrigeration

A direct expansion R12 system is recommended for use in banana rooms . Exposure to ammonia for even short periods of time may turn the peel surface black, rendering the fruit unusable. The air temperature used in ripening boxed bananas may vary

between 45⁰F to 66⁰F and 56⁰F to 68⁰F for stem bananas. During normal ripening cycles, heat is generally required only during the first 24 hrs to raise the pulp temperature to the desired level for application of ethylene gas. Ethylene is applied artificially at the initiation of ripening cycle to permit use of a safe temperature range.

Humidity plays a definite and important role in the processing of banana. High humidity in the ripening (90 % to 95%) contributed greatly to better appearance, salability and product life of bananas. Best result can be

attained through the use of automatic humidifiers with humidistat. Use of spray nozzles can be used for stem bananas.

VII-3 Beans

Beans are probably best stored at 45F to 50F at RH of 90% to 95%. It can be stored 8 to 10 days subject to wilting when RH is low.

VII-4 Beat roots

When stored at 32F with RH of about 95%, bunch beats should keep for 3 to 4 weeks.

VII-5 Carrots

Carrots can be best stored at 32F with 95% RH. This vegetable is subject to wilting if the humidity is too low. Carrots can be stored for 3-4 weeks.

VII-6 Cauliflower

Cauliflower can be stored for 2-4 weeks at 32F with a RH of about 90% to 95%. Crates should be handled carefully to avoid bruising of heads or leaves. Stacked with heads down to avoid bruising the curd, and arranged to permit air circulation.

VII-7 Oranges

Oranges can be successfully stored for 8-12 weeks at 32 to 34F with a RH of 85% to 90%. Oranges lose moisture rapidly. So, high humidity should be maintained in the storage room. Storage of oranges is often complicated by the fact that prolonged holding at relatively low temperature may induce the development of physiological rind disorders not ordinarily encountered at room temperature. Aging, pitting and witting breakdown are the most prevalent rind disorders induced by the low storage temperature. There

appears to be no short cut for successful long storage of oranges. Harvest at the proper maturity, careful handling of fruit, good packing house methods, fungicidal treatment and prompt storage after harvest are conducive to long storage life.

VII-8 Onion

A comparatively low humidity is essential in the successful storage of onions. Higher humidity in which most vegetables keep best, onions are disposed to root growth and decay and at too high temperature sprouting is encountered. Therefore storage at 32F with RH of 65% to 70% is recommended to keep them dormant. At this temperature and humidity, onions can be stored for 6-8 months.

VII- 9 Potatoes

The ideal storage condition for potatoes is 38 to 40F with RH of 85% to 90%. Potatoes can be stored for 5to8 months. They should be stored in dark and should not be kept in the same with fruits, nuts, eggs or dairy products because of the objectionable flavor they may impart. Late crop potatoes are better for long storage than early crop potatoes.

VII-10 Tomatoes

A temperature range of 57 to 60F with RH of 85 to 90% is considered the most desirable for slowing ripening without increasing decay problem. At this temperature the more mature fruit will ripen enough to package for retailing in 7-14 days. Storage below 50F is especially harmful to mature green tomatoes; these temperatures make the fruit susceptible to decay during subsequent ripening.

VII-11 Butter

For short time storage (up to 2 months), 32to 40F is satisfactory. For long time storage (up to one year), a temperature of -10 to 0F should be maintained. The butter should be protected with a covering so that

absorption of orders is prevented, oxidation of the fat on the surface of the butter is minimised and shrinkage in weight due to evaporation is prevented.

VII-12 Eggs

Use of refrigeration rank highest of all controls which may be applied in the preservation of quality in shell eggs. The criteria usually used in evaluating eggs quality are appearance, odor and flavor, nutritive value, culinary value and microbiological conditions. Qualitatively there are three distinct kinds of deterioration in shell eggs such as changes due to chemical reactions, decomposition by bacteria and changes due to absorption of odors and flavors from environment. Eggs can be stored for 8-12 months at a temperature of 35 to 40F and 80-85% RH.

VII-13 Meat products

Storage of variety of meat is dependant upon the end use by the establishments involved. For short storage under one week and for local use 32 to 24F internal product temperature is considered good practice. If stored for shipping the internal temperature of product should be kept at 0F or below. Recommended length of storage depends upon type of package, freezer temperature and relative humidity etc. the storage life vary from 2-6 months, depending on the above factors.

VII-14 Fish

Total storage life of fish varies from species to species. The storage life of fresh fish properly iced down and stored in refrigerated room (33 to 35F) is about 10-15 days depending on the condition of fish when loaded into the refrigerated room. Fresh fish should be stored in a room of low air velocity in order to hold high room humidity to prevent dehydration of the product. Frozen fish must be kept at 0F or lower in order to assure adequate shell life. Storage above 0F even for a comparatively short period of time will result in rapid loss of quality. Continuous and maintained storage at temperature lower than 0F reduces oxidation, dehydration and enzyme changes resulting in longer product shell life. It is important therefore that frozen seafood be kept at temperature as close to 0F as possible from the

time frozen until reaching the consumer. The storage life of frozen fish is about 8-10 months depending on the species.

The optimum storage temperature and humidity for various perishable items are shown in table below.

OPTIMUM STORAGE TEMPERATURE FOR VEGETABLES AND FRUITS

Sl.No	COMMODITY	TEMP(^oF)	HUMIDITY	APPROXIMATE STORAGE LIFE
1	Apples	34-36	85-90	4-6 months
2	Bananas	58-60	85-90	8-10 months
3	Grapes	32	85-90	3-8 weeks
4	Guavas	47-50	85-90	4 weeks
5	Lemon	32	85-90	1-4 months
6	Mango	55	85-90	2-3 weeks
7	Beans	45-50	90-95	8-10 days
8	Beet roots	32	90-95	10-14 days
9	Brinjal	47-50	90-95	4 weeks
10	Cabbage	32	90-95	3-4 months
11	Cauliflower	32	90-95	2-4 months
12	Ladys finger	42-50	90-95	2 weeks
13	Onion	32	65-70	6-8 months
14	Potatoes	38-40	90	5-8 months
15	Tomatoes	57-60	85-90	2-3 weeks
16	Oranges	32-34	85-90	8-12 weeks
17	Papaya	39-42	85-90	5 weeks
18	Pineapples	47-50	85-90	6 weeks
19	Pear	32-35	85-90	12 weeks
20	Sapotas	32-35	85-90	10 weeks
21	Chillies	45-50	85-90	4-6 months
22	Tamarind	45-50	85-90	4-8 months
23	Carrorts	32	90-95	3-4 weeks

