सत्यमेव जयते

National Centre for Cold-chain Development

Issue 4 | June 2014

Newsletter

ISSN 2395-4515

Private Circulation only

ISSN 2395-4515

The CEO's Desk

Our May edition mentioned a forthcoming trip by our engineering trip to Punjab, to assess possible solutions to modernise the ageing cold stores in that State. The result of that trip was not limited to standard equipment upgrades, but also threw light on possible design changes to allow for the handling of other crop types, specially vegetables.

In this month, NCCD also served the State Governments of Punjab and Haryana to help disseminate information on such solutions, as well to share understanding on the newly launched programs in regards to cold-chain infrastructure.

The month of June also saw other hectic activity as the NCCD Secretariat moved into its extended office at Janpath Bhawan. Readers may wish to take note that this shall be the mailing address (see back cover) for all communications.

-Pawanexh Kohli

CONTENTS

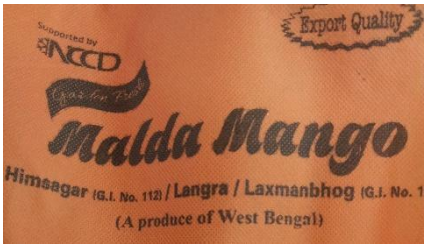
MALDA TO DELHI

The Government of West Bengal held its annual Malda mango mela in Delhi Haat this June. A unique aspect this year was that the movement happened under cold-chain care. In previous years, such attempts were considered "unfruitful", largely due to improper application of the cold-chain. NCCD was requested to provide guidance on post-harvest handling, from packaging, pre-cooling and the transportation protocols to use.

A total of 24 tons in three lots of specially packaged mangoes from Malda were transported to Delhi. The packaging was special because indigenous traditional crates were modified – each constructed to a pattern that uniformly aligned lateral and top vents to facilitate effective airflow and aid in removing of gas build-up from around each fruit. To counter any heat latency from the crates, the precooling time was suitably adjusted. The haulage protocol added replenishment of fresh air inside the reefer vehicle.

The impact of NCCD's innovative directions was a reduction of 60% on packaging cost (allowing for branded tertiary bags at market end), lowered handling wastage and a "fruitful" and successful 20 day mela.

The operations were looked after by the District Horticulture officers of Malda.



NCCD - STATE WORKSHOPS

As a follow-up to interactions at the conclave with Nodal Officers for Cold-chain Development from States, held last month, concerted efforts have been taken by the States of Haryana and Punjab to share the new concepts and propagate guidelines developed for integrated cold-chain development.

On 17-June-2014 a workshop was held with the State Horticulture Mission of Haryana. The one day workshop was arranged at Industrial Estate, Kundli, Sonepat. 2014 is the “Year of the FPO”, and the workshop was attended by 13 Farmer Producer Organisations (FPOs). In all, approximately 110 stakeholders attended and interacted at this workshop which included FPOs, various cold storage owners and a few traders. The audience in Haryana was highly interactive and inquisitive about how the recently launched guidelines and the newly introduced add-on technology components could aid their business operations.

Team NCCD presented on the technology solutions and best practices needed to help evolve the existent cold-bulk warehouses into efficient service platforms and integrate into cold-chains. Concerns regarding the electricity tariffs and market linkages were addressed by the State Horticulture Department and Team NCCD. The capacity building programs by NCCD were also shared with the gathered participants. In addition, the workshop included a visit to a commercial multi-product cold store (deep frozen and chilled range), FHEL (Concor’s subsidiary) Controlled Atmosphere Cold Store for apples and to a functional fruit and vegetable aggregation unit (operating without any cold-chain intervention) using dock levelers and bar-coding systems for traceability.

Another workshop was held in Jullundur on 20-June-2014, with the State Horticulture Mission bringing focus on the need to modernise the existing cold storage infrastructure in Punjab. This workshop was planned to bring exposure to many cold storage owners and entrepreneurs on the solutions possible, for upgrading their plant and machinery to make it more energy efficient.

The workshop also discussed on design changes that can enable these cold stores to cater to multiple product types. Earlier, in preparation, team NCCD visited cold stores in Punjab to assess the status first hand. Engineers from National Productivity Council (NPC) also accompanied NCCD to develop illustrative solutions. Recommendations had previously been sent to the Punjab government.

This workshop included presentation from two National banks (PNB and UCO Bank). Industry members of NCCD (Danfoss and Lloyd Insulation) also presented at this workshop. The event served as a one stop shop for all the queries directed by the audience towards NCCD, State Horticulture Mission, Equipment Suppliers and Banks. The audience in Punjab showed keen interest in the technology solutions presented by the NCCD members for up-gradation of their cold stores.

At this event, during his closing remarks, Shri. Arvinder Singh Bains (Special Secretary Agriculture, Punjab), stressed that a working group be established to fast track Punjab specific policy initiatives in liaison with NCCD.

In expectation, Punjab can foresee favorable options to modernise its considerable capacity in potato stores, into more energy efficient facilities as well opt for designs that will enable them to serve other more perishable cold-chain products.

In this period, the States of Arunachal Pradesh, Haryana and Uttar Pradesh have also appointed technical teams committed to cold-chain development. These technical teams will focus on reviewing the situation of cold-chain in their States and to liaise with NCCD to support development work.

Two more workshops are planned, at Hoshiarpur on 27-June and Ludhiana on 4-July-2014. A public notice inviting all NCCD members to take opportunity to share possible solutions for modernising almost 450 cold stores of Punjab has also been posted on NCCD website.

- Report by Vanshaj Kaul & Aman Bhatnagar

COLD-CHAIN INSIGHTS - III

Pawanexh Kohli

How does one correctly evaluate the capacity needs of a cold-chain? Only with access to relevant information and the understanding on what comprises the total cold-chain. Unfortunately, such assessments in the past have related to one component, the cold stores. The most commonly quoted capacity gap was assessed by the NSEL in 2010, where the report stated that the country needed creating another 37 million metric tons in storage capacity.

That analysis assumed that all infrastructure created, continued to be operational, irrespective of technology or ageing. The assessment did not resort to first hand data on the existing usable and available capacity in the country. As a desk review of statistics, with the existing capacity not assured, the gap mentioned served purpose at a basic level. Yet, many knowledge houses frequently continue to quote this primal assessment, not understanding or researching further. Many conjectured, that doubling the existing storage capacity was the urgent option for India. This easy assumption, extrapolated across all product types seems flawed and impractical. The first simple inference got propositioned beyond its original ambit. What comprises the cold-chain was not fully factored.

The reality is that our existing storage capacity or the stated shortfall, was not reviewed in terms of temperature zones or its position in product specific supply chains. In fact, demand from the food processing industry, or other commodities like spices and pulses may have been missed as each would translate into differing capacity types & in relation to volumetric requirements per product type, varying on the basis of product life cycle and the ensuing throughput cycle, across the cold-chain.

More drastically, any analysis cannot be limited to cold storages alone should refer to other correlated and necessary infrastructure. A cold-chain capacity gap report needs to detail the phenomenal deficit in transport – there is no cold-chain without this link. Most analysis, seem to blithely assume that all surplus production can undergo subsequent storage for viable sales in off-season periods, irrespective of feasibility or any other intervention. Basically, the need for production units or pack-houses is not being factored in... can there be a cold-chain without points of origin!

In case of some fresh produce, like the bulk of potatoes produces, spices, less than a half of apples produced, etc, the formula “production – local sales = storable surplus” can be used. But in case of most perishables, including many food products that come off a factory line, and dairy products, the cold-chain gap needs to be assessed in terms of throughput rates across each infrastructure item.

FRESH PRODUCE GOSSIP

- Blue and purple fruits help your memory 
- Green fruits help make bones and teeth strong. 
- Yellow fruits help keep you from getting sick. 
- Orange fruits help keep eyes healthy. 
- Red fruits help keep your heart strong. 
- A watermelon contains 92% water, 6% of sugar. 
- Litchi seeds are poisonous and should not be eaten. 
- Jamun fruit leaves and bark are useful for controlling blood pressure and gingivitis. 
- Sugar-apple seeds should not be eaten as are poisonous. 
- Avocado has more fat content than any other fruit. 
- Pineapples are berries, just like strawberries and blueberries. 

In these latter cases, a deficit in production capacity will impact feasibility of storage. The deficit in reefer transport, will forsake the supply lines. A shortfall in cross-docking distribution cold stores will reflect on delivery to markets. Any misalignment in these infrastructure components will break the cold-chain. In the fresh segment, the cold-chain misses pre-conditioning centres or pack-houses. To feed domestic farm produce to only 10% of our existing cold storage capacity, 30,000 pack-houses dotting across rural India, each feeding twice as many reefer transport units may be required. This is going to need influx of thousands of crores of rupees of capital, into rural India. This will also require another kind of capacity in cold chain – human capacity.

LITCHI TIME

Some factoids about Litchi.

Litchis are non-climacteric fruit and produce minimal ethylene. Litchis cannot ripen after harvest and hence are normally harvested after ripening on the plant.

Litchis are very sensitive to sunlight and heat. In uncontrolled ambient, its post-harvest life span is barely 2 to 4 days. When intended for markets that are more than a couple of day's travel, litchi should be treated and precooled to mitigate post-harvest deterioration.

Lychee deteriorates very fast after harvest. Pericarp browning is a major problem (associated with desiccation), rendering the fruit unmarketable. Even with most optimal care, post-harvest life of fresh litchi can be extended only a few weeks. Therefore, rapid evacuation and transport to consumers is the logically followed norm. Bhabha Atomic Research Centre (BARC) had developed a chemical treatment to maintain the quality of litchi fruit, for upto 45 days while being maintained at ambient temperatures of 4°C.

Litchi Respiration rate; ethylene production:

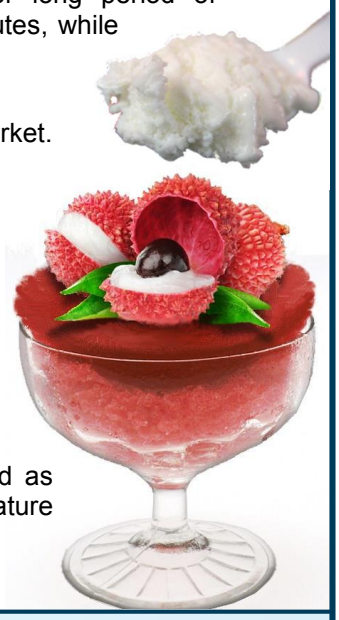
- @ 5°C: 5 - 8ml CO^2/kg·hr; >0.1 ul C_2H_4 /kg·hr
- @ 10°C: 10-15ml CO^2/kg·hr; >0.2 ul C_2H_4 /kg·hr
- @ 20°C: 25-40ml CO2/kg·hr; >0.5 ul C2H4 /kg·hr

When cooled from 20°C to 5 °C, physiological processes reduce drastically & respiration rates reduce almost 5 times.

At 20°C, a ten ton truck load of fresh litchi can generate heat of 44,300 kilo calories per day (this is equivalent to 1,76,000 BTUs of heat load per day). At 25°C this doubles but at 5°C, the heat generated can reduce fivefold. Techniques to extend marketable life include sulphur treatment and packaging in perforated plastic bags, stored at 2°C to 7°C storage.

Litchi Handling:

- Ethylene – Low Producer, medium sensitivity - do not store with high ethylene producers.
- Post-harvest treatment: Sulphur dioxide (SO^2) fumigation is used as a post-harvest treatment to reduce browning. SO^2 treated fruit turns uniformly pink in colour after 2-3 days. Fumigated fruits absorb 30-65 percent of applied SO^2 (residual limit is only 10ppm). For long period of transportation, 600-650g sulphur is recommend for the duration of 50-60 minutes, while for air transport 300-400g sulphur for 30 minutes is advocated.
- Careful packaging and handling, impact and chilling sensitive.
- Precool the packaged produce to 0-5°C before commencing transport leg to market.
- Post-harvest life potential 14 days at 7°C, and 30 days at 4°C.



Litchi Water Content:

- Comprising 77-86% water, a relative humidity of 85-95% is recommended during transport and storage.

Litchi Optimal Conditions:

- Mature litchi at 7°C can buy time to market of up to 2 weeks.
- At 4°C and maintaining 90-95% RH lets the fruit last from 20 to 30 days.

Processing of litchi pulp is commonly in form of canning, aseptically packed and as ready to serve lychee juice. Aseptically packed pulp can be stored at room temperature for a year until opened, while other pulp is kept at -18°C.

Pests: *LITCHI MITE*

The most important pest of young litchi trees is Erinose mite. Also known as hairy mite, hairy spider, or dog ear mite and rust mite, the mite causes the leaf surface to blister, while the underside develops a brown rust coloured felt.

This pest can damage trees and result in reducing flowering and fruit production. Should symptoms appear, the infested leaves must be removed and burned.

When a large number of trees are infested, each new leaf growth should be sprayed with dimethoate or with wettable sulphur every 10 to 14 days, from just before the leaf flushing (fresh leaf growth) until it hardens. This should be repeated for each new flush. Stop once the new growth shows no symptoms of the pest. Sulphur is less disruptive to beneficial insects and is preferred, except during hot weather days when temperatures are higher than 28°C.

NCCD GLOSSARY OF COLD-CHAIN

Our CEO, Mr. Pawanexh Kohli, explained the difference between controlled temperature, modified atmosphere and controlled atmosphere. The first is obvious and refers to the use of refrigeration to alter the temperature of the air in a chamber and the other two aspects relate to the gaseous composition of the enclosed atmosphere.

Modified atmosphere: this refers to changes in the atmosphere's composition inside an enclosed space, such changes being slowly induced due to the normal physiological activity of the occupant of that space. This is common in modern offices where human occupancy & activity induces changes to the atmosphere, by raising CO_2 and humidity levels beyond optimal conditions. These levels are monitored, and fresh air vent flaps accordingly operated, to keep the space fit for the human occupants. Modern cars have a vent flap near the AC for this reason.

All cold stores or enclosed spaces, that store fresh produce, experience this naturally induced phenomena or "modified atmosphere" (MA). While the raised CO_2 levels can help by lowering physiological activity, by causing somnolence (drowsiness), very high levels can cause death and loss of value. Though MA is a passive effect, slow in manifesting, the contents of the atmosphere needs to be monitored to maintain an optimal living condition, inside such spaces. This especially, where long term storage is the case - fresh air vents, or even windows and doors are opened regularly to keep the atmosphere conducive to sustained storage of fresh produce.

This self-induced (no external power is applied) phenomena can be exploited in case of fruits and vegetables by using MAP (modified air packaging). MAP means using semi-permeable packaging that permits specific build-up of other gases, while allowing minimal measures of oxygen inside the package itself (MA condition).

Controlled atmosphere: this refers to when an actively controlled change of the atmosphere is effected, utilising specialised equipment. The equipment normally used involves molecular sieves (mechanical or chemical) that changes the molecular composition of air. Basically, instead of waiting for the slow, passive, self-induced modification (from normal respiration and physiological activity) to atmospheric contents, the change is realised with active intervention.

External energy is used to generate an inerting gas which is used to physically purge the inside atmosphere, through controlled inflow of the gas. The gas used in cold stores is Nitrogen, which already exists in abundance in natural air (78%). Unlike normal cold stores, the purging generates a high room pressure inside the chambers and the chambers need to be designed with specialised sealing and doors and relief valves, to withstand the elevated pressures.

This active and rapid change to the atmospheric composition is produced to maximise the advantage of physiological slow down and others benefits for specific fresh produce. In some cities, many car owners also refill their tyres with nitrogen and next time you visit the neighbourhood fuelling station, readers may enquire to see their nitrogen generating equipment.

Normal atmospheric composition is 78% N_2, 21% O_2, 380ppm of CO_2, and other gases.

LUMINARY SPEAK

Shri Anup Kumar Thakur, Secretary Department of Animal Husbandry, Dairying & Fisheries, Ministry of Agriculture.

Cold-chain is most evident and a cause of the success of our expansive dairy sector and for exports in fisheries and meat products. What learnings can be adopted in other food sectors?

True, in milk we are the largest producers and have a huge distribution network; also the largest exporters of meat in the world and very much up there in case of fisheries. Yet, the scope is enormous and there are more successes to achieve! The learnings are obvious, the cold-chain must be dynamic with the purpose to connect with multiple markets. In fish and meats, there remains the opportunity to store the product for months, yet the industry pursues the logic of promoting steady supply lines, keeping storage strategic and largely to serve as a buffer to maintain steady supply lines – this can be a lesson to all other producers and suppliers.

Is this not best exemplified and apparent in the dairy supply chain?

In case of milk, being highly perishable, there is very little scope to store. It is obvious that in the dairy sector the cold-chain is used as a mechanism to effectively supply & spread networks to markets. This temperature controlled supply-chain is very energetic and always on the move. Of course, the dairy sector may not be easily compared with many others, yet the fresh milk example ought to be emulated by most supply chains that handle highly perishable goods. Mother Dairy & Safal do this. When having perishable goods, primary logic is not to hold inventory but to move to connect with markets. Shelf life is better exercised on shelves.

The common perception is that cold-chain is very technology intensive, your views?

It is the impact of the technology that bequeaths it the seriousness it deserves. Cold-chain may use relatively simple industrial technology but in comparison with related sectors, it greatly impacts on integrating agriculture with markets. The back-end includes advanced technology chillers, pre-coolers, temperature and atmosphere controls. Cold-chain also uses particularly advanced solutions in case of program logic controls, monitoring and tracking tools. The refrigerated transport systems are advanced in their sector, whether road, rail, sea or air.

Cold chains are by nature highly dependent on energy source. Cost of maintaining the cold-chain is frequently stated as its bane, do you see this changing, in terms of availability and sustainability?

Costs are offset through technology, affordability and innovation, and there is clearly positive change in these aspects. Energy costs can be offset by varied solutions, including hybrid use of conventional & renewable sources of energy. These options are increasingly becoming popular and more affordable. Greater demand and affordability of both service and product quality are also mitigators & these show upwards trends. Lastly, increased understanding of the total value chain has also negated some concerns. Congratulations to NCCD for ardently promoting effective & environment friendly solutions, as well for initiating concept level changes in this industry.

National Centre for Cold-chain Development

Mailing Address: II-Floor, 'B' Wing, Janpath Bhawan, New Delhi 110001

Email: Contact-NCCD@gov.in

Web: www.nccd.gov.in

Editorial Management

NCCD Executive Office

Critique Partner: *Pawanexh Kohli*

Mentor Director: *Sanjeev Chopra*

Contributors of the month

Angad Singh

Bikram Mehra