



National Centre for Cold-chain Development

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Newsletter

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The CEO's Desk

The start of 2015, this January was hot and hectic at NCCD. The cool weather was helpful at times though. This month involved us in the 7th session of the Indo-France Joint Working Group on Agriculture as part of our international cooperation activities. We are happy to report that the delegation from France expressed keen interest in continued collaboration in cold-chain, assigning this a priority area.

In this month, India also saw high profile visits from the Foreign Minister of Japan, Mr. Fumio Kishida and the President of USA, Mr. Obama. These instances also served to bring some focus on cold-chain development and relevant groundwork was undertaken.

At the close of January, we restarted the cold-chain technology trainings in Chennai at the new Danfoss learning facility, and a calendar of the future sessions is listed on our website.

The system standards, released in December 2014 by NCCD's committee on standards, were published and shared at the National Conference on Technical Guidelines and Standards, at PHD House in Delhi, on 29th January 2015.

-Pawanexh Kohli

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OP-ED INVITATION:

Readers are invited to articulate their ideas, concepts & comments. NCCD Annual Journal will be published in 2015 & scholarly studies are also invited.

EVENTS - WORKSHOPS



A National Conference on Technical Guidelines and Standards was held at PHD House (Delhi) with participation from infrastructure providers and cold-chain users on 29-January-2015. The event highlighted the "System Standards" developed by NCCD to guide users and government agencies as minimum standards when developing cold-chain infrastructure. Participants also insisted that development of protocols for handling specific produce also be undertaken by NCCD and that support for testing quality and freshness of fruits & vegetables be considered.

OPINION PIECE

At its Independence and for a few decades thereafter, India was dependent on foreign aid to secure food for its citizens. In 1947 our population was about 335 million and many doubted if India could ever be self-sufficient to feed its masses. Today, with a population about four times in size, we do not speak of lack of production but are worried about wasted surplus and effective food distribution. Our



focus is more about avoiding food loss and waste in our supply chain. We stand more concerned about price of food and access to food than merely the production of food.

India's success with agriculture manifests so - our grain production today stands close to 260 million tons, we underwent a white revolution where milk production is almost 140 million litres per annum. In high value crops, today our production in horticulture stands at 281 million tons. In fruits and vegetables alone, we produced 84 million tons and 170 million tons in 2013-14. In all food items, we have scaled production multi-fold in the last 5 decades.

Production figures (annual)			
Horticulture	(million MT)	Livestock	(million MT)
Potato	46.4	Meat & Poultry	5.9
Onion	19.3	Fish	9.6
Tomato	19.1	Inland Fish	6.1
Mango	18.7	Marine Fish	3.5
Citrus	9.9	Butter	4.9
Banana	27.6	Milk	137.0 (million litres)
Brinjal	13.9	Egg	69731 million pcs
Aromatics, Cashew, Flowers, etc.	20.2	Field Crops	(million MT)
Vegetables	170.2	Pulses	19.8
Spices	5.8	Rice	106.2
Fruits	84.4	Wheat	95.6
Total Horticulture	280.7	Coarse Cereals	41.6

Various - Annual Reports on Agriculture

Compared with what we produced at start of the 1960s, we now produce 40 times as much tomato, 14 times more potato, 8 times more wheat, thrice as much in poultry and meat, 13 times more in fish, 8 times more milk and almost 40 times more eggs. The scaling up of our food production far surpassed the growth in population (which grew about 2.8 times from about 460 million in 1961). Producing food in sufficient quantity is not really an immediate concern; instead, apprehensions are more about securing easy and cheap access to the food, of minimising post-harvest losses and in improving resource use and input management. With almost 155 million hectares under agriculture, India's concerns today, are about enhancing productivity and to make agriculture more 'green', environmentally sustainable and to bring our produce to more gainful end-use.

It is also notable that horticulture uses only 24 million hectares (approx. 15% of total area under agriculture) and contributes almost 30% of agricultural GDP. Combined with livestock produce, almost 60% of agriculture's contribution to GDP is covered, leaving the remaining to field crops, grains, pulses, cotton, etc. The prime drivers for rural wealth and economic productivity has changed.

India stands tall indeed, for having achieved a high level of food security in production terms as it safely accounts for almost 18% of global population. The focus has moved towards planning for the future (Indian population is estimated to touch 1.7 billion by 2050, against 1.28 billion today).

However, a major learning arises, that no matter how much food we harvest, the waste incurred enroute to consumers nullifies the benefits that ought to accrue. The supply chain mechanism has been unable to cope with the flood of farm produce. This inefficiency in our supply systems is a constraint, which in turn has direct impact on inflationary pressures and degradation in the produces' nutritional quality. In effect, production alone is not sufficient to ensure reach of food to our dispersed sub-continental footprint. The missing piece for achieving food security is a good distribution mechanism.

The Public Distribution System, though primarily for hardy crops like grains and pulses, fulfilled the distribution need to some extent. The PDS is also supplemented with other mechanisms such as mid-day meal for schools, and with special entitlements to pregnant and lactating mothers. Of late, the country also enacted a rights based approach to Food Security through legislation. The aim is not merely at making food available, but to make nutrition **available at an affordable cost**. This was a response to counter the rising cost of food and to assure nutrition at right cost to the underprivileged. With efficient logistics-supply-chains, maybe such an Act need not have been required. A revamped PDS, with intelligent cold-chains are clear options. Long-term price stability is best achieved through developing dynamic supply chains, designed to constantly feed demand and offset episodic sourcing.

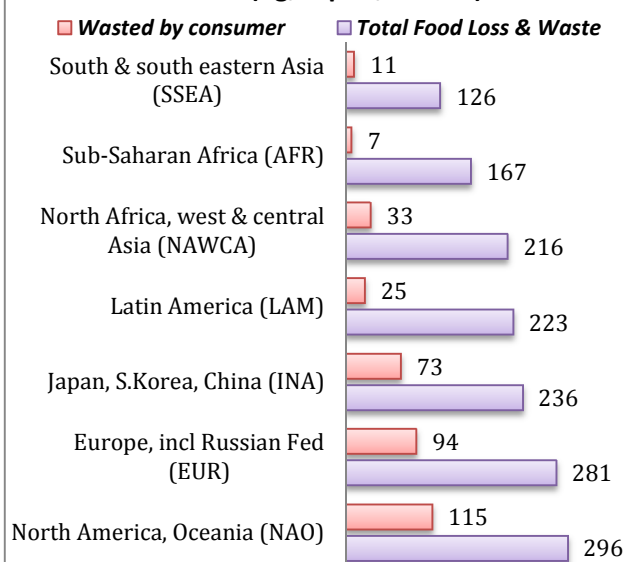
The primary concern for India today, is to bring its immense farm produce to gainful and effective end use - to reach the hands of consumers, regularly and efficiently. Every kilogram wasted due to poor post-harvest handling & logistics capabilities is also a loss multiplied in terms of resource wasted. Any loss on the supply side has immediate ramifications on price and inflation.

Food Loss: pre-consumer, post-harvest, in-transit | **Food waste:** post-retail, consumer-end, post-monetisation

The recent HLPE (High Level Panel of Experts) report by FAO reports that South and Southeastern areas incur a per capita annual Food Loss & Waste (FLW) of 126 kgs, which is the lowest globally. In comparison Europe (EUR) and North American (NAO) regions, suffer an annual per capita food loss and wastage in tune of 281 and 296 kgs respectively. Even if we ignore the waste, that occurs in the hand of consumers, the post-harvest loss is 181 kgs per capita in NAO, still higher (>57%) when compared with the 115 kgs per capita lost in SSEA. Nevertheless, given our population, the sum total quantity that is lost translates to two and a half times that in NAO and 30% more than that in EUR.

It remains obvious why improving post-harvest delivery systems of agricultural produce is a thrust area for India. Both in supplying fresh to market as well in semi-processed or processed formats, each being a productive end-use.

Food Loss & Waste (Kg/capita/annum)



HLPE, June 2014. Food losses and waste - A report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security, Rome 2014.

An assessment on the losses incurred in our agriculture supply systems was published in 2010 by CIPHET of ICAR. The study indicated that food losses ranged from an enviable 2.8% to a maximum of 18%, across the 46 food items studies, which included fruits, vegetables, livestock and grains. In comparing with assessments made by other agencies worldwide, the assessed losses are surprisingly low. A fresh study is being repeated with the same commodities to revalidate the status, and learnings from procedures and measures undertaken in conducting the first study would be incorporated.

On the other hand, readers may take note that even the report on Food Loss & Waste (FLW) by the FAO, in June 2014, highlights that there are myriad approaches to defining FLW globally, with "no agreed method to evaluate the quality of data, method and numbers". An approach to define the FLW parameters is the key and a welcome step towards globally harmonising important yardsticks. NCCD has frequently spoken on harmonising definitions and measures, as true standards of reference – a glossary of terms carried in our newsletters, is an extension of such attempts across segments.

When we look at Food Loss & Waste with clarity, one unambiguous rationale stands out – we farm food with one aim, to consume what is harvested; and deficit occurs when gainful-end-use is not achieved.

A crossword puzzle grid with the following words filled in:

- Across:** PLANT (Row 1, Columns 1-6), SAVEN (Row 4, Columns 1-6), TOSSES (Row 6, Columns 6-10).
- Down:** RATES (Row 2, Column 3; Row 3, Column 3; Row 4, Column 3; Row 5, Column 3), YIP (Row 5, Column 7; Row 6, Column 7; Row 7, Column 7).

There are five snowflake icons placed on empty grid squares at the following coordinates (Row, Column): (1, 7), (2, 8), (3, 1), (5, 8), and (7, 10).

-Pawanexh Kohli

This reported loss was quantified as 133 billion pounds (60.3 million tons); of 430 billion pounds (195 million tons) that reached retailers and consumers in US (this study was based on data collated in 2010). The top three food groups by their share in the total food loss were meat, poultry, and fish (30%); vegetables (19%); and dairy products (17%). In total economic value, based on retail prices, translated into \$ 161.6 billion in 2010. This food waste contributed towards 34 million tons of the 250 million tons of municipal solid waste in USA that year.

PORT GATEWAY

In our previous editions, we frequently wrote about innovative and energy effective applications in cold-chain. One of the opportunities we wrote about, and promulgated in seminars, was on recovering stranded cold - waste energy - at LNG regasification terminals. Naturally occurring gas, is converted into liquid state for logistical purpose - in doing so, the gas reduces in volume 600 times. The logistics efficiency is easily understood - storage tanks built on a 1 acre footprint will do the job of 600 acres. The liquefaction process requires the naturally occurring gas, to be refrigerated lower than -161°C and kept below its boiling point at the receiving terminal. However, before dispatching for consumption, the liquid is regasified by heating it to normal, safe handling temperature. This is done by circulating fresh air around pipes and the entire energy is dissipated into the outside air. In some cases sea water is used.

Approximately, 20 MW of energy per million metric ton of gas handled is wasted. Capturing this energy and utilising it for an "over-the-fence" cold storage hub, at the LNG port location is a simple enough process. Other opportunities from the energy recovered, like cryo-desalination, cryo-power generation, etc. also are feasible. After multiple interactions with Petronet LNG Ltd, and a techno-commercial feasibility study, the following EOI was released in January 2015.

**Petronet LNG Limited**

INVITATION FOR EXPRESSION OF INTEREST (EOI) FOR COLLABORATION/ PARTICIPATION/ BUILDING & OPERATING WORLD CLASS CRYOGENIC/ COLD-CHAIN BUSINESS WAREHOUSE NEAR LNG TERMINAL AT DAHEJ, GUJARAT


Petronet LNG Limited (PLL) is planning to set-up a world class cryogenic storage for variety of valuable products, speciality products, perishable products etc., requiring appropriate cryogenic and cold storage. The cryogenic facility is proposed to be developed adjacent to its LNG Terminal and shall be integrated with the existing LNG regasification terminal. This cold storage warehouse facility can be maintained and operated at significantly low temperature range of -10°C to -70°C and can be customized to requirement.

PLL is seeking Expression of Interest (EOI) for collaboration/ participation/ building & operating such facilities from national/ international companies engaged in the cold-chain business.

Other details about PLL, the project, details to be provided by the party expressing its interest, format for submitting the information, including last date of submission are available on PLL's website www.petronetlng.com/cold-chain/.

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Presenting the new energy for future-



Petronet now brings LNG directly to you through LNG Satellite Hubs / Stations that will serve - the industries not connected through Pipeline; heavy automobiles on Highways; Housing complexes etc.

This invitation for expression of interest was carried in three Indian newspapers, the International Journal of Cryogenic Society in America and communicated to CII, FICCI and to the embassies and consulates of 11 countries.

Reutilising stranded cold energy, that is otherwise wasted and factored into the cost of gas, translates into value in form of zero cost energy operations, zero polluting refrigeration, spare energy to convert salt water into potable water, and more. NCCD hopes that with proper application of technology and with appropriate collaboration, PLL may soon boast of the world's first ever zero CO_2 emission port facility.

Such a port gateway, designed and designated for perishable goods will help ease bottlenecks for both exports and imports of food items. Such a perishable port gateway would in all likelihood divert all food traffic through its facility with on-site phyto-sanitary clearance facilitating in ease of business with India.

Exemplary in the very concept, in its fruition, this would be the world's greenest cold-chain infrastructure.



COLD-CHAIN INSIGHTS

- VIII

Pawanexh Kohli

This February, the Group of 20 (G20) Development Working Group (DWG) will hold its first meeting in Turkey. The meeting is the start of many, to prepare for the G20 leadership summit in December 2015. Agriculture and an understanding of next steps in this sphere, is an important matter for discussions. Under the framework of the Food Security Network (FSN), some of the items to be discussed – **responsible investment** in food systems, enhancing **quality employment and incomes** in agriculture, **expanding food supply and sustainability** are key topics.

G-20 major economies:

The Group of Twenty (G20) consists of countries and regions that have systemic significance for the international financial system. G20 economies account for 85% of the global economy, 80% of world trade, and two-thirds of the global population. The members of the G20 are Argentina, Australia, Brazil, Canada, China, France, Germany, India, Indonesia, Italy, Japan, the Republic of Korea, Mexico, Russia, Saudi Arabia, South Africa, Turkey, the United Kingdom, the United States of America, and the European Union. Those simple facts underline the significant potential of the G20 as a global platform to enable international economic co-operation and policy making.

The G20 was formally established on 26 September in 1999, in the aftermath of the Asian Financial Crisis. Yet, the G20 convened for the first time at the leaders' level in Washington, D.C. in November 2008, to respond collectively to the 2008-09 crisis in order to restore global growth, strengthen the global financial system, and reform international financial institutions.

G20 incorporates policy contributions from a cross-section of society, organised under five groups: **Business-20, Labor-20, Civil-20, Think-20, and Youth-20**.

Of these, the Think-20 serves as an "ideas bank" for G20. For this purpose, T20 organizes the analysis of global think tanks and high-level experts in order to provide analytical depth to ongoing G20 discussions and produce ideas to help the G20 to deliver concrete and sustainable policy measures.

In all these subjects, the Indian development records important examples, in terms of best practises followed, and the experiences and learnings that resulted. The G20 will do well to take cognisance of the India story, especially in the *for agriculture* area including cold-chain sector.

Responsible Investment in food systems

Best Practises

- India has followed the practise of promoting private industry / entrepreneurs' investments in '*for agriculture*' infrastructure (both post-harvest and pre-harvest), as the preferred option. Most importantly, Indian government, linked its infrastructure subsidy to independent bank appraisals and to the quantum of credit taken and therefore to the commercial viability of such investment. India has also taken a "System Approach" to post-harvest infrastructure investments. This was done by recent rationalisation of its prevalent support schemes; including the induction of modern technologies.
- Rationalising institutional support into component items of post-harvest infrastructure allows scope to provide strategic direction to development. Weak areas can be included as a support component and the support for other components can be eased as per need. By promoting modernisation of existing infrastructure as well capacity expansion, the scope for unnecessary cost overruns and capacity overruns are reduced. Investors no longer need to view government assistance as a onetime opportunity but as strategic support that incentivises responsible development at each stage. Supporting modernisation has also made sure that we stay green and efficient in this sector.
- Investments that aid direct market linkage help to develop extended value chains from farm-to-market. This is a declared thrust area and key to sustaining economics & safeguarding inputs.
- Policy support is also directed at investments in planting material, water management, markets, farm modernisation & mechanisation.

Resulting Experiences & Learnings

- Taking a system approach with scope to add scale is more conducive to need based development viz a "one-off" one-time project based approach. This has allowed for expansion, integration and collaboration between existing and new infrastructure.
- There is burgeoning response from private investors in select areas. However, investors having a stake in integrated development across the extended value chain are not frequent. Experienced stakeholders are far and few, suggesting a need for greater capacity building.
- Instead of promoters raising excess capacity to take advantage of any one-time policy opportunity, a steady state open-ended support mechanism tends to result in a reduction of unnecessary spend and locking of capital in the unviable investment. This also helps free capital for other deployment and

for recurring operational expenses. The making available of institutional support for capacity expansion or modernisation has resulted in improved and more efficient technologies being inducted.

- Productivity measures need to be related to gainful end use and not only per hectare yield. A value chain approach to productivity needs to be promulgated. It is clear that investment in market connectivity leads to the development of market linked value chains and this in-turn allows for justifiable and responsible production based investments.
- Economy of scale in logistics requires partnerships at farm level and the breaking of cultural and regional barriers. A dynamic supply chain has greater positive impact on price stability and productivity, than disconnected static storage of food items. Logistics operated by produce owner are typically more efficient than service provider models. Currently, experience indicates that the preference from private stakeholders is to develop independent value chain components, and there are limited takers for public-private business models in the post-harvest perishables space. Public private partnerships are more easily acceptable in knowledge dissemination and research spheres.

Quality employment and increase Incomes

Best Practises

- Promoting of farmer groups and farmer producer organisations is the next step to farmer cooperative and one of the better examples from India.
- Implementing Centres of Excellence and technology demonstrations has improved skills and technical capacity at farm-gate. A readiness to develop modern pack-houses and collection centres at village level is evidenced. In association, the practise of promoting driver entrepreneurs linked to pack-houses is picking up.
- Besides weather forecast and soil health information through SMS-internet the nationwide practise of informing market arrivals and prices on a daily basis, is another practise which helps income generation.
- Promoting Solar / alternate energy powered equipment at farm-gate and in the cold-chain has helped develop innovative practises and brought quality near farm jobs. Similarly, localised project handling and equipment maintenance capabilities have been developed at rural end.



G20 Turkish Presidency in 2015

Resulting Experiences & Learnings

- Farmer cooperatives and farmer groups lead to more productive employment and a sharing of market access (transport) costs due to associated economy of scale. Negating Traditional and fragmented farming practises take extended persuasion periods.
- The development of back-end handling facilities (modern pack-houses), is expected to add to growing employment opportunity to rural women and youth at first mile of the value chain. Driver owners of perishable transport helps build market connectivity though this may require more support.
- Greater transparency that empowers farmers with the ability to take market linked decisions and allows for improved harvest patterns and resource management, leading to better risk reward ratios.
- Trends indicate a move towards more organised farming and a collaboration in high value farming, specially horticulture and animal husbandry. Increased ability to diversify into livestock, bee keeping, field crops and building alternate revenue sources as counter to uncertainty in single type agriculture.
- Rural community quick to accept green solutions. Greener and more environment friendly agriculture. Not only from production practises but also from reduced Food Loss & Waste. Localised project handling capacity requires continued development.
- Inherent self-reliance of rural community endorses near-farm employment opportunities. Benefits from creating near-farm-jobs in terms of value linked sustained employment, helps take agriculture from peasant mode to market linked. Associated logistical links do not develop as fast as is required.



Expand Food Supply, sustainable Productivity

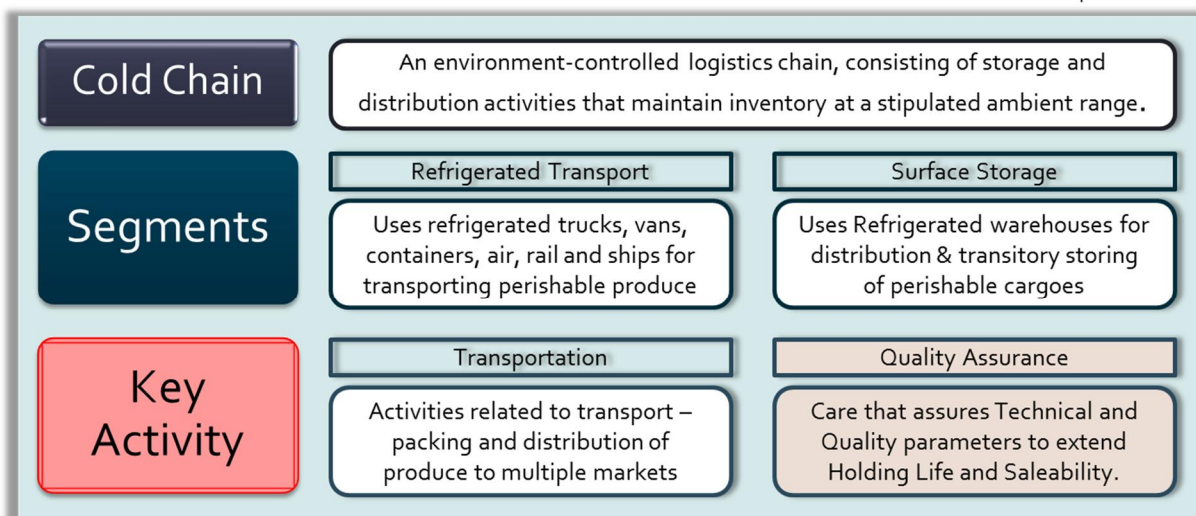
Best Practises

- Leverage an expansive PDS network and Adhaar system to provide access to food. Previously established PDS being revamped and upgraded. Concerted effort to promote development of privately driven supply chains, especially in cold-chain for fresh farm produce.
- Expanding food supply by expanding market footprints beyond the inherent limits of perishability - developing cold-chain as a thrust area, moving from storage to supply chain system.
- Rejuvenation of senile plantations and promoting crop rotation systems to make resource use more sustainable. Leads to useful productivity and greater sustainability.
- Water shed management and micro-irrigation/fertigation to mitigate water resource degradation. Coupled with soil testing programs for improved decision making in INM/IPM and cropping practises.
- Promoting organic produce for greater health of soil, consumer and economics. Greater international collaboration for technology and knowledge transfer, harmonising of practises, scientific resource sharing, R&D in building resilience in food species (crops and livestock).



Resulting Experiences & Learnings

- Improvement in Food and nutritional security with access to quality food by a larger consumer base. Greater reliance and improved value realisation from fresh whole food, and value added foods.
- Expanded market reach by producers, leads to a market driven increase in production. In addition, it feeds improved resource utilisation and greater productivity, both by area and by value realisation. Conceptual change in technology use and changed practises adds to valuable resource conservation.
- Production frequently surpasses supply chain handling capabilities. Expanding food supply and reach to more markets is key to reducing loss & waste, making agriculture economically sustainable.



Cold-chain is the sole logistics mode that establishes a safe and integrated farm-to-market conduit, thereby extending the market reach of farmers and producers. Cold-chain connects and expands our food supply.

PRODUCE SEGREGATION

Segregate fresh produce in storage and transport

There is frequent counsel given to handlers, that they must segregate produce in the cold-chain. This practise is necessary to mitigate risk that stems from the fact that fresh farm produce are many times incompatible with one another.

The primary level of segregation is of course temperature - the chart on the right will show that Apple is stored optimally closer to 0°C and Avocado requires a temperature of around 7°C. If kept in the same temperature as apples, the avocado crop would suffer chill injury and eventually suffer rot.

Cold-chain is not about temperature zones alone but must look at various compatibility aspects between different species of goods involved. Unlike aseptically sealed foods, the packaging of fresh produce has to allow access to the surrounding air and therefore makes it susceptible to tainting, moisture loss and biological triggers.

Tainting is easy to understand, in relation to odours. It is common know-how that when stored in an enclosure alongside garlic, banana will begin to taste of garlic. This cross-transfer of odour occurs due to air exchange in a common environment. Citrus items are known to contribute an "off-taste" in eggs or to open dairy products & meats.

Cross contamination also occurs when ethylene sensitive produce is stored alongside those that produce large amount of this gas. For example, brinjal will turn pithy and bitter when stored with banana or mango. This is because the latter crop types are high ethylene producers and brinjal will brown and mature faster when exposed to even mild levels of ethylene.

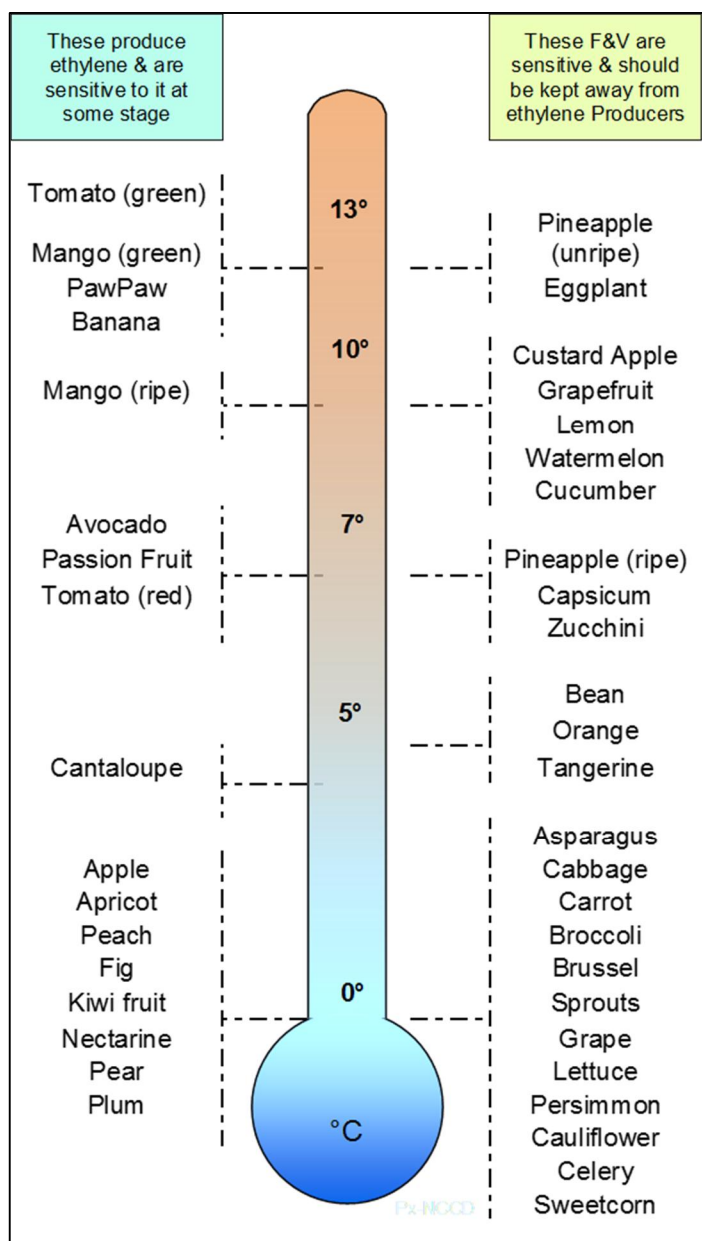
Similarly, storing apple or kiwi with cauliflower or lettuce will negatively impact upon the quality and saleability of the latter.

The compatibility is not limited only to cross-contamination of odours and exchange of physiological triggers such as ethylene. Humidity levels also require matching. While most fruits and vegetables are 80% to 90% water, some will catch rot if stored at very high moisture content.

For example, pumpkins, winter squash and peppers need low humidity conditions, whereas leafy greens and most fruits maintain best quality when held at above 95% RH levels.

Other produce types like melon, sweet potatoes, tomatoes and citrus will tend to grow mould if kept for long with leafy greens, asparagus and others that require very high humidity levels.

Compatibility must be understood by all cold-chain users. Luckily, cross contamination takes a while to effect and for short duration storage, like in home refrigerators, the last mile consumer need not be overly concerned.



Though storage temperature may be compatible, the commodity on left and right should not be held together.



NCCD GLOSSARY OF COLD-CHAIN

We frequently see confusion in use of the terms that describe or relate to different types of cold storage spaces. This section defines the basic categories of environment-controlled storage systems used in food supply chain.

COLD ROOM (STAGING): An insulated and refrigerated chamber, which serves as a transient staging space, and is necessarily attached to a Pre-Cooling Unit. Conjoined with pre-coolers, a staging cold room is primarily to free the pre-cooling room for undertaking the sequential batch load procedure for next lot of incoming freshly harvested produce. This component is typically installed at farm-gate (village level) as part of a modern pack-house, and temporarily stores preconditioned fresh produce, awaiting transport link to a distribution point (a cold store close to market). The dimensions created are such as to hold a maximum of two or three days batch load from the pre-cooler unit, to buffer any delay in arrival of the connecting transport. This is used for nearly all perishable horticulture and floriculture crops.

COLD STORAGE (BULK storage): A large environment controlled warehousing space with multiple chambers, intended for bulk storage of perishable produce. The chambers are designed to cater to long duration storage of the goods. The inventory should be held to serve as a buffer to smoothen the supply gap arising due to episodic production, and the intention is to stabilise & sustain the supply lines. This type of cold store is normally developed close to farm-gate, for a selective set of crops only. The common examples are cold stores designed for potato, apple, spices, pulses, seeds. In case of potato, spices, pulses, seeds, no precooling is necessary but in special cases, such as apple, if the cold store is designed with added refrigeration capacity to pre-cool the produce in-situ, a separate pre-cooler is not necessary. Produce like potato, spices, pulse, etc., on exiting such cold stores may not require onward cold-chain interface. Bulk cold stores are also used as stores of raw material, for captive use of processing factories.

COLD STORAGE (Distribution HUBS): An environment controlled distribution centre designed for short-term storage of produce so as to function as a logistics platform for frequent handling and throughput of packed (ready-to-retail) goods. These cold stores types are part of the uninterrupted farm-to-market supply chain - key to effective distribution of perishable produce and built at the front-end of the cold-chain. These are designed to have multiple temperature zones (frozen, chilled, mild-chill) and the storing methodology must facilitate frequent put-away and pick-up activities. These stores function like railway platforms or airports, as consolidation and distribution gateways for adjoining market centres. These storage hubs are used as perishable cargo centres, at sea ports, as city distribution centres, etc. and essential for maintaining the integrity of the cold-chain.

REEFER TRUCKS: Road transport vehicles with a fixed insulated body equipped with active refrigeration designed for environment controlled carriage of temperature sensitive produce. These are effectively cold rooms on wheels - mobile storage spaces. The refrigeration on long haul trucks is powered through integrated diesel driven motors, independent of the main truck engine. In case of small vehicles, the use of direct drive systems linked to the vehicle engine (like a car AC unit) or battery powered refrigeration is the norm. Electric power option for use when parked is also possible.

REEFER CONTAINER: An insulated container with in-built refrigeration, which unlike the fixed body of reefer trucks, can be removed & relocated from its wheeled carrier or chassis (trailer). Commonly used for multi-modal activities where rail-road-sea-air movements are involved in the distribution chain. The equipment is designed to source electric power from a separate generator (power-pack) which is independent of the reefer container. Grid electricity can also be connected when stationed on-site for temperature controlled storage pending subsequent logistics operations.

STORAGE CAPACITY: Is the holding capacity or measure of volumetric space (in cubic metres) of a transport or storage chamber. As a general norm, all holding capacity is measured in cubic metres since the volume to mass ratio of the cargo handled in cold-chain varies, depending on the density of the produce, the packaging used, the storage/stacking system used, space design, etc.



LUMINARY SPEAK



Hon'ble, Shri Radha Mohan Singh
Union Minister of Agriculture

Sir, Indian agriculture has undergone various changes. Your comments about the future of agriculture?

India is proud of its farming community since today we are not only self-sufficient in food grains but are also the largest producers of dairy and milk products. In horticulture, livestock and fisheries, we rank amongst the top producers in the world. This notable achievement is thanks to the efforts of our farmers. They have not only preserved our traditional food products and contributed to produce a balanced diet but have also safeguarded our agro-biodiversity.

Our Hon'ble Prime Minister, Shri Narendra Modi, has given a clear vision, for the increased use of technology to enhance productivity, establish better market connectivity and to ease flow of credit to agriculture. This will be done on a continuous basis for long-term strengthening the farming sector. Our ambition is to rise from the present achievement of self-sufficiency in food grains to establishing India as the world's premier agricultural power.

It is also clear that Horticulture and Livestock sectors have become the growth drivers. Today, these two sectors contribute the major share of agriculture GDP. This is extraordinary as these are mainly the domain of small / marginal land holders and this strength will be developed more.

About climate change and sustainable agriculture

Any detrimental effect due to climate change has to be offset by improved management of available resources and by enhancing productivity. Promoting of technologies for 'kam zameen, kam samay, zyaada upaj' and 'per drop, more crop' are steps in this direction. Strengthening our livestock breeds is also to offset vagaries of climate and increase production. Bringing North Eastern region and hilly areas under systematic cultivation is another creative step. My Ministry runs various programmes that promote sustainable and productive agriculture. Support for protected cultivation, better cropping practises, planting material and extension services are included. Promoting modern agri-logistics & cold-chain is done to add to overall economic gains.

About harvest that is perishable and about cold-chain

We require to develop advanced logistics infrastructure that will connect producing regions with consumption centres. This means not only cold stores but more transport connectivity, more collection centres with modern packing and pre-cooling infrastructure. We must promote value chains and activity chains that bring direct connectivity between farmers and markets and hence developing uninterrupted farm-to-market cold-chains is a thrust area. Special funds and Effective supply chains bring value to our millions of farmers and also helps to stabilise prices for our consumers. Perishable produce is high value agriculture and with appropriate cold-chain technologies and practises, we can produce in India, and supply fresh to the world.



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NCCD is an autonomous body set up by the Government of India with the aim to facilitate cold chain development across all user segments through policy intervention, capacity building and standardisation. NCCD has participation from private industry, policy makers, knowledge partners and government agencies.