

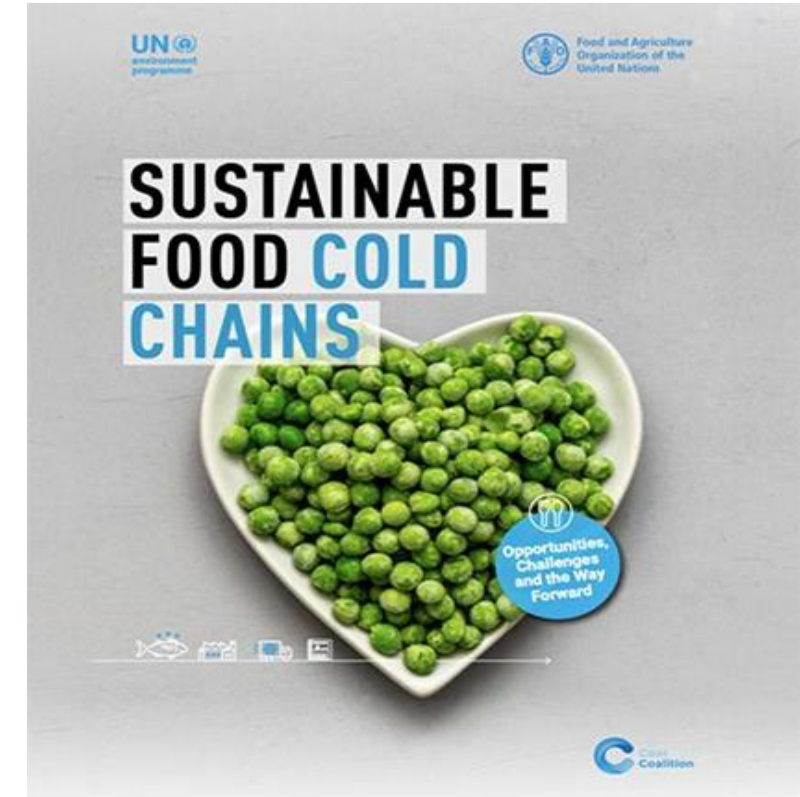


UNEP Cold Chain Programme: Sustainable cooling, cold chains and resilience

Food Saved is as Important as Food Produced

Lack of cold chains leads to considerable food losses

- An estimated **14 per cent** of all food produced for human consumption is lost before it reaches the consumer.
- Food lost due to a lack of a cold chain would be enough to feed **1 billion people** in a world where 828 million people were affected by hunger in 2021.
- Developing countries could save **144 million tonnes of food** annually with integrated cold chain systems



Source: Sustainable Food Cold Chain Report 2022

Agri Cold Chain: An Overview

- Each step protects against **heat-driven spoilage**
- Similarly, household refrigeration is crucial in heatwaves at 35°C, **perishable food spoils up to 3–5 times faster**



- Manufacturer
- Farms

- Climate Controlled Haulage

- Cold Storage
- Distribution Centre

- Refrigerated Secondary move

- Retail
- Consumption

Cold-chain Support Programme in India

Objective: Accelerate development of **integrated cold-chains** network that makes the food systems sustainable and improve farmer **livelihoods**, reduce **food loss** and **emissions**.

National programme supporting MoA&FW, MoEFCC and BEE:

- Support DFI and ICAP implementation **with priority on packhouse development**
- Integration with central policy frameworks and plans
- Energy Efficient Packhouse design guidelines (BEE)
- Investment and business incubation (SIDBI/NABARD-NABCONS)
- Awareness raising, training and knowledge sharing through CoEs and Resource Centres (Haryana CoE, NCCD)

Two states selected (*Bihar, Haryana*) for in-depth work & 1 additional pilot project (*Tamil Nadu*)

- Assess existing and required cold chain infrastructure and food loss.
- Assess and recommend improvement of state-level policies and financial support.
- Demonstration projects and investment pipeline for packhouses
- Awareness, training and capacity building,



National Level

BEE National Energy Efficiency Design Guidelines for climate-friendly packhouses.

First **National Cold Chain Conclave with MoAFW** to set a roadmap to net-zero cooling.

MIDH Guidelines update to accelerate creation of packhouse/cold-chain

State Level (Bihar & Haryana)

- **Operational packhouses** in Patna and Bihta, supporting farmer producer organizations and cooperatives.
- **Cold chain recognized as a priority adaptation strategy** in Bihar's 2024 Climate Plans
- **First state-level Cold Chain Policy** announced in March 2026 in Haryana
- **Haryana: USD 320M financing facility for pipeline of 500+ cold chain projects**, leveraging public-private capital.



PACKHOUSE DESIGN GUIDELINES

Design Guidelines for Energy Efficient



Bihar Case Study – Net Zero Packhouse

Key Findings

- Bihar produces **22 million MT horticulture annually**, but loses **20–30%** due to weak cold chains; **90% smallholder farmers**
- ICCP supported **India's first net-zero packhouse in Darbhanga** with natural refrigerants, renewable energy, and efficient design.

Impacts (per packhouse) – 1600 packhouse required:

- Avoided losses: **410 MT fruits/vegetables annually**
- Avoided emissions: **370 tCO₂e annually**
- Direct jobs: **50**; Farmers benefitted: **10,000–15,000 directly, 20,000 indirectly**

Practical Insight

- Integrated cold chains shift focus from potato-centric storage to diversified horticulture with market linkage.
- Every ton saved = avoided waste of **water, energy, and farmer labour**. Design around energy scarcity (Pair RE/solar PV & efficient design)
- **Use natural, low-GWP refrigerants; Build for climate resilience**

Cutting Post-Harvest Loss to Secure Food, Farmers, and Climate Resilience



Less loss means more market supply, better farm-gate prices for smallholders, and lower exposure to power and climate shocks

Litchi Cold Chain Guidelines

Key Findings

- Bihar contributes **44% of India's litchi output** (309,000 MT). India is the **world's 2nd largest litchi producer**
- Shelf life at ambient temp: **2–3 days** → urgent need for **pre-cooling, packhouses, reefer transport (extends shelf life 2-3 weeks)**.

Guidelines emphasize:

- **Sorting & grading systems in packhouse**
- **Pre-cooling & palletization** for domestic & export market readiness.
- **Training farmers** on harvesting and handling practices.

Resource Efficiency Insight

- **Water footprint:** 1,600–1,800 L/kg litchi.
- Loss of 100 MT = waste of **160–180 million liters of water**, plus energy and labor.
- Sustainable cold chains ensures resource use efficiency, extend shelf life, reduce spoilage, and protect farmer incomes..



Mango Cold Chain Guidelines

Key Findings

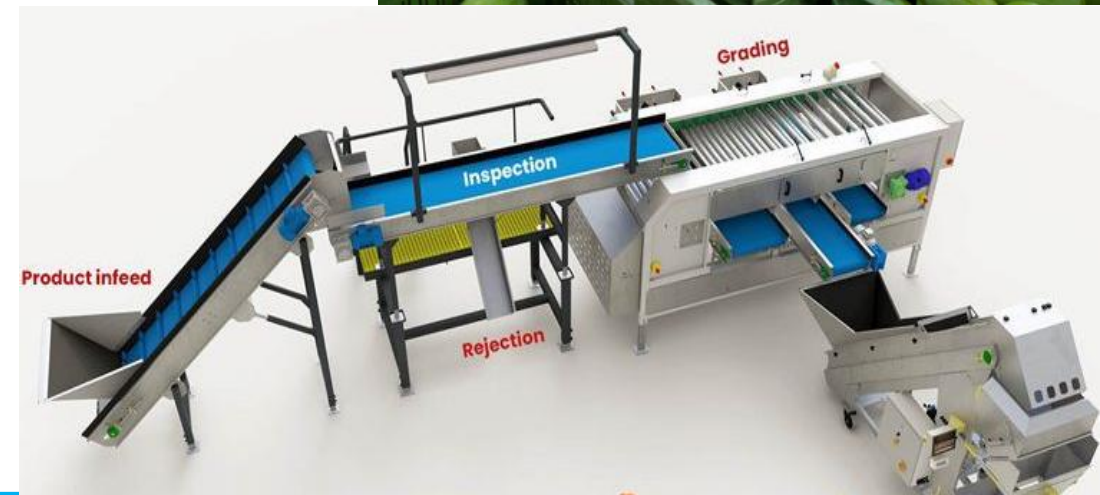
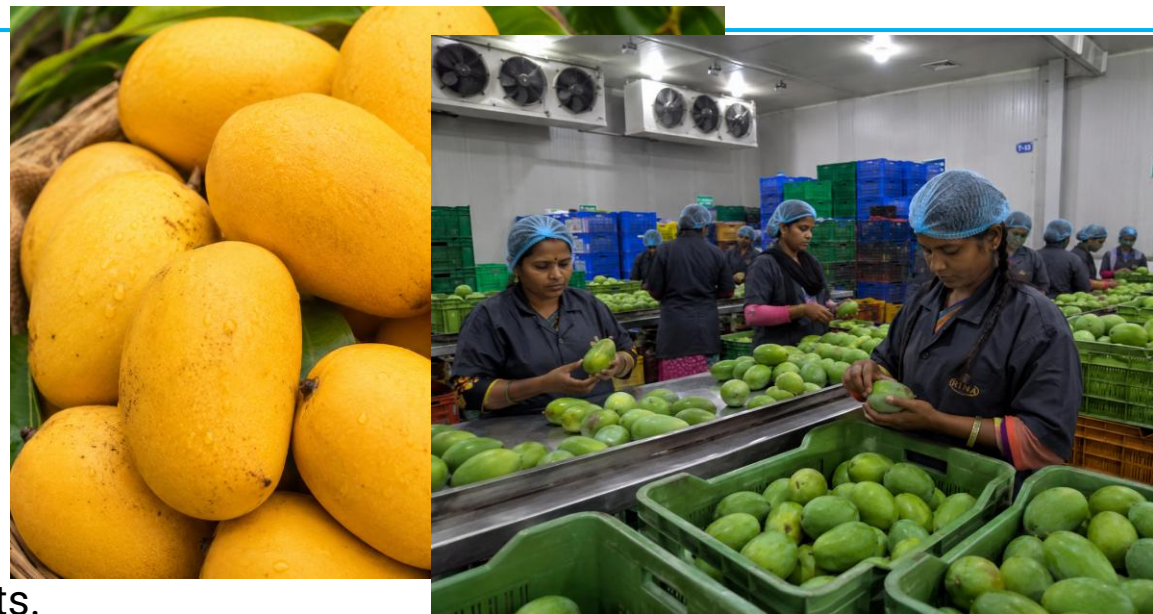
- Bihar is India's **3rd largest mango producer** (1.57 million MT, 7.5% of national output).
- Challenges: **spoilage losses, poor packhouse infrastructure (farmgate), limited awareness.**

Guidelines emphasize:

- **De-sapping** to prevent latex blemishes.
- **Hot water/vapour heat treatment** for exports.
- **Pre-cooling & reefer transport** to connect to distant markets.

Resource Efficiency Insight

- **Water footprint:** 950–1,600 L/kg mango (variety-dependent).
- Loss of 1,000 MT = waste of **950 million liters of water.**
- Sustainable cold chains reduce food loss, improve export potential, and enhance farmer resilience.



Cold chain = food security + climate resilience + farmer prosperity.