Sustainable Technological Approaches for Management of Horticultural Produce

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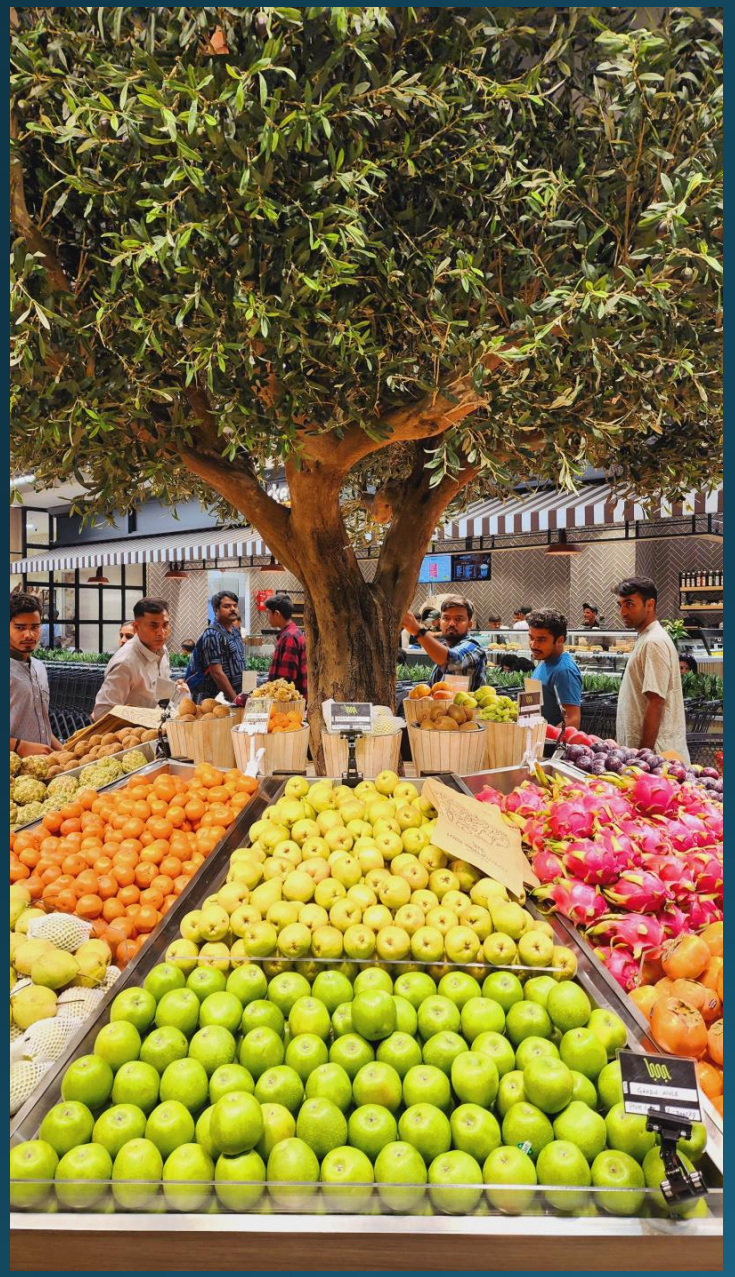
Outline of presentation

- Introduction
- Production systems, practices, and technologies
- Value chains-
- Pre-harvest factors
- Harvesting
- post-harvest handling
- Issue of food losses and waste
- Post-harvest facilities
- Processing – value addition, upcycling, waste utilization
- Processing for upcycling case studies
- Application of Digital technologies- traceability, ICT and information communication, block chain

- Markets and market linkages
- Informal retail markets
- Formal retail food markets
- Export markets niche markets
- Horticulture and Livelihood strategies
- Empowerment of women and youth
- Capacity building & skill labour requirement
- Home gardens - children and nutrition education and
- Horticulture extension
- Conclusion

Horticulture Sector in India

- Horticulture is a potential agriculture enterprises for growth of the Indian Economy.
- India is the second largest producer of horticulture crops globally.
- India produces 11% of the world's production of fruits and vegetables.
- During the year 2022-23, the country recorded its highest ever horticulture production of 350.9 million tons.
- Production has increased 14 times since independence.
- These crops account for 37 per cent of the total exports of agricultural commodities from India.




Dried Roses

India grows more food, wastes more, while more go hungry

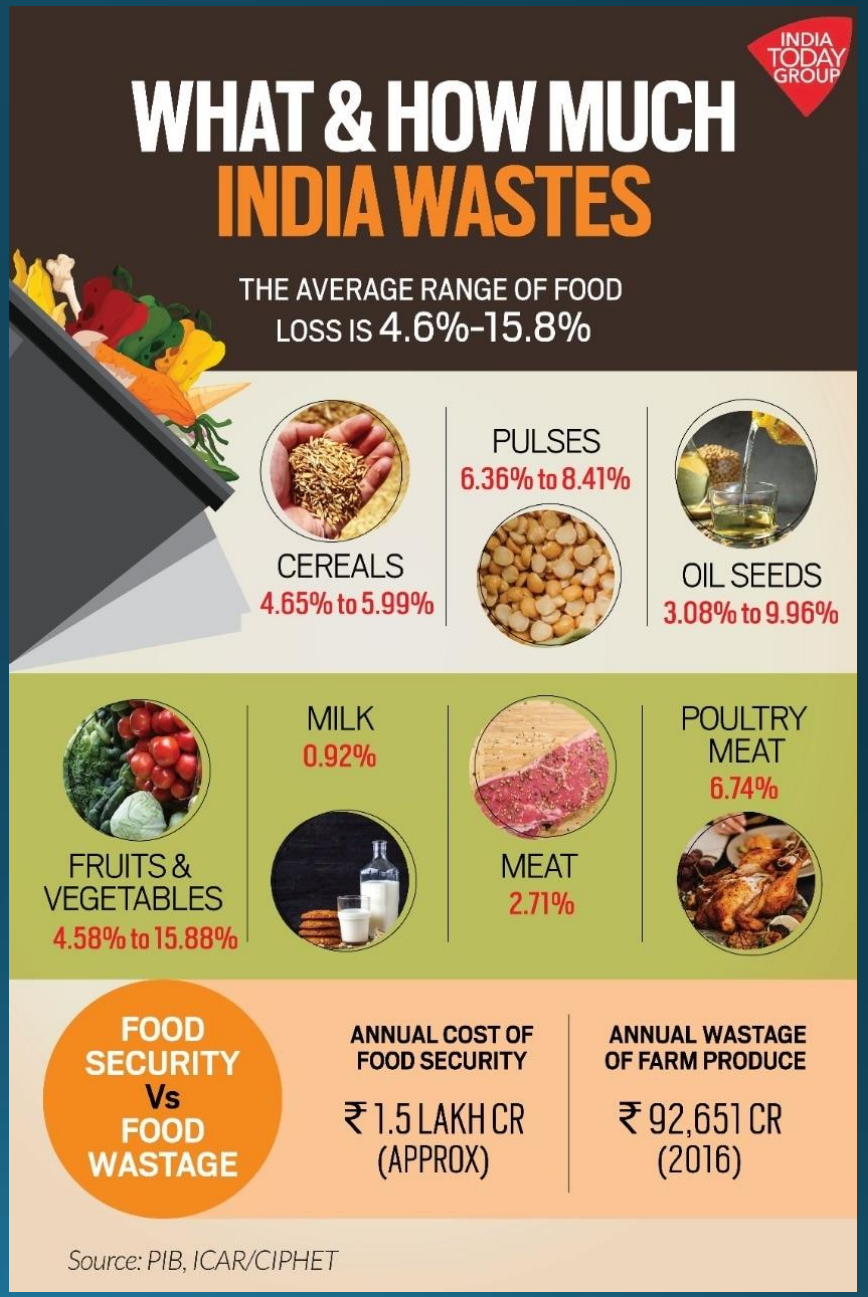
India's 107th position in the Global Hunger Index (GHI) lies Indian agriculture's third shocking reality – **farm produce wastage**.

Sl. No.	Commodities	Food Loss (%)
1.	Fruits & Vegetables	4.58 -15.88
2.	Cereals	4.65-5.99
3.	Pulses	6.36 – 8.41
4.	Oil seeds	3.08-9.96
5.	Milk	0.92
6.	Meat	2.71
7.	Poultry Meat	6.74

Nanda et al.2012)

Citation :
Nanda, SK, RK Vishwakarma, HVL Bathla, A Rai and P Chandra (2012). Harvest and Post Harvest Losses of Major Crops and Livestock Produce in India. All India Coordinated Research Project on Post Harvest Technology, (ICAR), Ludhiana.

https://www.indiatoday.in/india/story/india-grows-more-food-wastes-more-while-more-go-hungry-1752107-2020-12-22



Horticulture value chain-supports livelihood

1. Introduction

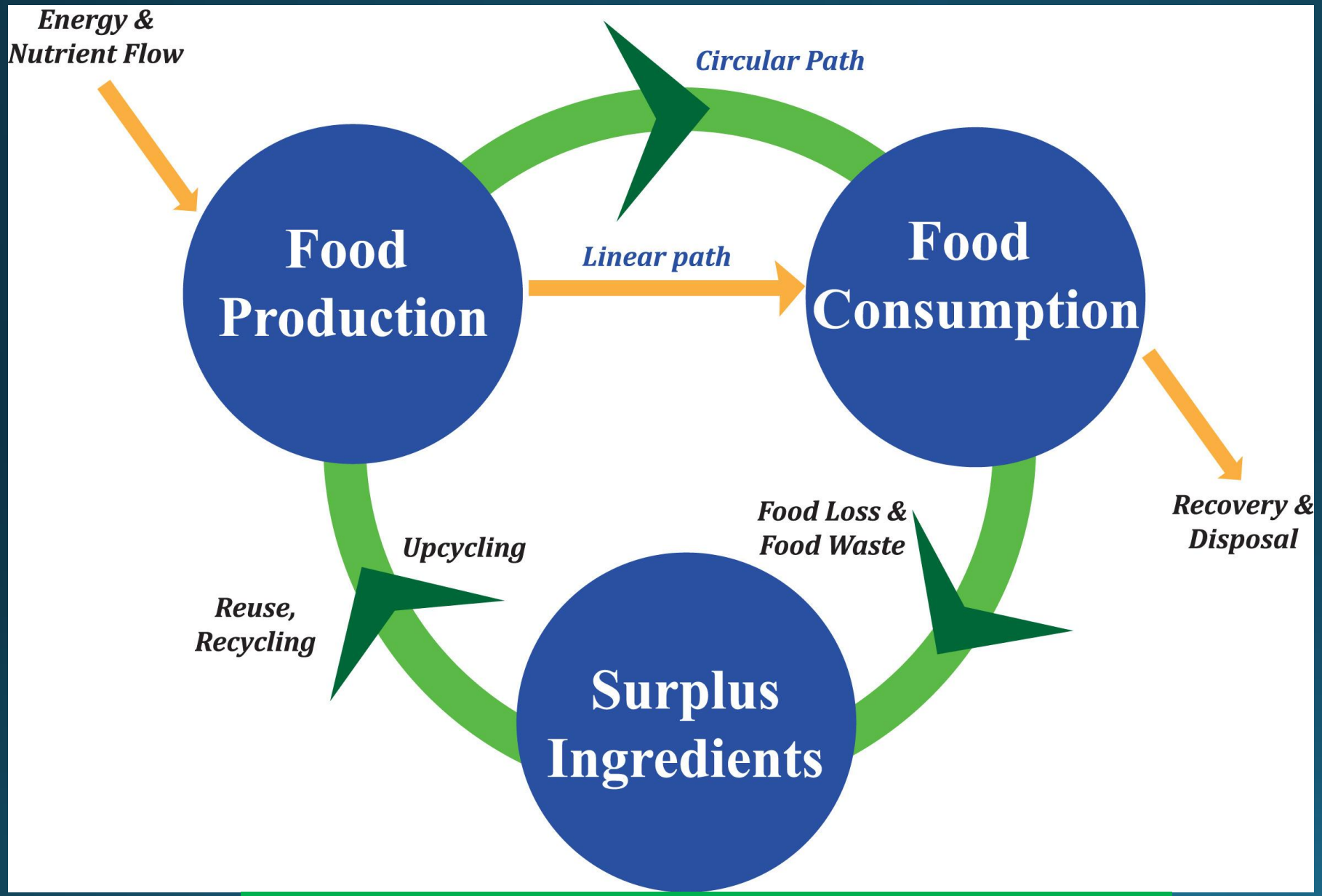
Increasing the sustainable production of fruit and vegetables is necessary to fulfil global nutrition requirements (SDGs 2 and 3).

To meet target 2 of SDG 2 (Zero Hunger) it is necessary to end malnutrition in all its forms by 2030, and is therefore critical that fruit and vegetable production and also consumption is increased.

Addressing the high levels of food loss and waste in fruit and vegetable production and supply chains can make a significant contribution towards achieving target 3 of SDG 12 (Responsible Production and Consumption): "By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses". It is also essential that production practices change to make production more efficient. There is little point in producing more if one-third of it still goes to waste.

Regardless the origin of sustainability problems (food losses or wastes), tackling them in efficient, sustainable and integrated ways appears as a smart strategy to both feed people and optimize the use of natural and financial resources.

This approach requires the optimization of food processing procedures, streamlining supply chains and linking farmers to markets.



Circular Bioeconomy Concepts.

Fig. 3. **Circular Bioeconomy Concepts**. The circular economy follows the circular path which allows it to maintain its value for a long time. The bioeconomy focuses on the renewable biomass in the food supply chain. The combined concept of Circular Bioeconomy would reflect in all the stages of the Food Waste Hierarchy including Upcycling.

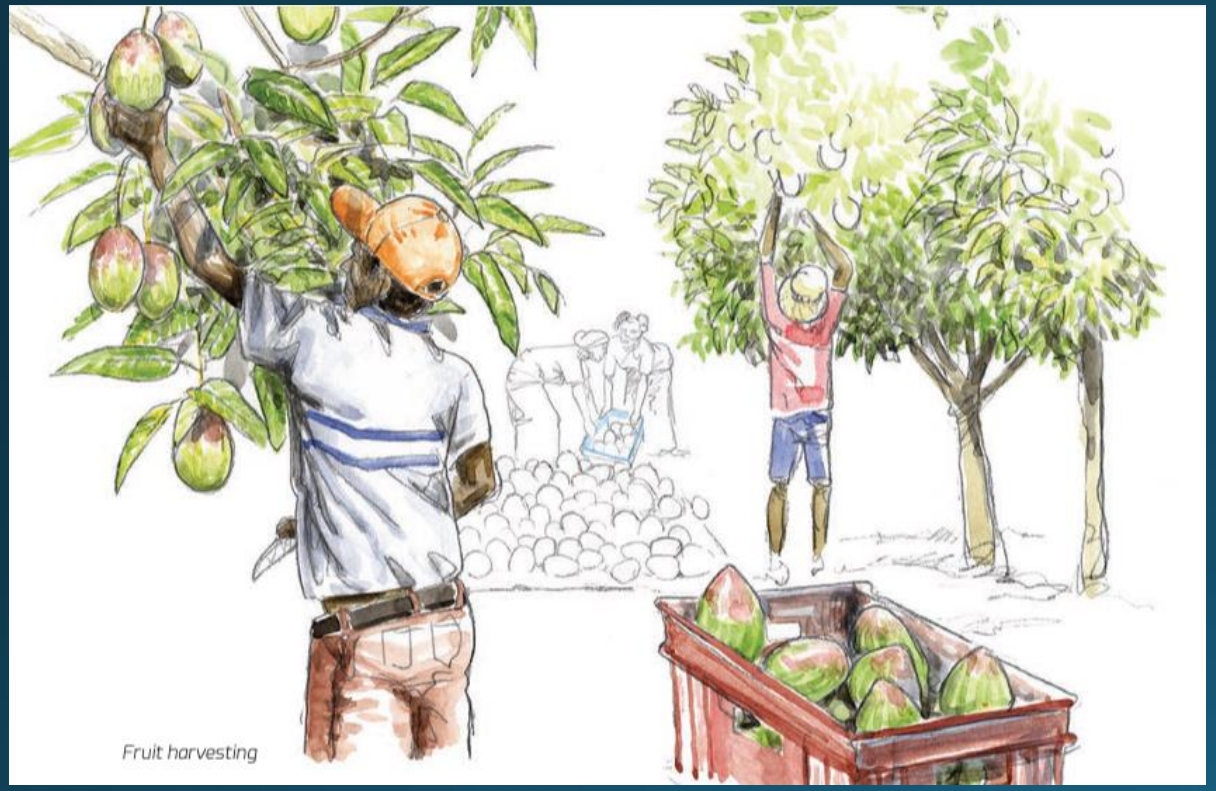
Problems and Opportunities in Fruit and Vegetables Supply Chains:

Although both “food loss” and “food waste” contribute to unsustainable food supply chains, it is important to point out the differences.

Whereas, “food loss” is mainly caused by the malfunctioning of the food production and supply system or its institutional and policy framework (*e.g.*, management, technical limitations, lack of storage facilities, cold chain, proper handling practices, infrastructure, packaging and efficient marketing systems),

“food waste” refers to the removal of still consumable products from the food supply chain (either by choice or after expiration of food products, as result of poor stock management or neglect) (3).

Cultivation-Harvesting- Food Chain



Harvesting is a deliberate human act with the intention of starting it on its way to the table.

Post harvest begins when the process of collecting or separating food of edible quality from its site of immediate production has been completed.

2. Production systems, practices, and technologies

Since fruit and vegetables are often eaten fresh, food safety is a critical issue and promoting good practices in the production, harvesting and post-harvest handling of fresh produce lowers the risk of food contamination and helps maintain quality (SDGs 2 and 12).

Good Agricultural Practices for Quality Production

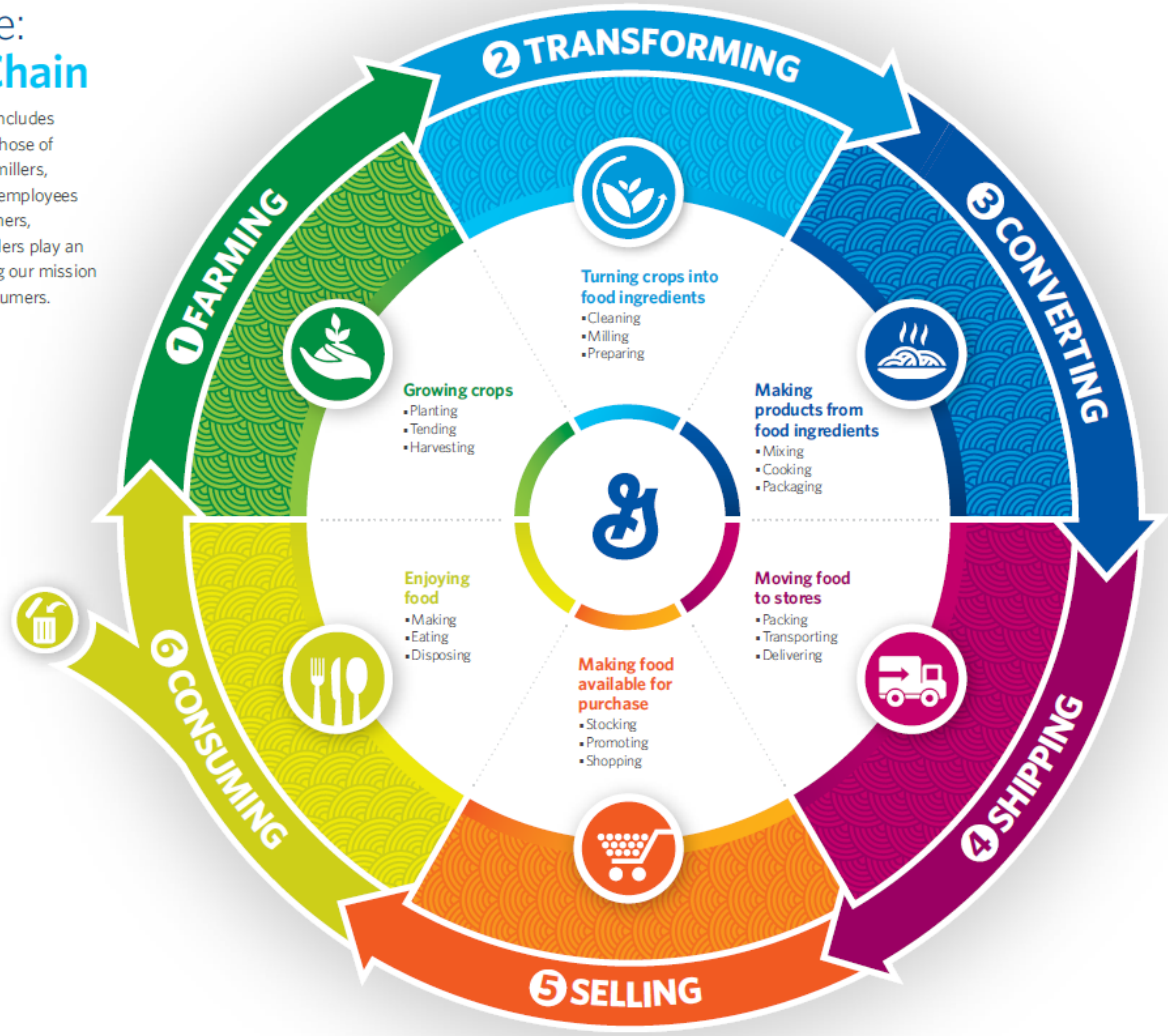
Cucumber and Muskmelon

Mushroom Production

3.Value chains

Field to Table:
Our Value Chain

The General Mills value chain includes our own operations as well as those of our partners, such as farmers, millers, transporters and retailers. Our employees as well as our suppliers, customers, consumers and other stakeholders play an essential role in helping to bring our mission to life and our products to consumers.




market cafe

Food Value Chain

Fruits & Vegetables

- Perishable- Many of these fruits and vegetables contain a large quantity of initial moisture content
- They are highly susceptible to rapid quality degradation leading to the extent of spoilage
- Need to use reliable storage systems
- Need to convert these perishable products into more stabilized products by processing such as drying

Value chain

Issues and challenges in current value chain in India:

- Low productivity
- Seasonality of production
- Increasing biotic and abiotic risks
- Inadequate storage facilities
- Price volatility
- Regional concentration in production
- Low level of processing
- Export irregularities
- Unorganized and fragmented supply chain

Critical Dimensions of a Value Chain

Inputs Production Processing Retailing

Product Flow

Financial Flow

Information Flow

Incentives and Governance

Share content

4. Pre-harvest factors

Maturity Indices

- **Mature-green stage (color change from dark to light green)**
- **Firm-half-ripe stage**
- **Fully-ripe stage**
- **Specific gravity : less than one**
  - **Fruits of specific gravity > 1.02 are immature.**
- **Flavour improves with advancement of maturity**

Maturity of guava fruits

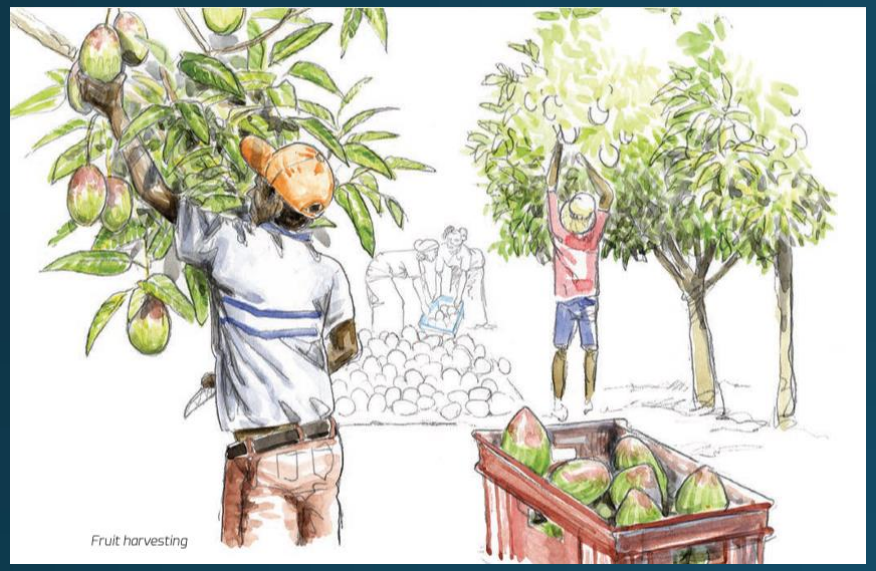
➢**Guava fruits are harvested at mature-green stage (color change from dark to light -green), half ripe or fully ripe depending upon consumer preferences and market- local or distant marketing.**

5.Harvesting

Fruit and vegetable value chains are capital intensive and benefit from investment in protected cultivation technology, adequate storage facilities (particularly cold storage), processing facilities and smart ways to harmonize production and marketing to reduce losses.

Post Harvest Food Losses

The Neglected Dimension in Increasing the World Food Supply



Post harvest begins when the process of collecting or separating food of edible quality from its site of immediate production has been completed.

The food need not be removed any great distance from the harvest site, but it must be separated from the medium that produced it by a deliberate human act with the intention of starting it on its way to the table.

The post harvest ends when the food enters the mouth; it does not cover inefficiencies in human metabolism and utilization of the food.

HARVESTING

Guide for Storage and Ripening of Mangoes

- **CONDITIONS FOR HARVESTING AND PUTTING INTO STORAGE**
- **Maturity** It is very important to harvest mangoes at right stage of maturity at right time with right method of harvesting to have better quality and storability.
- Mangoes should be harvested at mature green stage, which can be judged by following (Fig. 1):
- a) Fully developed cheeks with outgrown shoulders and prominent pit at the stalk end;
- b) Change in skin colour from dark-green to light-green;
- c) Visibility of lenticels;
- d) When the spurt of sap exudation from the cut end of stalk is very less;
- e) Change in flesh colour from white to yellowish; and
- f) When specific gravity is more than 1.0 (Alphonso, Kesar, Langra, Raspuri).

FIG. 1 IMMATURE ALPHONSO MATURE ALPHONSO

FIG. 2 HARVESTING BY HAND PICKING HARVESTING USING MANGO HARVESTERS

Indian Standard

GUIDE FOR STORAGE AND RIPENING OF MANGOES

(First Revision)

1 SCOPE

This standard describes methods for obtaining conditions for the successful storage of important varieties of mangoes (*Mangifera indica* L.) for table purposes and for processing them into various mango products.

2 TERMINOLOGY

2.1 Gray — Gray (Gy) is the unit of absorbed radiation dose. 1 Gy is equal to 1 Joule of energy/kg of material being irradiated.

2.2 D min — It is the minimum absorbed dose received by the food samples when subjected to radiation treatment.

3 CONDITIONS FOR HARVESTING AND PUTTING INTO STORAGE

3.1 Maturity

It is very important to harvest mangoes at right stage of maturity at right time with right method of harvesting to have better quality and storability.

Maximum fruit quality is attained when the fruits are harvested at optimum stage of maturity as immature fruits develop into inferior quality after ripening. Mangoes should be harvested at mature green stage, which can be judged by following (Fig. 1):

a) Fully developed cheeks with outgrown shoulders and prominent pit at the stalk end;
b) Change in skin colour from dark-green to light-green;
c) Visibility of lenticels;
d) When the spurt of sap exudation from the cut end of stalk is very less;
e) Change in flesh colour from white to yellowish; and
f) When specific gravity is more than 1.0 (Alphonso, Kesar, Langra, Raspuri).

The quality of Alphonso fruits after ripening will be very good when the fruits are harvested at a specific gravity of 1.01 to 1.02.

3.2 Method of Harvesting

If harvesting is not done properly it will injure the fruits which may be visible or not, but this injury becomes entry point for microorganisms causing spoilage during storage and ripening. So, mangoes should be harvested properly either by hand (small trees) or using harvesters (big trees) (Fig. 2). It is always better to harvest with stalk so as to avoid the sap being fallen on fruit surface. Harvested fruits should be placed in clean plastic crates and kept under shade till they are transported.

3.2.1 *Pre-storage Operations*

3.2.1.1 *Sorting*

Sorting has to be carried out to remove immature, undersized, damaged, bruised, scarred, misshapen or ripe fruit. Diseased and infected fruits should be removed to avoid spread of decay during storage

3.2.1.2 *De-sapping*

The sap if fallen on the fruit surface causes sap-injury/sap-burn. After harvest, the sap should be allowed to drain away from the fruit by placing the fruits in inverted position. Clip the stems short (1 cm), while holding the fruit with stem end down. Place the fruit on de-sapping bench or specially knitted pallets as shown in Fig. 3 and allow them to drain for 20 to 30 min until the sap flow is stopped. In the modern pack-houses de-sapping conveyor belts are used for de-sapping purpose.

3.2.1.3 *Washing*

Fruits are to be washed properly to remove any latex stains, spray residues, sooty molds, etc. with clean water. Sodium hypochlorite at the rate of 100 ppm can be added to the wash water. Washed fruits should be air dried thoroughly to remove surface moisture before keeping for storage. Under automated systems, the fruit passes under a spray washer and onto a moving conveyor belt for hot air drying (Fig. 4).

FIG. 1 IMMATURE ALPHONSO MATURE ALPHONSO

FIG. 2 HARVESTING BY HAND PICKING HARVESTING USING MANGO HARVESTERS

FIG. 3 DE-SAPPING BENCHES DE-SAPPING CONVEYORS

5.Post-harvest handling

To be sustainable, the production of fruit and vegetables must be linked intrinsically to markets and consumers through stable value chains. Main focus should be on post-harvest activities while recognizing that many of the decisions made by farmers influence the suitability of produce for post-harvest activities and markets.

Post-harvest handling :

- ✓ Post-harvest handling is critical to ensure quality, food safety and marketability
- ✓ In some cases, farmers may need to store produce before transporting it to a post-harvest facility
- ✓ Post-harvest facilities-Post-harvest operations reduce food loss and expand market opportunities

Pineapple

Graded pineapple in mandi

Transportation

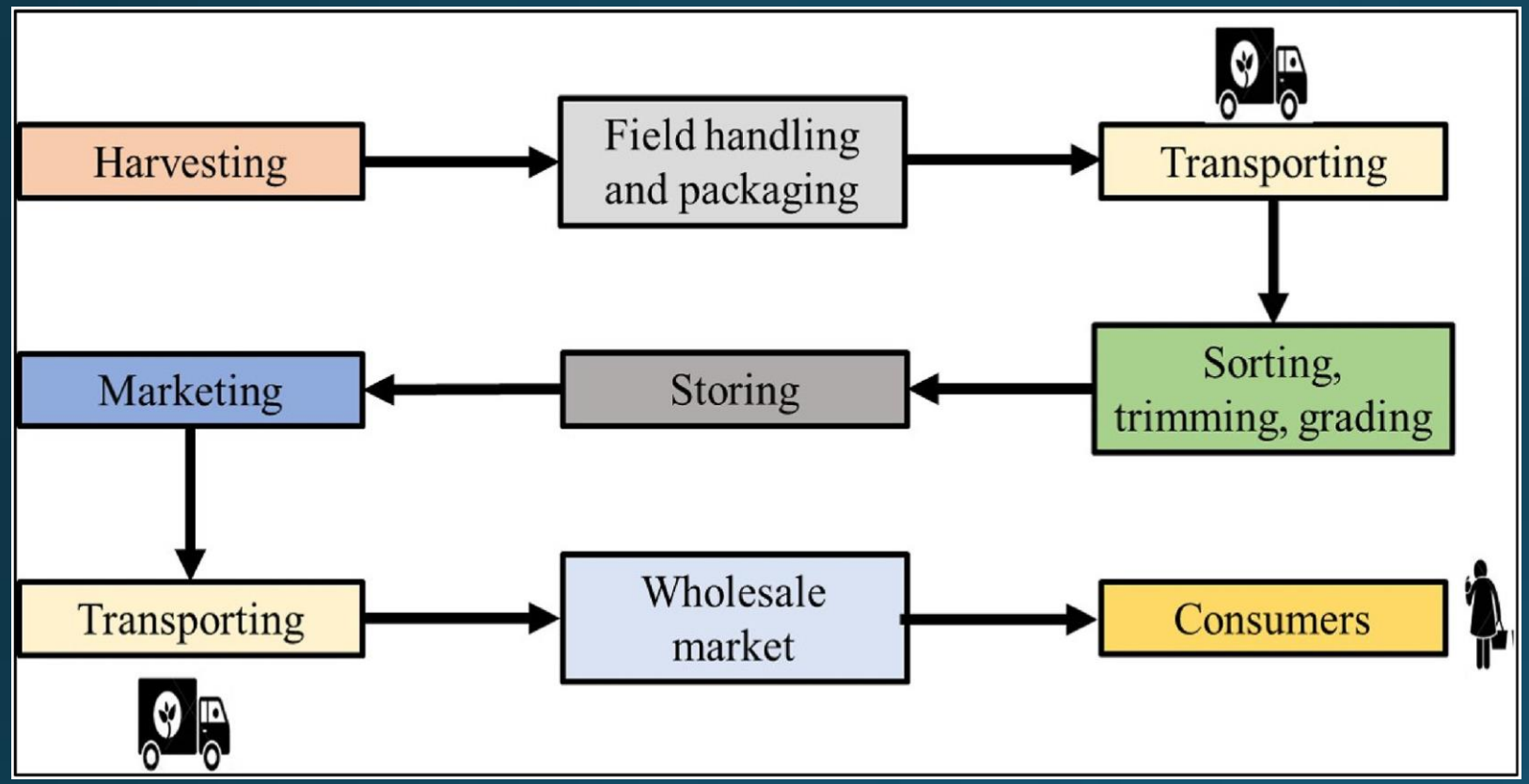


Fig. 1. Postharvest supply chain of fresh produce.

Transport is an essential linkage in postharvest storage, handling, and distribution. Transporting fresh produce from the production centers to the retail markets is carried out by truck, rail, ship, or airplane (Nath et al., 2018).

POMEGRANATE

Transportation

Transportation affects the quality of fresh produce in the distribution system. Inadequate transport infrastructure -can damage food products due to bruising and other injuries. Losses during transportation are quite low in advanced countries as engineering facilities and road infrastructure result in minimal to no damage to fresh produce (Sawicka, 2019).

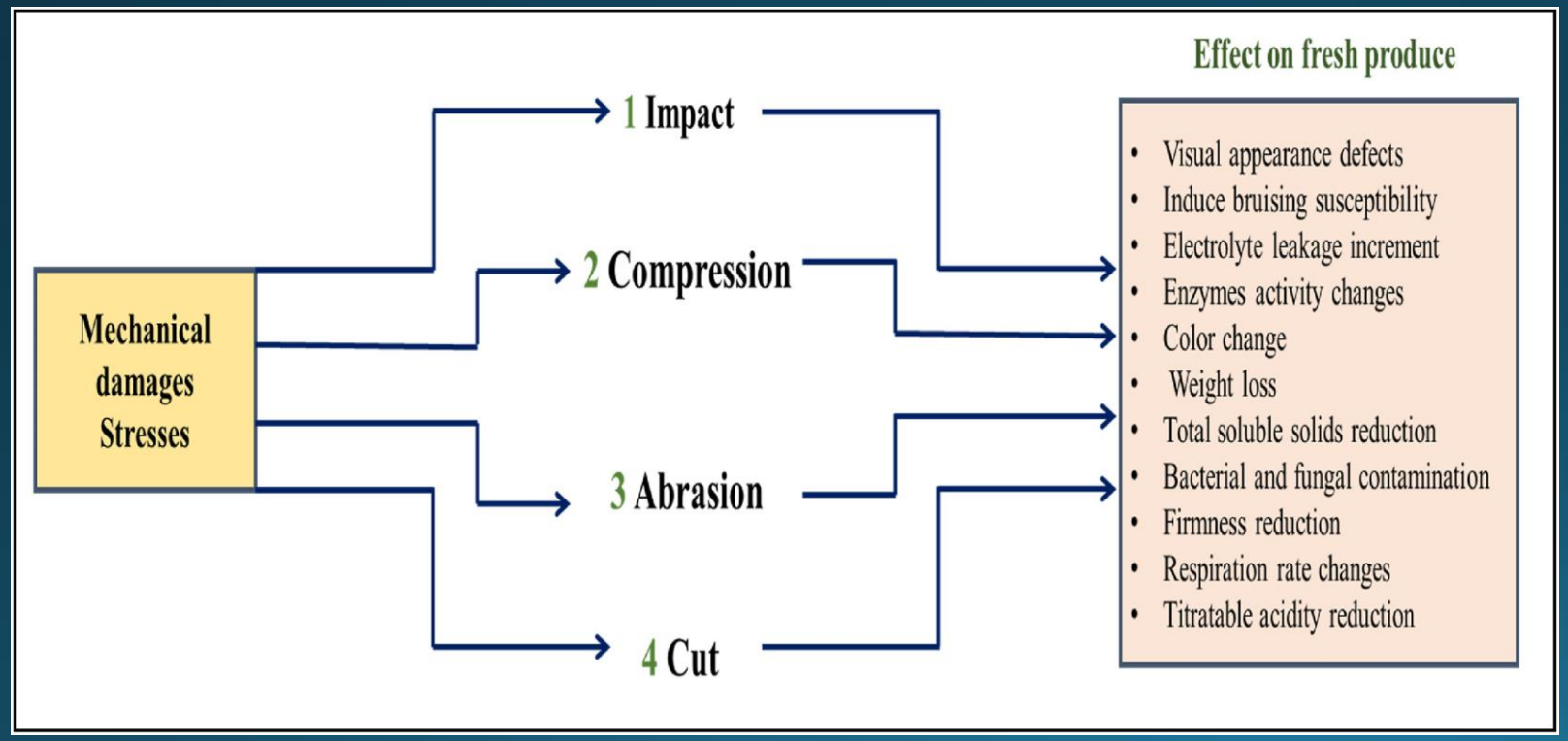


Fig. 2. Effect of mechanical damage stresses on fresh produce.

7.Issue of food losses and waste

Fruit and vegetables are highly perishable crops, making them a

“hot spot”

in the fight to reduce food loss and waste (SDGs 2 and 12).

Issue of Improper handling of F&V

Handling of Banana in a local market in Kerala

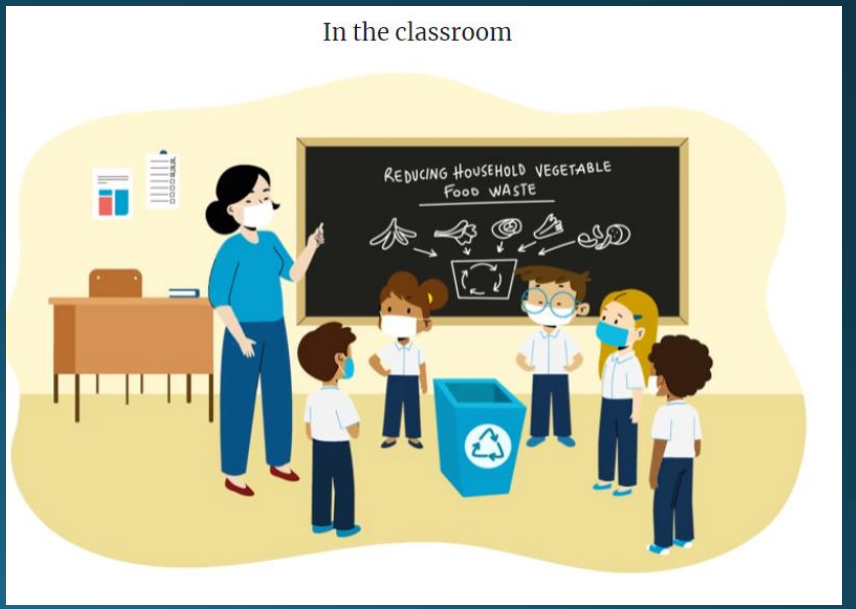

Sahaja
Organics


KA 52 B 0664
EXTRA LONG
INDIA

Food Loss vs. Food Waste

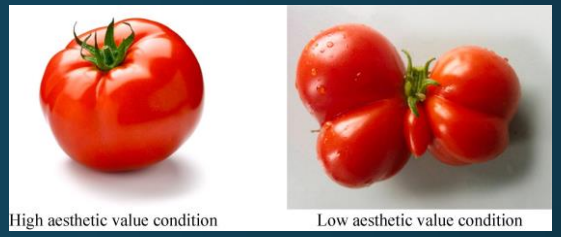
FOOD LOSS: is an “unintended result of agricultural processes or technical limitations in storage, infrastructure, packaging, and marketing” (Johnson et al. 2019). With fresh fruit and vegetable crops, food is lost in the field due to economic reasons or weather constraints.

FOOD WASTE : It’s lost elsewhere in the supply chain because of culling, slicing, dicing, and chopping during processing and reaching the expiration date while still on grocery shelves.



II. Causes of food losses and waste

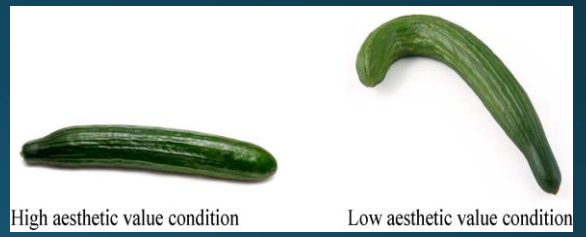
- **Food waste: Idealized prototypes and the aversion to misshapen fruits and vegetables**



Wasting safe and edible but **suboptimal produce** contributes to resource and nutrient losses and has a negative environmental impact. Cereal, fruits, and vegetables represent the three food groups that contribute the most to waste and nutrient losses along the supply chain (Chen, Chaudhary and Mathys, 2020).

Food producers, wholesale, retailers, and households contribute to food waste by discarding large amounts of perfectly edible food because it is considered suboptimal either through its physical appearance, by other product characteristics (tactility, smell, etc.) or because of issues concerning the expiry date of the product (Hingston and Noseworthy, 2020, Mookerjee et al., 2021).

Research suggests that the interrelation between awareness and behavior towards suboptimal food remain complex. The potential for information provision to raise food waste awareness at the retail level as a communication measure to influence preferences for suboptimal food remains an open question.



Sean T. Hingston, Theodore J. Noseworthy, (2020) https://doi.org/10.1016/j.foodqual.2020.103999

The first category includes the following solutions:

- 1.To transform products into soups, sauces, and dishes (i.e., in canteens)
- 2.To preserve products by making them into canned products, juice, jelly, dried fruit, frozen food, or jam
- 3.To process the products by adopting physical pre-treatments (i.e., beer or fruit such as pineapple)
- 4.To produce food from upcycled ingredients (i.e., flakes and flour from potatoes, defatted sunflower seed flour, etc.)

Three solutions have been identified in the second category to manage the FLW for human consumption without processing, detailed below:

- 1.WP Donations through food banks, charities, or food rescue programs

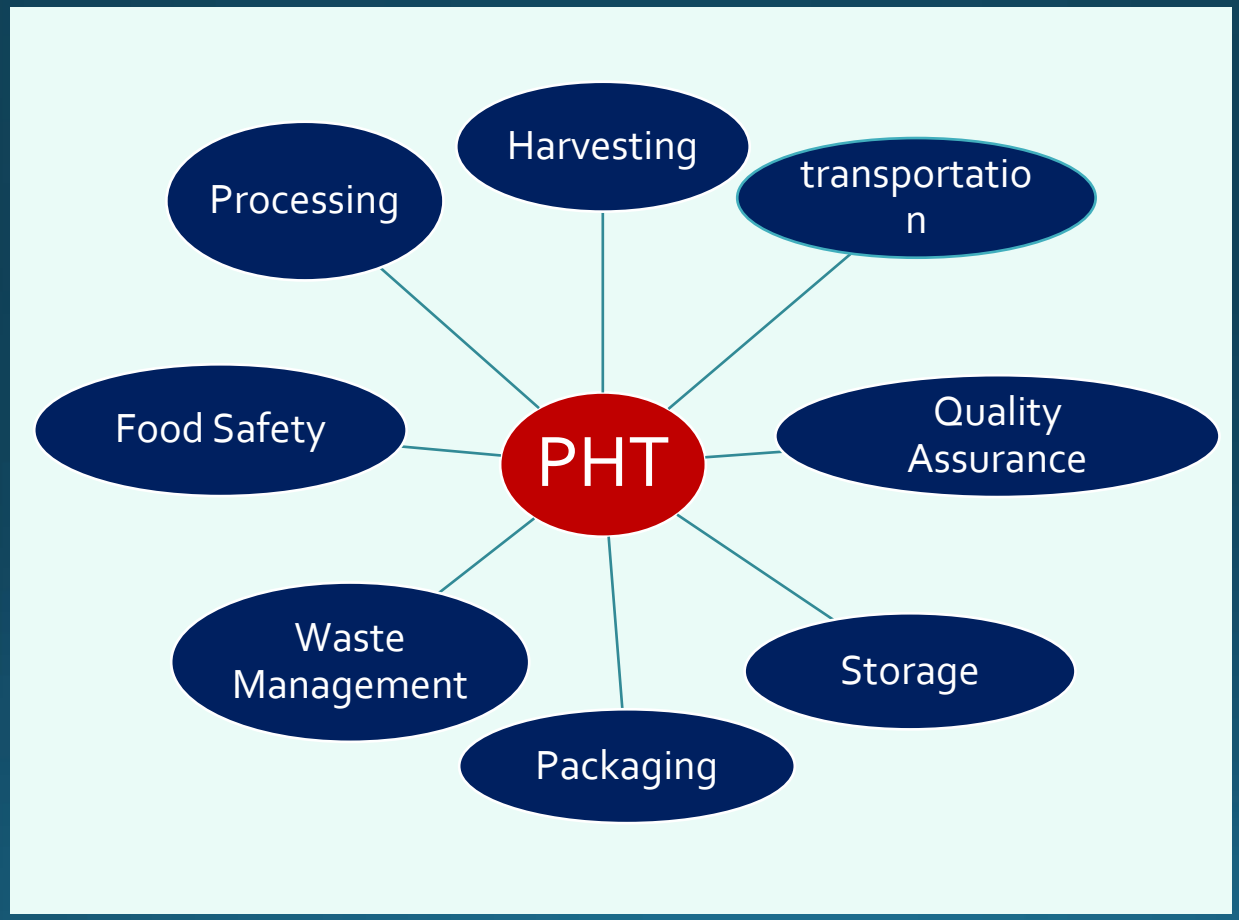
- 2.WP Social supermarkets and other similar shops dedicated to low-income people

- 3.WP Promotions and discounted products or a secondary market to sell substandard items or discarded products

- From a social perspective, donations improve the lives of disadvantaged families.
- In economic terms, the high costs due to the adoption of solutions ensuring long-term food safety represent the negative issues of this strategy (Mourad, 2016).
- Furthermore, the prediction of the food supply, considering the transport capacity, storage, and distribution of donated food in a cost-efficient vision, is the biggest challenge for food banks (Brock & Davis, 2015).
- Technologies based on artificial intelligence and ICT technologies, such as web applications, blogs and digital platforms (Cane & Parra, 2020) can support this strategy (Vågsholm et al., 2020).

8. Post-harvest facilities

Post harvest technology and its sub disciplines



Actions under PHT

- Pre-Cooling
- Cleaning
- Washing
- Waxing
- Grading
- Ripening
- Packaging
- Storage
- Transportation
- Distribution

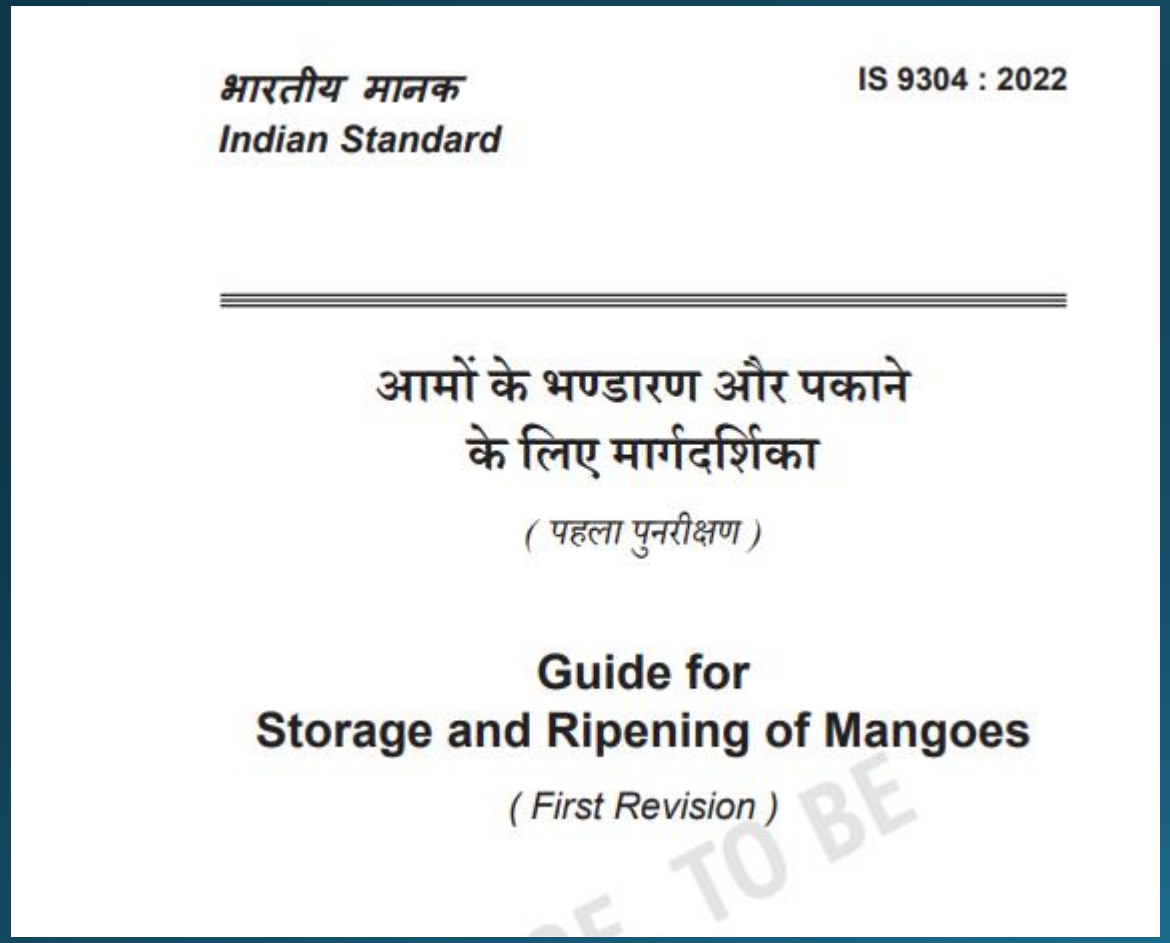
Post-harvest refers to the period after crops have been harvested and includes all the activities involved in managing the crops, from harvesting to storage, transportation, and processing.

Fresh fruit supply chain- storage, ripening marketing

Grading Packing Fresh market chin

Mango processing into pulp

BIS- Standards



भारतीय मानक
Indian Standard

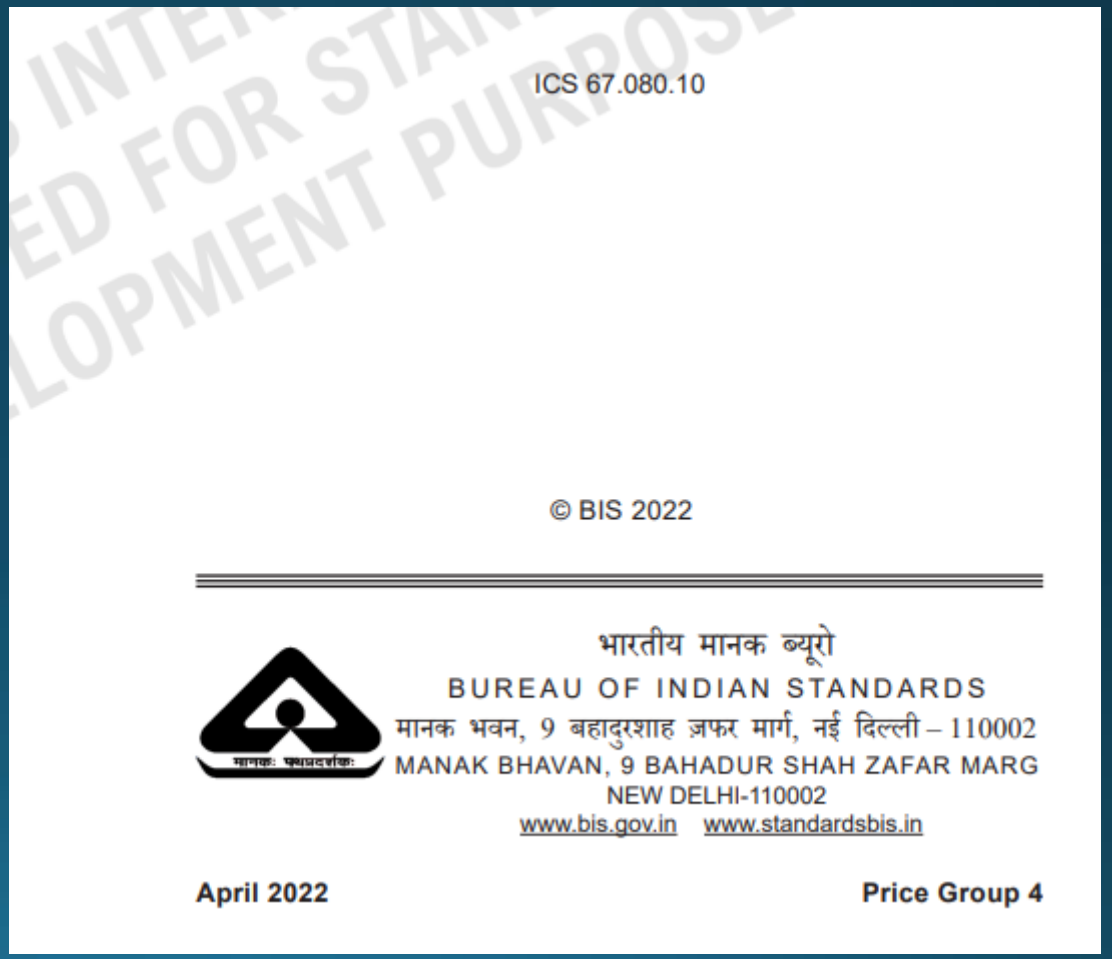
IS 9304 : 2022

आमों के भण्डारण और पकाने
के लिए मार्गदर्शिका

(पहला पुनरीक्षण)

Guide for
Storage and Ripening of Mangoes

(First Revision)



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April 2022 Price Group 4

Fresh fruit and vegetable storage

- Means that are commonly used to prevent spoilage of fruits must include:
- care to prevent cutting or bruising of the fruit during picking or handling;
- refrigeration to minimize growth of micro-organisms and reduce enzyme activity;
- packaging or storage to control respiration rate and ripening;
- use of preservatives to kill micro-organisms on the fruit.

During storage deterioration of fruits and vegetables is mostly caused due to:

- Loss of moisture
- Loss of carbohydrates and vitamins
- Physiological disorders
- Shoot growth
- Root growth
- Seed germination
- Attack of pests and diseases

Definitions…

Controlled Atmosphere Storage

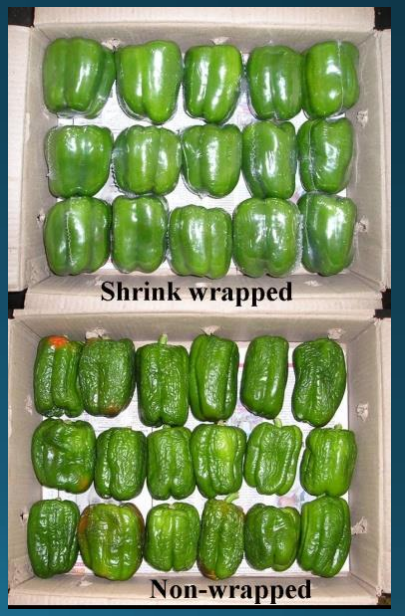
Maintaining a precisely defined atmosphere in the storage chamber

Modified Atmosphere Storage

Packaging of a perishable product in an atmosphere which has been modified so that its composition is other than that of air

Shrink film Packaging

Product is packaged so that there is effectively no headspace in the package, once the package is in intimate contact with the product regardless of the product's shape



Transportation along with leaves

Sorting

- To remove bruised, malformed

Shelf- life of F&V under storage methods

Commodity	Treatment	Storage Temp.	Storage life
Mango	Hot water treatment	13°C	3 weeks
	MA packing	13°C	25 days
	CA storage	13°C	40 days
Banana	Ethylene absorbent	25°C	+ 6ays
	MA packing	15°C	5 weeks
	CA storage	15°C	8 weeks
Grape	Grape guard	25°C	5- 6 days
		0-2°C	10-12 weeks
Mandarins	Wax + fungicide	25°C	3 weeks
		10°C	5-6 weeks
Pomegranate	Shrink wrapping	25°C	3 weeks
		8°C	10-12 weeks
Sapota	LT Storage	15-20 °C	12-15 days
Custard apple	LT Storage	15°C	8-9 days

Commodity	Treatment	Temp.	Shelf-life
1. Capsicum	a. MAP (100gauge PE)	7 °C	20 days
	b.Individual Shrink Wrapping (D 995)	7 °C	35 days
	b.Individual Shrink Wrapping (D 995)	25 °C	12 days
2. Cucumber	a. MAP (100gauge PE)	10 °C	22 days
	b.Individual Shrink Wrapping (BDF)	25 °C	10 days
3. Cabbage	a. PE 100 gauge lining of crates	0 °C	80 days
	b.Individual Shrink Wrapping (D 995 & BDF)	0 °C	100 days
	c. b.Individual Shrink Wrapping (D 995 & BDF, 100 PE)	27 °C	2 days
4. Beans	a. MAP (100gauge PE)	10-13 °C	15 days
5. Okra	a. MAP (100gauge PE)	10 °C	10-12 days
6. Brinjal	a. MAP (200gauge PE with 0.6% ventilation)	10 °C	12 days
	b. MAP (100gauge PE)	25 °C	7 days
7. Mushroom	a. MAP (100gauge PE)	0 °C	10-15 days
	b. 100ppm Vit C + MAP (100gauge PE)	24 °C	<2 days

9. Processing – value addition, upcycling, waste utilization

Major aims of food processing:

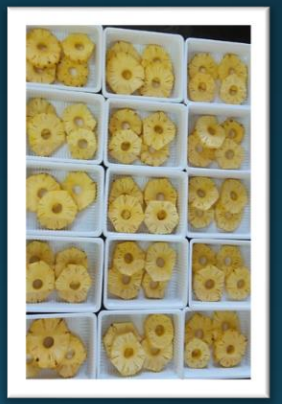
- Extend the shelf-life of food and serve as the surge capacity in nature's seasonal cycle. (*Supply-Demand*)
- Enhance the acceptability (flavor, color, texture) and safety of food. (*Tasty and safe*)
- Provide nutritious foods enhancing good health, strengthening bodies and empowering mind. (*Healthful diet*)
- Help build communities and generate income for the farmers and manufacturers. (*Business*)

Preservation Techniques Commonly Used Today

- Canning
- Dehydration
- Freeze-drying
- Freezing
- Salting
- Pickling
- Pasteurizing
- Fermentation
- Chemical preservation

- **Fresh cut vegetables:** Capsicum, cabbage, cucumber, radish, cauliflower, fenugreek leaves and microgreens, carrot, garlic, onion, cilantro leaves etc.
- **Increases shelf life from 6-22 days under refrigerated conditions depending on the vegetable**

- **Fresh cut fruits:** jack fruit, pineapple, papaya, musk melon, pomegranate & pommelo
- **Achievement : 10 days shelf life under refrigerated conditions depending on the vegetable**

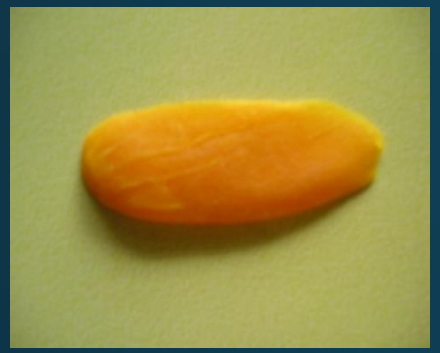


- Probiotic fruit and vegetable beverages: mango, pineapple, pomegranate, guava, carrot, kiwi fruit, aonla
- **Three months shelf life from under refrigerated conditions**
- Avocado spread & avocado chutney
- Bittergourd juice

Processing

- Food processing businesses can be operated at a very small scale or at an industrial level and generate employment opportunities in the areas where the fruit and vegetables are grown.
- They play a critical role in reducing food loss by taking the produce that is not up to the standard for fresh retail markets and converting it into nutritious and profitable products.
- Processed products have the advantage of not being limited by shelf life and can be introduced to markets throughout the year.
- They are not sensitive to price fluctuations due to seasonal prices for fresh produce and gluts in production and can provide some out of season nutrients and affordable products.

Nutritionally dense food



Steps for Osmo-dehydrofreezing of Mango

Storage at -18°C

Freezing at -40° C

Value added Jackfruit products

Arka Anytime Jack Chunk

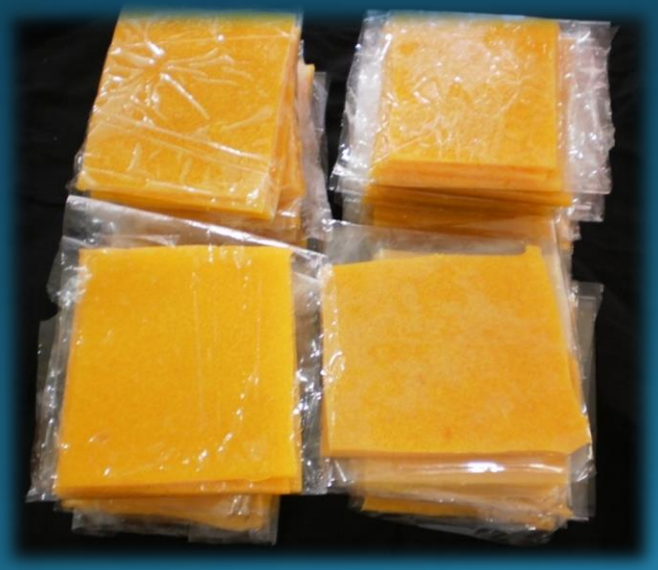
Arka RTE Jack Curry

Arka Jackies

Arka Jackolate

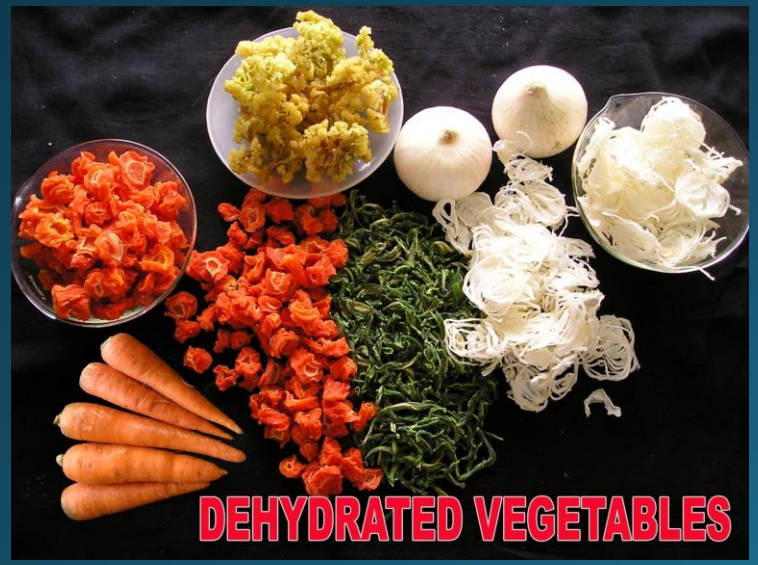
Fruit Bar-Special Features

- Nutritious.
- Good eye appeal.
- Delicious.
- Easy to transport.
- Easy and convenient.
- Value addition:
  - Blending
  - Fortification
- Good shelf life.



Drying (Dehydration)

- One of the oldest methods of preserving food
- Removes moisture stops the growth of bacteria, yeasts & molds that normally spoil food
- •Slows down but doesn't completely inactivate enzymes



Nutritional Value of Dried Foods

- Fresh produce provides calories, fiber, minerals and vitamins. Changes that can be expected in home-dried food are:
- Calories: No change
- Fiber: No change
- Minerals: Minimal loss
- Vitamins: Greater loss during dehydration process (more susceptible to heat, air and light)

Use of sustainable energy

Solar drying

- Solar drying is a continuous process where moisture content, air and product temperature change simultaneously by the solar radiation.
- The drying rate is affected by ambient climatic condition- temperature, relative humidity, sunshine hours, available solar radiation, wind velocity, frequency and duration of rain showers during the drying period.

Value Added F&V Products- at ICAR-IIHR

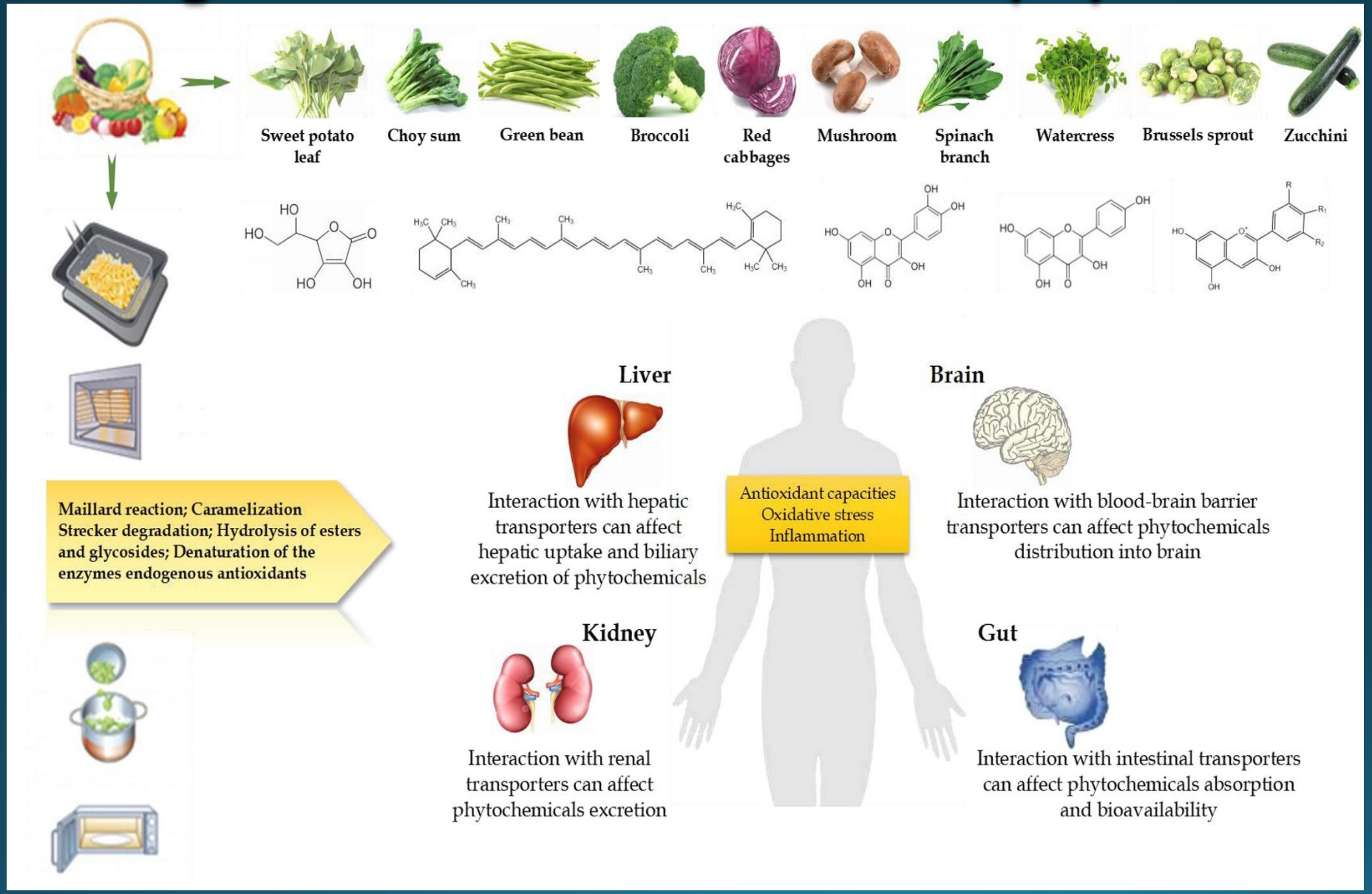
Osmotic dehydration of fruits and vegetables: for mango, papaya, guava, banana, pineapple, jackfruit, sapota, aonla, carrot, pumpkin, beetroot and muskmelon,

Fruit bars: mango, papaya, guava as well as there blends have already been developed at

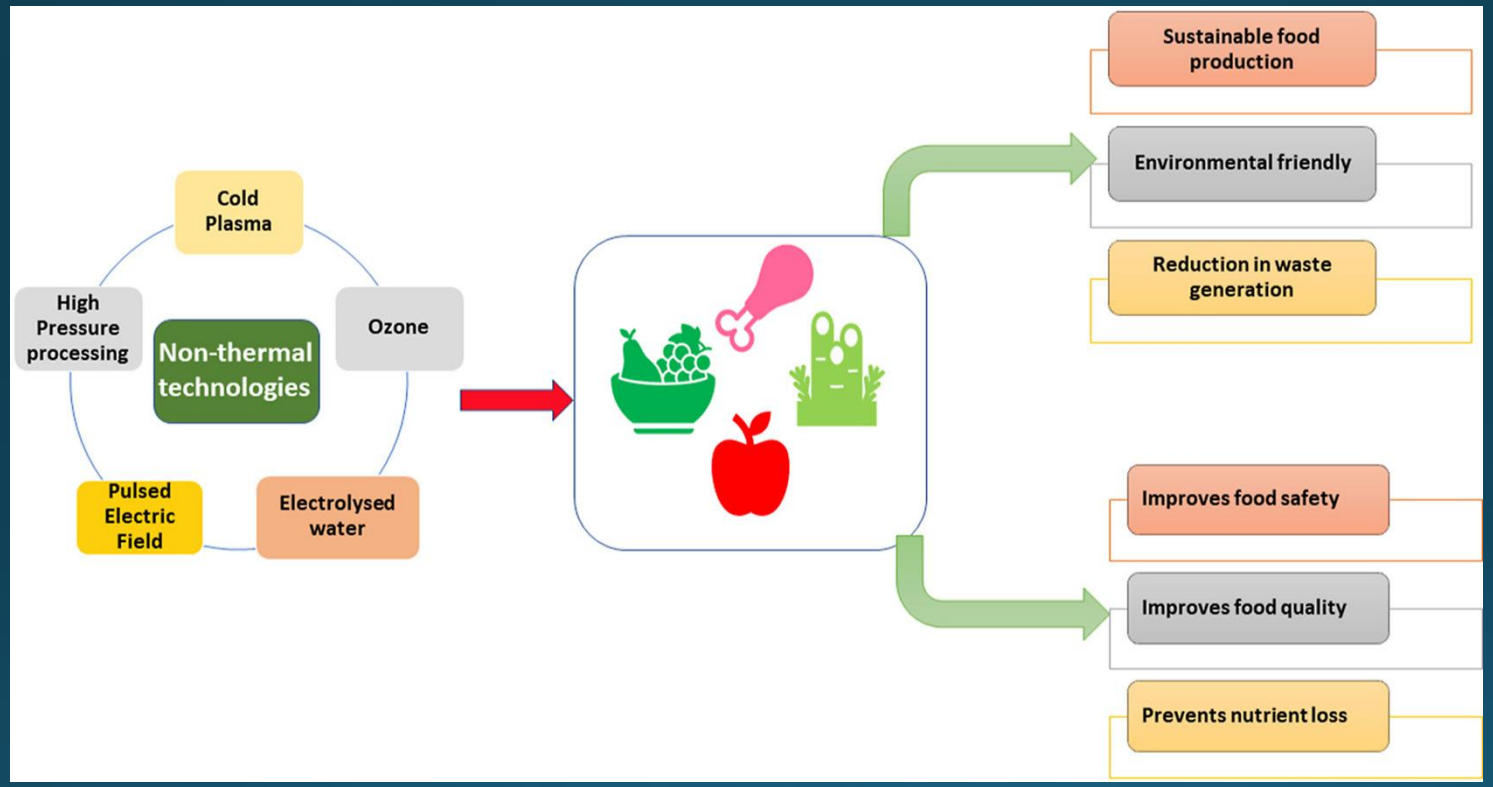
Dehydrated vegetables: Onion, carrot, cauliflower, carrot, pumpkin.

ICAR-IIHR has commercialized these products to several entrepreneurs.

Fruits & vegetables are rich source of phytochemical



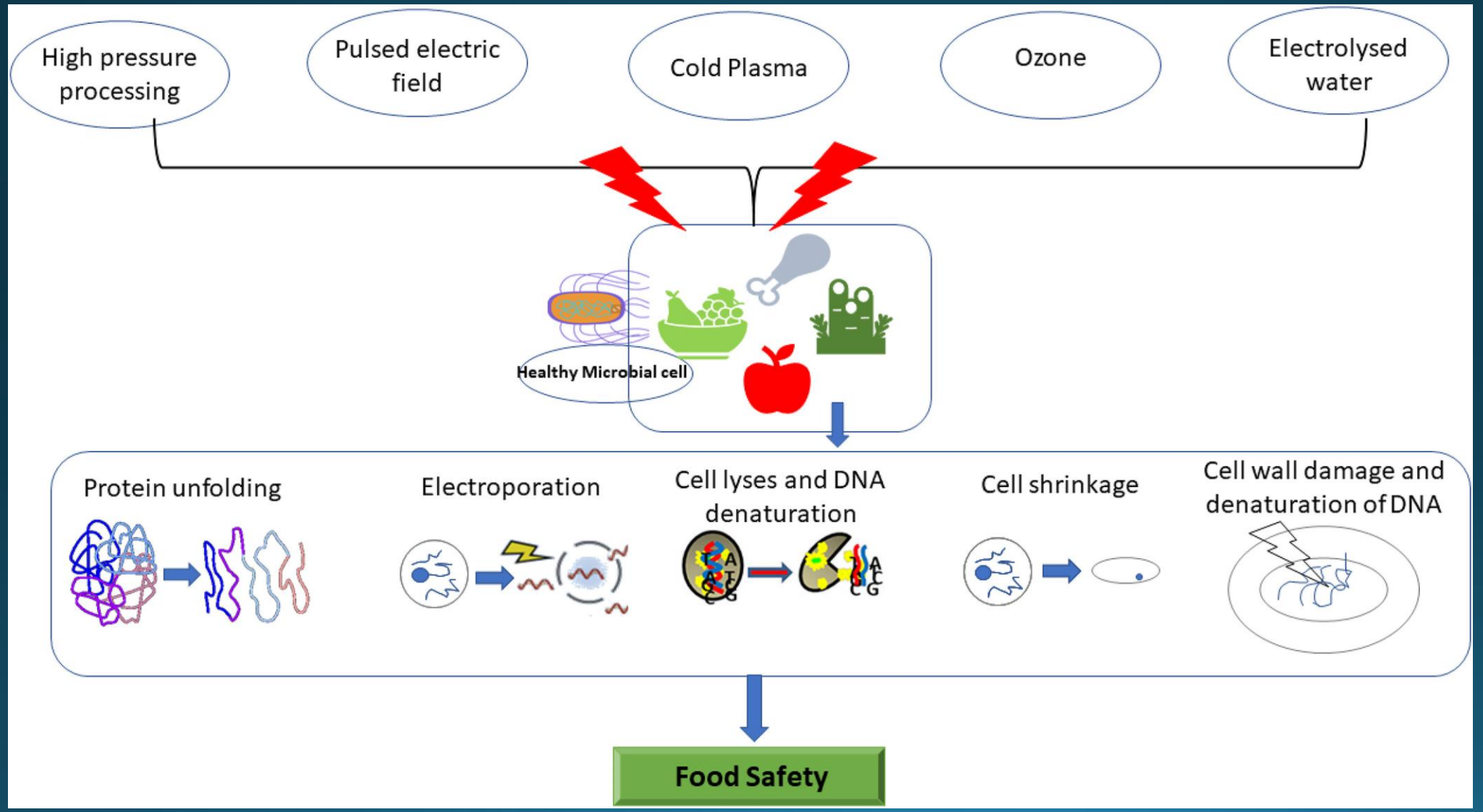
Use of green technologies for sustainable post-harvest management and processing



Post-Harvest Losses and their impact on Food Security and Livelihoods

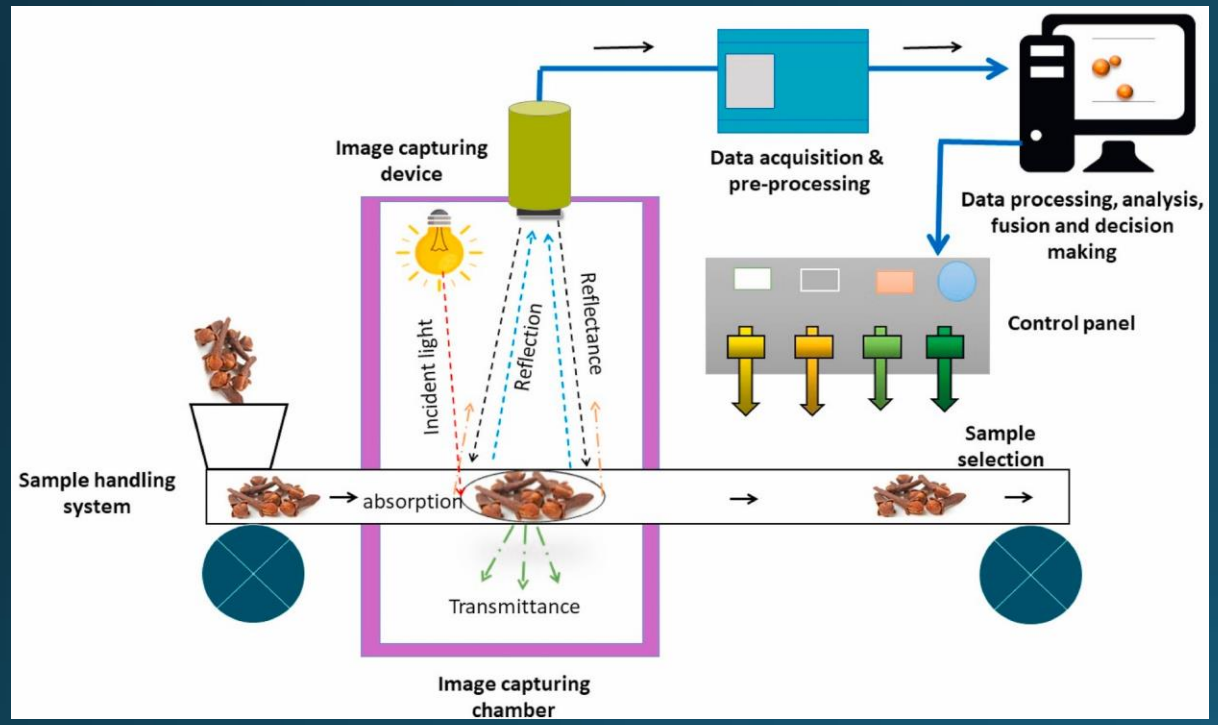
https://doi.org/10.1016/j.lwt.2021.112140

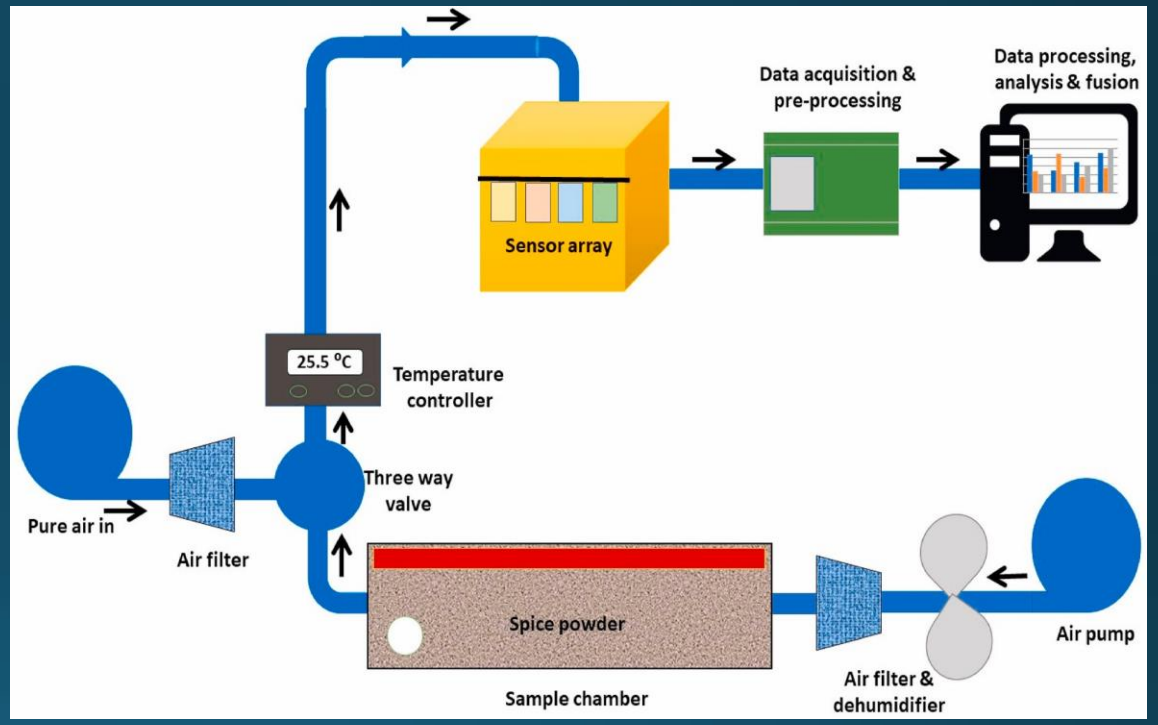
Fig. 1. Action mechanisms of selected nonthermal technologies to achieve food safety.



Technology for Processing of Spices

- Non-destructive methods for quality and safety monitoring of spices



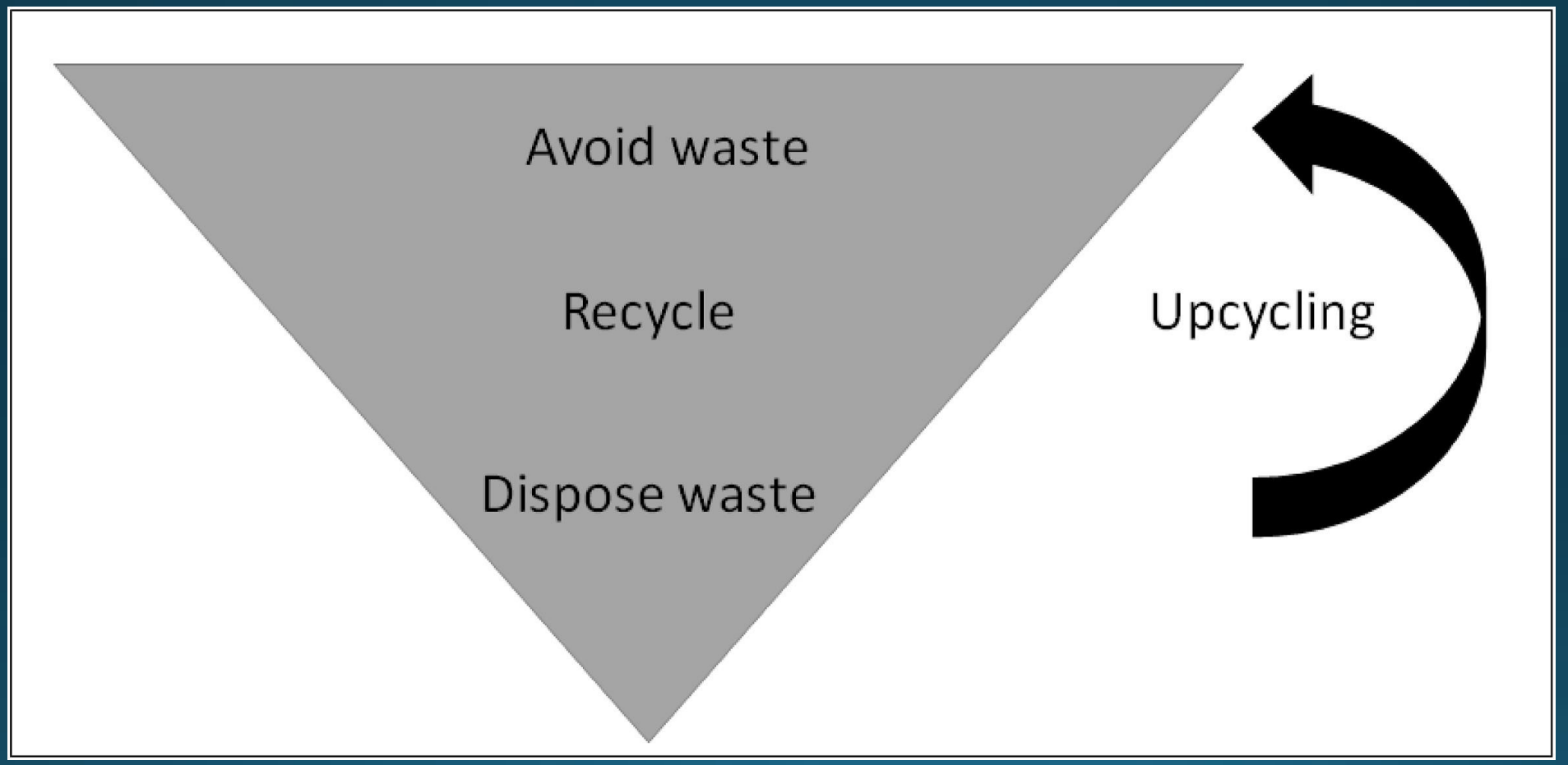


Computer vision system.

Electronic nose system.

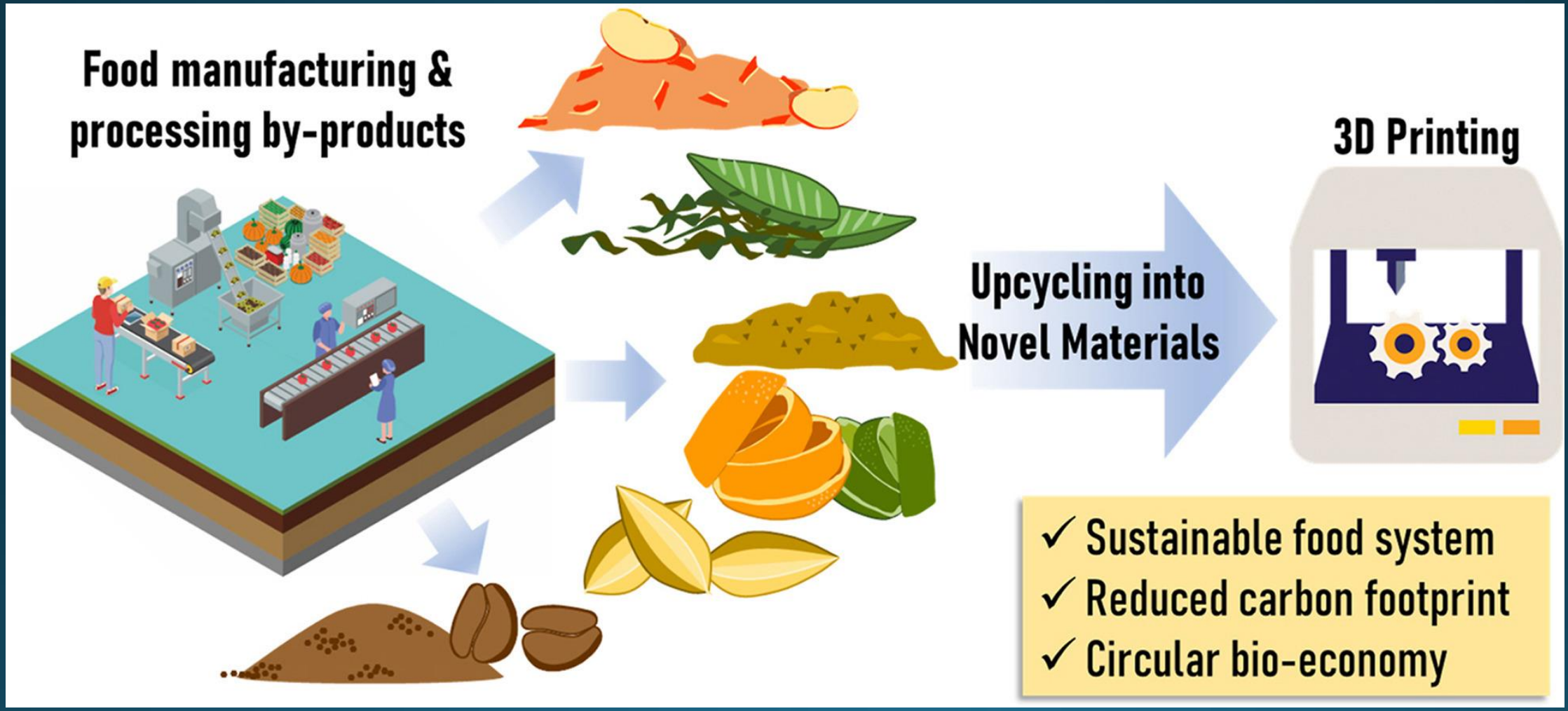
https://doi.org/10.1016/j.tifs.2020.12.021

10. Processing for upcycling case studies



A simplified waste hierarchy and the contribution of upcycling

https://doi.org/10.1016/j.tifs.2023.01.001


Food manufacturing &
processing by-products
Upcycling into
Novel Materials
3D Printing
✓ Sustainable food system
✓ Reduced carbon footprint
✓ Circular bio-economy

2. What is upcycling

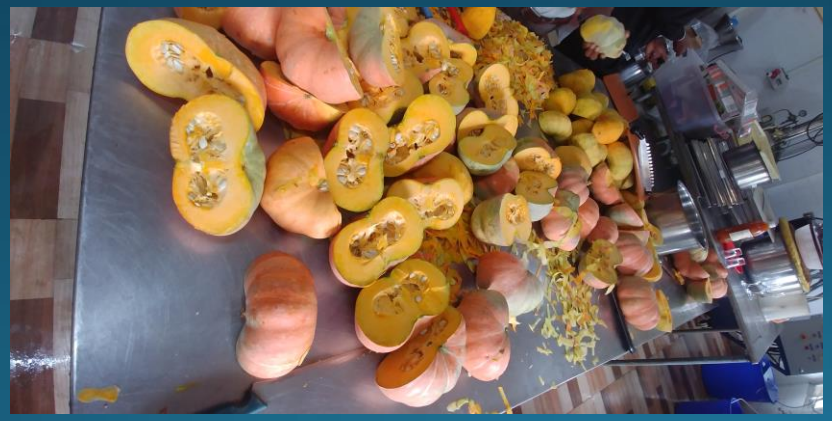
The word ‘upcycling’ was coined in contrast to recycling, which is understood as ‘downcycling’.

It goes back to the groundbreaking cradle-to-cradle (C2C) design concept, where it was defined as “cyclical, cradle-to-cradle ‘metabolisms’ that enable materials to maintain their status as resources and accumulate intelligence over time” (Braungart et al., 2007, p. 1338).

Braungart et al. (2007) criticized that the ‘recycling’ far too often meant that the material was downgraded and lost its value, as for example if different types of plastic is mixed and melted together as park benches, with the recycling just another stage on the way to disposal.

Utilization of papaya for Seed Production

Upcycling of Pumpkin



Cyclone Tauktae near peak intensity approaching Gujarat in India on May 17, 2021

THIS STORY IS FROM MAY 16, 2021

Gujarat: Mango farmers fear cyclone Tauktae may cause serious losses

Jay Pachchigar & Nimesh Khakhariya / TNN / May 16, 2021, 07:04 IST

SHARE AA

ARTICLES

- Gujarat: Mango farmers fear cyclone Tauktae may cause serio...
- Asian Paints is all praises for their new brand ambassador PV...
- Ahmedabad: Dariapur MLA Gyasuddin Shaikh writes to chief...
- Gujarat government requests Centre to expedite vaccine...

Ten percent mangoes damaged due to Cyclone Amphan

May 22, 2020

Growers fear 75% loss in Malda mango and litchi production

Cyclone Amphan, lockdown and series of storms cause irrepairable damage to 'ma economy'

ne Amphan in Malda district

a | Published 31.05.20, 07:19 PM

Cyclone Amphan: Mango Farms Destroyed in These States of India

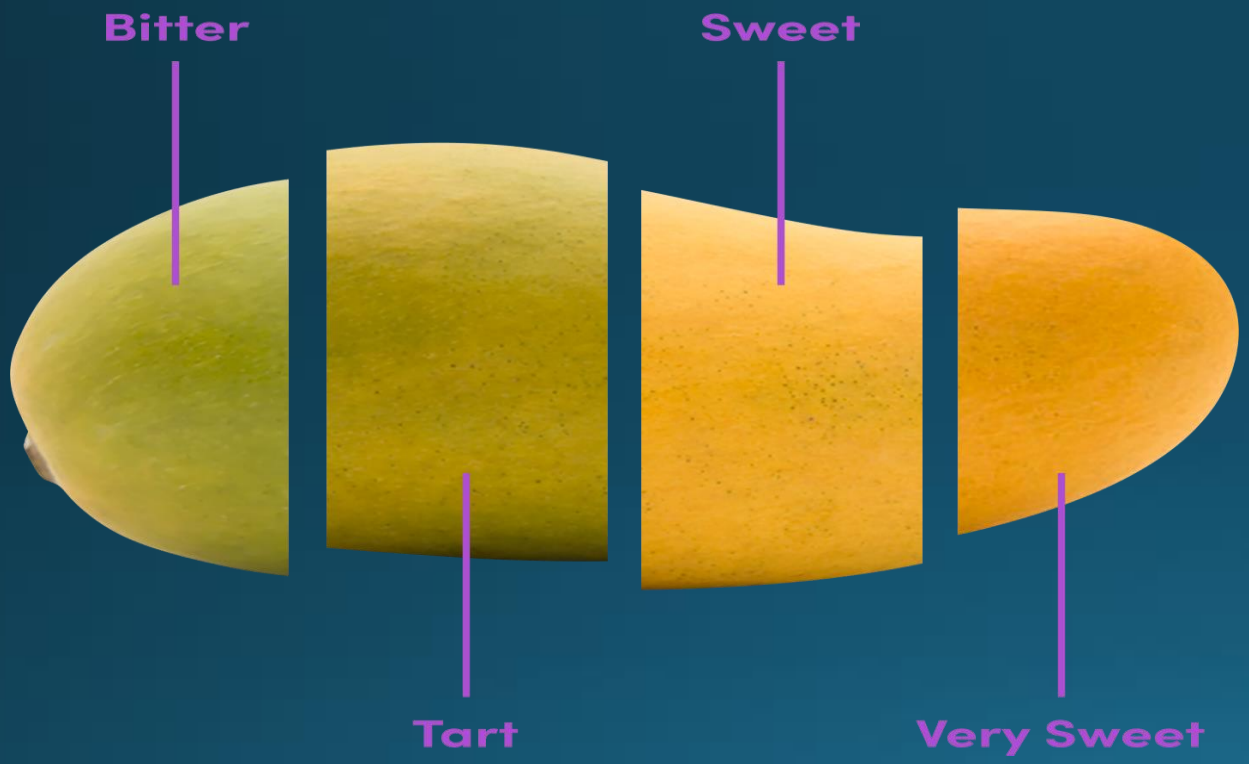
On one hand, while the farmers across the nation are bearing heavy losses due to the lockdown, the situation of the farmers in West Bengal and Odisha has even worsened. With Cyclone Amphan hovering over these states, the farmers are bound to see terrible fate with their farms being destroyed.

Nikita Arya Updated 25 May, 2020 4:13 PM IST

Google News

An Indian farmer separates damaged unripened mangos collected on a roadside in **Malda, some 350 kms north of Kolkata on April 16, 2010**, after they fell due to a sudden hailstorm.

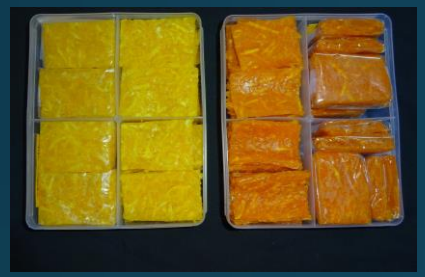

Mango ripeness


Bitter
Sweet
Tart
Very Sweet


Osmo-dried Mango

Conclusion:

- Hence, it is concluded that through combination processing unmarketable raw and discarded mango fruits can be utilized for making nutritious and crispy snacks which in turn can make mango production more sustainable.



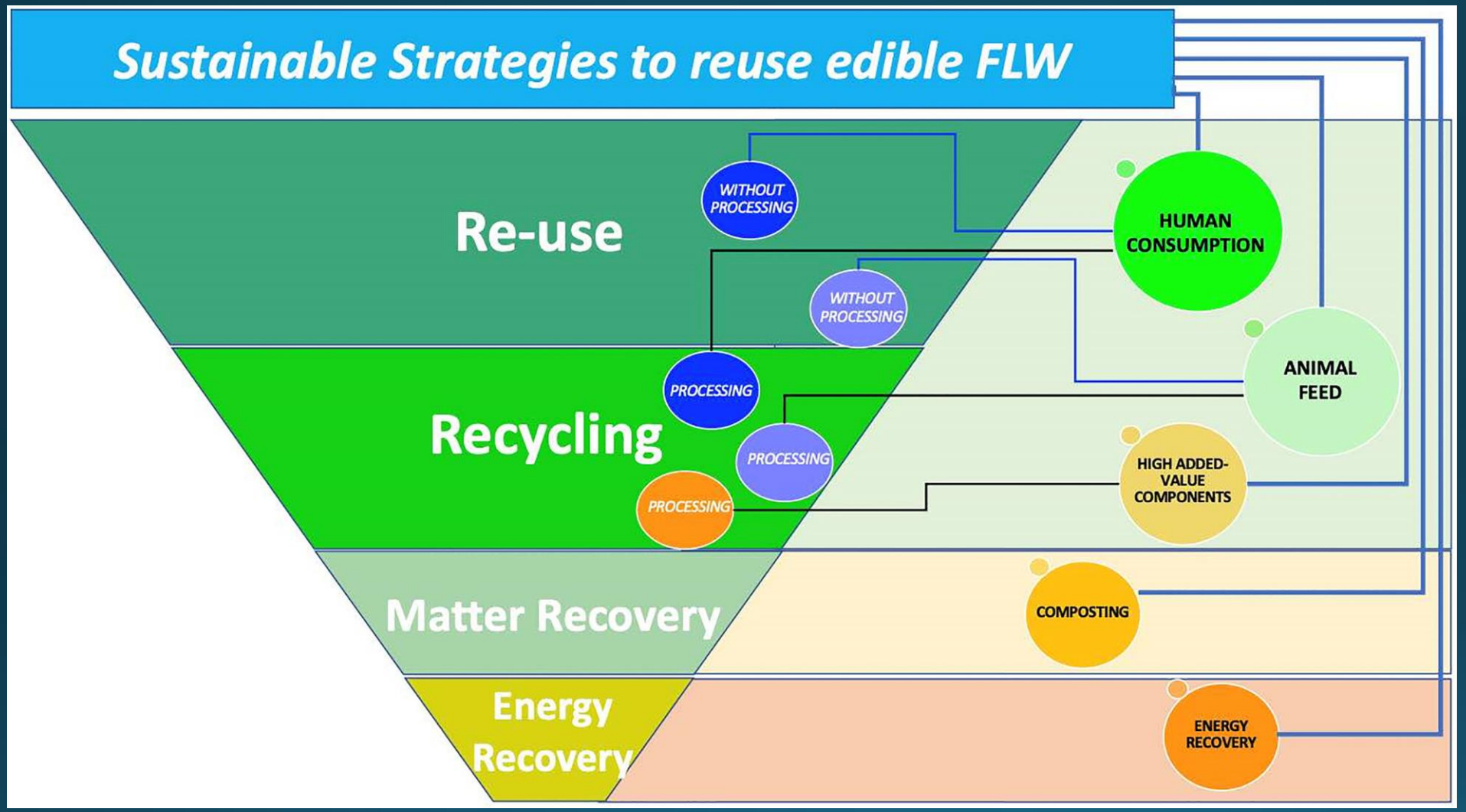
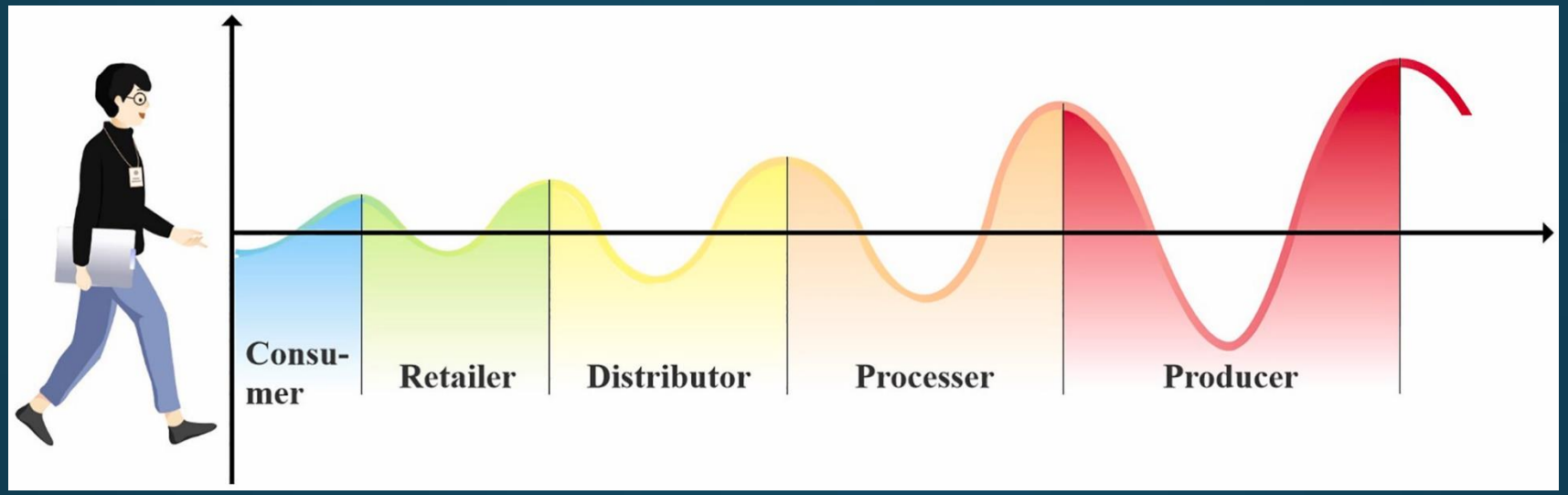


Fig. 10. Sustainable strategies to manage edible FLW from the fruits and vegetables processing stage.

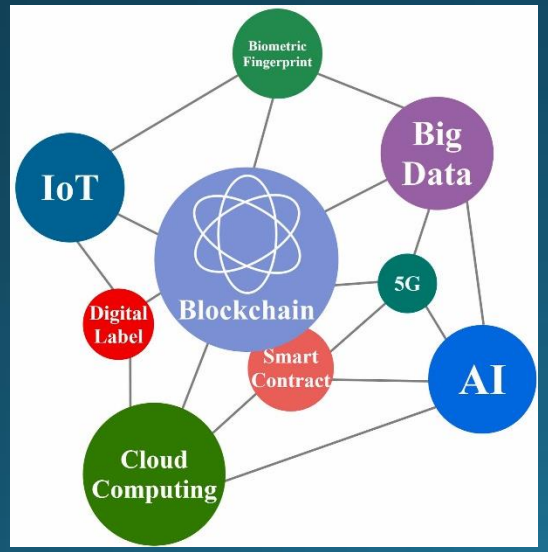
11. Application of Digital technologies- traceability, ICT and information communication, block chain etc.

Traceability system

- IT sholud be developed with **clear objectives of the stakeholders** in the food supply chain, with effective product tracing.
- It should be simple, user friendly and **globally accepted**, as well as have the ability to leverage existing industry systems.
- Standardized ways of expressing key data elements should be agreed upon
- Education on Critical Tracking Events and key data elements should be developed,
- Evidence of appropriate implementation should be part of standard audits



- Bullwhip Effect represents the fruit demand information transmitted from the consumer to the fruit grower, which is incorrectly expanded by step in the process of fresh fruit supply chain information trans.



The combined use of blockchain with other emerging digital technologies to overcome some technical obstacles

Traceability

The Weather Company An IBM Business

IBM Food Trust™
IBM Agritech Platform

"BLOCKCHAIN TO SAVE THE FOOD INDUSTRY **$31 BILLION** BY 2024, DRIVEN BY IOT PARTNERSHIPS"

"Blockchain & the Internet-of-Things - A Powerful Duo"

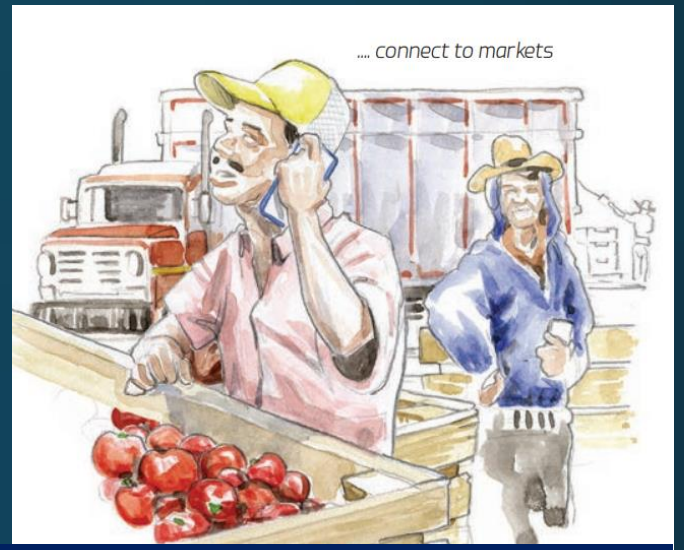
"Compliance costs will be reduced by 30% by 2024"

JUNIPER RESEARCH

Source: Juniper Research - 25th November 2019

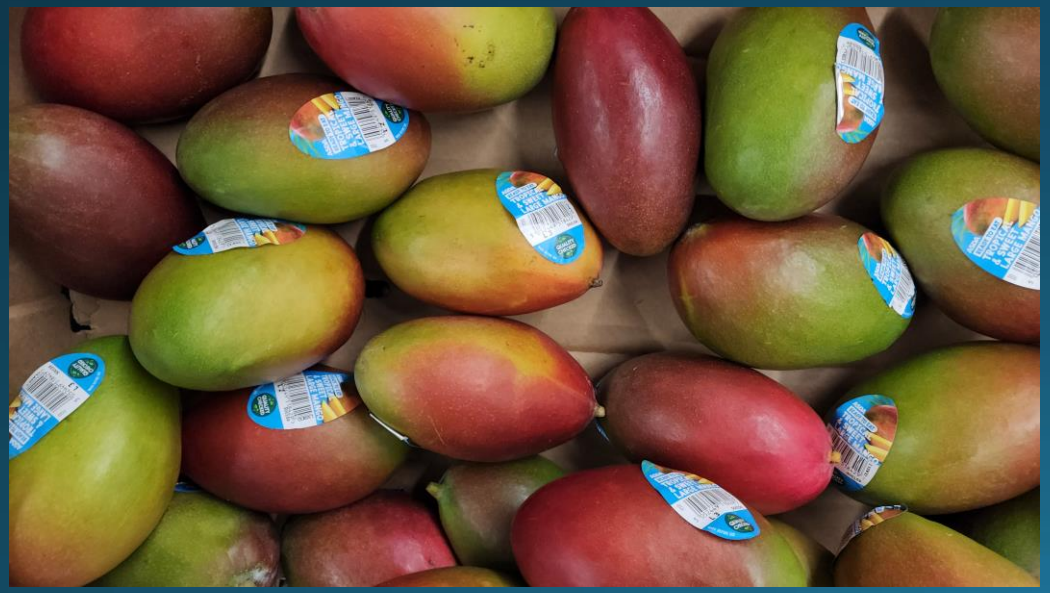
https://www.juniperresearch.com/press/press-releases/blockchain-to-save-the-food-industry-%2431-billion-b

12. Markets and market linkages



The diversity of fruit and vegetables gives producers and suppliers a broad range of market opportunities.


£1

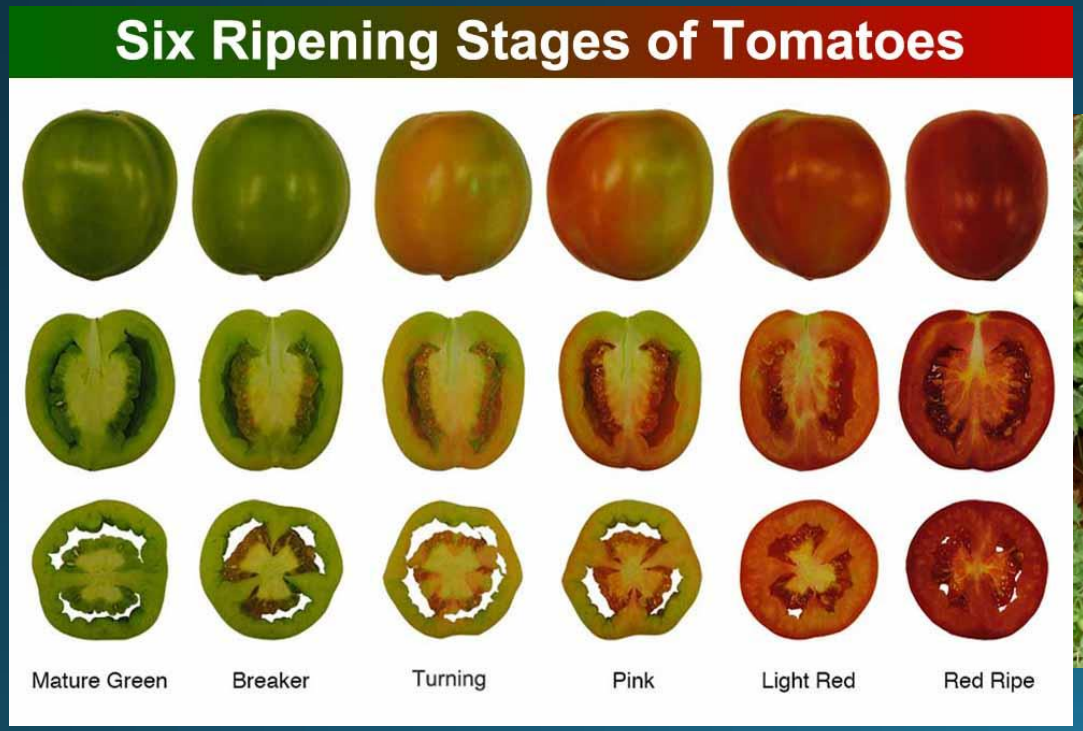



market cafe


market cafe

Market Intervention

	Present	Intervention strategies
Harvesting	Different stage without having purpose and strategies to sale, no grading, poor packaging, no storage Market at distance place	Harvesting as per market requirement, grading and storage



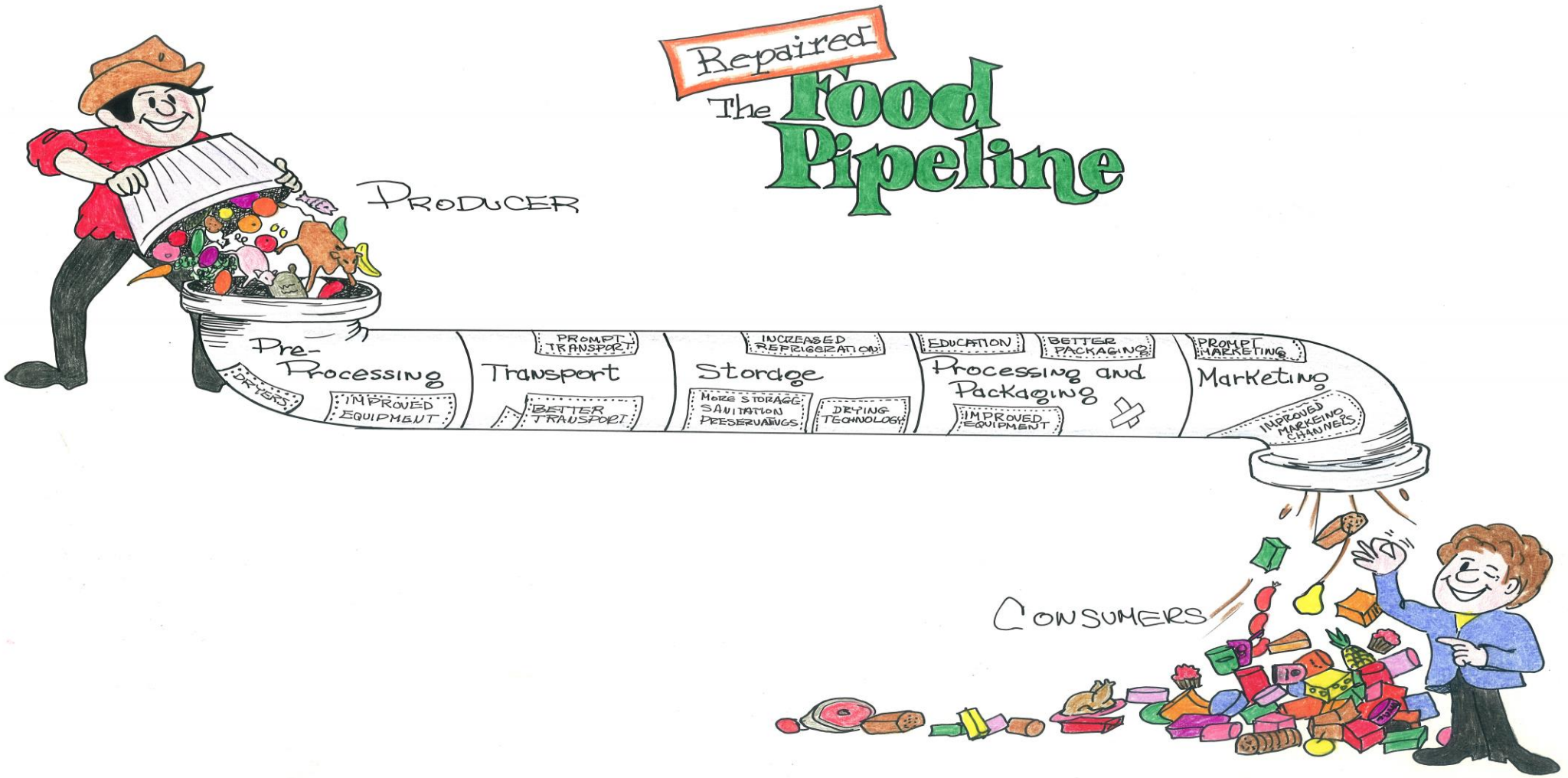
Market Intervention

	Present	Intervention strategies
Packaging and transportation	mixed fruit, poor packaging, non-uniform packaging No graded fruits	Harvesting and Grading of tomato as per market requirement as well for local inter and intra city transport, inter state and export, Storage , warehouse, refrigerated for distance market,

Types of Refrigerated Vans

Market Intervention

	Present	Intervention strategies
Market	Market at distance place, mixed fruit, poor packaging, no storage Some time gets glut and forced for distress sale, price fluctuations,	Strategy to harvest as per market requirements per market, consolidation, and storage, use refrigerated vehicles for distance market and export Market intelligence, e-market, linking with institutional byers – like Big Basket


Repaired
The Food Pipeline
PRODUCER
Pre-Processing
DRYERS
IMPROVED EQUIPMENT
PROMPT TRANSPORT
Transport
BETTER TRANSPORT
INCREASED REFRIGERATION
Storage
MORE STORAGE
SANITATION
PRESERVATIVES
DRYING TECHNOLOGY
EDUCATION
BETTER PACKAGING
Processing and Packaging
IMPROVED EQUIPMENT
PROMPT MARKETING
Marketing
IMPROVED MARKETING CHANNELS
CONSUMERS

13. Informal retail markets Formal retail food markets Export markets niche markets

Farmers need a secure market before investing in vegetable and fruit production due to the perishability and higher costs associated with their production, harvesting and post-harvest handling.

The diversity of fruit and vegetables gives producers and suppliers a broad range of market opportunities.

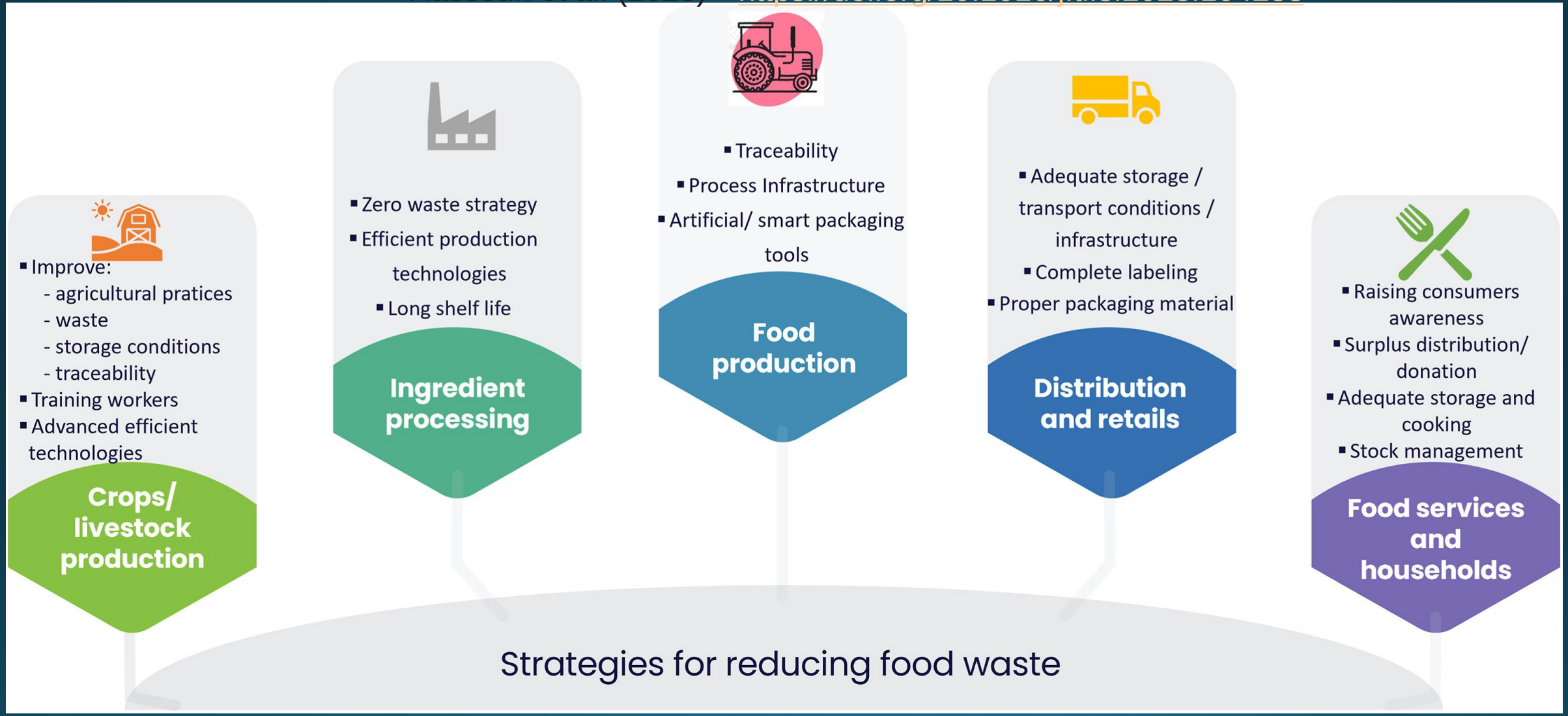

big
basket
India's largest online supermarket

14. Horticulture and Livelihood strategies

Fruit and vegetables are high-value crops that can be grown on small areas of land, creating economic opportunities for small-scale farmers in rural, peri-urban and urban settings as well as in conflicts and fragile contexts (SDGs 1, 3, 11 and 16).

Horticulture value chain-supports livelihood

Hassoun et al. (2023) https://doi.org/10.1016/j.tifs.2023.104238



Examples of strategies for reducing food waste

15. Empowerment of women & youth

Initiatives to make fruit and vegetable production and supply chains more sustainable can be particularly strategic entry points for empowering women (SDG 5)

Horticulture value chain-supports livelihood

Sorting

Trimming

Processing

Ripening

Processing

Processing

Entrepreneurship Development – empowering women and youth

- Post harvest management and value addition
- Botanicas and microbial products
- Protected cultivation
- Mushroom production and processing
- micro nutrient formulations

16. Capacity building & skill labour requirement

Since fruit and vegetable value chains are labour and knowledge intensive, they can generate on-farm and off-farm employment opportunities, especially for youth and other vulnerable populations such as migrants (SDGs 4 and 8).

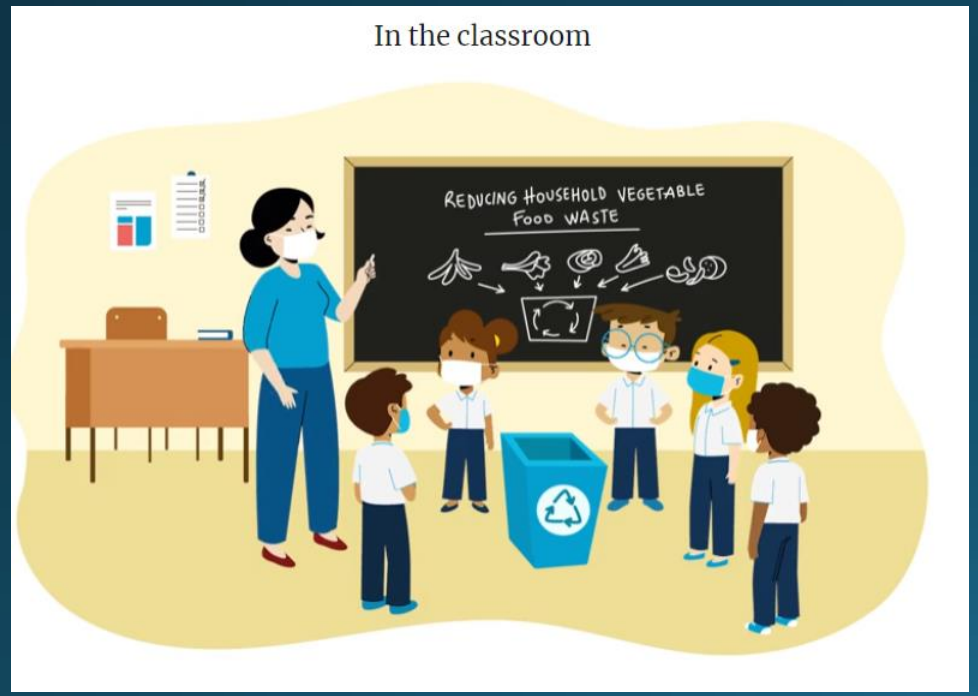

JUMBO
PEEPEE
Group Since 1909
JUMBO
FOOD PRODUCTS
NATURE 'N' NATURE
FOOD PRODUCTS
Jumbo are part of the food division of a century old PEE PEE Group.
group was laid in 1909 with the supply of stainless-steel sheets
sumer durable producing companies and currently branched
into various divisions of business activities.
e state of the art manufacturing facility at Manali Mathur - Chennai,
ith an ongoing expansion, the manufacturing facility is moving
acre facility at Tiruvallur District, Tamil Nadu, India.
are available across the country at all major retail outlets and
online shopping platforms.
Scan QR code for E-catalogue & more information


JUMBO


Unice
Assorted Dehydrated Fruits
Assorted Dehydrated Fruits
Assorted Dehydrated Fruits
Assorted Dehydrated Fruits

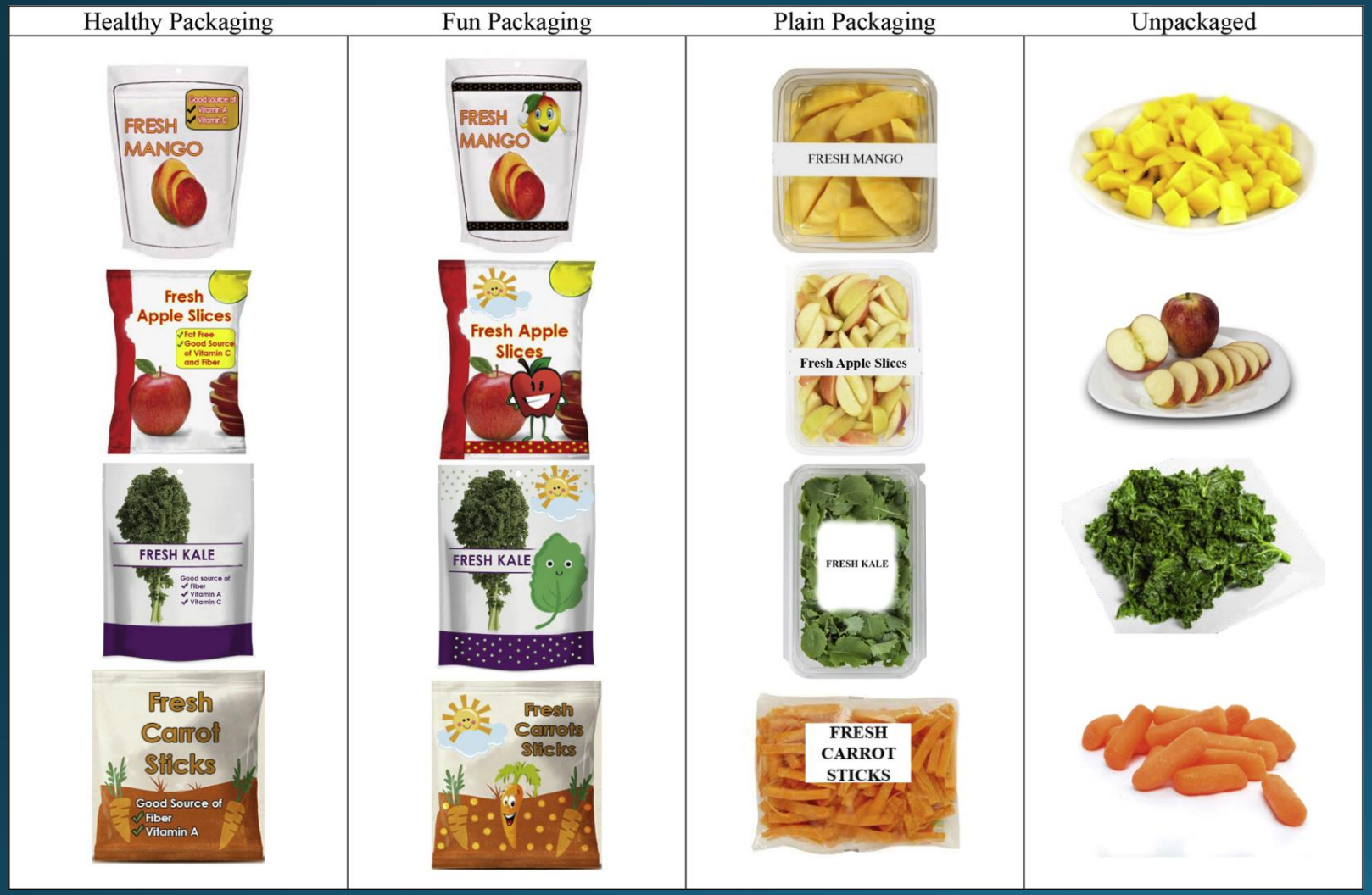
17.Home gardens - children and nutrition education

Food and nutrition education in schools School food and nutrition programmes that teach children about healthy diets are important for addressing malnutrition and building future consumer demand for fruit and vegetables.



Sensitizing the young mind

how to promote increased fruit and vegetable consumption among children



This study examined how different types of packaging (i.e., healthy, fun, plain, unpackaged) of fruits and vegetables influence children's health and taste evaluations. children respond more positively to visually appealing packaging than to plain packaging

https://doi.org/10.1016/j.appet.2020.104591

Power of packaging

Fig. 1. Examples of package types (Lauren A. Dial, Dara R. Musher-Eizenman, 2020)

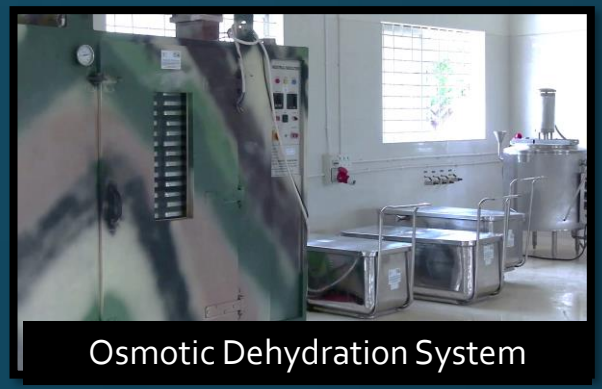
18.Horticulture extension

To reduce losses of fruit and vegetables, governments at different levels should also consider providing incentives for public-private partnerships to improve dry-storage facilities, for example, by establishing systems that can supply farmers with sturdy stackable plastic containers that can be cleaned easily and reused for their harvested produce, or to improve transportation conditions of both cold and dry chains

- Fresh produce, especially vegetables, usually require considerably more labour than other crops for production, harvesting and postharvest handling.
- Furthermore, sustainable production requires a broad range of skills and knowledge. In addition, small-scale farmers need to engage with a range of providers including advisory services and those providing production inputs such as seeds or planting materials, trellising, stakes, nettings, IPM inputs, fertilizers, an array of small tools and equipment (including for irrigation), renewable energy systems and for supply and maintenance of protective structures.

- Fruit and vegetable value chains are capital intensive and benefit from investment in protected cultivation technology, adequate storage facilities (particularly cold storage), processing facilities and smart ways to harmonize production and marketing to reduce losses.

BESST-HORT (A NIDHI Technology Business Incubator of ICAR-IIHR, Bengaluru)



Osmotic Dehydration System

Beverage Processing Line

- **Business Entrepreneurship and Start-up Support through Technologies in Horticulture (BESST-HORT)**, is a **NIDHI-Technology Business Incubator of IIHR, granted in 2018 by the National Science and Technology Entrepreneurship Development Board (NSTEDB) of Department of Science and Technology, Government of India.**
- **To promote knowledge and innovation driven start-up enterprises in the area of horticulture & allied fields.**
- **NSTEDB was established by Government of India in 1982 with a broad objective of promoting gainful self-employment amongst the Science & Technology manpower to setup knowledge based and innovation driven enterprises.**

Incubation facilities have been developed under BESST-HORT for the following food products:

- 1. Fruit/ vegetable washing, waxing & drying facility
- 2. Juice Processing facility
- 3. Osmotic dehydration facility
- 4. Fruit bar making facility
- 5. Modified atmosphere and vacuum packaging fac
- 6. Baking facilities
- 7 Tomato processing facility

8. Solar drying facility

20.Conclusion

- To achieve SDGs 2 and 3, fruit and vegetables must be made available and affordable to consumers. Sustainable production of fruit and vegetables, combined with stable value chains, is therefore a national, regional and global priority to meet global nutrition requirements.
- The high-value and yet perishable nature of fruit and vegetables offer significant opportunities for new businesses and decent work. These include technical advisory services, input supplies (seeds, trellising, protected cultivation systems, drip irrigation, fertilizer, pest and disease management technologies), post-harvest services (grading, washing, sterilizing, packaging, processing, transportation, storage) and market linkages (food technologies, branding, marketing, participatory guarantee systems, digitalization, traceability schemes and blockchain).
- The labour and knowledge intensive demands from fruit and vegetable value chains can generate on-farm and off-farm employment opportunities, especially for women and youth, to achieve SDGs 4, 5 and 8.

Thank You