Save Indian Farmers Report on

Farm Produce Storage Solutions

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Background Information

Storage held an important role in selling of goods, which not only stores it but preserves it from the time it is produced till consumed. The farm produce is required to store properly to avoid or minimize post-harvest losses. Farm storage refers to the facilities and methods used by farmers to preserve agricultural products.

As per the United Nations Sustainable Development Goals (SDG), "by 2030, to halve per capita global food waste at the retail and consumer levels and reduce the food losses along production and supply chains, including post-harvest losses''.

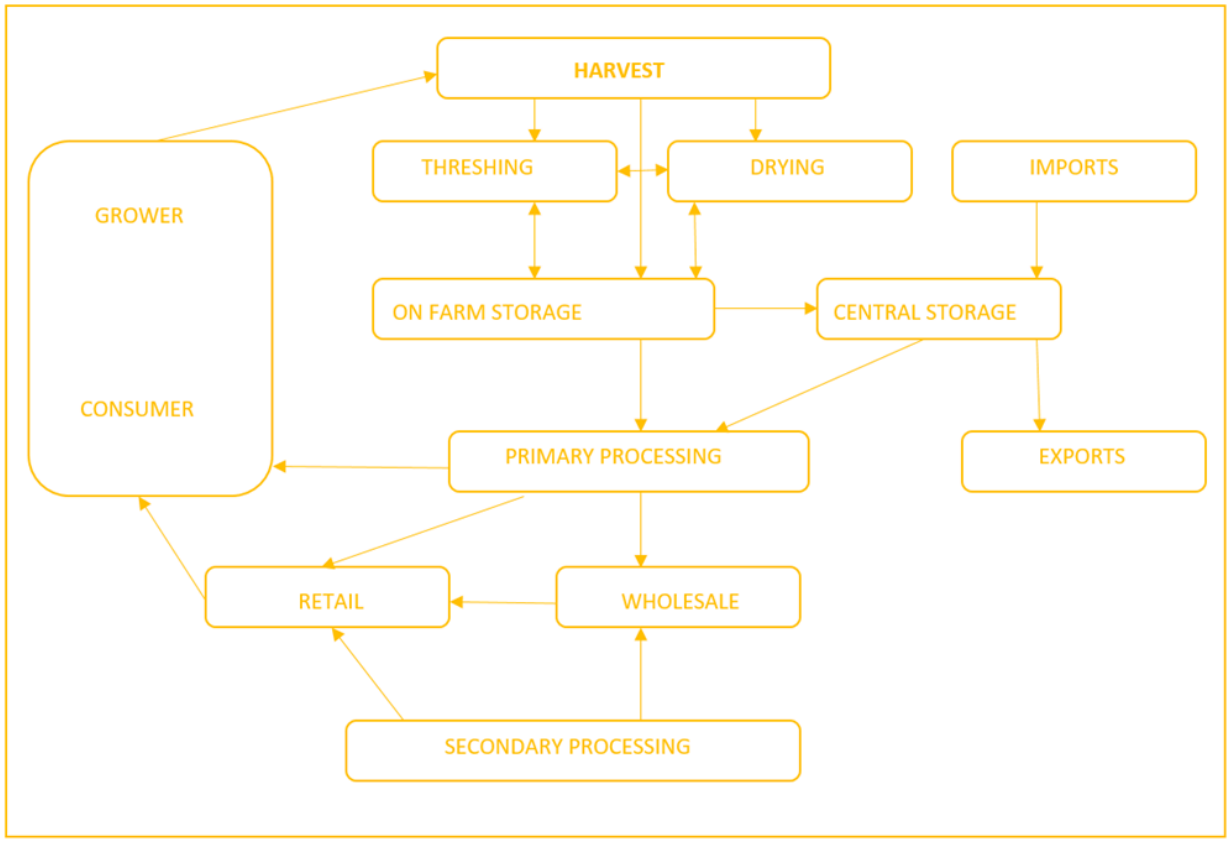
In India, post-harvest losses caused by unscientific storage, insects, rodents, micro-organisms etc., account for about 10 to 33 per cent of total food grains. The major economic loss caused by grain infesting insects is not always the actual material they consume, but also the amount contaminated by them and their excreta which make food unfit for human consumption.

There is a direct relationship between Relative Humidity (RH) of the ambient air and the moisture content attained by the seed stored. High moisture and RH encourages pest and disease attack.

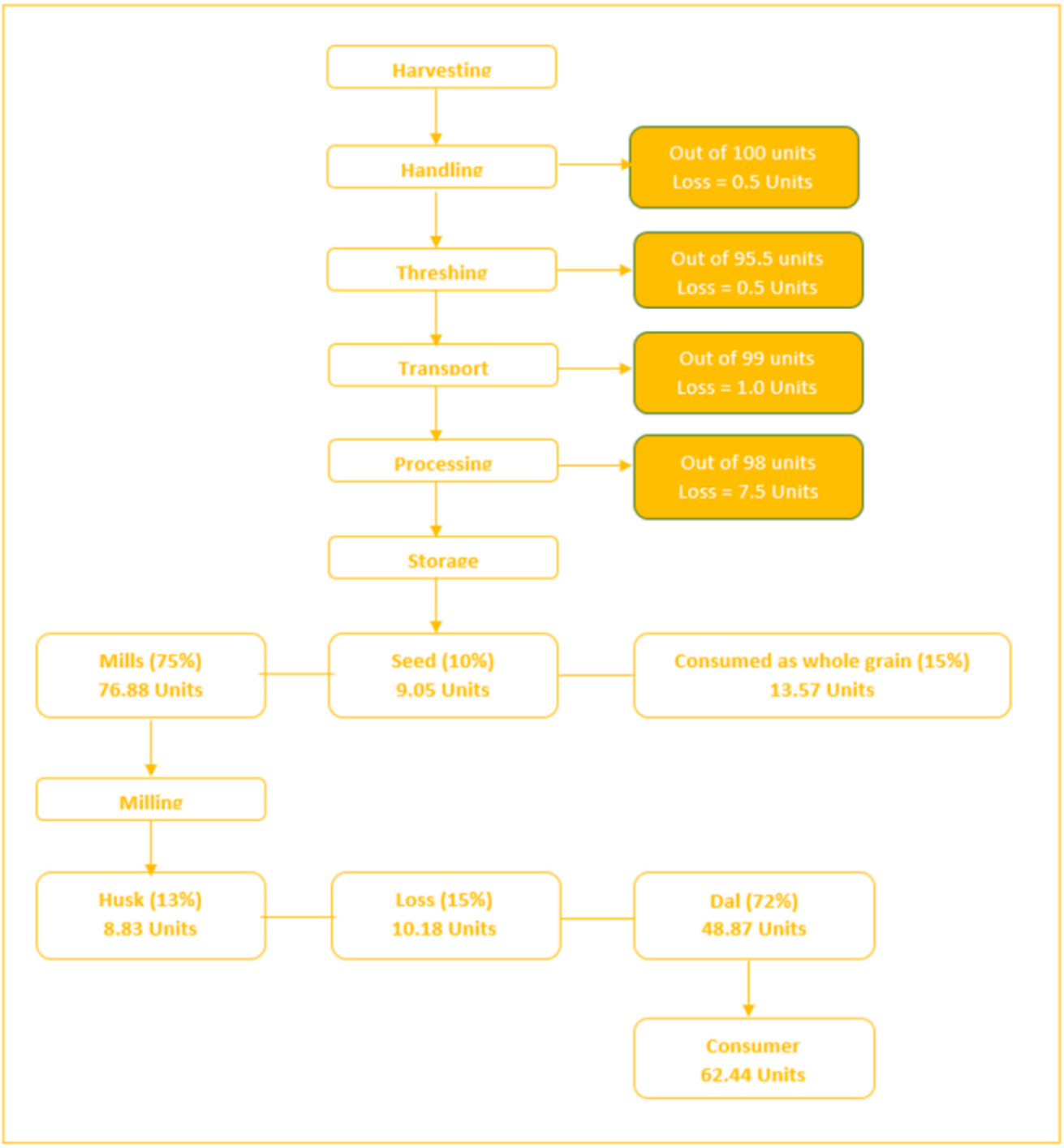
Due to lack of processing facilities, great losses occur in fruits and vegetables. It is therefore necessary to give thrust on processing of fruits and vegetables both in informal and organized sectors. The processed products have great demand both in domestic and export markets.

Pomegranate orchard. Storage and processing of fruits is very important to minimize the post-harvest loss.

Grape is perishable farm produce. Cold storage facility is very important for getting higher price.



Post harvest chart



Post harvest profile: At every stage of the food chain, some losses take place

Farm Produce Storage and its need:

Produce derived from farms is called farm produce.

Types of farm produce:

1) Food grains (cereals, pulses and oilseeds)
2) Vegetables
3) Fruits
4) Flowers
5) Spices and condiments
6) Aromatic and medicinal herbs,etc.

Following table shows the post-harvest losses of major crops and commodities in India.

Crops/Commodities	**Loss (%)**	
	As per ICAR-CIPHET Study (2015) *	As per NABCONS study (2022)**
Cereals	4.65 - 5.99	3.89-5.92
Pulses	6.39 - 8.41	5.65-6.74
Oil Seeds	3.08 - 9.96	2.87-7.51
Fruits	6.70-15.88	6.02-15.05
Vegetables	4.58-12.44	4.87-11.61
Plantation Crops & Spices	1.18-7.89	1.29-7.33
Milk	0.92	0.87
Fisheries (Inland)	5.23	4.86
Fisheries (Marine)	10.52	8.76
Meat	2.71	2.34
Poultry	6.74	5.63
Egg	7.19	6.03

Source: https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1885038

ICAR-CIPHET: Indian Council of Agricultural Research-Central Institute of Post-Harvest Engineering and Technology

Need of Farm Produce Storage

- The storage of goods from the time of production to the time of consumption, ensures a continuous flow of goods in the market.
- To minimize the post-harvest loss
- Storage protects the quality of perishable and semi-perishable products from deterioration
- To minimize the damage by pests (store grain insect pests) and diseases (fungi & bacteria) after the post-harvest
- Protect farm produce from damage due to rainfall
- Selling of the produce at right time
- To supply the produce in the off season
- To export the produce at the right time
- Storage helps in the stabilization of prices by adjusting demand and supply
- To gain higher returns from produce
- To provide food grains for the public distribution system
- To contribute in national and nutritional food security
- To produce value added products
- Storage provides employment and income through price advantages

Effect on consumers/Demand-supply

Farm produce storage helps in the stabilization of prices by adjusting demand and supply. Insufficient or lack of storage facility not only adversely effect on the consumer needs but also creates imbalance between demand and supply. This will create an adverse impact on food and nutritional security of the people.

This will lead to

- High volatility of the produce /commodity prices
- Inferior quality produce will be available to the consumer
- Farmers or producers will not be able to get the optimum price for their produce, thus resulting in loss of the income.

- A lose- lose situation among the stakeholders (producers, market participants and consumers)
- High pressure on the public food distribution system
- High inflation
- Hunger, malnutrition and poverty among the marginal people
- More diseases and health issues to the people

The quality of grains evaluated by...

- Moisture content: Suitable for storage or further handling.
- Colour: Homogeneous and appropriate to the type of grain under consideration
- Odour: It can't be hinted for any biochemical change is going on
- Cleanliness: The number of impurities must conform to established standards of quality
- Infestation: The absence of insects or other living organisms must be ascertained.

Existing Storage Solutions

State and central government policies/solutions

Farmers benefit from these policies/solutions

The Ministry of Food Processing Industries is mandated to create post-harvest infrastructure and processing facilities to boost the overall development of the food processing sector including reduction in post-harvest losses and enhancing value addition.

Central Warehousing Corporation (CWC)

The Central Warehousing Corporation provides safe and reliable storage facilities for about 120 agricultural and industrial commodities.

State Warehousing Corporations (SWCs)

Separate warehousing corporations were set up in different States of India. The areas of operation of the State Warehousing Corporations are centres of district importance.

Food Corporation of India (FCI)

The Food Corporation of India is the single largest agency which has a storage capacity of 371.93 LMT

Private Cold Storage Facilities

Paid farm produce storage facilities for the farmers

Example: Storage of grape, raisins, banana, apple etc

Indigenous cold chamber for farm produce storage

A layer of mud between two layers of brick wall and thatch in roof insulates heat transmission.

Onion Storage Structures

Maharashtra government is providing subsidy for onion storage structure (*kanda chal anudan*).

Installation of Processing Unit

Central and state government schemes are supporting farmers and farmers producers' organizations for installation of storage & processing units.

Farmers benefit from..

- Store or preserve the farm produce
- Maintain quality of the farm produce
- Mitigate, minimize or avoid the post-harvest loss
- Produce value added products
- Sell the produce at the right time for the best price

Solutions proposed by researchers

Challenges in implementing those solutions for India's farmers

According to the farmers, current markets are dominated by middlemen and the prices of produce are decided by them. In order to avoid the exploitation, the farmers should form cooperative and open their sale outlets in urban areas, assert the experts (Yadav, 2020).

Solutions proposed by the researcher

- Proper pest management of the crop
- Harvest the farm produce at the right time (at maturity stage)
- Harvesting of fruits and vegetables in the morning
- Adequate cleaning and processing of the food grains
- Proper drying of food grains
- Drying under the sun: Traditional method of food grain drying up to optimum moisture level to avoid or minimize post-harvest insect pest and diseases
- Cleanliness of the food grains store
- Fumigation and pest control of the store

- Use of clean and appropriate packaging material
- Proper packaging and transport of farm produce
- Control of Relative Humidity and Temperature of the food grains store
- Reduction of oxygen and increasing carbon dioxide levels in the store
- Precooling of fruits and vegetables after harvest
- Perishable (Fruits/vegetables/flowers) produce should be processed and stored in cold storage (pack house)
- Farm produce should be stored in warehouse (government/private/co-operative)
- Controlled ripening of fruits
- Storage in controlled environment
- Use of solar dryers: To maintain and keep the quality of the farm produce
- Producer to consumer direct sell of farm produce or value-added products (*shetkari te grahak theth shetmal vikri*)

It is very important to process perishable farm produce which can't be stored for longer duration in order to avoid/minimize post-harvest losses. The processing of these value-added products not only increases shelf life but fetches more return.

Examples of processed products

i) Drying of vegetables: Onion, carrot, spinach, coriander, methi

ii) Onion: Powder

iii) Tomato: ketchup

iv) Lemon, ber and mango: Pickles

v) Grape: Raisins

vi) Banana: Powder, chips

vii) Fig: Dried fig

viii) Custard apple: Powder, milk shake, ice cream

ix) Amla: Jam, squash, pickle

x) Mango: Squash, pickle, poli, powder, juice

xi) Tamarind: Sarbat

xii) Pomegranate: Juice

Application of Artificial Intelligence (Moisture Sensor)

- Helps in knowing right time of farm produce harvesting
- Use of moisture sensors in the stored produce. Optimum moisture level is very important to avoid /minimize the damage by store grain pests and diseases.
- Helps in maintaining the quality of the farm produce

Challenges in implementing farm produce storage solutions

- Untimely rains, hail storms and floods cause crop damage at the harvesting stage of the crops, this results in losses during harvesting and storage of the produce.
- Sun drying of grain becomes difficult during the rainy season and in cloudy weather conditions.
- Solar dryers also need investment and awareness. Adoption & scale is the main concern for the use of solar dryers.
- Complexity in processing technology of perishable farm produce, limits its adoption by the farmers.
- Cold storage requires high investment
- The setting up of processing plants are costly. Awareness, capacity building (training) and technical guidance is prerequisite for the scale.

- Limited knowledge of machineries or technology transfer

Processed product: Pomegranate juice

Grape and pomegranate farm in Solapur District of Maharashtra State (India). Cold storage facility is very important for storage of the fruits for getting more returns to the growers.

Farmer selling grape on the road side direct to consumer

Raisins making unit in Solapur District. Agriculture department giving subsidy for the raisins unit.

Banana farm in Kandar village of Solapur District

Banana harvesting, cleaning, grading and packaging at Kandar village in Solapur District of Maharashtra State (India)

Cold storage

Suggested roles for state and central governments

Government, Non-Governmental Organizations (NGOs) and the private sector play a very important role in the farm produce storage infrastructure.

Role of the government

- To strengthen the public extension system for creating awareness among farmers about reducing post-harvest losses of farm produce.
- To encourage farmers for processing of farm produce (post-harvest technology)
- Implementation of the good policies for creating best storage infrastructure for farm and allied produce.

- More investment in innovative storage solution research and their adoption on higher scale,
- Training and capacity building of the farmers for adoption of best storage practices and processing of farm produce.
- Building partnerships with NGOs and the corporate sector for the best storage facilities.

Suggested roles for NGOs and private entities

Role of the NGOs

- To create awareness among the farmers to avoid, mitigate or minimise the post-harvest loss
- Information and technology transfer about post-harvest technology (processing of farm produce)
- Training and capacity building of farmers on adoption of best storage practices for all types of farm produce.
- Exposure visits of farmers to best storage facility and processing units
- Building partnership with government and private sector related to post harvest technology

Role of the private players

- To provide quality storage solutions for farm produce in cost effective manner
- Building partnership with government for providing post harvest technology and best storage solution to the farmers
- More investment in post harvest technology

There is a need for convergence among these stakeholders for the best storage solutions. Public private partnership (PPP) is crucial in building the best in class storage infrastructure.

Grape post harvest operation: Grading, packaging and transport

successful examples of farm produce storage facilities implemented in India

There are many successful examples of farm produce storage facilities implemented in India.

- Warehouse (government/co-operative/private): Storage of foodgrains (cereals, pulses and oilseeds). Example: Maharashtra State Warehousing Corporation (MSWC) is providing commodity spot exchange sevice.
- Rural Godowns

- On farm storage facility
- Cold storage facilities: Storage of fruits and vegetables (grape, banana, apple, pomegranate, raisins, potato, chilli)
- *Kanda chal* ((onion storage structure): Storage of onion, Tata Steel onion storage structure
- Sun dryers: For leafy vegetables (dehydration). Fenugreek, spinach, coriander
- Sun drying: Tradition method of drying of food grains upto optimum moisture content and then keeping in gunny bag or metal container

Simple field warehouse

Conclusion

Due to lack of storage and processing facilities, great amount of farm produce is wasted. Appropriate storage is required to avoid or control post-harvest losses. It also helps in the stabilization of prices by adjusting demand and supply.

Insufficient or lack of storage facility adversely effect on the consumer needs and create imbalance between demand and supply indirectly making an adverse impact on food and nutritional security of the people.

Perishable farm produce like fruits and vegetables cannot stored for longer duration. The processing of these goods is not only important to avoid or minimize the post-harvest losses but also increases shelf life. These processed products have great demand both in domestic and export markets. The return on these processed value-added products can be expected more.

Government, Non-Governmental Organizations (NGOs) and the private sector play a very important role in the farm produce storage infrastructure. There is a need for convergence among these stakeholders for the best storage solutions. Public private partnership (PPP) is crucial in building the best-in-class storage infrastructure.

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