STORAGE OF GRAINS

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INTRODUCTION

 Food grains form an important part of the vegetarian Indian diet. Grain production has been steadily increasing due to advancement in production technology, but improper storage results in high losses in grains. According to World Bank Report (1999), post-harvest losses in India amount to 12 to 16 million metric tons of food grains each year, an amount that the World Bank stipulates could feed one-third of India's poor. The monetary value of these losses amounts to more than Rs 50,000 crores per year (Singh, 2010).

 Natural contamination of food grains is greatly influenced by environmental factors such as type of storage structure, temperature, pH, moisture, etc.





Grains are stored for three purposes

Food

Feed

Seed





Reasons for storage

prevent the food grain loss
to change the traditional poor
storage practices of the rural people.
to meet the growing shortage of the materials traditionally used for the construction of grain stores.

to prevent the entry and spread of exotic insect pests of grains.

the introduction of HYV seeds of grains disrupted the traditional storage systems.

STORAGE PRACTICES:

- 1. Traditional storage
- 2.New on farm (modern) storage





Traditional storage methods Temporary

Aerial storage

Storage on the ground

Open timber platforms

• (i) Aerial Storage

- Maize cobs, sorghum or millet panicles are sometimes tied in bundles, which are then suspended from tree branches, posts, or tight lines, on or inside the house (.This precarious method of storage is not suitable for very small or very large quantities and does not provide protection against the weather (if outside), insects, rodents, or thieves.
- (ii) Storage on the ground, or on drying floors
- This method can only be provisional since the grain is exposed to all pests, including domestic animals, and the weather. Usually it is resorted to only if the producer is compelled to attend to some other task, or lacks means for transporting the grain to the homestead.
- (iii) Open Timber Platforms
- A platform consists essentially of a number of relatively straight poles laid horizontally on a series of upright posts. If the platform is constructed inside a building, it may be raised just 35-40 cm above ground level to facilitate cleaning and inspection. Platforms in the open may be raised at least 1 metre above ground level. They are usually rectangular in shape, but circular or polygonal platforms are common in some countries.

Traditional storage structures Long term

Storage baskets made up of plant materials.

Calabashes or earthern ware pots

Jars, solid wall bins, underground storage, sacks, metal or platic drums.

• (i) Storage baskets (cribs) made exclusively of plant materials

• In humid countries, where grain cannot be dried adequately prior to storage and needs to be kept well ventilated during the storage period, traditional granaries (cribs) are usually constructed entirely out of locally available plant materials: timber, reeds, bamboo, etc.

• Calabashes, gourds, earthenware pots

- These small capacity containers are most commonly used for storing seed and pulse grains, such as cowpeas. Having a small opening, they can be made hermetic, by sealing the walls inside and out with liquid clay and closing the mouth with stiff clay, cow dung, or a wooden (cork?) bung reinforced with cloth.
- If the grain is dry (less than 12% moisture content) there there is usually no problem with this kind of storage.

- Jars
- These are large clay receptacles whose shape and capacity vary from place to place. The upper part is narrow and is closed with a flat stone or a clay lid: which is sealed in position with clay or other suitable material. Generally kept in dwellings, they serve equally for storing seeds and legumes. So that they may remain in good servicable condition, they should not be exposed to the sun and should not be either porous or cracked.
- Solid wall bins
- Such grain stores are usually associated with dry climatic conditions, under which it is possible to reduce the moisture content of the harvested grain to a satisfactory level simply by sun-drying it. Solid wall bins are therefore traditional in the Sahel region of Africa, and in southern African countries bordering on the Kalahari desert.
- The base of a solid wall bin may be made of timber (an increasingly scarce resource), earth or stone. Earth is not recommended because it permits termites and rodents to enter. The better base is made of stone.

Under ground storage

- The advantages of this method of storage are:
- few problems with rodents and insects;
- low cost of construction compared to that of above-ground storage of similar capacity;
- ambient temperatures are relatively low and constant;
- hardly visible, and therefore relatively safe from thieves;
- no need for continuous inspection.
- The disadvantages are:
- construction and digging are laborious;
- storage conditions adversely affect viability; the stored grains can only be used for consumption;
- the grain can acquire a fermented smell after long storage;
- removal of the grain is laborious and can be dangerous because of the accumulation of carbon dioxide in the pit, if it is not completely full;
- inspection of the grain is difficult;
- risks of penetration by water are not small, and the grain at the top and in contact with the walls is often mouldy, even if the rest of the stock is healthy.

Alternative storage wall bins

- The pusa bin
- The burkino silos
- The USAID silos
- Concrete or cement silos
- Ferrocement silos
- Ditcher stave silos
- Metal silos
- Synthethic silos





"Pusa" bin

Pusa bin

- Developed by the Indian Agricultural Research Institute (I.A.R.I.), these silos are made of earth or sun-dried bricks; they are rectangular in shape and have a capacity of 1 to 3 tonnes.
- A typical "Pusa" bin has a foundation of bricks, compacted earth, or stabilised earth. A polyethylene sheet is laid on this, followed by a concrete slab floor 10 cm thick. An internal wall of the desired height (usually 1.5 to 2 metres) is constructed of bricks or compacted earth, with a sheet of polyethylene wrapped around it. This sheet is heat-sealed to the basal sheet, and the external wall is then erected. During the construction of the wall an outlet pipe is built into its base.
- The concrete slab roof is supported by a wooden frame and, like the floor, is constructed of two layers separated by a polyethylene sheet. During its construction, a man-hole measuring 60 x 60 cm is built into one corner.
- The "Pusa" bin (has been widely adopted in India, and has been demonstrated in some African countries. It gives good results when loaded with well dried grain.



Pearl millet grain is stored traditionally in mud bins or straw bins or bamboo bins or in metal bins.

Mud bin



Bamboo bin

The storage structures in rural areas are not ideal from scientific-storage point of view, as substantial losses occur during storage of grain from insect pests, moulds, rodents, etc.



Metal bin

Keeping the requirements of the farmers in view, the Indian Grain Storage Institute (IGSI), Hapur, Uttar Pradesh, with its branches at Ludhiana and Hyderabad, India, have developed several metal bins of different capacities for scientific storage of grain in rural areas.

New on farm storage structures

- 1. traditional basket storage
- 2. bagged storage
- 3. air tight storage
- 4. earthern structure
- 5. Cement and concrete structures
- Indoor and out door bins
- Indoor bins= kanaja, sanduka, kothi, earthern pots.
- Outdoor bins= gummi, kacheri, hagevu.
- Improved s
- tructures: PAU bin, pusa bin, hapur tekka

@ farm level

- Coal tar drum bin- central institute of agricultural engineering (CIAE)
- Domestic hapur bin- Indian grain storage institute (IGSI)
- Chittore stone bin
- Double walled, polyethylene- lined bamboo bin.
- On farm storage- Pusa bins are widely used.

@large levels

- Bag storage
- Bulk storage
- Airtight storage
- Drying
- Sun drying
- Balooning techniques.

Bag storage





Bulk storage



Air tight storage



Balooning technique





Bulk storage

- 1. FOOD CORPORATION OF INDIA FCI
- 2. CENTRAL WARE HOUSING CORPORATION CWC
- 3. STATE WARE HOUSING CORPORATION SWC
- 4.GRAIN MARKETING CO-OPERATIVES- GMC
- 5. COVER AND PLINTH STORAGE- CAP
- 6. COMMUNITY STORAGE STRUCTURES-CSS
- 7. RURAL GODOWNS

- RURAL GODOWNS:
- At rural level, farmers store the produce in their own houses and by using different structures. It is a known fact that the marginal and small farmers are not economically sound to retain their produce till the market prices are favourable for sale. Considering the importance of rural storage in marketing of agricultural produce, the **Directorate of Marketing and Inspection (DMI)**, an attached organization of Ministry of Agriculture, Government of India initiated a Rural Godown Scheme in collaboration with NABARD and NCDC to construct Rural Godowns.
- Mandi Godowns The farmers after harvest transport their produce to the mandis. It is transported in bulk or in bags, but mostly in bags. Most of the states and U.T. have enacted the Agricultural Produce Marketing Regulation Acts. The Agricultural Produce Market Committees have constructed their godowns in the market. In the same yard, private traders, CWC, SWC and Co-operatives Societies were also allowed to construct the godowns. At the time of storing the produce in the godown, a receipt is issued indicating the quality and weight of the produce stored. That receipt can be treated as negotiable instrument and eligible for pledge finance.

- CMP STORAGE
- METAL SILOS:
- Economically valid for storing large quantities (over 25 tonnes), metal silos are often regarded as too costly for small scale storage.
- Such silos are made of smooth or corrugated galvanised metal, and are cylindrical in shape with a flat metal top and, usually but not always, a flat metal bottom.
- A man-hole with a cover, which may be hinged but is nevertheless lockable, is located, usually to one side, in the top panel; and an outlet pipe provided with a padlock is fitted at the base of the wall.
- Metal silos should be placed on platforms or plinths, to facilitate emptying. Large capacity silos are usually constructed without base plates on raised concrete slabs. In this case, bitumen or cement mortar is plastered around the base of the wall to prevent penetration by water and pests.
- As with concrete silos, it is essential to provide cover, to avoid excessive variations in temperature and moisture translocation

SILOS

- A silo is a structure for storing <u>bulk materials</u>.
 Silos are used in <u>agriculture</u> to store <u>grain</u> or fermented feed known as <u>silage</u>.
- Silos are more commonly used for bulk storage of grain, <u>coal</u>, <u>cement</u>, <u>carbon black</u>, <u>woodchips</u>, food products and <u>sawdust</u>.
- Three types of silos are in widespread use today tower silos, bunker silos and bag silos.
- <u>Missile silos</u> are used for the storage and launching of ballistic missiles.

SILOS



METAL BINS

- A bin is typically much shorter than a silo, and is typically used for holding dry matter such as concrete or grain. Bins may be round or square, but round bins tend to empty more easily due to a lack of corners for the stored material to become wedged and encrusted.
- The stored material may be powdered, as seed kernels, or as cob corn. Due to the dry nature of the stored material, it tends to be lighter than silage and can be more easily handled by under-floor grain unloaders. To facilitate drying after harvesting, some grain bins contain a hollow perforated or screened central shaft to permit easier air infiltration into the stored grain.

Metal bins





Factors affecting the choice of method for storage



Factors influencing storage loss



Assignment

- Take a piece of paper or a chart piece and write down what you have learnt/ understood from this chapter.
- Use points only, no description required
- Take a photo and share it in whatsapp!

Scientific methods of cultivation

- Agriculture ?
- Why do we/ farmers need scientific methods for cultivition?
- 1. to increase productivity
- 2. to solve the problems specific to farma dn farm families.
- 3. to improve the standard of living





- Replaces labour
- Enhances productivity
- Irrigation:ditch/drip/terraced/springler





Other techniques

- Crop rotation
- Cover crops
- Natural pest predators















Lacewing

Ladybird beetle



Dragonfly

Reduviid bug





Spider

Praying mantis

Praying mantle















Post harvest technology

- Cleaning
- Sorting
- Transporting
- Packing
- Labelling
- Processing
- Marketing







Post-harvest technology stimulates agricultural production by:

prevents post-harvest losses;
 improves nutrition ;
 adds value to agricultural products;
 opens new marketing opportunities; and
 generates new jobs



What PHT aims at?

- specifically involves the movement and the operations that commodities undergo from harvest to the time immediately before meal preparation.
- concern is to keep commodities in an acceptable state from harvest until it reaches the consumer since most commodities are transported in their perishable state.
- aims to minimize losses at the least possible cost.
- The existing postharvest environment requires appropriate technologies to maintain quality of commodities.
- Poor handling of agricultural commodities can result in quality deterioration and losses.

Objectives of applying PHT

- 1)to maintain quality (appearance, texture, flavor and nutritive value)
- 2) to protect food safety, and
- 3) to reduce losses between harvest and consumption.





Importance of Postharvest Technology

- It has capability to meet food requirement of growing world population by eliminating avoidable losses making more nutritive food items with higher values by proper processing, storage, packaging, transport and marketing.
- Use of appropriate postharvest technology not only reduces the postharvest and storage losses or adds value to the product, but more importantly it provides the potential of higher employment including fortification of agricultural and agro-industries.
- > Establish food security for green and happiness society.
- An inter-disciplinary and multi-dimensional approach, which includes, research capability, scientific creativity, technological innovations, productive sectors participation, human resources development, in an integrated manner to the developmental needs of the country.

THANK YOU