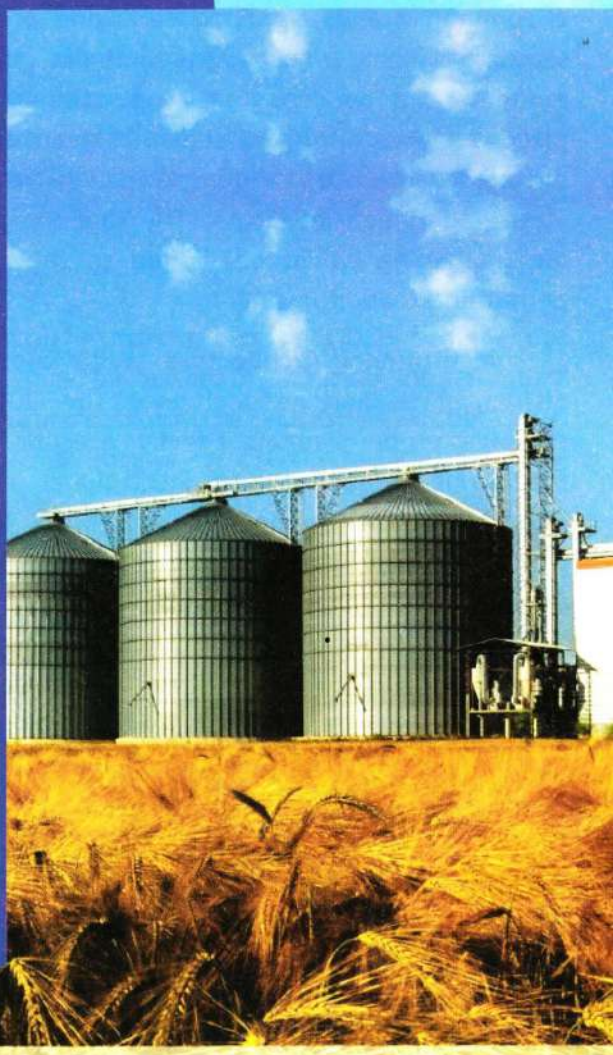
An Overview
Traditional Storage Infrastructure and Practices in India



India is heading towards the position of leading global exporter of food grains. We must explore the various food storage infrastructure and practices that are indigenous to our nation. These practices are not only cheap but also sustainable. They store grains without contaminating them with harmful chemical preservatives. This can help India to build an image of an exporter of clean and organic food grains to the entire world.

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In the year 2022-23, India has crossed a major milestone by producing 3296.87 lakh tonnes of food grains which is higher by 140.71 lakh tonnes than the production of food grains of 3156.16 lakh tonnes achieved during 2021-22. Further, the production during 2022-23 is higher by 308.69 lakh tonnes than the previous five years (2017-18 to 2021-22) average production of food grains. India is not only self-sufficient in food grain production but also a leading exporter to other countries. However, to maintain this position, we must build enough infrastructure for storage of food grains. The food grain storage infrastructure is the baseline for achieving food security at the national level.

Interestingly, securing the food supply is a topic of interest of our ancestors too. The knowledge of storing grains in different types of bins or granaries as well as in underground godowns, was known from the Vedic age. Till today, such types of granaries can be seen in our

villages. To build these bins, various types of materials were used from the ages. It included wood, cane, hay, cow dung, and clay.

During 2000 B. C. Aryan people settled in different colonies, towns, cities, etc. It is found that in such towns, hoards of grains were seen in common granary. That food distribution system must have been adopted by the people of Harappa and Mohen-jo-daro is highlighted by the evidence of granaries. Such evidences are also found in the Mahabharat era, and now in the modern era, we have fully developed this science. But still, it is debated that the traditional structures and practices of storing food grains are more sustainable and eco-friendly. These are the practices that are still supporting the small farmers who are not able to afford the modern sophisticated storage facilities.

Certain studies have estimated that nearly 60-70 per cent of the food grains produced in the country are stored at a home level in indigenous structures by using traditional practices. Therefore, it is very important to understand these practices and incorporate them into our policy circles.

Traditional Storage Structures in India

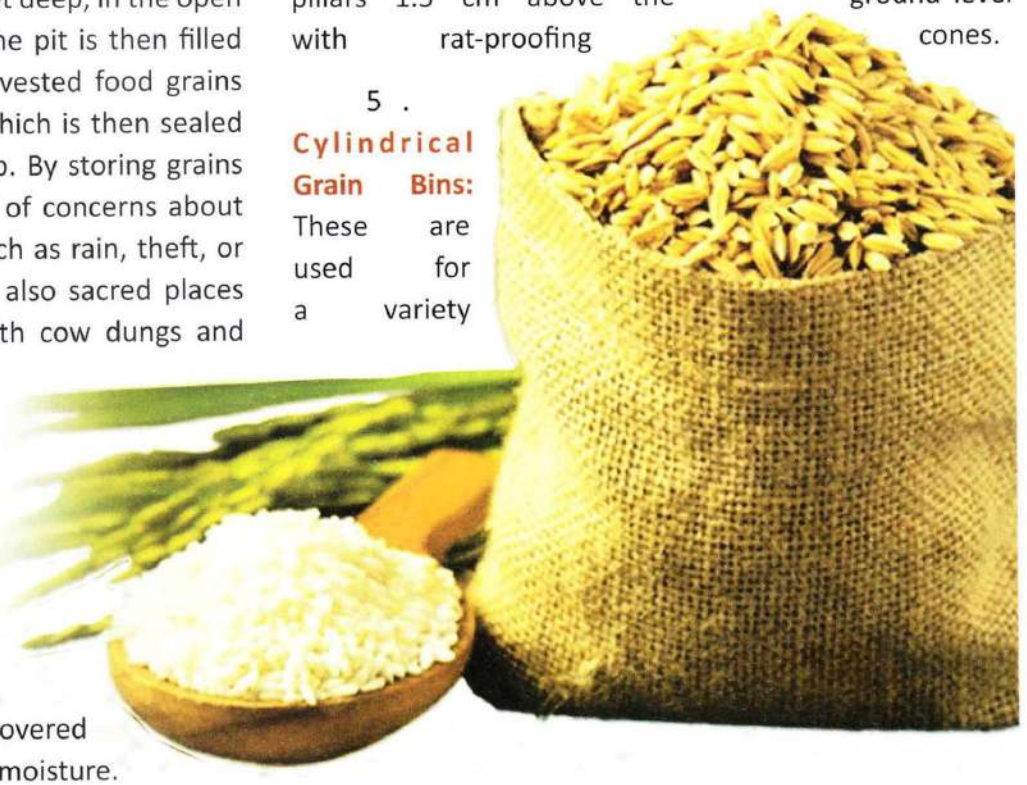
1. The farmers of Andhra Pradesh have adhered to their century-old traditional storage pits which can store grains for nearly a decade. The process involves digging a rectangular pit, at least 6 feet deep, in the open space in front of farmers' houses. The pit is then filled with a mixture of hay and clay. Harvested food grains are carefully placed inside the pit, which is then sealed with mud, creating a protective heap. By storing grains in this manner, farmers are relieved of concerns about potential losses due to calamities such as rain, theft, or fire accidents. These pits which are also sacred places for farmers are regularly coated with cow dungs and traditional rangoli by the women of the house.

2. **Bukhari:** It is a square-shaped structure constructed either with mud or brick and cement and also has an opening/outlet at the ground level. The upper portion of the Bukhari is plastered with mud and straw and covered with polythene to protect against moisture. This structure is raised above the ground by a wooden or masonry platform. It generally has a capacity of 3.5 to 18 tonnes.

3. **Morai:** This type of structure is used to store paddy, maize, and jawar in rural areas of the eastern and southern regions of India. These structures are like the shape of an inverted cone. The improved structure consists of circular wooden plankfloors supported on pillars using timber joints. The bamboo splits are placed vertically along the inner surface without leaving any gap between them. The height of the bamboo split is equal to the height of the structure to store the desired amount of grain. Keeping the bamboo splits in position, the grains are filled up to the cylinder height and then the bamboo splits are held straight and continuous filling of grain and winding of the rope goes on simultaneously. To provide a smooth surface, about 1 cm thick layer of mud plaster is applied over the rope. A conical roof with an ample overhang is placed. Rat-proofing cones are also provided 1.5 m above on all four pillars to avoid damage by rats.

4. **Kothar:** It is common in the northern part of the country and is used to store paddy, maize, sorghum, wheat, and barley. The capacity ranges from 9 to 35 tonnes. It is a wooden box-type structure elevated from the ground by pillars. The roof is tilted and can be made of planks or corrugated metal sheets with sufficient overhang on all sides. The structure is raised on timber pillars 1.5 cm above the ground level with rat-proofing cones.

5. **Cylindrical Grain Bins:** These are used for a variety



of food grains. It has a capacity of 10 to 40 tonnes. The structure has a concrete base and is supported by columns. Two openings are given in the structure for taking out and putting grains in. The top hole which has a locked hinged cap is wide enough for a person to get in for cleaning purposes. The manhole at the top is also provided with a watertight steel lid.

6. **Rectangular Grain Bin:** On a farm, different kinds of grains are raised and therefore there is a need to make storage structures that can store different grains. In this type of storage, different storage bins are made under the same shed. The bin walls are made 11.5 cm thick and laid in cement mortar. The front wall is provided with a rectangular hole at floor level to take out grains.

7. **Bharola:** It is an egg-shaped earthen yet portable storage bin that has a capacity of at least 40-80 kgs of food grains.

8. **Kupp:** It is a cheap and easy way of storing the chaff and wheat straw, which are eventually used as cattle fodder. After the area for making a Kupp is earmarked a circular boundary of straw and sticks is laid out. After this chaff is filled into the center to ensure it fits tightly into the earmarked space. This process is repeated several times till a particular height is reached. The hay is then secured with the help of rope or metal wire.

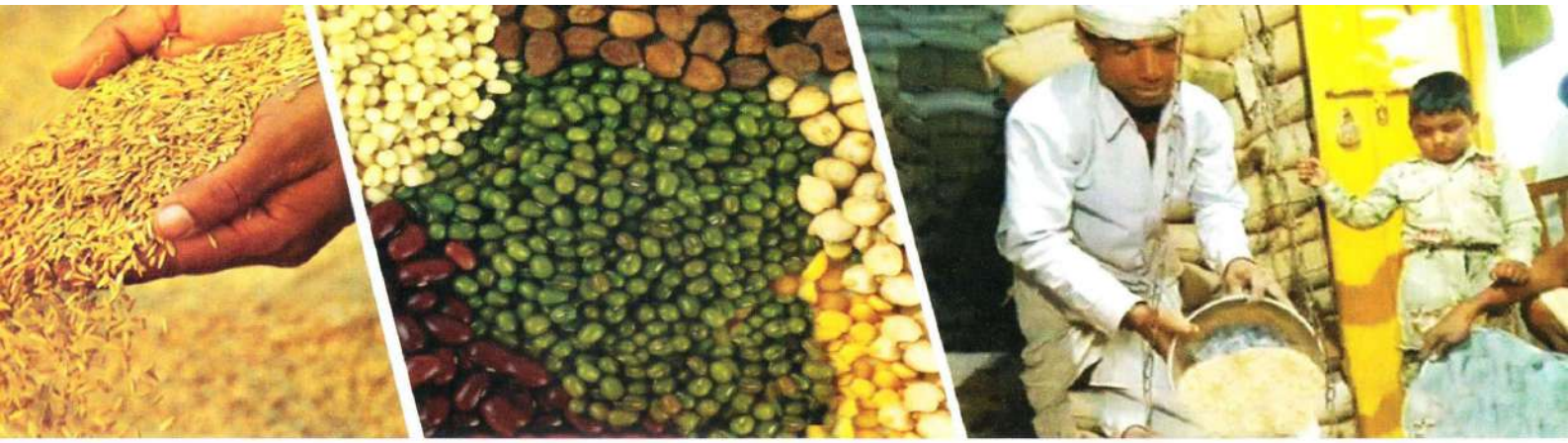
9. **Crib:** This is entirely made up of bamboo, wood, and metal wires, and roofed with thatch straws in a way that air can perpendicularly pass through them. It is a rectangular-shaped structure and elated above ground by 0.5m to 1m. The legs are fitted with a rat-proof device to prevent them from harming the product. Its shape allows the drying process of grains with ease as the natural ventilation continues.

10. **Kanaja:** It is an underground grain storage container made of bamboo. The base is usually round and has a wide opening at the top. The height and capacity vary. The Kanaja is plastered with mud and cow-dung mixture to prevent spillage and pilferage of grains. The top is also plastered with mud and cow dung mixture or may be covered with paddy straw or gunny bags.

11. **Sanduka:** These are usually used for storing smaller quantities of grains, pulses, and seeds. The storage capacity of these boxes may vary from 3 to 12 quintals. Partition walls may also be made inside the box to store two to three types of grains simultaneously. A big lid on the top with a small opening enables taking out the grains. To protect the grains from moisture, the box is kept 12 inches (about 30.5 cm) above the ground level with the help of stands/legs. The box must be regularly polished for its maintenance.

Traditional Storage Practices in India

1. In the northern part of the country, farmers indigenously store wheat after drying it in the sun and cleaning it by sifting it. It is scientifically agreed that this process reduces the chances of attack of storage pests.



2. Farmers store red gram after mixing with common table salt. These mixed grains are later packed in jute gunny bags and stitched. The corrosive action of salt on the skin of insects prevents the movement of insects in the gunny bag. This practice can be used to store red gram for a short period of 6-8 months.

3. Ash at the ratio 1:4 can be used to store Sorghum seeds in the airtight jute gunny bag. It has been reported that in Rajasthan and Punjab, farmers mix moth bean and moong with ash to prevent the attack of beetles. According to agro-scientists, Ash contains silica which acts as an insect repellent. Farmers strongly believe that ash application can control crop damage by 80 per cent.

4. Farmers in Tamil Nadu use neem and thumbai leaves in the storage of ragi. These leaves are cheap, organic, and safe methods to get rid of pests. Farmers also use neem seed kernel extract to treat the jute bags which can be further used to store food grains.

5. Camphor is also being used by the farmers to repel pests and insects during the storage of pulses and grains. The strong odor of camphor can protect grains for 3 months from the pests.

6. There is a practice of mixing Gingelly seeds (Sesamum) with paddy to prevent the webbing of larvae of Indian meal moths in oil seeds. This method can be used to store the oil seeds for at least 3 months. Gingelly oil which is also used to cook food in some regions of India, is stored with palm jaggery pieces in the tin container. This not only avoids the problem of rancidity but also helps to preserve oil for at least 18 months. To tackle the problem of spoilage and fetid in stored oil, farmers first heat the long iron rod of 8 cm width and 6.93 length on the earthen stove for 30 months. When the iron rod becomes reddish then it is dipped in stored oil for 5 minutes and the narrow opening of the container is tightly sealed with a cotton cloth.

7. There is a practice of storing tamarind in earthen pots with salt. This will help in loosening the flesh of tamarind and prevent it from pests and moths.

8. For the last 40 years, farmers have been practicing an indigenous technique of storing grain with sweet flags. In this technique grains, pulses, etc are mixed with powdered sweet flag. The strong odor of the sweet flag prevents the infestation in the grains.

These traditional structures and practices of storing food grains are mostly eco-friendly, cheap, and well-suited for the region in which they are used. These traditional methods of foodgrain storage are time-tested and have evolved to avoid losses that occur due to insect and pest infestation. The evolution of traditional storage practices has taken place because of the diverse agro-climatic conditions prevalent in India. Traditional storage structures have varying designs, materials, and capacities suiting different agro-climatic regions. It enables food grain storage at the pan-India level, besides helping against any imminent collapse of the food-supply system in the advent of any natural calamity (Mann et.al, 2016). But these have some weaknesses too. They are good to use at the farm level but when one thinks about the national food security, these are not sufficient. We need to integrate these traditional structures with new and modern technology to generate more sustainable, long-lasting, and gigantic structures that can operate at the national level.

Several steps must be followed before the storage purpose. The better handling of grains at these stages can save a considerable amount of grains for the storage stage. To minimise the loss of crops before storage, some precautions should be taken which are described below:

1. The harvesting time of the grains should be appropriate. Harvesting should be done at the right time to ensure grains' optimum moisture level and maturity.

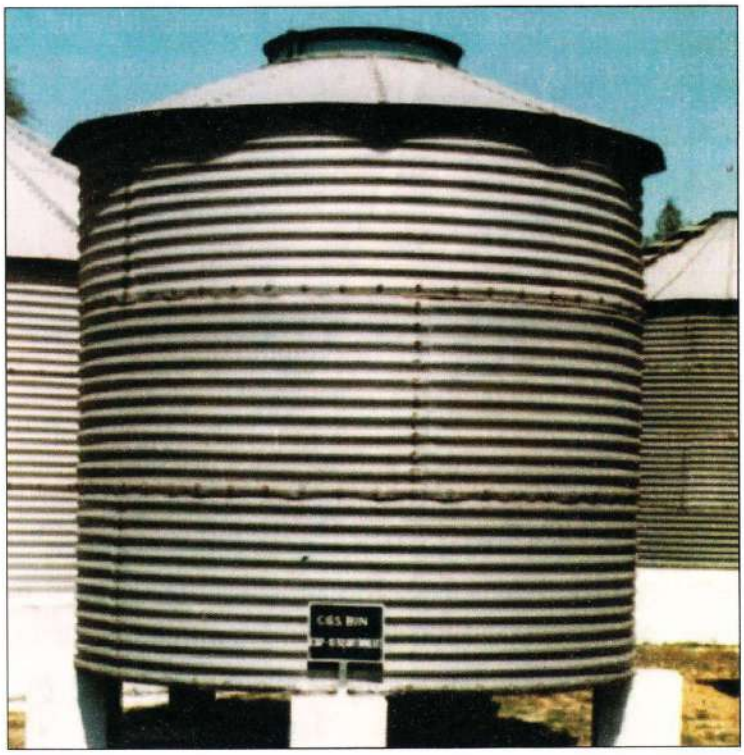
The premature grains will contain more moisture and natural chemicals known as enzymes and therefore more susceptible to damage. It also increases the drying cost of the grains before storage. On the other hand, harvesting grain in the post-maturity period will increase the chances of pests, rodents, and fungi attacking the crops. A study conducted in Karnataka, India found that delayed harvesting caused paddy harvesting losses to rise by 10.3% (from 1.74% to 1.92%) (Kannan et al.,2013, MuganyiZi et al.,2023)

2. India being a labour-intensive country, still uses traditional methods of harvesting like sickles and knives. These methods are not only affordable but also much more accessible to the small farmers. However, usage of the same wastes a substantial amount of grain in shattering and scattering. This necessitates the use of machines on the farms. Similarly, in the case of threshing, the use of manual threshers results not only in high operating costs due to limited output but also in considerable grain losses due to spills, grain cracking unexpected downpours, and fire incidents.

3. Cleaning and winnowing are the common methods to clean the grains after threshing. But again, manual methods result in substantial grain loss. However, an India-based hand-driven mechanical winnower is a simple, eco-friendly, and efficient technique that not only minimises the loss of grains but also provides a 90 per cent cleaner product.

4. The loss of grains can also be minimised by using solar dryers which is an environmentally friendly and cost-effective way to remove moisture from the grains and make them ready for storage. The other conventional methods result in the wastage of grains.

5. The traditional formats of transportation of grains that farmers generally use are marred by the risk of grain spillage and damage during transit, as well as being contaminated with undesirable substances. Therefore, at the farm level farmers should be encouraged to use innovative methods like solar-powered electric vehicles and better transportation bags. At the regional and national level, the Government should encourage the increased use of fuel-efficient vehicles with a low carbon footprint. Moreover, the Government should make the necessary investments in rural transportation infrastructure and services, not only to cut transportation



costs but also to alleviate poverty and enhance living and economic standards in rural areas. ❑

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