

Quadrant II – Notes

Programme: B. Sc. (Hons.) Agriculture

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Course Title: Pests of Crops and Stored Grain and their Management

Module Name: Storage structure and methods of grain storage and fundamental principles of grain store management.

Module No: 38

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Notes:

Storage structure and Methods of grain storage and fundamental principles of grain storage management

1. Traditional storage structures
2. Improved storage structures
3. Modern storage structures
4. Farm Silos

I. Traditional Storage Structures

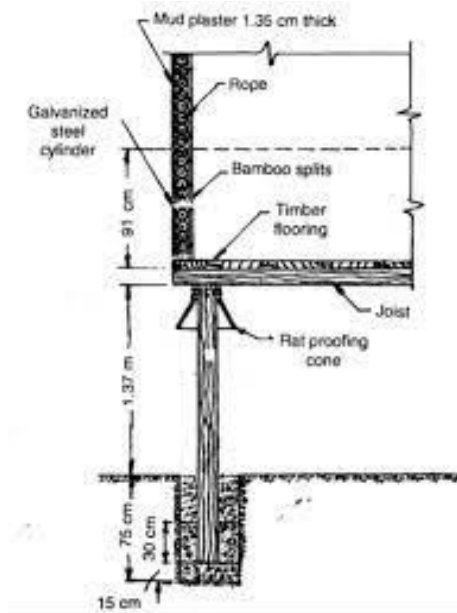
In these types of storage structures the grain is generally stored in bulk. These types of storage structures having generally capacities between 1 to 50 tonnes. The storage of grain is generally done in one of the following storage structures in the different rural and urban regions of India in bulk as well as in bag storage.

- a. Morai type storage structures
- b. Bukhari type storage structures
- c. Kothar type storage structure
- d. Mud Kothi type storage structure
- e. Muda type storage structure
- f. Kanaj type storage structure
- g. Kuthla type storage structure

h. Metal/ Steel bin type storage structure

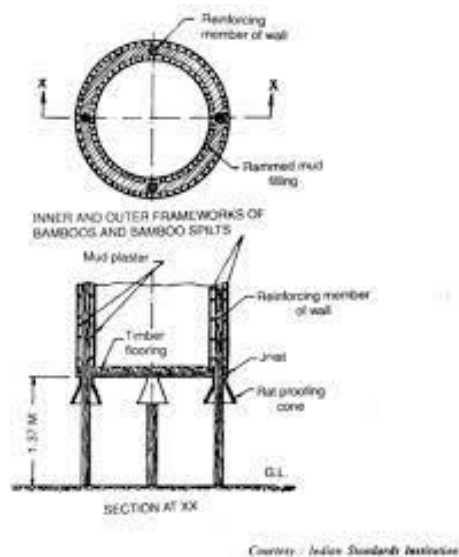
i. Bag type storage structure

a) Morai type storage structure



Morai type of structure is used for the storage of paddy, maize and sorghum (jowar) in the rural areas of eastern and southern regions of India. Its capacity varies from 3.5 to 18 tonnes. These structures are very similar to the shape of an inverted cone. They are placed on a raised platform supported on wooden or masonry pillars. The improved type of structure consists of a circular wooden plank floor supported on pillars by means of timber joints. The planks are joined together with lap joints. All around the wooden floor a 22-gauge corrugated metal cylinder of 90 cm height is nailed to it. The edge of the cylinder is flushed with the bottom end of the floor. Inside the cylinder, 7.5 cm diameter ropes made of paddy straw or similar material are placed, beginning from the floor level upto a height of 90 cm. Then bamboo splits are placed vertically along the inner surface without leaving any gap between them. The height of the bamboo splits is equal to the total height of the structure. Keeping the bamboo splits in position, the grain is poured in up to the height of the metal cylinder. By then the bamboo splits are held erect in position. Now the winding of the rope as well as the pouring in of grain are done simultaneously. This process continues till the required height is attained. The top most ring of the rope is secured in position by tying to the lower four rings. To provide a smooth surface, about 1 cm thick layer of mud plaster is applied over the rope. A conical roof is placed on the top of the structure having an ample overhang all around.

b) Bukhari type storage structure



Bukhari type storage structures are cylindrical in shape and are used for storage of sorghum, wheat, paddy, Bengal gram, maize etc. Bukhari structures generally have capacities between 3.5 to 18 tonnes, however, smaller capacity structures also exist.

This may be made by mud alone or by mud and bamboo. The cylindrical storage structures are raised above the ground by wooden or masonry platform. The floor of the bin is made either by timber planks or by bamboo splits, plastered over with mud mixed with dung and paddy straw. The walls of the structure are made of timber or bamboo frame work and bamboo matting. Over the walls, mud-straw plaster is applied on both sides. An overhanging cone type roof is provided on the cylindrical structure. The roof is generally made of bamboo framework and straw.

The structure is raised on timber or masonry pillars to a height of about 1.5 m from ground level. Rat proofing cones are placed on all the four pillars to avoid rats entering the storage structure.

c) Kothar type storage structure



These are used to store paddy, maize, sorghum, wheat etc. Their capacity varies between 9 to 35 tonnes. The storage structure is box like made of wood and raised on pillars. Both the floor and walls are made of wooden planks whereas the thatched or tiled roof is placed over it to protect the grains from the sun or rain. The improved Kothar structure is generally made of 5 cm thick wooden planks and beams. The walls and floor are made in such a way that no gap

exists between the planks. The gabled roof on the top may be made of planks or corrugated metal sheets and should be sufficiently overhang on all sides. The storage structure is raised on timber post to a height of about 1.5 m above the ground. Rat proofing cones are provided on all posts to avoid entry of rats in the structure.

d) Mud Kothi (Mud bin)



These storage structures are quite common in rural areas for storage of grains and other seeds. The capacity of such storage structures varies from 1 to 50 tonnes. These are made from mud mixed with dung and straw. These Kothies are generally rectangular in shape but cylindrical Kothi is also common in some region. There are many sizes and dimensions of Kothi made for storing grains. These are in use for storing grains in the rural areas of Bihar. The capacity of muda varies between 1 to 3 tonnes. It is being made of "Narai" ropes. The shape of muda is cylindrical and being made in various sizes.

e) Kanaj type of Storage Structure

These storage structures are very common in the rural areas of Karnataka and Maharashtra for storage of grains. The capacity of Kanaj varies between 1 to 20 tonnes. It is being made by bamboo splits. The shape of storage structure is cylindrical. The walls of storage structure are sealed with mud plaster on both sides. The roof of the structure is conical and thatched. The roof overhang on all sides.

f) Kuthla

These storage structures are very much common in rural areas of Bihar and Uttar Pradesh. These structures are kept inside and made of burnt mud.

g) Bag Storage Structure



These structures are generally used for the storage of 25 to 500 tonnes of grain. The length of the structure is about twice the width or greater than that. A typical floor plan of such a structure large enough to store about 6000 bags (500 tonnes) of grain. Bags of different capacities (35, 50, 75 and 100 kg) with or without inside plastic lining are used. The standard size of a 100 kg bag is 100 cm x 60 cm x 30 cm i.e. length of bag is 100 cm, width of bag is 60 cm and height of filled bag is 30 cm. This bag can store 93 Kg of Wheat and 75 Kg of Paddy.

h) Metal Bin



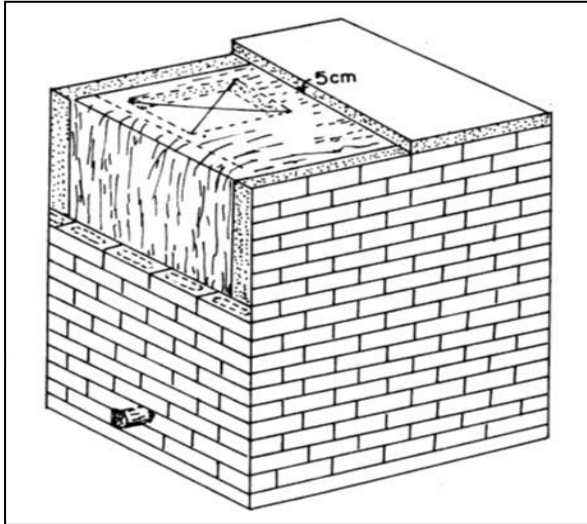
Bins made of steel, Aluminium R.C.C are used for storage of grains inside and outside the house. These bins are fire and moisture proof. The bins have long durability and produced on commercial scale. The capacity ranges from 50 kg to 10 tonnes.

II. Improved Storage Structures

Improved storage structures are the storage structures for storage of food grains. In this type of storage structures there are some improvements made in traditional storage structures.

This type of storage structures having a higher storage capacity and long term storage of food grains than traditional storage structures. Improved type of storage structures having capacities is generally 1.5 to 150 tonnes. The storage of grain is generally done in one of the following storage structures in the different rural and urban regions of India in bulk, bag as well as bag and bulk storage.

a. Pusa bin

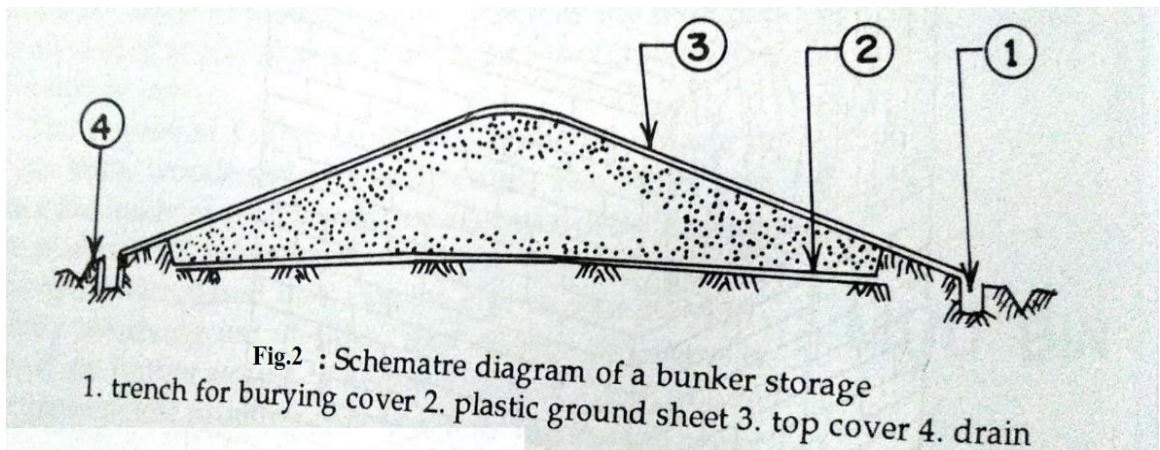


Pusa bin is like other traditional storage structures made of mud. To make the storage structure moisture proof a plastic film is used in all the inner sides of the bin.

b. Brick and cement bin

These type of storage structures are very strong and effect of seasons on these is minimum.

c. Bunker Storage



These type of storage structure is used for long term storage and a larger volume of grains storage.

d. CAP (Cover and Plinth) Storage structures



The word CAP is used for cover and plinth, plinth from the bottom and cover from the top. This type of open storage is considered as transit storage and serves the purpose of storage of food grains in bags for short period.

III. Modern Storage Structures

In India, for larger volume of food grains are to be stored in bulk is 'silo' and conventional godowns (Shed) designed for bagged storage. The godowns side walls are of brick or stone masonry and sloped roofing in asbestos or Corrugated Galvanized Iron (CGI) sheets over steel trusses. Silos are constructed from steel or reinforced concrete. There are a cluster of adjoining silos in any modern large/ capacity processing plant. The modern permanent storage system should be selected for the safe keeping of stored grains and other products. The modern storage structures should be selected on the basis of first on quality and then on cost considerations. There are following types of modern storage structures.

a. Silo type of storage structures



Silos/bins are classified into two groups depending upon the relative dimensions of the container. These are classified as, (1) deep bins and (2) shallow bins.

d. Shallow bins



Squat silos are comes under shallow bins. A squat silo has a wall height to diameter ratio 0.5 or even less. Squat silo can compete with sheds for low-cost quality storage.

e. Deep bins

Vertical Silos are comes under this type of storage structures. There are two types of vertical silos a) Flat bottom vertical silo and b) Hopper bottom vertical silo.

f. Shed

Generally, a horizontal sheds have been used to provide low- cost, large volume storage. For storing grains and other products a very large volume sheds have also been constructed by Central Warehousing Corporation.

IV. Farm Silos

Farm silos is a farm structure used to store and protect the animal fodder so that it is preserved in an ideal condition for farm animals. Animal fodder is cut and packed in the air tight silo to allow a partial fermentation to occur. The storage fodder is known as silage. There are two types of farm silos.

i) Tower silos and ii) Horizontal silos.

a. Tower silos

Cylindrical Shape and made of masonry, wood or metal. Cost of construction is comparatively much higher than that of horizontal type. Loading of animal fodder is difficult. Mechanical loader or a large capacity of blower is essential. This type of storage structures are not recommended under Indian conditions.

b. Horizontal silos

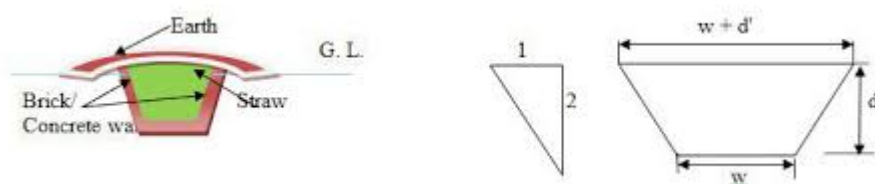
In horizontal silos pit type, bunker type and trench or stake type of storage structures used for storage of animal fodder. There are surface as well as below ground (underground) types of storage structures used on most of dairy farms as temporary and permanent storage structures for silage. The spoilage of silage and dry matter losses of these silos ranges between 20 to 30 percent.

c. Pit Silos

Permanent pit silo is a circular deep well which is lined all around the side, and sealed from bottom, so that water may not rise in to it. Made in areas where the soil is deep and the water table is very low, made up of bricks, stones or concrete, and either cement or lime

can be used as a binding material. A 22.5 cm thick wall will be used satisfactory up to 15 meter depth. The entire surface which is coming in contact with the silage should be plastered to make it smooth, air tight and water tight. Simple roof is made over the silo to protect the silage from sun and rain. Corrugated metal sheet dome or half pitch roof with ample overhang on all the sides are most economical and provide more space for filling. Stairs may be built along with wall for removing silage from the silo. The diameter of a silo is usually limited to 6 m and its depth is kept 2 to 3 times that of diameter. When the silo is opened for removing the silage, nobody should enter till the gases are removed.

d. Trench Silos



Unlined trench silo can be made easily without involving any investment on building materials such as brick, cement and sand. Unlined silos give more spoilage and are likely to have caved side walls due to excessive rain and tend to become muddy at the bottom. So, lined trench silos are therefore become popular. The walls of the trench silos can be lined with brick, concrete or cement plaster with reinforcing wire mesh. If possible the silo should be roofed. Drains should be made around trench to intercept surface water. To facilitate drainage it is desirable to locate the trench silo on slopping ground. Capacity is depends on size of herd and number of day the silage is fed in a year. It is always economical to construct only one trench silo, even if it is quite larger. Sidewalls are given generally 33 per cent slope.

Principles of grain storage management

a) Conditions of the Grains

It was mentioned in Section 3.3 that only clean, unbroken kernels should be selected for storage. Now two other elements can be added to this list. The grain should be dry and it should be cool when it is put into storage.

b) Climatic Conditions

Grain stores best in weather which is dry and cool. Unfortunately, the weather is not always dry and cool. During the serious rainy season even well dried grain can become wet again if it is exposed to very wet air or rain. Since grain must be stored during all kinds of weather the type of storage method chosen must protect the grain from the worst possible weather conditions.

c) Store Conditions

A grain store must perform one task: the store must protect the grain from its natural enemies: mould and fungus, insects, rats, birds, and other animals.

To do this a grain store should have the following properties:

- The store must be dry.
- The store should be cool.
- The store should keep out the sun.
- The store should be clean.
- The store should have no holes or cracks in the roof, walls, or floor.
- The store might need to be treated with insecticide.

Indigenous technical knowledge for safe storage food grains in Goa

Storage structures

Kadatari is Storage structure made up of rattan plant (*Calamus* sps.) or Bamboo. It is mainly used for storage of paddy after proper drying. The cylindrical structure is prepared as per the capacity needed. The bottom of the structure is covered with a layer paddy straw. After filling grains, the top is covered with gunny bags or thick plastic sheets or piece of cloth. This structure protects the paddy from pest and disease infestation.

Vurlo is also made up of *Calamus* sps. it is a traditional structure used by Goan farmers for storage of Nagali. This pot like structure could be used for a longer period if pasted with cow dung. Size of the structure varies with the needs of the farmer.

Mudi is prepared with dried paddy straw and threads of local plants. Basically, the mudi is round in shape and the top part is open. The open top will be closed after filling the grains. Paddy straw protects the grain from moisture so postharvest losses will be avoided.

Kado is prepared by using bamboo mat and plastered with cow dung. After drying both the ends of the mat are brought together and tied to bamboo stick with the help of rope. Plastic sheet is used to cover the bottom of the structure. Generally, the capacity of the structure is 20 gunny bags. Size varies with the need of the farmers.

Earthen pots are used for the storage of Cereals, pulses and tubers for seed purpose.