



FARM AND AGRICULTURAL ENGINEERING

**FREE EBOOK
NABARD GRADE A**

Farm and Agricultural Engineering

ARD Notes for NABARD Gr. A Exam

Agricultural Engineering (also known as Agricultural and Biosystems Engineering) is the field of study and application of engineering science and designs principles for agriculture purposes, combining the various disciplines of mechanical, civil, electrical, food science, environmental, software, and chemical engineering to improve the efficiency of farms and agribusiness enterprises as well as to ensure sustainability of natural and renewable resources. (Wikipedia)

Water Harvesting Structure

A **rainwater harvesting system** comprises components of various stages - transporting rainwater through pipes or drains, filtration, and storage in tanks for reuse or recharge, A roof made of reinforced cement concrete (RCC), galvanised iron or corrugated sheets can also be used for water harvesting.

- The **main purpose of a water harvesting system** is to use that water in agriculture, for bathing or washing clothes so as to reduce the use of groundwater for same work, Thus, reducing the wastage and shortage of groundwater, Source which fills the ponds behind harvesting structures is rainwater.
- Any rainwater harvesting system has three components: **Catchment, Conveyance, and Storage**. There are two classes of rainwater harvesting systems: Systems that collect roof runoff for household use.
- Today, scarcity of good quality water has become a major cause of concern. However, rainwater which is pure and of good quality is lost as runoff.

Benefits of Rainwater Harvesting

- Can supplement other sources of water supply such as groundwater or municipal water connections.
- Ability to build or farm in areas with no other water supply.
- High-quality water - pure, free of chemicals.
- Lower water supply cost.
- Reduced flood flows and hence reduced topsoil loss.

Farm Ponds

- Farm ponds are small water bodies formed either by the construction of a small dam or embankment across a waterway or by excavating or dugout.
- The water is usually harvested from a small catchment area and then used for irrigation during prolonged periods.
- Farm ponds are small tanks or reservoir like constructions, are constructed for the purpose of storing the surface runoff, generated from the catchment area.
- The farm ponds are the water harvesting structures, solve several purposes of farm needs such as the supply of water for irrigation, cattle feed, fish production etc.

Agro-Processing

- Agro-processing could be defined as a set of techno-economic activities carried out for conservation and handling of agricultural produce and to make it usable as food, feed, fibre, fuel, or industrial raw material.
- Hence, the scope of the agro-processing industry encompasses all operations from the stage of the harvest till the material reaches the end-users at the desired form, packaging, quantity, quality, and price.
- Ancient Indian scriptures contain vivid accounts of the post-harvest and processing practices for preservation and processing of agricultural produce for food and medicinal uses.
- Inadequate attention to the agro-processing sector in the past put both the producer and the consumer were at a disadvantage and it also hurt the economy of the Country.



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- Agro-processing is now regarded as the sunrise sector of the Indian economy in view of its large potential for growth and likely socio-economic impact specifically on employment and income generation.

Controlled and modified storage, Perishable food storage, Godowns, Bins and grain silos.

- Controlled atmosphere (CA) and modified atmosphere (MA) storage are technologies for extending the shelf life of foods, especially fruits and vegetables; and for eliminating pests in stored grains and oilseeds.
- The most important application of CA and MA is for the long-term storage of apples, but the shelf life of certain other fruits (pears, sweet cherries) and vegetables (cabbage) can also be extended by these methods.
- In addition, there is considerable evidence that MA can extend the shelf life of meat, fish, poultry, fresh pasta, sandwiches, eggs, and bakery products, because grains and oilseeds are more stable than high moisture foods (e.g., fruits, vegetables, meats), CA and MA are used primarily for disinfestation rather than for increasing the shelf life.

Benefits and Limitations of CA and MA Storage

- The benefits can be divided into quality advantages and marketing and distribution advantages.
- The improvements in quality arise from the general reduction in the rates of metabolic processes, retardation of physiological ageing, enzymatic spoilage, and reduction in microbial growth.

The Marketing and Distribution Advantages of CA or MA Technologies Include:

- Reduction in fresh food spoilage and quality loss through the distribution at the retail level.
- The expanded radius of distribution systems and market area.
- Improved branding options and product differentiation.
- Potential for increased profitability in all fresh or chilled food operations.

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.


- Morai type storage structures
- Bukhari type storage structures
- Kothar type storage structure
- Mud Kothi type storage structure
- Muda type storage structure
- Kanaj type storage structure
- Kuthla type storage structure
- Metal/ Steel bin type storage structure
- Bag type storage structure

Improved Storage Structures

- Improved storage structures are the storage structures for the storage of food grains.
- In this type of storage structure, there are some improvements made in traditional storage structures.
- This type of storage structure having a higher storage capacity and long-term storage of food grains than traditional storage structures.

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- An improved type of storage structure 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.

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.

Brick and Cement Bin

- These types of storage structures are very strong and the effect of seasons on these is minimum.

Bunker Storage

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

'CAP' 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 transit storage and serves the purpose of storage of food grains in bags for short period.

Modern Storage Structures

- In India, a larger volume of food grains is to be stored in bulk in '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 is a cluster of adjoining silos in any modern large/ capacity processing plant.
- The modern permanent storage system should be selected for the safekeeping 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 the following types of modern storage structures.

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.

Shallow Bins

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

Deep Bins

- Vertical Silos are coming under this type of storage structure.

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- There are two types of vertical silos
 - a) Flat bottom vertical silo and
 - b) Hopper bottom vertical silo.

Shed

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

Farm Silos

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

Tower Silos

- Cylindrical Shape and made of masonry, wood, or metal.
- The cost of construction is comparatively much higher than that of horizontal type.
- Loading of animal fodder is difficult.
- A mechanical loader or a large capacity blower is essential.
- This type of storage structure is not recommended under Indian conditions.

Horizontal Silos

- In horizontal silos pit type, bunker type and trench or stake type of storage structures used for storage of animal fodder.
- There is surface as well as below ground (underground) types of storage structures used on most 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.

Pit Silos

- A permanent pit silo is a circular deep well that is lined all around the side and sealed from the bottom, so that water may not rise into it.
- Made in areas where the soil is deep, and the water table is very low.
- Made 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, airtight, and watertight.
- A simple roof is made over the silo to protect the silage from sun and rain.
- A corrugated metal sheet dome or a 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 walls 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.

Unlined trench silo can be made easily without involving any investment in building materials such as brick, cement, and sand

- Unlined silos give more spoilage and are likely to have caved sidewalls 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 the trench to intercept surface water.
- To facilitate drainage, it is desirable to locate the trench silo on slopping ground.
- Capacity depends on the size of the herd and the number of days 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 a 33 per cent slope.



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