

# FARM STRUCTURES

## **Introduction**

**Farm structures** are different types of physical constructions that are put up in a farm for the purpose of livestock and crop production.

These structures help increase efficiency of agricultural production.

Most of the farm production processes are carried out under controlled environment in order to maximize the output. For instance:

- i) Animals must be protected from rain, wind or high sunlight intensity in order to keep healthy.
- ii) Harvested crops must be protected from water, insects, fungi and extremes of temperature.
- iii) Farm machinery must be protected from rain and dirt to keep depreciation level to a minimum.

## **Siting**

Farm structures must be located in suitable areas for a farmer's ease of use. Therefore, siting is very important in the construction of farm structures and buildings.

**Sitting** refers to locating an area where a particular farm structure or building is to be constructed.

## **Factors considered when site selecting.**

- (i) **Topography:** If the land is too sloppy, there are high chances of landslide occurrence; and if it is too flat, there is likelihood of poor drainage that leads to flooding. A relatively flat free drained area is most suitable.
- ii) **Prevailing winds and rainfall:** Windbreaks are put perpendicular to the direction of wind to reduce wind velocity. Strong winds can destroy buildings. Site the farm buildings facing away from the direction of wind, and away from the direction of prevailing rains in order to minimize chances of water entering the buildings
- iii) **Soil type:** Soil characteristics and strength determine its ability to withstand stress exerted by a building. Erect structures on firm, well-drained soils.
  
- (iv) **Nearness to utility sources such as electrical power lines, telephone lines and piped water:** This allows cheaper access to essential services.
- (v) **Sewage disposal:** The design must be in such a way that the lengths are in straight lines for ease of cleaning when blocked. The system should be accessible to a disposal vehicle.
- (vi) **Security:** The area chosen must be secure against theft, vermin intrusion, fire or trespassers.
- (vii) **Accessibility to roads:** The farm structures and buildings should be located near the public road. This facilitates fast access of farm produce to the market.

## **Parts of a farm building**

Most farm buildings comprise of the following parts:

### **(i) Foundation**

It is made on the firm sub-soil.

They are laid to a depth of about 1-2m depending on the soil type e.g. in clay soils, deep foundations are laid, while in sandy soils shallow foundations are made.

*How foundations are laid*

Farm building foundations are laid on a firm soil layer (i.e. sub-soil) since top soil has poor bearing capacity. Therefore it is recommended to dig down to a layer of firm soil. Trench work is done on site after marking out the foundation outline.

Set out and check the diagonals for accuracy, excavate the trench of at least 400 mm wide to allow someone to work in it. The sides of the trench are trimmed to get a straight, vertical and fair finished face of the sides.

### **(ii) Walls**

They are vertical loaded parts of a building.

These can be made of stones, bricks, timber, blocks.

They should withstand side pressure from wind etc.

The wall should be strong to carry load of the roof and their own weight.

**The type of materials used to construct the wall is determined by the following factors:**

- (i) Availability of the materials.
- (ii) The use of the building.
- (iii) Weather conditions of the place.
- (iv) Strength of the soil in the area.
- (v) Cost of the materials.
- (vi) Level of technology to be used.

### **iii) Roof**

**It protects the house from rain, sun, wind and cold.**

**It** provides protection to the animals or stored crops from damage by adverse weather conditions.

Features of a good roof: must be leak proof, able to withstand the load of the roofing material, durable, fire proof and a good insulator of heat.

Common roofing materials are: timber, steel and the roof covers are grass, galvanized sheets, asbestos, tiles, fiber glass, etc.

### **Roofing**

Roofing is done after wall construction.

Procedure for roofing:

- (i) Positions of the post are marked.
- (ii) Supports for the joints are prepared.
- (iii) Timber joints are then fixed on the supports.
- (iii) Firming piece are fixed on the joints to provide the required fall
- (iv) Tongues or grooved boards are fixed on the joints covering the whole roof surface.
- (v) Fascia boards are nailed at the lower and sloping edges of the roof to conceal the joints. Gutters are fixed to collect water from the roof.

## **Types of farm buildings**

### **Livestock buildings and structures**

These are structures used for handling livestock during various routine management practices or for housing the livestock.

They include: crushes, dips, spray race, calf pens, dairy shed/parlour, poultry houses and structures (deep litter, coops, folds/arks, runs, battery cages), rabbit hutches, piggery/pig sty, fish ponds, silos, zero grazing unit, bee hives.

#### **1. Crushes**

These are used for restraining an animal when carrying out certain livestock routine practices, such as, spraying and milking.

Crushes have a holding yard and consist of a head rail and a horizontal split which allow easy access to the sides of the animals' body.

The horizontal and vertical bars aid in fixing the animals' head during dehorning.

The tad bar at the entrance holds an animal in.

There is an open gate at the front of the crush to allow exit of the animal.

**A crush is used while carrying out the following operations:**

- Hand-spraying or hand dressing to control ectoparasites (ticks).
- Drenching animals against internal parasites.
- Vaccination against diseases.
- Artificial insemination.
- Applying identification marks e.g. branding, ear notching.
- Taking body temperature of an animal.
- Close examination of sick animals.
- Milking.
  - Pregnancy diagnosis .
  - Dehorning.

Examples of the crushes:

- (a) A three post crush: Normally used when handling one animal.
- (b) A crush for a small scale farmer: It is longer than the three-post crush.  
Its length is 3 m and width is 1 m.
- (c) A crush for holding many animals: This is mainly used during vaccination of livestock.

#### **Management of animals in a crush**

- Animals should be arranged in a single row. Animals of the same ages should follow one another.
- Care should be taken to prevent the bunching of animals together.
- Animals should move towards one direction only.
- Restrain vicious animals.

#### **Maintenance of a crush**

- Repair any broken or worn out posts and rails.
- Apply old engine oil on the post made of timber to prevent destruction by termites. Carry out regular checks for any loose frames.

## **2. Dips**

It is a farm structure designed to accommodate a chemical dip wash in which animals are immersed for the purpose of controlling ticks.

### **Components of a dip**

#### **a) Collecting yard**

It is used for holding animals before dipping. It should allow for about 2 m<sup>2</sup> space per (cattle) head. There should be a water trough for animals to drink before dipping. The floor should be built of waste quarry stones to help remove mud from animal hooves.

#### **b) Foot bath**

Its purpose is to wash hooves of animals so that they are free of mud. It contains copper sulphate solution to control foot-rot disease. The number of footbaths depend on the soil type. One or two footbaths may be placed at the dip entrance.

#### **c) The jump**

This is a narrow entrance to the dip tank with short steps. It is 34-45 cm above the dip wash level hence it allows for maximum immersion and enables dip wash splash to return into the dip .

#### **d) Dip tank**

This is where animals are immersed. It contains the acaricide solution.

#### **e) Draining race**

It helps in recovery of the excess dip wash back to the dipping tank. This is possible since it has a sloping floor towards the dipping tank. It should be water tight, rough and have no cracks, pot holes and long enough to increase the back flow of water.

**f) Silt trap outlet**

Mud and dung in the dip wash is trapped here as it flows back to the tank from the draining race. This helps to reduce siltation of the dipping tank .

**g) Roof**

It is made using corrugated iron sheets to reduce evaporation and dilution of the dip by direct sun and rain water, respectively. It is also referred to as dipping tank shelter. It may be used to trap rain water for use in the dip.

**h) Soaking pit**

Used for dumping sediments from the dipping tank. This ensures no pollution of the environment.

**Types of dips there are two types of dips**

- Plunge dips
- The machakos dip
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**Factors to consider before constructing a dip**

- Nearness to the grazing areas so that animals do not walk for long distances.
- The site should be on a firm ground to be able to withstand the pressure exerted on the ground by trampling of livestock.
- Good drainage of the construction site. This minimizes flooding in the surrounding areas that could lead to dilution of the dip wash. It also reduces soil erosion which causes siltation in the dipping tank.

**Cattle management at the dip**

- (i) The frequency of dipping depends on the tick infestation level, otherwise once or twice per week is adequate.
- (ii) The best time to do the dipping is in the morning or during cool weather.
- (iii) Provide the animals with drinking water before dipping so that they are not tempted to drink the acaricide solution.
- (iv) First, run 10 -15 animals through the dip so that they mix the dip wash, then Dip them a second time.
- (v) Animals should be arranged to enter the dip in a single file.
- (vi) Do not dip sick, injured or pregnant animals and too young calves.
- (vii) Dip the animals according to their ages.
- (viii) Dip all the cattle the same day.
- (ix) Keep records of all the animals dipped.

**Maintenance of a cattle dip**

. Regular testing of the dip-wash by use of a dip-testing kit to keep the dip chemical strength at the correct concentration.

Clean foot bath before and after dipping.

Lock securely the entrance and exit to the dip to prevent access by intruders or stray animals.

Drain away the dip wash carefully to avoid the contamination of pastures and nearby water sources.

Ensure the roof of the dip is leak-proof to keep off rain water. Replenish dip wash by topping its level as necessary.

Repair any cracks in collecting yards, foot baths, dipping tank, silt trap, draining race and walls.

### ***Advantages of a plunge dip***

- Many animals can be dipped in a single operation.
- Because of the replenishment of the bath, it can be used several times.
- The cost of dipping is low due to less wastage.
- Requires less technical skills and labour than a spray race.
- Every part of the animal is reached by the solution due to total immersion of the animal's body.

### ***Disadvantages***

- There is risk of excessive dilution of the dip wash due to evaporation during the dry season or by rain water, or by impurities introduced by the animal and through leakage at the bottom or cracks at the sides.
- It cannot be used on sick, heavy, young and pregnant animals.
- The spread of viral diseases e.g. foot and mouth is possible through dipping of infected animals.
- It is cumbersome to replenish or empty it.
- There is a high initial cost of construction hence individual farmers cannot afford it.
- Maintenance costs may be high due to repairs of the cracks and purchase of repair materials.

## **3. Spray race**

This is a structure used for tick control.

Its main principle of operation is showering of animals with an acaricide rather than immersion. Animals walk through a confined area (race) where a pipe system with many nozzles (usually 20 - 30) are fitted at certain intervals and at particular angles.

The animals are wetted as they walk through the length of the race with dip-wash sprays coming through the nozzles.

The nozzles are placed at strategic places on the side, floor and overhead pipes and at such angles that the animal gets wetted from all sides.

The wash is drawn from a reservoir besides the race through a centrifugal pump driven by an engine or tractor and is circulated under pressure through the piping to the nozzles.

### **Components of a spray race**

#### ***Delivery pipes with nozzles:***

The pipes are made of metal to withstand the pressure of the spray wash. The pipes run on the floor, the side walls and overhead and are fitted with nozzles which release the spray wash at appropriate points. The pipes are joined as two suction pipes originating from a reservoir tank.

#### ***The side walls:***

They may be made of concrete blocks or stones. They provide a secure enclosure for the animals being sprayed and prevent the spray drift i.e. being swept away by wind.

#### ***Guard rails:***

These are made of metals and guide the animals through the spray race.

#### ***Control valve:***

This is the valve used to open the delivery pipes for chemicals to flow out.

#### ***Reservoir tank:***

This is the tank which contains the acaricide.

#### ***Agitator pipe.***

The pipe that maintains pressure to ensure that the chemical is properly mixed.

#### ***Suction pipe:***

It sucks the chemicals under pressure from the reservoir tank and is connected to the delivery pipes.

***Filter mesh:***

Filters any foreign materials from the spray wash draining back into the reservoir tank.

***Pressure gauge:***

It ensures that the machine is operating under correct pressure.

***Drainage pipe:***

When the chemical needs to be replenished, the drainage pipe is used to clear the tank.

***Power source:***

This is used to drive the machine. It can be tractor P.T.O shaft, electricity, etc.

**Maintenance of a spray race**

- (i) Pump out dirty spray wash into a safe disposal pit in a fenced area. Great care should be taken to avoid contamination of pastures and water sources.
- (ii) Clean the nozzles to avoid blockage so that the acaricide gets out with ease during spraying.
- (iii) Leave some wash in the pump to keep the foot valve in working condition and prevent cracks in the pump floor.
- (iv) Repair any leakages/cracks in the side walls

**Stock management at the spray race**

- Arrange the animals in a single file as they enter the race.
- Check to ensure that the animals lift their tails as they walk through the length of the tunnel so that under tail wetting takes place.
- Clip the hair in the ears inner surface and tail switch for better wetting.
- The young and new animals should be encouraged to go through the race by lowering the amount of pressure and later increasing the shower pressure.

**Advantages of a spray race'**

- It is faster and can spray more animals per hour than a plunge dip.
- Suitable for pregnant, heavy, young, goat, sheep and sick animals as they do not get shock.
- Fresh wash every spraying time.
- It is economical.
- It is less laborious.
- No poisoning of animals due to swallowing of the acaricide wash.

**Disadvantages**

- It requires high technical skill to operate and maintain.
- In wet weather, the nozzles may get clogged with dirt found in the wash.
- It is only economical with a large herd.
- High initial cost of construction.

**4. Dairy shed/ parlour**

A dairy shed is part of the dairy unit that is used during milking.

**It comprises of the following parts:**

- A night shade.
- A calf pen which should be fitted with a feed and water trough.
- A feeding and watering area.
- The milking section.

- A feed and equipment store.

### **There are two types of milking sheds:**

#### **i) Permanent milking shed:**

This has a milking machine permanently installed at the milking section.

#### **ii) Movable milking shed:**

. These units are fitted with small wheels which facilitate their movement to different sites.

Movable milking sheds are common in large dairy farms.

Cows are fed on **concentrates** while in the parlour.

### **Factors to consider in the construction of a dairy shed**

#### **(i) Resting area:**

Gives the cow room to rest and chew the cud.

(ii) should be **spacious enough** to allow room for exercise enhancing proper physiological body functioning.

(iii) should have **adequate feeding and watering space**. It is important to separate these from the resting area to avoid accumulation of dung and urine around the feeding and watering points.

(iv) Separate milking area from the feeding, watering and exercise areas .

(v) should have a **feed and drugs store** and milking equipment.

(vi) Calf pens must be near the dairy shed.

(vii) Provision for proper waste disposal.

(ix) The floor of the milking section, feeding, watering and exercise area need to be built of concrete to withstand the weight of the cattle and facilitate cleaning.

#### **Maintenance of a dairy shed**

- Repair worn out or broken parts immediately they are noticed.
- Clean the dairy shed regularly with detergents and disinfectants.
- Ensure proper drainage in the surrounding area.
- Ensure proper ventilation.

## **5. Calf pens**

These are structures for housing calves.

The calf pen can be either **communal** or **individual**.

#### **Individual calf pens are most suitable**

They prevent cross-suckling among calves which results in hair balls in the rumen,

Provide for better individual attention given to the calves

Minimize spread of diseases.

Calf pens should be located near or within the dairy unit.

### **Features of a good calf pen:**

- It should provide complete separation of calf from other calves thus eliminate the chances of navel suckling and spread of diseases.
- **It** should be easy to clean. This prevents accumulation of dirt.
- It should be spacious.
- It should allow the calf to see the mother cow and other animals.
- It should provide facilities for individual feeding and watering.
- It should allow the calf to have access to sunlight.

- It should be well. Ventilated to prevent infection.
- It should be durable.
- It should be economical to construct.

### **Types of calf pens:**

#### **(a) Permanent calf pens:**

These are **fixed on the ground** and cannot be relocated to other areas.

They are prominent in the **zero-grazing** method of livestock rearing.

#### **(b) Movable calf pens:**

These are **mobile** and can be relocated to new sites as a farmer may decide.

They are most common in the **paddocking** method of animal grazing.

### **Maintenance of a calf pen**

- (i) **Clean** the calf pen regularly.
- (ii) **Repair leaking roofs** to prevent wetness of the floor.
- (iii) **Repair** any worn out parts.
- (iv) **Paint** the walls **white to keep off flies**. White wash is preferred.
- (v) Ensure there is proper ventilation.

## **6. Poultry houses and structures**

These are housing structures used for **poultry production**.

They should be sited in free draining areas and away from main house.

- All the structures must provide warmth,
- Be properly lit and
- Well ventilated.
- They should be kept damp-free.

They include :

- i. poultry shed run,
- ii. deep litter,
- iii. battery cage,
- iv. fold/ark: •

### **(a) Poultry shed and run**

This structure has a shed and run and is sometimes attached to a nest box.

The **run** is enclosed with a chicken wire.

It has a door for use by the keeper to gain entry into the run when there is need.

The **shed** should preferably be made of wooden walls.

It provides protection against bad weather and predators.

It must be properly ventilated to allow free air circulation, easy to access for cleaning, collection of eggs and for the arrangement of feeding troughs. Place nest boxes inside the shed. The stand must be fitted with rat guards to prevent entry of rats into the shed.

### **(b) Battery cage system**

These are the structures used to house birds under the **intensive system of poultry production**.

**Individual birds or a few birds** are confined in **cages or batteries arranged from side to side**.

The size of the cage is about 0.5 m-per hen. A 10 cm length of feed trough should be allocated per cage. The farmer can, however, have one long feed trough that runs through several cages in each tier. Battery cage can be multiple tier, stair step or flat-deck.

### ***Advantages of the battery/cage system***

- **Less spread of parasitic diseases** ego worms and coccidiosis since the birds do not come in contact with their droppings.



- **Less feeding cost.** This is because the birds have little exercise.
- **Culling is easy** since one can easily identify the less productive birds easily.
- **No broodiness in hens** since they do not come in contact with the eggs.
- **Farmer gets clean eggs.**
- **Accurate production records** are easily kept.
- Reduced incidents of feather-plucking, cannibalism and egg-eating vices.

### **Disadvantages of battery/cage system**

- High initial capital.
- Higher maintenance costs where automation is used.
- Birds may get fatigue due to lack of exercises lowering their productivity.

### **(c) Coops**

These are specialised types of cages that are used for rearing hens that are brooding. They are commonly used in small scale, non-commercial poultry rearing systems.

### **(d) Fold/Ark**

It has both the run and the shelter section.

The run is covered with chicken wire mesh.

It provides birds with space for exercise and to get natural vegetation and insects.

The shelter part of the fold is covered with solid materials to provide protection against predators and bad weather conditions.

The fold is moved to new sites at regular intervals to reduce the accumulation of bird droppings. One fold can carry up to 25 birds. Normally a fold measures about 3.5 m x 1.5 m wide x 1.5 m high.

### **e) Night shelters**

These are used in free range system where birds are allowed to move within a fenced enclosure called a run.

Birds spend the night in these shelters but are allowed to go out and scavenge for food during the day. These structures are also equipped with laying nests.

The night shelters are mostly used by small-scale, non-commercial poultry keepers.

Night shelters are raised off the ground by use of stands or hung on a tree to keep off predators. Movable house shelters are preferred as they prevent build-up of parasites and diseases.

### **f. Deep litter**

This is a poultry house where birds are confined.

A deep litter has a low masonry wall of 0.6 m on the leeward side.

The rest of the upper part is made of wire mesh.

The floor space should allow for 4-5 birds/m<sup>2</sup>.

The house should contain laying boxes and perches for the hens.

Keep the roof leak-proof and avoid dampness in and around the house.

The building must keep away stray birds, predators and rodents.

### **Features of A good deep litter**

1. Well ventilated: The leeward side should have walls up to 1.5 m but not below 0.6 m. The rest of the upper section is made of wire mesh.
2. Draught-free: The wall section facing the windward side should be solid from bottom to top .:

3. Litter size: The litter on the floor must be between 15 - 30 cm deep. This helps to keep the poultry house warm and absorb birds' droppings. The litter should be kept dry.
4. Spacious: The house must be spacious enough to accommodate the number of birds reared without overcrowding. There must be enough space for each bird i.e. 4 - 5 birds per m<sup>2</sup>.

### **Advantages of deep litter housing**

- (i) Easy access to the feeds and water by birds.
- (ii) Easy collection of eggs.
- (iii) Regular cleaning of the house is not necessary since the litter absorbs the droppings.
- (iii) Allow high stocking rates.

### **Disadvantages of deep litter housing**

- (i) Eggs become dirty since most birds lay on the litter.
- (ii) It is difficult to identify non-laying birds.
- (iii) Cannibalism and egg eating vices are common.
- (iv) Diseases spread easily within the flock.
- (v) High cost of building deep litter houses.

### **Maintenance practices of poultry houses**

- Regular cleaning and disinfecting of the poultry houses.
- Ensure roofs are leak-proof.
- Minimize entry of dust into the poultry house. Dust is a predisposing factor to respiratory infections in birds.
- Put the poultry house into a resting period before start of a new project.
- Repair broken parts of the structure.
- Dusting should be done regularly to control external parasites.

## **Rabbit hutches/Rabbitry**

These are houses for keeping rabbits.

The house should be painted white to reflect much of the solar radiation that causes sunburn in rabbits.

A rabbitry unit is divided into two parts: The feeding and watering area and the resting and exercising area. A wire netting of 1 cm mesh or wooden slats fixed 1 cm apart can be used for the floor. It has a hinged door for easy opening and closure.

The hutch is fitted on stands of about 60 cm above the ground. Inside the hutch, provide feed and water troughs and a nest box of size 38 cm X 25 cm X 20 cm.

Place the hutch under a shade and in a site protected from the prevailing wind direction.

### **Features of a good rabbitry**

1. Adequate ventilation and well lit but protected from direct sun rays.
2. Spacious: Space requirement for a doe is 80 - 115 cm<sup>2</sup>.
3. Must be protected from direct rain and wind.
4. The sides and floor of the hutch should have chicken wire mesh.

5. The rabbitry must be safe from predators and pests like dogs, cats and snakes
6. It should be raised off the ground.

The floor of a rabbit hutch may be made of solid wood or wire mesh.

The advantage of a solid floor is that it allows for comfortable placement of bedding materials which help prevent hock sores in rabbits.

It also allows rabbit cages to be stacked in tiers.

However, its disadvantages are that it is difficult to clean, and that feeds and water can be easily contaminated by the droppings.

The advantages of a perforated floor or a wire mesh floor are that they are self cleaning since the droppings and urine pass through easily, and the contamination of feeds and water is much reduced.

### **Maintenance of a rabbit hutch**

- Repair broken parts.
- Repair leaking roof to prevent dampness inside the rabbitry.
- Paint the wooden posts to last long. Apply old engine oil to keep off ants.
- Clean regularly.

### **Piggery /pig sty**

Pigs are housed in a structure known as piggery or pig sty.

Pigs are very sensitive to extreme weather conditions, therefore a piggery should provide warmth and be well ventilated.

### **Essential features of a piggery**

#### ***Farrowing pen*** –

It is used for **farrowing** and ensuring the safety of the piglets.

The pen is provided with a **farrowing crate** to prevent the sow from lying on the piglets and a heat source to protect the piglets against chilliness.

It contains a **creep area** where only the piglets can access creep feed.

#### ***Weaners pen*** –

It is where weaned pigs are kept.

It should have a feeding, watering and resting section.

#### ***Boar pen*** –

This is where breeding boars are kept.

It allows room for sows to be served during the breeding season.

#### ***Gilts pen*** –

**Fish ponds**                    1g young female pigs up to the age of service (usually 12 months).

These are structures that are constructed in the farm for rearing fish.

Fish ponds require a large amount of water; therefore it is important to construct them near a water source such as a stream or a river.

The water should come from a higher ground so that it flows downhill into the fish pond and be drained out easily.

The site of a fish pond must be well selected for successful construction and maintenance.

### **Procedure of establishing a fish pond:**

- (i) **Site selection:** Select a suitable place where water flows gently from the source.

The ground soil of high water-retention capacity is preferred.

- (ii) **Site marking:** After selecting the site, use pegs to mark the channel from the river, the entrance and exit of the pond, and the channel to take water back into the river.
- (iv) **Clearing the land:** All vegetation is cleared off the site of the pond area.
- (v) **Digging the pond:** Soil is dug out. The top soil is placed in a particular place as it will be reused. The upper side of the pond is dug 0.5 m deep and the lower side of the pond 1.5 m.
- (v) **Construction of dyke:** The dyke is the wall constructed all round the pond.

#### Pond floor

- (vi) A cone is established by digging a trench 0.5 m wide and lower than the general level of the pond bottom. It is then filled with clay soil and compacted or concrete is used to help prevent water seepage.

### Parts of a fish pond

#### **Inlet:**

This is the canal or a pipe that brings water into the fish pond.

It is made in the dyke slightly above the level of the pond water.

A screen of fine mesh is fitted across the inlet to prevent the entry of undesirable species of fish into the pond.

#### **Outlet:**

This is made at the deeper end of the pond just a little above the bottom of the pond.

A pipe is connected to it to make the outlet firm.

A screen is fitted at the mouth of the outlet to prevent the fish from escaping from the fish pond.

It is used to drain water back into the river during harvesting.

#### **Spill way:**

It is the channel that allows removal of excess water from the pond.

It is made at the top of the dyke on the lower side of the pond.

The spillway prevents the water from overflowing on the dykes.

### Factors to be considered when siting a fish pond

- (i) **Topography:** The selected area should be gently sloping. This allows easy flow of water into and out of the pond. It also helps avoid flooding of the fish pond.
- (ii) **Accessibility to the fish pond:** It should be located near the homestead or where it can be reached easily.
- (iii) **Security of the area:** The site must be protected from trespassers, thieves or predators such as mongoose, kingfishers, etc.
- (iv) Free of pollutants from sewage and dumping sites.
- (v) **Nearness to water source:** A fish pond should be constructed near a reliable water source. This ensures an adequate water supply.
- (v) **Soil type:** The ground where the fish pond is constructed must have soils with a high water retention capacity to minimise water seepage. Clay soil is preferred.

### Care and maintenance of the fish pond

- (i) Feed the fish daily.
- (ii) Fertilize the pond twice a week.
- (iii) Check on the water level in the pond regularly and top up when necessary.
- (iv) Repair any leaking parts of the fish pond.
- (v) Remove aquatic weeds around the pond.

### Silos (for silage)

These are structures used for preparation of silage. There are different types of silos. The most common are:

- i) Pit/Trench silo.
- ii) Tower silo.
- iii) Clamp or bunker silo.

In siting silos, consideration should be made for access to loading and proximity to the zero-grazing unit.

### **Tower silo**

This is made of concrete above the ground. The concrete wall is usually perpendicular on three sides, leaving one side open for the filling and removal of the silage. The floor of the tower silo can be cemented or lined with polythene sheet.

Materials used to construct silos are timber, compacted soil, and polythene sheets.

### **Clamp or Bunker silo**

This structure is constructed above the ground level. Its sides or the walls are slanted. The silo is usually constructed using timber.

### **Zero grazing units**

This is a structure for housing livestock in total confinement.

The animal is fed in the unit and is rarely moved out.

The zero-grazing unit comprises of: a feeding area, milking section, sleeping area, feed store, and calf pen, milk recording room, feed preparation section and dunging area.

The floor is preferably made of concrete for ease of cleaning while the walls can be made of timber, bricks, stones, meshed wire, metal columns, pipes or iron sheets.

All sections of the unit are roofed except the resting area where the animal does exercises and gets sunshine.

Roofing material may be iron sheets or grass.

### **Bee hives**

These are structures in which bees are kept.

There are many types of bee hives used by farmers in Kenya.

But the most common ones are log hive and Kenya Top Bar Hive (KTBH).

### **Types of bee hives**

#### **1. Log hive**

It is made of a hollow log which is split into two parts, one being larger than the other.

The larger part is made into a trough shaped structure by removing the inner tissues of the log stem using a sharp chisel.

Holes are then drilled on the sides. The smaller part forms the floor board.

The two parts are tied together using wires.

#### **2. Box-hive**

Made of sown timber cut to length of 1 m.

The best timber size for a box hive is one metre long with the inner area measuring 30 cm x 30 cm. The top side and end boards are nailed together while the bottom board is attached by means of wires or supported by 4 small pieces of timber which are detachable.

For ventilation and entrance of bees, holes are drilled in the bottom board, two near the ends and one in the centre.

#### **3. Kenya Top-Bar Hive (KTBH)**

This is a wooden box. It has long sloping sides which incline at an angle of 65°.

It has a series of bars forming the top of the hive where the bees attach their combs.

The bars allow for easy inspection of honey combs and honey harvesting since they can be removed and replaced easily.

Each bar measures 3.2 cm wide by 48 cm long.

The hive measurement is 90 cm long, 48 cm wide at the top and 23 cm base width.

The top has a cover made of iron sheet with a wooden frame used for covering the hive top.

Coat the hive with wood preservative to protect it from insect damage or effect of rain water:

The hive has wide loops attached to its upper section used for its hanging it. KTBH is a modern bee hive and is the most widely used in East Africa.

### ***Advantages of the Kenya Top bar Hive***

- The top bars can be easily removed and replaced during inspection of the combs.
- Honey combs are removed without disturbing the brood.
- Easy to construct and repair.
- A queen excluder can be used in the centre of the hive to separate honey from the brood.

### ***Disadvantages***

- Top bar hives are expensive to construct.
- Combs built on top-bars require careful handling to prevent breakage.
- Top bar hives are not easily moved from one location to another without breaking the combs.

### **Maintenance of the Kenya Top bar Hive**

- Repair leaking lid.
- Replace the broken and worn out bars or sides.
- Ensure that there are no spaces between the bars.

### **Farm stores**

These are structures that are built for storage of seeds, animal feeds, farm tools, chemicals and crop produce that are used in crop and livestock production. There are various farm stores used for different purposes e.g. grain stores, feed stores, chemical stores, machinery stores and tool stores.

### **Feed store**

These are houses constructed for keeping livestock feeds.

Most farmers normally buy feeds in bulk for use over a longer period of time.

### **Features of a good feed store:**

- i. Spacious: To allow easy movement when placing and removing the feed.
- ii. Easy to clean: Proper hygiene must be observed in the feed store to prevent contamination of the feeds.
- iii. Easy to load and off-load.
- iv. Damp-proof: Free from moisture.
- v. Rodent free: It should contain raised crates for holding feeds and should have rat guards.
- vi. Proper ventilation: To allow free air circulation.

### **Farm produce store**

These are structures used for storing cereal produce such as maize, millet, sorghum, wheat, finger millet.

They can also be used to store pulse crops e.g. peas and beans.

Requirements of a good farm produce store:

- (i) **Damp proof:** Ensure the roof is not leaking, and that there are no cracks on solid walls. Dampness encourages fungal or weevil attack on the grains. Preferably construct a store raised off the ground i.e. about 60 cm above the ground.
- (ii) **Easy to clean:** Good hygiene is very important for successful storage of farm produce. Therefore it is necessary that the store be easy to clean.
- (iii) **Vermin-proof:** Rodents such as rats, mice can cause great damage to the stored produce. Prevent entry of such rodents by fitting rat guards or deflectors on the posts.
- (iv) Should have proper ventilation to allow free circulation of air.

### **The size and type of farm produce store depend on:**

- The amount of the crop produce to be stored. There is need to construct a big store for storing large amount of farm produce.
- Specific storage needs of the crop e.g. temperature and relative humidity.
- Availability of materials for construction.
- Cost of the materials.
- How the crop is to be stored e.g. shelled and un shelled maize have different space requirements.

### **Types of farm produce stores**

Stores vary from plastered baskets for small quantities of grain to silos for large quantities of grains, usually in tonnes.

They include:

#### **1. Sheds**

Constructed for temporary storage of grains during harvesting. They are reinforced with wooden or metal pillars and have a water proof slanting roof.

#### **2. Godowns**

These are more permanent structures for bulk storage of food grains.

They can also be used to store farm inputs like fertilizers.

They are normally leased to farmers since they are expensive to construct.

#### **3. Silos**

A silo is an airtight storage facility that is specially constructed to allow easy loading and off loading of grain.

Most modern silos are fitted with conveyor belts to transport the grains up or down the silo.

#### **4. Bins**

These are made of steel, aluminium or concrete and are normally circular in shape. Improved grain bins have the following features:

- They are raised above the ground to avoid dampness and prevent moisture entry.
- Have rat guards on the supporting posts.
- Have impermeable walls to guard against rain water.
- Have proper ventilation to control temperature variations.

Have proper roofing to protect grain from sunlight and rain

#### **Basket granaries**

Construct a platform on which the basket can rest. This helps prevent moisture from reaching the baskets. The granaries should be made air tight by plastering. Dust them with insecticides to prevent insect attack. Instal rat guards on base posts.

#### **6. Gunny bags**

These are stored in a structure that is free from dampness, insect attack and rodents.

## ***Advantages of gunny bags***

- Gunny bags can be easily isolated and labelled to contain different grain products without the risk of mixing grains.
- Gunny bags can be easily moved, especially when transferring the stored products.

## **Machinery store**

These are structures where farm machinery are kept. Such machinery include tractors, trailers, combine harvesters, etc.

The store should be spacious enough and secure to guard off thieves or burglars. The store should be constructed with strong building materials i.e metal bars, bricks concretes. It should be accessible to the farming fields or the main house in the homestead.

## **Tool store**

This is the structure where small garden tools, livestock tools and workshop tools are kept. It is also referred to as a tool shed. It should be spacious, preferably contain a tool rack and have a roof to shelter it from rain and direct sun. The wall must be solid and constructed using timber, bricks or iron sheets. Ensure the tool store is always dry and cleaned at regular intervals.

## **Chemical store**

These are structures for safe keeping of various chemicals. The common agrochemical substances include: acaricides, pesticides, herbicides, drugs for injection or vaccination purposes, disinfectants, rodenticides and fertilizers.

It is important that chemicals be safely stored away from reach of children or people and fire sources. The chemical store should be made of bricks, stones or strong corrugated iron sheets. They must be damp-proof, have leak-proof roofs and be kept clean always.

Provide lockable cabinets for safe storage of the chemicals. Vaccines require special storage facilities like deep freezers.

## **General maintenance of farm stores**

1. Regular cleaning. Dusting of farm stores must be carried out frequently.
2. Maintain good hygiene around the farm store.
3. Repair broken or worn out parts e.g. leaking roofs, broken doors, cracking walls.

## **Fences in the farm**

These are structures that enclose designated areas and form physical barriers for animals and human beings restricting their movement within the enclosed area or preventing their entry into the enclosure. Any type of fence must allow easy entry and exit of livestock, people, and farm machinery through the designated entrance or exit areas.

## **Importance of fences in a farm**

1. Perimeter fences establish boundary lines which help reduce land disputes between neighbours.
2. Fences keep out intruders e.g. trespassers, thieves, straying wild animals, etc.
3. Rotational grazing is more effective through paddocking of the fields.
4. Live fences act as windbreaks. This helps to reduce wind erosion or lodging of weak stem crops such as maize.
5. Double fencing is an effective measure for controlling ticks.
6. Diversified production. Fences protect crop from damage by animals where mixed farming is practised.
7. Fencing enhances control of diseases and parasites by restricting movement of livestock. Stray animals from other farms are kept off.
8. Facilitate the isolation of sick animals or pregnant cows, etc.



9. Helps a farmer to carry out control breeding through ensuring the animals are grouped as designed by the farmer. It eliminates random mating or inbreeding.

## **Types of fences**

### **1. Barbed wire fence**

These are fences made of barbed wire. They are commonly used in fencing cattle ranches. A single wire fence consists of 4-5 lines of barbed wire depending on the resources available.

It easily causes injury to farm animals by making cuts on the animals' body. In sheep, it removes fleece.

#### **Advantages**

- (i) Effective in controlling livestock and wild animals.
- (ii) Fairly cheap to establish.

#### **Disadvantages**

- (i) Can hurt the livestock by pulling or tearing parts of their body, which may lead to infections and lowers quality of hide.
- (ii) Less durable, especially, the posts which can be easily attacked by ants and termites.

### **2. Plain wire fence**

It is ideal for fencing farms where sheep, goats and dairy cows are kept. About 6-8 lines of the wire can be fitted to a height of 70-90 cm above the ground. A wire of thickness 3.25 - 4.0 mm is recommended.

#### **Advantages**

- (i) Do not cause injury to livestock.
- (ii) It is cheap to maintain.
- (iii) Easy to handle during fencing.

#### **Disadvantage**

Animals can go through it very easily since it is not prickly.

### **3. Electric fences**

These are made of plain wires that conduct electricity. The wires are fixed on movable metal posts.

A portable low voltage battery is used to supply the electric current which gives a small shock to an animal when it comes into contact with the wire. It is mainly used in strip grazing and in the fencing of high potential or valuable crops prone to destruction by wild life. It is also used to protect high security areas such as homesteads, military barracks, game reserves, etc.

#### *Advantages*

- (i) Durable once installed.
- (ii) Can easily be relocated.
- (iii) It is very effective in protecting crops from big wild game. *Disadvantages*

- (i) Unapproved electric controller units can be dangerous.
- (ii) May become less effective when grass, weeds or shrubs touch the wires.
- (iii) Requires constant recharging of the battery.
- (iii) Expensive to maintain and construct.

### **4. Wall fences**

These are made of stones, bricks or concrete blocks and are mostly used around farm buildings in urban areas to keep off intruders. They are expensive to construct.

### **5. Chicken wire fences (wire mesh)**

They are used for fencing poultry runs.

The thin gauge hexagonal open mesh is used to control movement of birds.

The mesh netting is embedded 15-30 cm into the ground and one metre above the ground to keep off intruders such as goats, sheep, pigs, poultry.

## 6. Wooden fences

These are the most economical to construct where timber is available. However, wooden fence is susceptible to attack by termites and fungi. It is also less durable and can catch fire easily.

## 7. Live fences

These are formed from growing trees e.g. Kei apple, Mauritius thoms, *Lantana camara*, cactus, bougainvillea, sisal and cypress. They are slow to establish and are not effective in restricting the movement of animals. They act as good wind breaks when mature and form hedges

### Gates

- (i) Gates should be hinged on posts separate from the fence post.
- (ii) Most farm machinery require 4.3 - 4.6 m width of gates for easy passage.
- (iii) **Entrance or gates for pedestrians can be accommodated within the fence.**

Gates can be made of timber or barbed wire. Passes are constructed using strong poles.

### Fence reinforcement

This is done by use of struts, brace posts and droppers. The struts (brace post) are used to reinforce the strength of the fencing wire and are normally placed at the comers to prevent the king post (comer post) from bending inwards.

Droppers are fixed in between the standard posts. They must be dry and should not touch the ground.

### Maintenance of the fences

- Repair any broken part of the fence.
- Strain the wire if loose, particularly for barbed or plain wires.
- Trim overgrown branches of live fences.
- Clear the fence lines to destroy habitats for rodents.

### Tools and materials

Tools used in construction of fences are:

- Pegs** - - used to set out position for holes.
- Claw hammer** - driving in nails/staples.
- Bow saw** - cutting branches on the posts.
- Hand saw** - cutting posts to the right length.
- Wood chisel** - boring holes and slots on the posts.
- Pair of pliers** - cutting the wires.
- Drill/auger bit** - boring holes in posts.
- Soil auger** - digging holes on the ground.
- Claw bar** - removing staples.
- Mallet** - hitting the chisel when making slots.
- Wire strainer/stretcher** - straightening the wires.
- Tape measure** - measuring distances.
- Ramming rods** - firm soil around the posts.
- Panga**- shaping pegs.
- Axe** - splitting the posts.

Materials: **Wires, staples, nails, post, droppers**

## **Green house**

### **Meaning**

It is an enclosed structure used for raising tender plants which require a controlled environment to grow.

The structure provides optimum environmental conditions for the crops.

The structure must be able to withstand strong winds, rain, hailstones, snow, etc. It must also allow as much light as possible to filter through for plant growth.

The structure is designed in such a way that the crops can be handled efficiently, with minimum labour.

The crop environment is highly controlled.

### **Construction materials for green house**

The following are the common construction materials for green houses; aluminium, steel, wood, glass, fiber glass, reinforced panels, acrylic panels, polycarbonate panels, plexi glass and rigid polyvinyl chloride, polyethylene and polyvinyl fluoride films.

#### **(a) Covering material**

Must be clear enough to provide optimum light transmission, be durable and economical. However, the structural components required to support it are usually costly.

Types of covering material:

##### **(i) Fiber glass**

This is rigid, and durable. Its disadvantage is that it is susceptible to ultra violet light radiation which causes the fibresto swell resulting in a decrease in light transmission

(ii) Double sheet of polythene film inflated with air This requires constant refilling of the air.

##### **(iii) Poly carbonate materials**

Are rigid but flexible enough to be used in a quonsetstyle green house. They are impact resistant.

##### **(iv) Acrylic**

These are the most current but very expensive. Their advantages are: high light transmission, high impact resistance and great strength.

Properties of good construction material:

- **Combustibility:** Materials which are highly inflammable are not good for construction.
- **Durability:** Should be long lasting.
- **Insulation:** Refers to heat retention. This is relative to the number and thickness of layers used.
- **Maintenance cost:** This should be affordable.

#### **(b) Framing materials:** .These include:

##### **(i) Aluminium**

This is the most economical material for constructing green house frames. It has the longest life span and allows for light reflection.

##### **(ii) Steel**

It is heavier than aluminium hence it requires additional support. It has to be painted or galvanized to resist high moisture conditions within the green house.

##### **(iii) Wood**

This can be used but its disadvantage is that it deteriorates fast. If wood is to be used, then treatment is necessary. However, avoid using pentachloride and creosote since they liberate fumes that are harmful to plants.

### **Uses of the green house**

It is used for raising tender crops which are of high value but require a highly controlled environment for successful production e.g. flowers. The aim of using a green house is to reduce evapotranspiration by increasing the humidity and controlling the level of dryness.

Examples of crops grown in green houses are:

- Flowers e.g. roses.
- Peas, french beans, onions, vegetable, lettuce, conifers, melons, tomatoes.

