

## **AGRICULTURAL MECHANISATION AND FARM MACHINERY**

Agricultural mechanization is the application of power or mechanical aids to all types of agriculture operations making farming less dependent on physical labour.

Mechanization in broad sense includes the manufacture, distribution and operation of all types of tools, implements and machines for agriculture land development. Further more it includes operations such as land preparation; spraying to control pests and using machines; processing of crops and animal products.

### **Benefits of Agricultural Mechanization**

- 1 It helps to increase agriculture output by increasing the amount land under cultivation.
- 2 It helps farmers to do jobs which would be impossible to do by hand e.g. uprooting big trees, ploughing in dry weather etc.
- 3 Releases human labour to be used in farm operations that cannot be mechanized
- 4 It ensures timely farm operations, e.g. quick seed bed preparation leads to early planting and harvesting.
- 5 It discourages land fragmentation which is uneconomical for mechanization.
- 6 It encourages quality production e.g. products harvested mechanically are more uniform than those done by hand
- 7 Eases problem of labour shortage during farm work since one machine can do work for many people.
- 8 It is faster hence saves time for other job on the farm.
- 9 It helps to reduce human drudgery by enabling farmers to do difficult and unpleasant jobs more easily hence making agriculture dignified and attractive profession.
- 10 Allows better combination of enterprises through saving time for different operation.
- 11 Encourages proper planning and management of the farm.

### **Limitations of Agricultural Mechanization**

- 1 Most farmers have small plots which make it uneconomical to mechanize
- 2 Farmers lack adequate capital to purchase or have machinery.
- 3 There is always free/cheap human labour from family members; therefore many farmers would not go for machines.
- 4 It may lead to over production which eventually leads to lowering of market prices.
- 5 It requires skilled man power i.e. there are few people who can operate and maintain machinery.
- 6 Clearing land by machines exposes soil to effects of rain water and thus soil erosion.

- 7 Some farm operation such as coffee picking is not easily mechanized.
- 8 Some areas are hilly and mechanization cannot work properly.
- 9 Some farmers are very conservative and cannot adopt mechanization.
- 10 It decreases job opportunity for the masses which leads to unemployment.
- 11 Encourages quick farming which compromises careful farming leading to poor yields.

#### **Factors limiting mechanization**

- Unavailability of machines/tractors for use.
- High costs for hire of machines and use
- Inadequate money to purchase machines.
- Inadequate skills to operate machines that could have been used in mechanization.
- High maintenance costs for agriculture machines
- Poor land tenure system which discourages use of machines.
- Tall vegetation which impedes machine movement
- Lack of enough demonstration centers where machines are tested before adoption.
- availability of excess cheap human labour in the community
- Land fragmentation which discourages use of machines

#### **Factors limiting use of draught animals**

- Heavy/sticky soils making it difficult to work by animals
- Absence of work animals that can provide the needed power
- Prevalence of pests and diseases
- Inadequate advisory/extension services on use of animals
- Topography-Hills and steepy areas do not easily encourage animal power
- Lack of capital for purchase of animals and Ox-ploughs.
- Nature of crops grown-broadcasting does not easily allow mechanization
- lack of enough grazing land for animals
- presence animal pests like tsetse flies that discourage rearing of animals

#### **Factors that encourage agriculture mechanization**

- 1 Extension service; farmers needed to be educated about machines and their importance in agriculture mechanization.
- 2 Land tenure system; mechanization requires large piece of land for it to be economical.
- 3 Cost of machine; Cheaper and simple machines are needed that are affordable to the farmer.
- 4 Formation of cooperatives/Farmers organisation; this encourages farmers to own machines as a group which is relatively cheap.

- 5 Flexibility of machine; farmers will prefer a machine that performs more than one job to reduce costs that would have been handled on other machines.
- 6 Presence of engineering workshop; These are important in repairing machines and giving advice to farmers on machines
- 7 Availability of loans and subsidies; these will make it easy for farmers to obtain expensive machines.

### **Steps taken towards agricultural mechanization**

- 1 Need to educate farmer as the importance of mechanization
- 2 Large areas of land are needed to make mechanization economical.
- 3 provide loans to farmers that can be used in purchasing machinery
- 4 develop simple and less expensive machinery for use
- 5 provide machines that are suitable for the prevailing environmental conditions
- 6 encourage farmers to own and operate machinery collectively to reduce individual costs
- 7 the process of mechanization should be gradual beginning with areas that are economically viable
- 8 agricultural engineering workshops should be provided in districts to handle farm machinery
- 9 taxes on farm machinery should be reduced so that it becomes affordable

***Qn. Explain the factors that have favoured the use of ox-ploughs/ animal power in Teso region***

### **Levels of Agriculture Mechanization in Uganda**

The size of the farm and the kind of agriculture production on it determines the extent of mechanization on the farm. There are three levels to the application of mechanization;

#### **1<sup>st</sup> level**

- 1 This level involves the use of hand tools e.g. pangas, hoes, slashers, wheel barrows etc. It is a subsistence level of agriculture production.

The problem facing farmers at this level is the low output i.e. yields are very low.

***The following factors have contributed to the continuous use of hand tools or persistence of level one in agriculture.***

- i) Peasant farmers and other low income earners who are interested in farming cannot afford to buy machinery
- ii) High prices and taxation imposed by government on farm machines making it unaffordable.
- iii) Land tenure system like land fragmentations do not justify the use of such sophisticated machines.

- iv) Farmers are conservative i.e. they are unwilling to adopt new methods of technology.
- v) Farmers lack the skills and training to handle modern machines.
- vi) Illiteracy has hindered effective advertisement and demonstration of use of machines to farmers.
- vii) Availability of cheap human labour making it uneconomical to use machines.

**The need to move to level 2 is justified by;**

1. Increase in demand for food as human population increases
2. Reductions in family labour as children go to school under free primary and secondary education
3. Introduction of new farming techniques like row planting that may require a more powerful source of power
4. Availability of enough grazing land for animals
5. Increased profits in agriculture availing capital required for use

**2<sup>nd</sup> Level**

This involves the use of animal power, particularly where land and other facilities are available.

This involves the use of animals like oxen, horses, donkeys, camels and buffaloes. Special harnesses and yokes are used to clutch various equipment to the animals.

Animals generally have the capacity to be over loaded however for a short period of time. They provide good traction/grip even in difficult conditions.

**The output available from farm animals depends on;**

i) Feed intake

This naturally affects power output; normally animals are in their poorest condition after dry season. Soon after that their conditions change when the rain starts and that's when their load should be increased

ii) Animal health

Sick animals are always weak hence cannot carry out work as expected

iii) Breed of the animal

The breed of the animal should be chosen such that it's adapted to harsh environmental conditions such as high temperatures; Long drought seasons; therefore local breeds are preferable to exotic breeds.

iv) Load of work available; this strains animals making it less efficient at work

v) Training given

Training can also yield better performance. Its said that donkeys are easier to train for farm than bulls.

vi) Yoke used for hitching

The influence of the yoke on power output is quite significant. A good yoke should be able to cover animals adequately that are hitched together.

vii) Type of animal; big animals like cattle may provide more power than the small animals

viii) environmental conditions; working under harsh conditions may reduce the amount of power provided by animals

### **Advantages of using Animal power**

- i) It does not required skilled workers as compared to the engine power.
- ii) It can transport heavier loads than hand power.
- iii) Animals can operate well in land fragmentation areas.
- iv) Initial cost of buying and maintaining animals and their implements are lower than that of tractors.
- v) A fairly large area of land can be cultivated.
- vi) animal power is faster than hand labour
- vii) They have good traction ability in any area hence increase in efficiency
- viii) Animals can work and survive well in harsh climatic conditions.
- ix) Animals are more reliable than human power

### **Disadvantages;**

- i) A big piece of land is required in grazing the animals
- ii) Animals cannot manage to plough very hard and dry soil.
- iii) The amount of work done depends on the health of the animals.
- iv) Performance decreases with increase in hours worked
- v) Animals need training and farmers must have experience of animal husbandry
- vi) In cultures that doesn't permit use of animal power, the power potentials is not exploited e.g. in Ankole where animals are treasured
- vii) Animal output is reduced by environmental factors such as high temperatures, excessive rainfall.
- viii) animal parasites like tsetse flies may limit use of animals in some areas

### **3<sup>rd</sup> Level**

In order to increase production and efficiency and reduce hand labour a good number of farmers have changed from the previous two levels to engine power production

### **Advantages**

- i) It saves the farmer hand labour which is expensive
- ii) Increases efficiency and ensures timely farm operations
- iii) Machines can work continuously without suffering from fatigue
- iv) Machines are more economical for large areas in the long run
- v) Big areas of land can be cleared.
- vi) They produce quality work

### **Disadvantages**

- i) They require skilled man power to operate
- ii) They have very high initial and maintenance cost
- iii) They may create unemployment.
- iv) they produce fumes that pollute the environment
- v) may require a lot of skill to be operated
- vi) maintenance costs are high
- vii) they can destroy soil structure exposing soil to erosion

### **Factors considered before selecting machinery and equipment for use**

1. Nature of work; every machine is made for a particular purpose which it must do
2. Financial status of the farmer; some machines are too expensive for the farmers hence cannot be purchased
3. Type power used; machines using electricity may not be used where power is not available
4. Topography; hilly place may not favour use of machines like tractors due to steepness of land
5. Skills of the farmer; highly skilled farmers can use a number of machines and equipment.
6. Flexibility of a machine; machines that can perform more than one type of work are more economical to use
7. Adaptability of the machine to different environmental conditions
8. Level of production; large machines are required for a high level of production due to their power production
9. Efficiency of the machine at doing the work to be done

### **SOURCES OF POWER ON THE FARM**

Power is the major driving element in mechanization it's needed on the farm for a variety of operations which maybe mobile or stationary.

Mobile operations include transportation of produce, field operations like ploughing, weeding etc

Stationary operation includes pumping water, extracting oil, drying, threshing etc

Common power sources on the farm include human power, animal, wind, solar, electric, hydro, biogas, fuel power, thermal power and engine power, nuclear power

### **WIND POWER**

Its power provided by wind and can be used in doing light farm work like;

Pumping water, winnowing crop produce and generating electricity.

#### **Advantages**

- It's a cheap source of power since it is free
- Wind is free
- does not pollute environment
- Can be used sustainably
- Clean source of power.

#### **Disadvantages**

- Has high initial cost for purchasing and installing a wind mill
- Wind is unreliable/unpredictable
- Wind cannot be controlled
- Its power is limited to stationary work

### **HUMAN POWER/HAND POWER**

This is also known as human power i.e. it is a power produced by human beings. It's the main source of power on a farm using simple machines, tools and implement.

#### **Advantages**

- Has low initial capital hence sustainable for peasant farmers
- Very flexible i.e. can be used for a number of farm operations
- Can perform work in the absence of a farmer in the field
- Human labour is readily available in Low Developing Countries
- Cannot be limited by land tenure system and size of land
- Poses no pollution threats to the environment
- Family and casual labour can provide man power

#### **Disadvantages**

- It's slow in operation

- Cannot cope with large amount of work
- Efficiency declines with increase in number of hours worked
- Performance is influenced by health; maturity etc
- It's expensive in the long run.
- Does not provide uniform work hence less efficient.

**NB:** The extent to which human power can be used as a source of power depends on the degree of mechanization e.g. some parts of the world where mechanization is high man acts as a control device but where mechanization is low man acts as source of power

### **SOLAR POWER**

Its power got through harvesting the sun's energy by special devices. It can be used in; drying farms produce, pumping water, lighting and on farm fences.

#### **Advantages**

- Has low maintenance costs
- Does not pollute the environment
- Light energy is freely produced by nature and cannot be exhausted
- Produce clean power for farm jobs.

#### **Disadvantage**

- Light may be unpredictable since it depends on weather
- Has high initial cost for buying and installing the materials for trapping light.
- May not be used in performing heavy work in farm like grinding grains

*Qn. Describe the factors that affect the use of ox cultivation (animal Power in Uganda).*

### **ENGINE POWER**

This comes from engines sparked by gasses from burning fuel like kerosene, petrol, diesel and coal. It can also come from steam of boiling water heated by burning fuel such as fire wood and coal.

The engine is fitted with a piston which converts kinetic energy of the gasses from burning fuel to useful mechanic energy that drives machines like grinders, millers, tractors etc.

#### **Engines can perform the following functions on the farm**

1. Drive the tractor to carry out a number of operations like ploughing, mowing, harrowing etc.
2. Provide transport on the farm by pulling a trailer
3. Operate a water pump for farm water
4. Drive a grinding mill
5. Operate a milking machine
6. Drive a generator that produces power
7. Drive grass cutters



## 8. Drive crop sprayers and harvesters

### Types of engines

- 1 **External Combustion** engine power; this is where the burning of fuel is done outside the combustion chamber e.g. in a steam engine
- 2 **Internal combustion** engine power; this is where the burning of fuel is inside a combustion chamber.

Internal combustion engines are of two types namely; **4 stroke** engine and **2 stroke** engine. Both use either diesel or petrol as a source of fuel.

### **Differences between a 2 stroke and 4 stroke engines**

	4 stroke engine	2 stroke engine
1	Gives one power stroke in four strokes i.e. in 2 revolutions of the crankshaft	Power stroke takes place in every two strokes i.e. one power stroke for a revolution of the crankshaft
2	Due to more idle strokes and non uniform load on the crankshaft, a heavier flywheel is required	Engine has more uniform as every time the piston comes down it is power stroke hence a light flywheel is required
3	Engine is heavy since it has more parts	Engine is light since has less parts
4	Engines are more expensive since they have more parts	Engine is cheap since has less parts
5	Engine produces more power since fuel is burnt completely	Engine produces less power since fuel is not burnt completely
6	Uses less fuel due to reduced wastage	Uses more fuel due to increased wastage
7	Engine produces less noise some of it is absorbed by water jacket	Produces more noise due to absence of water jacket to absorb excess noise
8	Produces less smoke due to complete combustion of fuel	Produces more smoke due to incomplete fuel combustion
9	Engine is big hence occupies more space in the vehicle	Engine is small hence occupies less space
10	Consumes less oil as it gets recycled in the engine	Uses more oil since there is no recycling
11	It has <b>valves</b> that allow in fuel air mixture or air	It has <b>ports</b> that allow in fuel air mixture

### **Advantages of using internal combustion engine**

- Its faster and saves time and labour
- It can work continuously without fatigue unlike man and animals.
- It enables farm operations to be achieved in time.
- It's economical in the long run.

### **Disadvantages**

- It requires skilled man power to operate, maintain and prepare.
- It needs high initial capital
- It's expensive to maintain, prepare and buy spare parts.
- It depends on petrol, diesel and oil which are expensive.

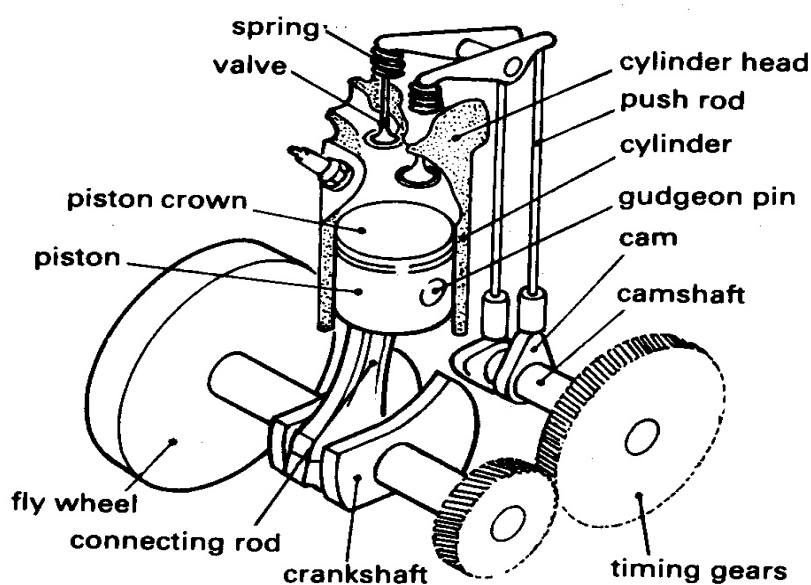
The principle source of mechanical power on a farm is the engine which gives power to the tractor.

### **TRACTOR**

A tractor is versatile machine since it provides power for many entities for both mobile and stationary jobs, these include;

- Provides a pull from the rear for machines e.g. ploughs and tractors.
- Provides a push at the front for equipment
- Provides a drive to the PTO shaft (power take off) for machines such as mower and grinders etc.
- It provides hydraulic power to a three point linkage for lifting equipment
- It provides a means of transport.

### **Parts of an engine**



**COMPONENTS OF AN ENGINE**

## **Components of the combustion engine and their function**

**Engine block;** it's the foundation block on which all components are directly or indirectly attached.

**Cylinder;** it is the nucleolus of all activities but principally its for receiving and burning the fuel.

**Connecting rod;** it transmits power to the crankshaft and assists in changing the up and down ward motion of the piston to rotary motion of the crankshaft

**Piston;** it receives power from burning gasses to move down wards taking power to the connecting rod and crankshaft

### **Functions of a piston**

- Mix air and fuel for those with combustion chamber on top
- Transmits power produced in power stroke to crankshaft.
- Pushes exhaust gases out during exhaust stroke
- Works as a guide for upper part of connecting rod.
- Carries compression rings which seal the combustion chamber from sump.

**Crankshaft;** this is responsible for converting the up and down movement of pistons into rotary motion a usable form of power.

**Cylinder head;** this covers the top of the cylinders and houses other components such as a spark plug, injector nozzles and valves

**Inlet valve;** it allows in fuel air mixture or air into the cylinder,

**Exhaust** valve expels the burnt gases.

**Gasket;** its used to make a gas and water tight seal between the cylinder head and the cylinder or oil sump and engine block.

**Gudgeon pin/piston pin'** it attaches the piston to the connecting rod.

**Crank case;** It covers the bottom of the cylinder and holds the lubricating oil and other components like crankshaft

**Combustion chamber;** this is where the actual combustion of fuel/air mixture takes place.

**Camshaft;** it's a pump on which the cans are mooned on. It enables the valves to open only once per cylinder. The can shaft is driven at half the crank shaft space

**Cams;** these are mounted on the camshaft to control opening and closing of the valves which must coincide with particular movement of the pistons.

### **Piston rings**

- Seals the combustion chamber and does not allow gases to escape to the sump (pressure ring)
- Carries away heat from piston to cylinder wall (pressure ring)
- Lubricate cylinder walls (oil ring)

- scrap oil from cylinder wall and return it to the sump (oil ring)
- Resist high pressure and high temperature (pressure ring)

The valves are always working together with the movement of the piston. The timing gears also drive the injector pump that injects diesel into the combustion chamber.

**Fly wheel;** this one is fitted onto the crankshaft just to absorb power during the power stroke. It is a heavy wheel that runs by its inertia during the idle stroke

It maintains the speed of the crankshaft

**Piston rod;** transmits power from the piston head to the crankshaft

### **Engine Terminology**

#### 1. Bore

It's the diameter of the cylinder

#### 2. Stroke

It's the maximum length of travel of the piston from one extreme position to the other in one direction.

#### 3. Top dead centre (TDC)

It's the highest point a piston can move towards the cylinder head.

#### 4. Bottom dead centre (BDC)

It's the lowest point a piston can move towards the crank case.

#### 5. Piston displacement

It's the volume displaced or covered by the piston when it moves from TDC to BDC

#### 6. Clearance volume (CV)

It is the space/volume between top of the piston and the engine cylinder head when the piston is at the top dead centre

#### 7. Compression ratio

Is the ratio of total cylinder volume to clearance volume

#### 8. Total cylinder volume

This is the volume designated by the sum of the piston displacement and clearance volume (PF fCV)

## **TYPES OF INTERNAL COMBUSTION ENGINE**

There are two types of internal combustion engines namely;

- 1 Spark ignition (petrol) engines.
- 2 Compression ignition (diesel) engines.

### **Petrol Engines**

These engines are equipped with a device for ignition called the spark plug which produces an electric spark to ignite the compressed gases and fuel in the cylinder. Most of today's petrol engines have a **carburetor** which atomizes fuel and mixes both air and fuel. It then injects the mixture into the cylinder but others that do not have the carburetor but inject fuels directly into the cylinder for ignition.

### **Diesel Engines**

In diesel engines, ignition is produced by the heat of compressed air in the cylinders where fuel is mixed with compressed air unlike in the petrol engine where by air and fuel is mixed in the carburetor.

### **Difference between Petrol and Diesel ignition**

<b>Petrol</b>	<b>Diesel</b>
Use petrol as fuel	Uses diesel as fuel
Fuel is ignited by a spark from the spark plug	Fuel is ignited by hot compressed air
Has a carburetor to mix air and fuel	Has an injector pump to drive fuel into the cylinder.
Has a spark plug	Has an injector nozzle
Has low compression ration of 5:1-8:1	Has a high compression ratio of 14:1 - 20:1
Air and fuel meet first meet in the carburetor	Air and fuel first meet in the cylinder (air goes 1 <sup>st</sup> then followed by fuel)
Produces less smoke	Produces more smoke
Petrol engine produces less noise	Produces more noise
A petrol engine is light in weight and is suitable for light work	Heavy in weight and suited for heavy work.
Petrol engine consumes fuel very fast per minute work done	Diesel engine consumes less fuel per unit work done
Petrol is too expensive to purchase but	More expensive to purchase but

expensive to maintain	maintenance cost is low
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## **KINDS (MODELS) OF INTERNAL COMBUSTION ENGINES**

Depending on the number of cylinders the engine has there are two kinds;

- 1 Two stroke cycle engines
- 2 Four stroke cycle engines

### **2 Stroke cycle engines**

This is an engine in which all the events/strokes are completed in two strokes of the piston. It combines **induction and compression, power and exhaust strokes**

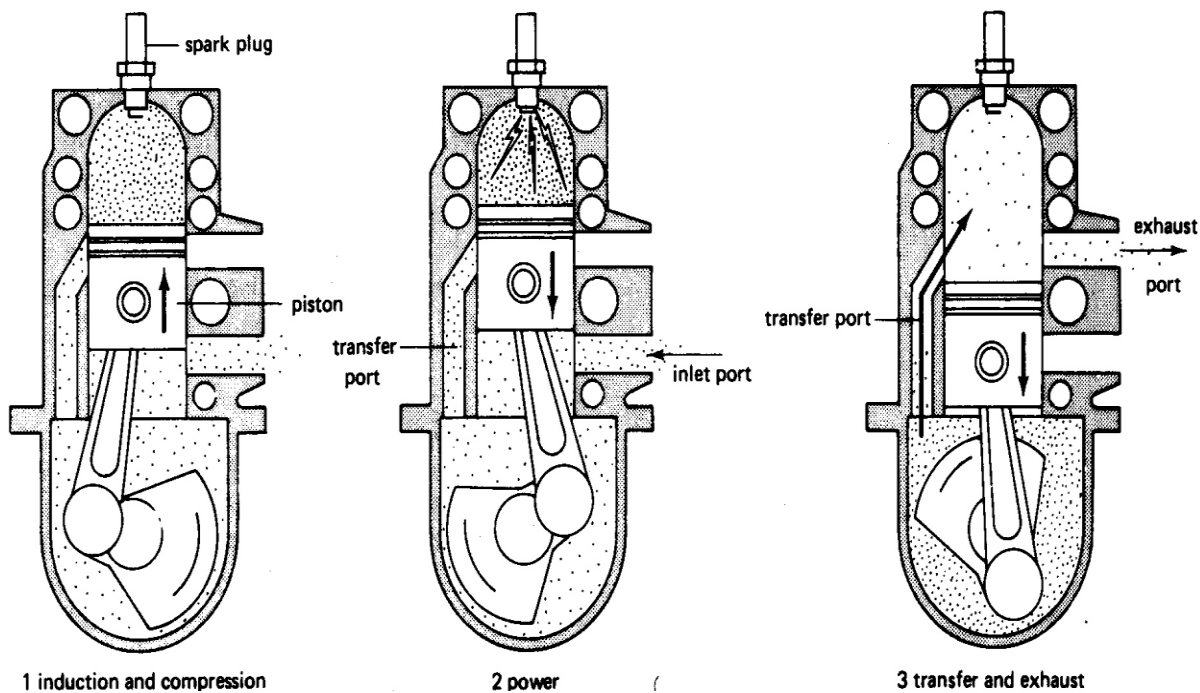
#### **Induction and compression (1<sup>st</sup> stroke)**

- The piston moves up
- Exhaust and transfer ports are closed
- Inlet port is opened
- Fuel air mixture is compressed in the combustion chamber
- Fresh supply of fuel air mixture and oil is allowed into the crank case
- At the end of the stroke, fuel air mixture is ignited

#### **Power exhaust stroke (2<sup>nd</sup> stroke)**

- Inlet port is closed by the piston moving upwards
- Fresh fuel air mixture is trapped in the crank case
- Exhaust and transfer ports are opened
- Exhaust gases are expelled through the exhaust port

## 2 STROKE POWER CYCLE



## 2 STROKE ENGINE CYCLE

the following

- Intake (Induction) stroke
- Compression stroke
- Power / ignition stroke
- Exhaust stroke

### a) Intake (Induction) stroke

#### **Petrol engine**

- The air fuel mixture is drawn into the cylinder through the inlet valve
- The piston moves down the bottom dead centre as initiated by the movement of the crank shaft.
- At this time the exhaust valve is closed.

#### **Diesel engine**

- The air is drawn into the cylinder through the inlet valve

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- The piston moves down the bottom dead centre as initiated by the movement of the crank shaft.
- At this time the exhaust valve is closed.

**b) Compression stroke**

**Petrol engine**

- The piston moves up to compress fuel air mixture
- Inlet and exhaust valves are closed

**Diesel engine**

- The piston moves up to compress air
- Inlet and exhaust valves are closed

**c) Power**

**Petrol engine**

- Inlet and exhaust valves are closed
- A spark is introduced into the cylinder by the spark plug to ignite compressed fuel air mixture
- Burnt gases expand and force the piston down wards

**Diesel engine**

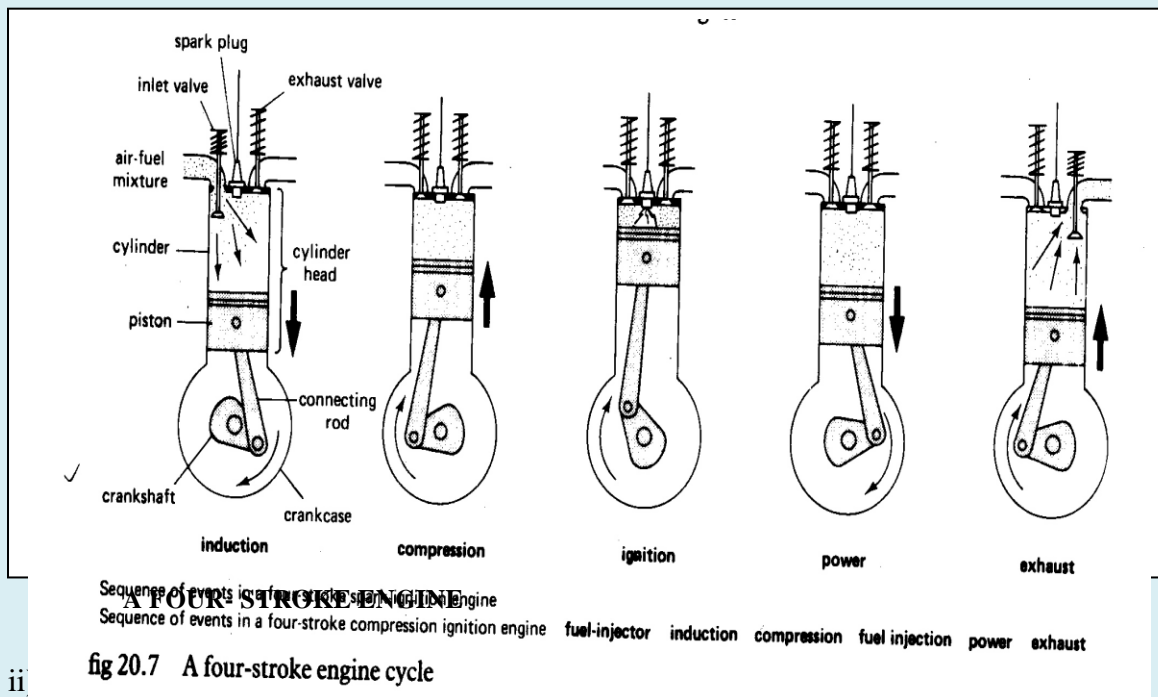
- Inlet and exhaust valves are closed
- A jet of diesel is introduced into the cylinder by the injector nozzle to be ignited by hot compressed air
- Burnt gases expand and force the piston down wards

**d) Exhaust**

**For diesel and petrol engines**

- Exhaust valve is opened to allow exhaust gasses out
- Inlet valve is closed
- Piston moves up to expel burnt gasses





### Advantages of using a 4 stroke engine

- i) They produce a lot of power and therefore

- ii)
- iii) Exhaust gasses are sufficiently expelled from the cylinder reducing pollution
- iv) They are efficiently cooled with water
- v) They have heavier crank that absorbs the vibration of the engine.
- vi) They perform a wide range of farm operations.

### Disadvantages

- i) Initial costs buying the engine are very high
- ii) They are very expensive to maintain
- iii) They need very skilled operators and support services e.g. servicing, repairing and installing spares
- iv) Their use is limited to flat areas

### Advantages of a two stroke engine

- i) They are cheap to buy and easy to maintain
- ii) They use little fuel
- iii) They do small jobs which cannot be done by 4 stroke engines
- iv) They can be used in a wide range of farm land e.g. in hilly areas.

### Disadvantages

- i) They produce low power therefore cannot do heavy work.
- ii) They are insufficient in oil and fuel utilization.
- iii) They are mainly air cooled thus limited in size.
- iv) They are slow and cannot satisfactorily operate under fluctuating loads

### **Firing order**

This is the order/sequence in which the power stroke occurs in a multi cylinder engine. The order of cylinders firing minimizes stress on the crankshaft. A 4 cylinder engine would have any of the following firing orders. **1,2,3,4** or **1,3,4,2**, and **1,2,4,3**

### **Compression ratio**

Not all air in the combustion chamber is compressed but some remains. The ratio of the total air in the cylinder and that which is compressed is called compression ratio.

In petrol engines it ranges from 5:1- 8:1 and in diesel engines 14:1-20:1. Diesel engines are therefore more efficient and economical than petrol engines.

## **ENGINE SYSTEMS**

Internal combustion engines have a number of interrelated functions each of which have to work efficiently. The engine systems of a tractor include ;

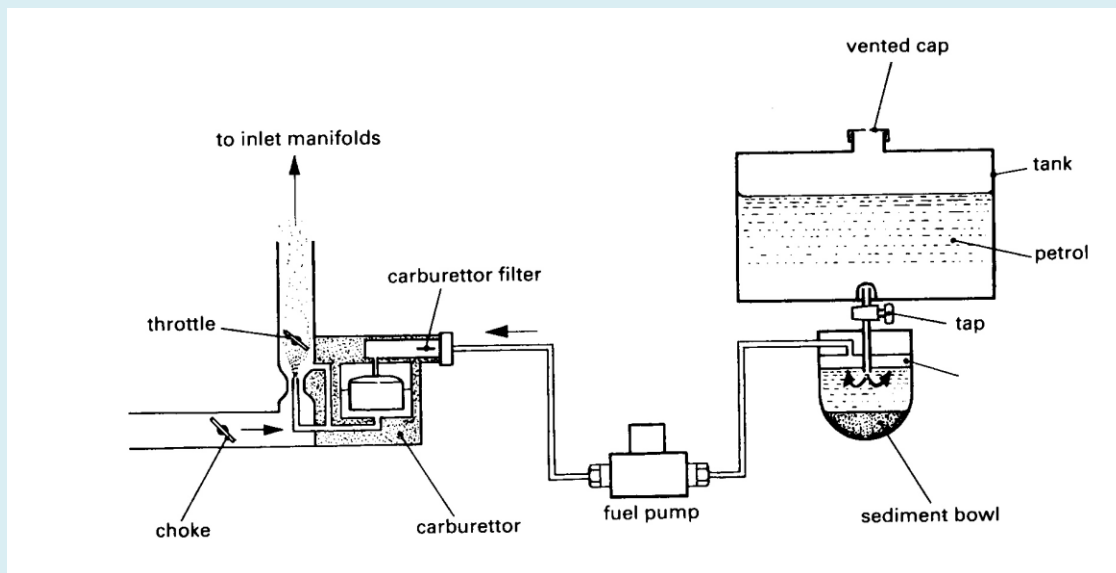
- Air and fuel system.
- Cooling system
- Lubrication system
- Electrical system
- Transmission system

### **1. THE AIR AND FUEL SYSTEM**

The commonest fuels used in farm engines are petrol and diesel. Diesel has almost replaced other petrol engine as the power unit of the farm tractor .why; diesel has high power output compared to petrol.

Although the diesel engine is more expensive to buy and maintain the advantages of compression ignition will quickly compensate this high costs.

A) **Fuel system in a petrol engine**



**PETROL FUEL SYSTEM** The system is to store and supply the engine with clean fuel in correct ratio over a wide range of engine speed and load.

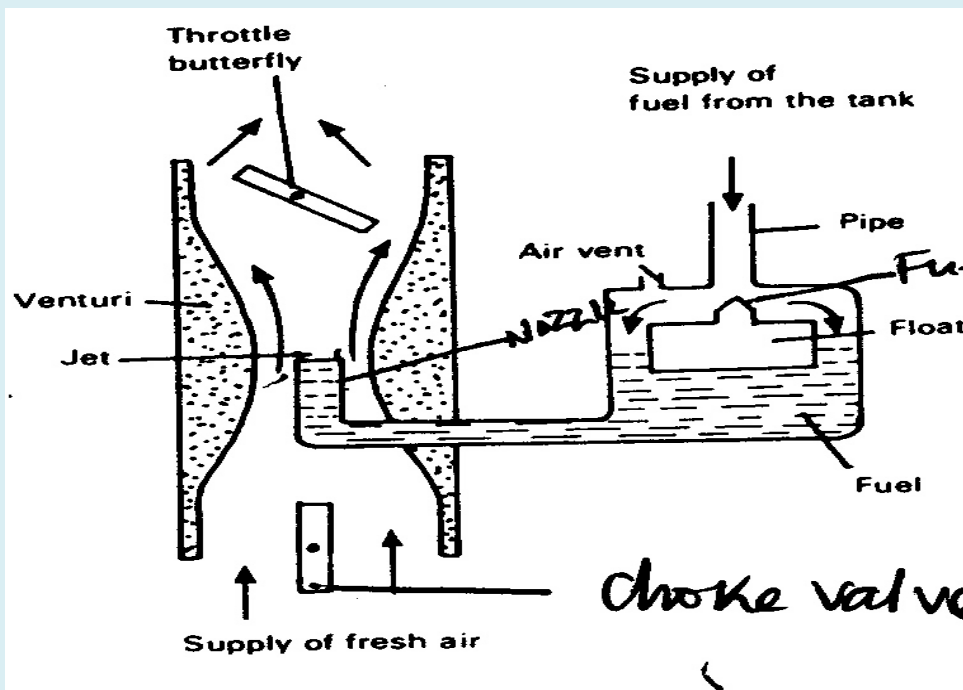
The fuel air ratio is normally 14:6:1 it's for every one part of petrol of air. But by native it contains more than a part of petrol in 14:6 parts of air, therefore it's called a rich mixture.

**The carburetor**

This performs two main factors;

- i) It maintains fuel air mixture under all operational conditions.
- ii) It breaks the fuel dropouts into fine mist to be carried into the cylinder by a stream of air. This is called atomization.

Diagram of a carburettor



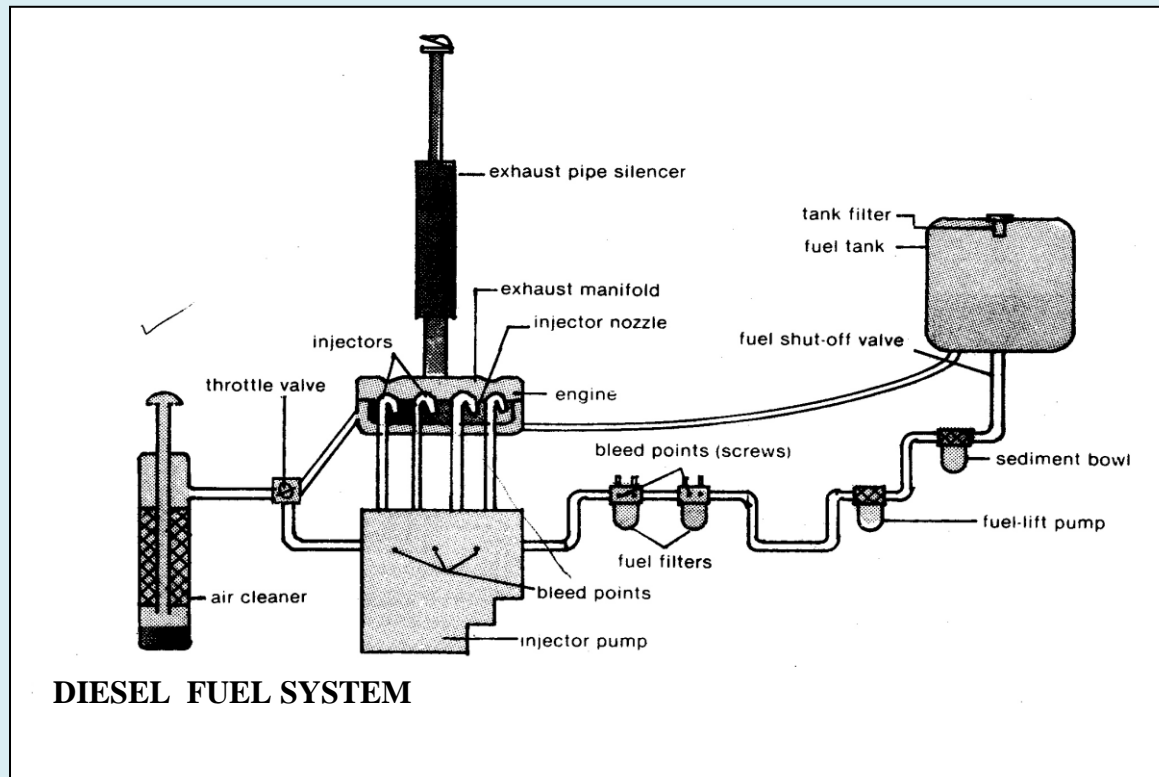
## CARBURETTOR

### Working of a carburettor in petrol fuel system

- During the inlet stroke, a fuel air mixture is drawn into the cylinder.
- The petrol leaves the fuel tank through the fuel inlet pipe situated at the base of the tank.
- It's then filtered by the fuel filter and enters the float chambers by way of the needle valve or **fuel intake valve** on the carburettor.
- The **float** has the function of maintaining a constant level of fuel in the float chamber.
- From the bottom of the **float chamber**, fuel is fed through a jet **discharge tube/ nozzle** to the venturi.
- When the engine is running the downward movement of the piston in the induction stroke causes suction pressure in the cylinders.
- The result is that air rushes in and passes through the choke valve to the venturi which mixes fuel with the air.
- The fuel air mixture which is in vapour form enters the cylinder through the throttle / butter fly valve.
- The **choke valve** (strangler) controls the air supply to the carburettor and is normally closed when starting the engine to enrich the fuel mixture.

- The **throttle/butterfly** valve helps to adjust the quantity of fuel air mixture going to the combustion chamber hence controlling the speed and power generated by the engine. This valve in turn is connected to the accelerator.

## FUEL SYSTEM IN THE DIESEL ENGINE.



### Description

The fuel flows from the **tank** situated above the engine that acts as storage. The fuel tap should always be left open to prevent an **air lock** forming in the system.

The flow of

diesel from the tank may be by **gravity** or by **lift pump**. All petrol engines in a tractor usually rely on gravity flow to the engine but in the case of diesel engine by use of lift pump provides fuel at a constant pressure to the **injector pump**

The lift pump is operated by the means **cams** on the **camshaft** so that it pumps continuously as long as the engine is running.

### Priming lever

This is a manually controlled button which is used to supply fuel when starting the engine or when removing an air lock.

### Fuel filter

Some tractors have two filters for cleaning the fuel as it moves from the fuel tank to the inject plump.

### **Injector Pump**

This is a very important and expensive part of the diesel engine. It must deliver fuel accurately and in small quantities to the injector nozzles. it **atomizes** diesel fuel

### **Injectors/ injector nozzles**

Their work is to inject into the cylinder small quantities of fuel. The amount of fuel injected controls the engines speed.

### **Leak off pipe**

This returns any over flow of fuel back to the tank for recirculation.

### **Governor**

It controls the speed of a diesel engine by regulating fuel supply once the speed is beyond a certain level. This will prevent damages and also helps to maintain speed for any particular machine that the engine may be driving.

### **Maintenance of fuel systems;**

- i) Fuel Filters need regular replacement for every service
- ii) here try to follow manufactures instructions during use
- iii) The sediment bowl should be cleaned regularly to remove dirt
- iv) Bleed the system to get rid of trapped air /air lock for diesel engines
- v) Ensure that the fuel tank cap is tightly placed to avoid spillage of fuel
- vi) Tighten the pipes of injector and fuel delivery tube to reduce fuel loss
- vii) Use the correct type of fuel for the engine always
- viii) Always use clean fuel from a reliable source so that the system is not blocked
- ix) Seal off all the leakages in the system to reduce fuel loss
- x) The injector pump or carburettor should be cleaned regularly by removing dirt

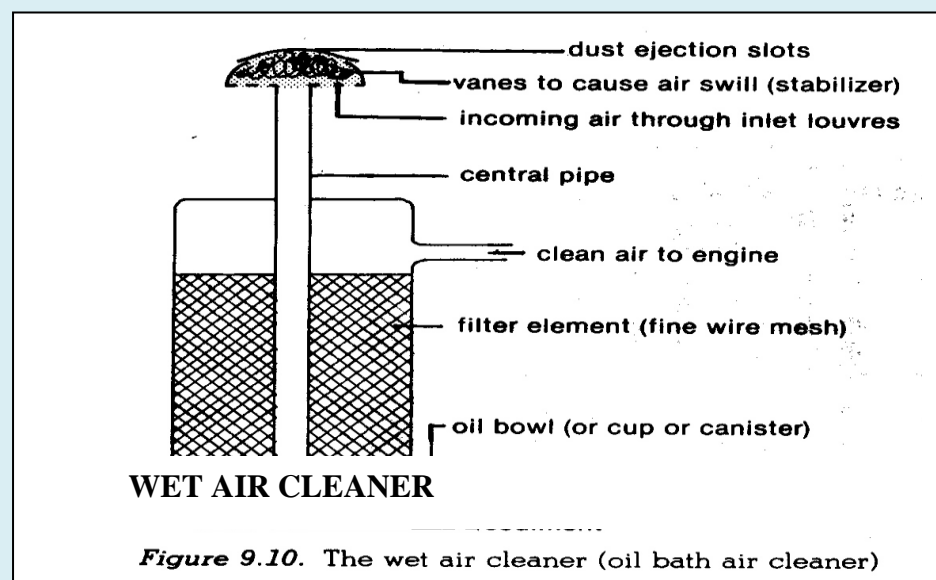
### **Air supply system**

- a) The air supply system is similar in both petrol and diesel engines. Clean filtered air is drawn into the cylinder during the induction stroke.
- b) During the course of operation, tractors and other machines used for farm work suck in quite a lot of air which may contain a large proportion of dirt.

- c) Whether an engine uses petrol or diesel as fuel, an air cleaner is an essential component of a complete fuel system.
- d) An air cleaner does its job of preventing dust, dirt and other foreign particles from entering the engine.
- e) Air must be cleaned because dust, sand particles and other similar materials can cause rapid wear of valves, pistons, cylinders and all rings
- f) There are also rapid build up of carbon in the combustion chamber and on the valves. This carbon will glow red hot thus affecting the running of the engine.
- g) Two types of air cleaners are used and both types are capable of removing up to 95% of the harmful particles from the air that enters the engine.

a) **Wet type/oil bath air cleaner**

This type is very popular because it can be fully cleaned and serviced regularly moreover cheaply because only new oil is needed during servicing.



### **Description/ mechanism of operation**

- i. The dirt laden (heavy) air enters the **pre cleaner** where it meets the vanes that cause swirling.
- ii. The swirling helps to throw out the dust particles through the dust **ejection slots** on top of the pre-cleaner. These particles may include leaves, insect and other big particles.
- iii. Air passes rapidly down the **stack/ central pipe** to the **oil bowl/cup/canister** container carrying the lighter dirt.
- iv. Much of the lighter dirt gets stuck in the **oil bath** as air passes through it
- v. From the oil bath, air passes through the **wire gauze** (filter element) which traps any dirt that may have escaped the oil bath
- vi. Apart from the cleaning effect, the filter element dries the air and prevents any oil from reaching the engine.
- vii. Finally, clean air goes through the outlet to the engine cylinders.

### **Care and service of the oil bath air cleaner**

1. Under normal working conditions the oil bath cleaner should be checked weekly.
2. If there is more than  $\frac{1}{2}$  cm of dust in the oil bath then it should be cleaned out and refilled with fresh clean oil.
3. If a tractor is working in very dirty or dusty conditions then the oil bath should be checked daily for the thickness of dirt.
4. Periodically the wire mesh should be thoroughly washed in paraffin to remove trapped dirt.
5. Use the recommended type of oil for the bath that is able to trap dirt
6. Sediment bowl should be washed regularly to remove dirt

#### **b) Dry type Air cleaner**

This type does not contain an oil bath but a replaceable element made of wash paper material.

This must be changed when it becomes dogged with dirt. But the changing interval will depend on the conditions in which the tractor is operating.

Some tractors have a visual check monitor fitted on the engine induction system to warn the driver when the filter is becoming clogged. It can be cleaned by tapping it gently with the palm of the hand or by blowing compressed air through it in a normal air flow direction.

### **Mechanism of operation**

1. An air current is created when the tractor is in motion
2. air is drawn into the dry air cleaner
3. the dry paper on the cleaner removes dirt from air
4. the air current inside the container is forced to swirl



5. air enters the dry paper filter
6. dust particles are filtered out by the paper
7. clean air passes through the manifold to the combustion chambers

### **Maintenance of dry air filter**

- Regularly blow out dust and dirt using compressed pressure
- Do not wet the paper with water

## **THE COOLING SYSTEM**

This system gets rid off excess heat produced in the engine. A lot of heat is produced in a tractor when fuel is burnt to be turned into a useful work. Most is passed out with exhaust gasses and the remaining is reduced by the cooling system.

### **Importance of the cooling system**

- i) It removes excess heat thus preventing over heating of the engine.
- ii) Reduces damage to the engine i.e. engine cracking.
- iii) It controls the temperature of the engine within specific range for its proper operation.

### **Problems of engine overheating**

- i) It leads to expansion of engine parts thus distorting the shape which leads to gas leakage, loss of power, valve burning and even cracking of the cylinder head (engine knock).
- ii) There is high fuel consumption
- iii) It leads to pre ignition i.e. some of the parts of the cylinder surface may become hot enough to ignite the fuel reducing fuel efficiency.
- iv) It leads to dilution and contamination of lubricating oil.
- v) can cause burning of the engine

## **TYPES OF COOLING SYSTEMS**

There are two types of cooling systems.

- 1 Combined water and air cooling system.
- 2 Air cooling system.

Most machines are water cooled especially heavy machinery only few are air cooled.

### **Combined Water and air cooling system;**

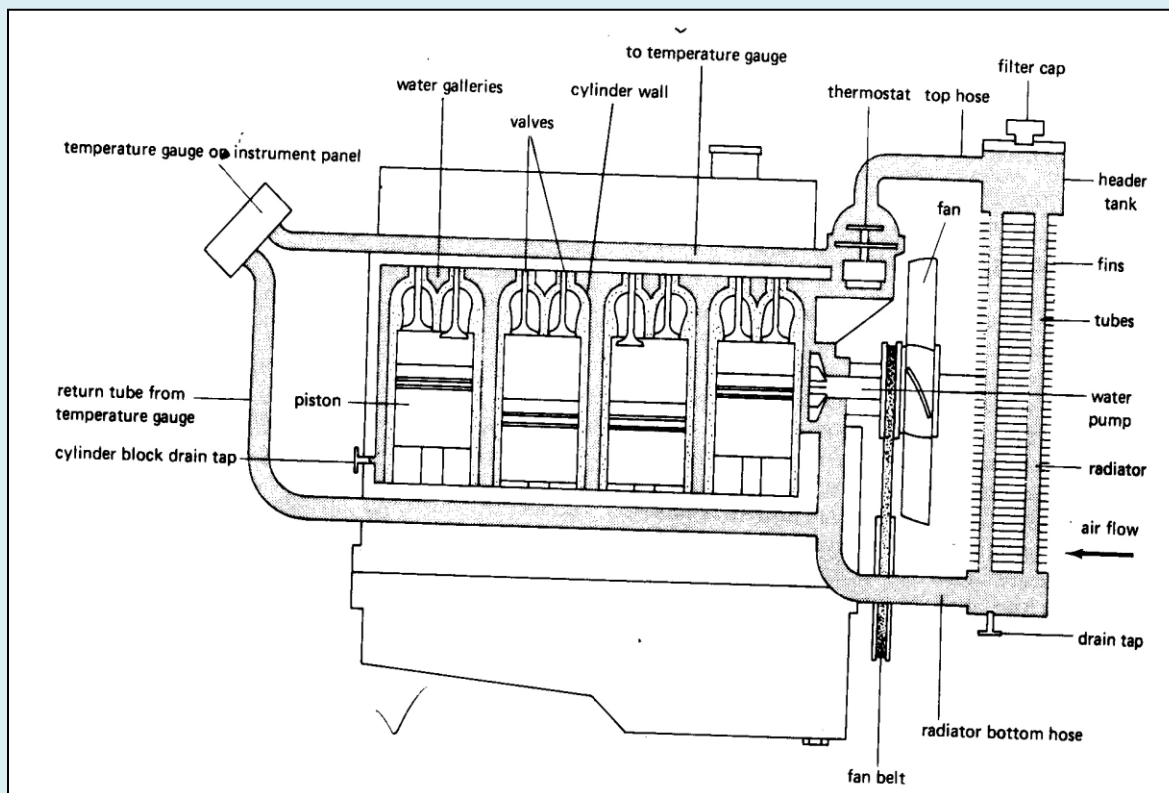
It uses cool water to saturate round the engines while air takes away excess heat from the hot water. Water as a coolant has the following advantages;

- i) It absorbs heat at a reasonable rate.
- ii) It saturates freely at a big range of temperatures because of having a low freezing point.
- iii) It's readily available every where.

However, water can cause rusting of the radiator parts more especially the water jackets

The major components of this system are radiator fins, H<sub>2</sub>O hoses, cap, water pump/ impeller, water jackets, and fan and thermostat.

### **WORKING OF THE COMBINED WATER AND AIR COOLING SYSTEM**



- i) When the engine is started by a starter motor a lot of heat is produced

**fig 20.13 The water-cooling system of a tractor**

**Combined air and water cooling system**

- ii) Cool water flows from the bottom tank of the radiator with the help of the water pump, bottom hose pipe into the water jackets in the engine and circulates within the engine block.
- iii) As it circulates, it absorbs heat produced in the engine block and its temperature rises
- iv) When water is heated, it becomes lighter and begins to rise up to the top of the radiator
- v) Rising hot water is replaced by cool water from the radiator being pumped into the water jackets by water pump

- vi) The hot water comes into contact with the thermostat which regulates the temperature of water in the engine between  $(50-90)^{\circ}$
- vii) when the engine is cold, the thermostat valve closes and prevents water circulation into the head tank of the radiator;
- viii) When the temperature runs to  $90^{\circ}\text{C}$  the thermostat valve opens and allows water to go back to the radiator through the top hose pipe for further cooling.
- ix) As the heated water flows to the bottom of the radiator, it is cooled by an air current being blown through the fins by the fan and the cycle continues again.

### **Components and their functions**

#### **i) Radiator**

Water returning from the water jacket is cooled here by use of conventional current. The tubes in the radiator increase the cooling surface.

#### **ii) Water jackets**

This is the area around engine cylinders in which the water circulates. It's connected to the radiator through the bottom and top hose pipes

#### **iii) Water pump**

Pumps cool water from the bottom tank to the engine cylinders

#### **iv) Fan**

Sucks cool air from the out side over the radiator fins to cool hot water

#### **v) Thermostat**

It's an automatic device which regulate engine temperature by controlling circulation of water in the water jackets

#### **vi) Temperature gauge**

It indicates to the driver engine temperature so as to avoid overheating of the engine.

#### **vii) Fins**

They increase the surface area for cooling of water in the radiator

### **Adaptation of the radiator to its factions**

- 1 It has fins which provide large surface area for cooling of water
- 2 It has thin pipes/tubes for easy movement of water from the top horse pipe to the bottom.
- 3 Its made of copper which is a good conductor of heat
- 4 It has a fun which drives away the heat using air it blows.
- 5 it has a water pump that pumps cool water into the water jackets

6      it has a drain tap used to get rid of dirty water in the radiator

### **Maintenance of water cooling system**

- i) Fill the radiator always with clean water before starting a day's work.
- ii) Repair any linkages in the radiator to reduce water loss
- iii) Remove all rubbish from the radiator fins that may reduce cooling surface.
- iv) Remove dirty water from the radiator through the drain tap and should be cleaned thoroughly after 60 hours of work.
- v) A radiator cap should be firmly secured to prevent water spillage
- vi) Ensure that the fan belt is not broken for proper function
- vii) Check the tension of the fan belt i.e. it should neither be too loose nor too tight which can lead to poor performance.
- viii) Water pump should be greased periodically for efficiency
- ix) Hose pipes should be tight to reduce water loss through leakages
- x) The thermostat should be checked to ensure it's in good condition.

### **Advantages of using a combined air and water cooling system**

- Water takes heat away quickly since its in direct contact with cylinder walls
- Water circulates freely between freezing and boiling points
- Water jackets damps down sound of engine
- Engine working temperature can be controlled
- Engine with water cooled system can be fitted in any position of the vehicle

### **Disadvantage**

- Radiator increase the dead weight of the vehicle
- Water boils and evaporates early at 100<sup>0</sup>C
- Radiator fitted in front of the vehicle increases air resistance hence slowing down speed
- Water corrodes metal parts in the cooling system
- Overheating of the engine may result knocking due to carelessness
- Warming up of the engine may be slow leading to cold running which accelerates sludge formation
- Water freezes at zero degrees which is a disadvantage in temperate regions

### **Causes of overheating in engines**

- Leaking radiators
- Leaking water pump
- Choked or leaking hose pipe
- Leaking head tank

- Loose fan belt which fails to blow air for cooling water
- Choked radiator fins
- Rusty water jackets
- Defective thermostat
- Low engine oil level
- Choked air cleaner

### **Air cooling system**

It uses air to circulate round the engine block while carrying away excess heat.

It is used mainly on small engines like water pumps, motor cycle, sprayers etc.

The cylinder end is provided with fins through which heat is lost to the surrounding air.

### **Characteristics of air cooling engines**

- They have a fan and blade usually fitted on the fly wheel to assist in air circulation over the fins
- They are light in weight because they do not need radiator, H<sub>2</sub>O jackets, hoses etc.
- They are of simple construction.

### **Problems of air cooled engines**

- They get hot quickly and use heavy lubricating oils
- It's impossible for them to get adequate cooling under all conditions.

### **Maintenance**

- Remove rubbish and dirt from the fins
- Check the tension of the fan belt

## **LUBRICATING SYSTEM**

Is a system that reduces friction as well as wear and tear of rubbing parts.

### **Functions of a lubricating system**

- It reduces friction by establishing a film of lubricating oil between the moving parts.
- It acts as a cleaning agent i.e. washes off all dirt, soot and dust from metal surfaces.
- It acts as a sealing agent i.e. seals the piston rings and cylinder walls preventing loss of compression.
- It acts as hydraulic fluid.
- It's a cooling agent i.e. carries away heat from working surfaces.
- Prevents rusting of metals.
- Reduces noise as engine parts move against each other.

### **Classification of lubricating oil**

Lubricants are classified according to thickness or viscosity. Viscosity is the measure of ability of lubricants to flow at various temperatures. The classification is based on a numbering system adopted by USA society of automobile engineers (S.A.E).

The numbering system is such that S.A.E<sub>10</sub>, S.A.E<sub>20</sub>, S.A.E<sub>30</sub> and S.A.E<sub>40</sub> are used for fast moving parts of an engine higher number i.e. S.A.E<sub>50</sub>, S.A.E<sub>60</sub>, S.A.E<sub>70</sub>, S.A.E<sub>90</sub>, and S.A.E<sub>140</sub> are for transmission gears where the parts move slowly. Lower numbers indicate lower viscosity oils suitable in cold areas whereas higher numbers suitable for hot areas.

### **Detergent oils**

Certain oils contain additives designed to prevent formation of carbon inside an engine. Such oils are called HD (heavy Duty) and these are usually recommended for diesel engines. If non detergent oil has been used in an engine, care has to be taken before switching to a detergent type of oil as the carbon that may be washed out by the detergent oils may clog the oil ways and filters.

Flush the engine with special flashing oil before switching from a non detergent to a detergent type of oil.

### **Grease**

This is a semi solid combination of petroleum products and soap. Grease is applied through the grease nipples by means of a cylinder pressure greasing gun.



### **Properties of a good Lubricant**

- 1      **Low viscosity** i.e. should have low ability to flow at either high or low temperatures
- 2      **High flash points**  
This is the point at which explosion occurs when a enough vapour has been given off by oil after which the vapour ignites
- 3      **Ability to pour**  
This is the lowest temperature at which oil will flow freely i.e. low pour point is required
- 4      **Good body**  
Should be thick enough to prevent contact between two moving parts
- 5      **Good film strength** i.e. should be able to resist pressure.
- 6      **Detergents quality**  
It should have a substance which have cleaning properties
- 7      **Oiliness**  
It should be smooth and slippery.

### **Sources of oil contamination**

- Dust which passes the air cleaner and crank case breather
- Products of combustion like water and carbon
- Products of compression e.g. acids on metallic parts.
- Unburnt fuel due to uncompleted combustion.
- Metallic particles as a result of engine wear and tear
- Moisture produced as a result of condensation
- Acids which are formed when oil decomposes.

### **Changing engine oil**

#### **Procedures**

- i) Clean the area around the dipstick, withdraw the dipstick from the sump and clean it with white paper.
- ii) Replace the dipstick in the position, withdraw it again.
- iii) Hold it almost horizontally and take the reading at the level to find out the oil level in the sump.

- iv) If the level is at a low mark, more oil should be added.
- v) Examine the conditions of oil and if the oil has become very dark or thick it is necessary to drain the sump and replace the oil.

## **LUBRICATION SYSTEMS**

- 1 Flash system
- 2 Internal force feed
- 3 Oil mist system

### **Oil Mist system**

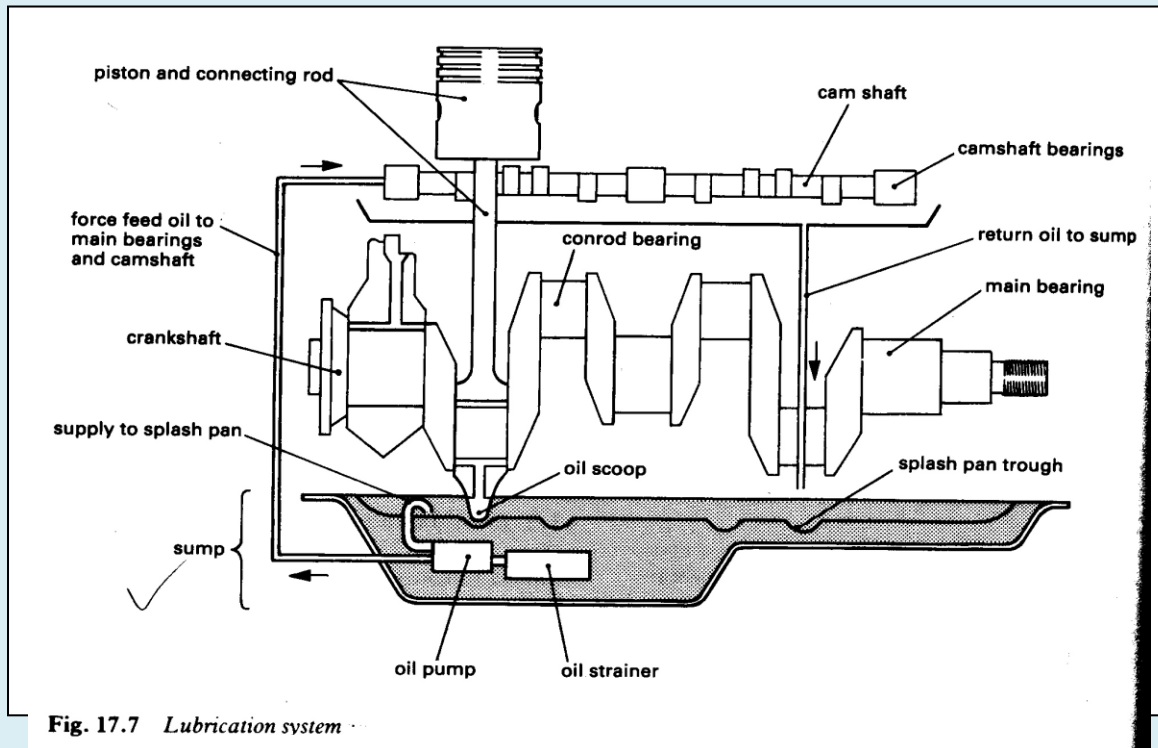
This is known as petrol lubrication and is specifically used for small 2 stroke cycle engine. The system involves mixing oil with petrol in proportions of 16:1.

Lubrication occurs as part of engine operations. The cranks case of this type of engine must be drained periodically to prevent build up of oil in order to lower the difficulties involved in starting the engine.

## Flash system

The lubricating oil is splashed over the moving parts by an extension (tube) on the big end bearing cap of the crankshaft. the system does not have an oil pumps

## Force feed lubrication system;



a) Most modern tractors use the system and the main components include oil pump,

**FORCED FEED LUBRICATION SYSTEM**  
oil filter, oil strainer and oil ways.

- b) Oil which is stored in the oil sump is drawn by the oil pump through the strainer and than pumped to the oil ways and other bearing surfaces such as crankshaft, cylinders, camshaft values and pistons.
- c) It circulates around the engine through the oil ways under pressure maintained by the **oil pump** that derives power from the **camshaft**
- d) After circulating around the engine, it drips back into the sump and the cycle continues
- e) Continuous circulation make the oil dirty reduces in volume. This can be checked using a dip stick that is inserted in the oil sump

## Functions of the main parts

- 1 Oil sump  
It stores oil
- 2 Strainer

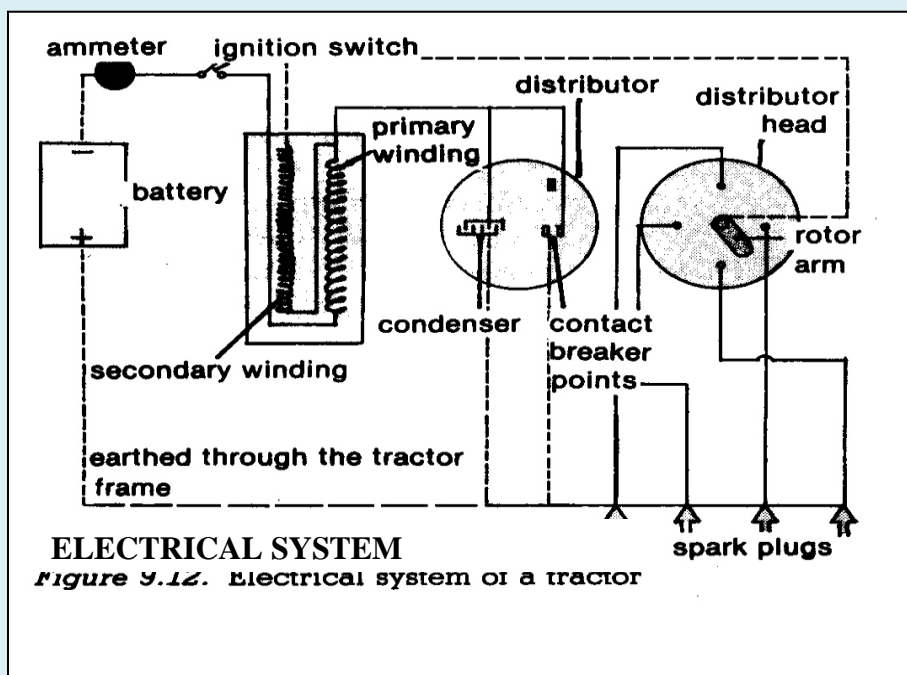
Ensures that clean oil is taken by the oil pump by removing dirt

- 3 Oil pump  
This is driven by the camshaft and ensures oil is distributed to all parts of the engine.
- 4 Oil filter  
Ensures oil is cleaned again before it's supplied to bearing and oil ways.
- 5 Oil ways  
These are pathways that assist in the distribution of oil to all different parts of the engine.

### **Maintenance**

- 1 Check the level of the oil with a dipstick daily. If it is below the recommended level fill it up to the mark of the dipstick.
- 2 Change engine oil periodically according to manufactures instructions
- 3 Use the correct grade of oil for the engine.
- 4 Change the oil filter at every change of oil.
- 5 Clean the crank case breather as directed by the manufactures.
- 6 Drain the oil when it's still hot to avoid it sticking on the walls of the sump.
- 7 Avoid using contaminated or old oil in the engine

### **ELECTRICAL SYSTEM:**

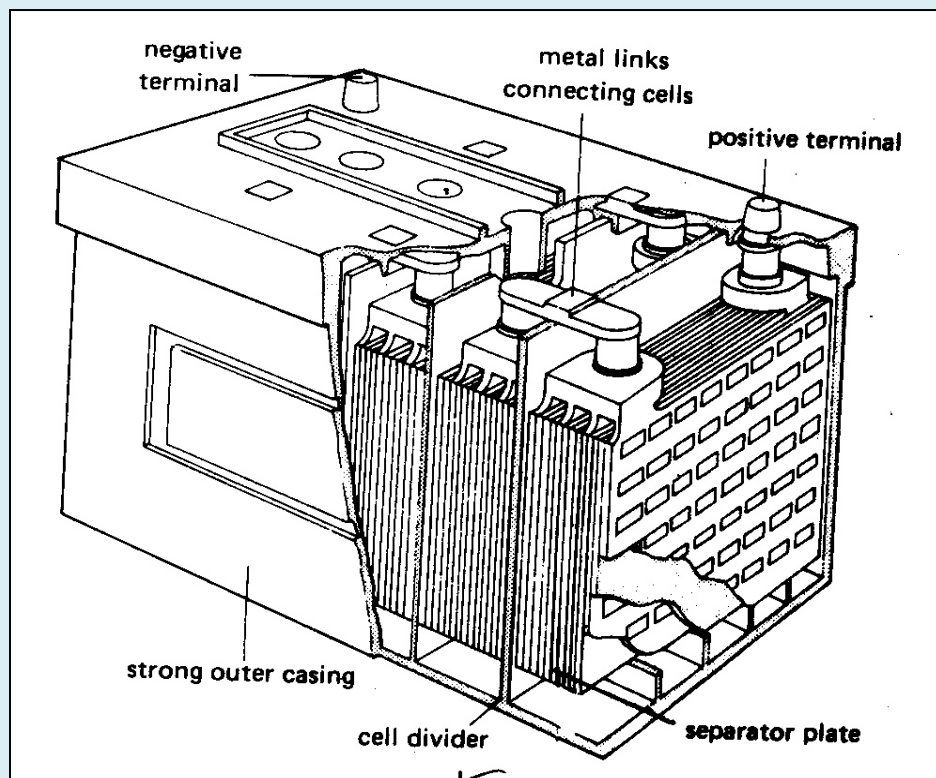


This is a system that provides electric current for igniting fuel air mixture in a petrol engine. It also provides current for lighting tractor indicators etc.

The major parts of the electrical systems include the following;

- voltage control box
- Battery
- Starter motor
- Ignition switch
- Induction oil
- Spark plugs
- Connecting wires
- Dynamo
- distributor

**Battery**; it's made up of bakelite; it has the following components; lead plates, concentrated sulphuric acid, terminals, vent holes and distilled water.



**fig 20.14 A lead-acid battery**

#### Functions

- 1 It stores electricity (6-12V)
- 2 It provides current used for igniting fuel mixture in a petrol engine.
- 3 It provides current for lighting in vehicles.

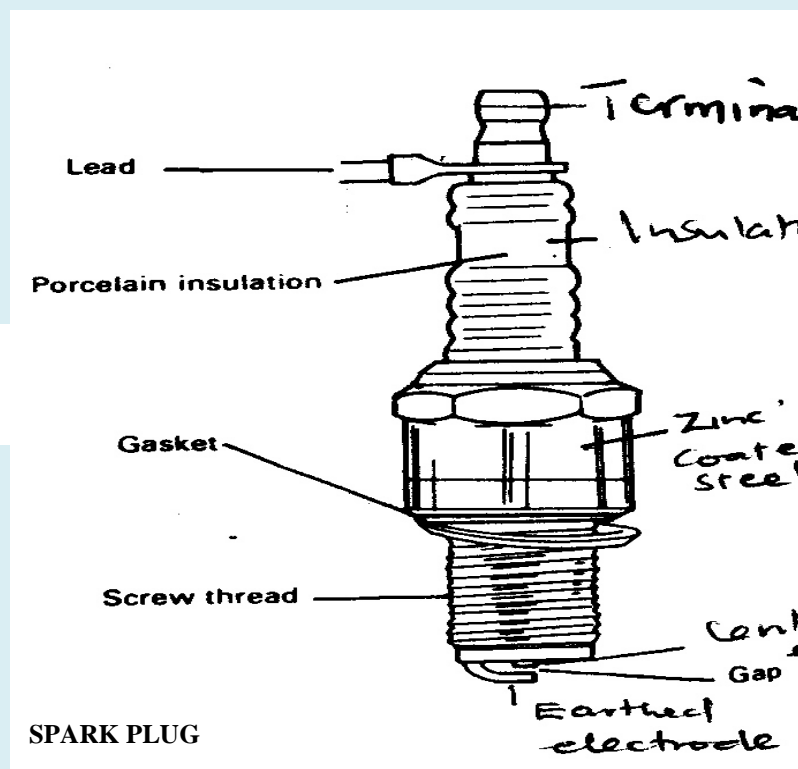
#### Care and maintenance of the battery

- i) Check and if necessary correct the level of the electrolyte if it is low add distilled H<sub>2</sub>O up to required level.

- ii) Ensure that the battery is firmly secure (fixed) onto the tractor to prevent splashing of the electrolyte due to the engine vibrations.
- iii) Keep the casing and terminals of the battery clean and dry by using petroleum jelly and a wire brush to clean.
- iv) Keep the ventilation holes free from blockage allow easy escape of gases from the battery.
- v) Grease terminals to avoid corrosion.
- vi) Empty the battery and Keep it up side down when not in use.
- vii) Place the battery on an insulator or wood but not directly on the ground to avoid power loss once out side the tractor.
- viii) Replace all the acid with new conc acid when power reduces.
- ix) Never bring naked flame near the battery
- x) Battery cable should remain clipped up with chassis since loose cables may get their insulation peeled off due to engine vibrations

### Sparking device

The major sparking device is the spark plug. It's made up of special alloys of steel, chromium and nickel. Chromium is important in that it allows the spark plug to withstand high temperature.



### Functions

It provides a spark necessary for ignition of compressed fuel/ air mixture in petrol engines

Ignition in a petrol engine takes place with aid of a spark plug. It's always fixed on the combustion chamber. A spark plug has electrodes between which a spark is transmitted. One electrode is on the body of the spark plug and it's earthed

The second one which receives high voltage is in the centre of the spark plug, its connection passes through a direct resistant insulator.

A spark plug has an open air gap of 0.0012-0.1cm between two electrodes. It's across the gap that the spark developed is able to jump.

There are two ways in which fuel can be ignited especially in petrol engines.

- 1      **Magneto-ignition;** it occurs in small engines e.g. motor cycles. It generates power by rotating a magnet around a stationary wiring. This creates current due to magnetic influx  
It is this current which is supplied to the spark for ignition of compressed fuel air mixture
- 2      **Battery ignition;** it occurs in big petrol engines and the battery is the sole source of current for ignition

### **Description**

- 1      When the ignition switch is turned on and the engine is turned over by the starter motor.
- 2      Current from the battery flows to the primary circuit creating magnetic field in the primary windings of the induction coil.
- 3      When the contact breaker point is interrupted or is opened by the cam it causes the primary circuit to break.
- 4      This induces a high voltage (7000-10,000) V. in the secondary circuit / winding.
- 5      The current flows through heavily insulated wires to distributor head via the rotor arm which supplies it to each spark plug.
- 6      The high voltage creates a spark across the plug units and the mixture in the cylinder is ignited.
- 7      The engine then starts to run.

### **Summary of electrical system**

Parts	Function	Maintenance
Battery	Stores electricity	- Keep terminals clean on top up electrolyte. - Secure it firmly.
Induction oil	Steps up voltage from 12v-10,000v	- Keep it clean - Secure the connections tightly.
Distributor	- Activates induction oil	- Keep the top clean

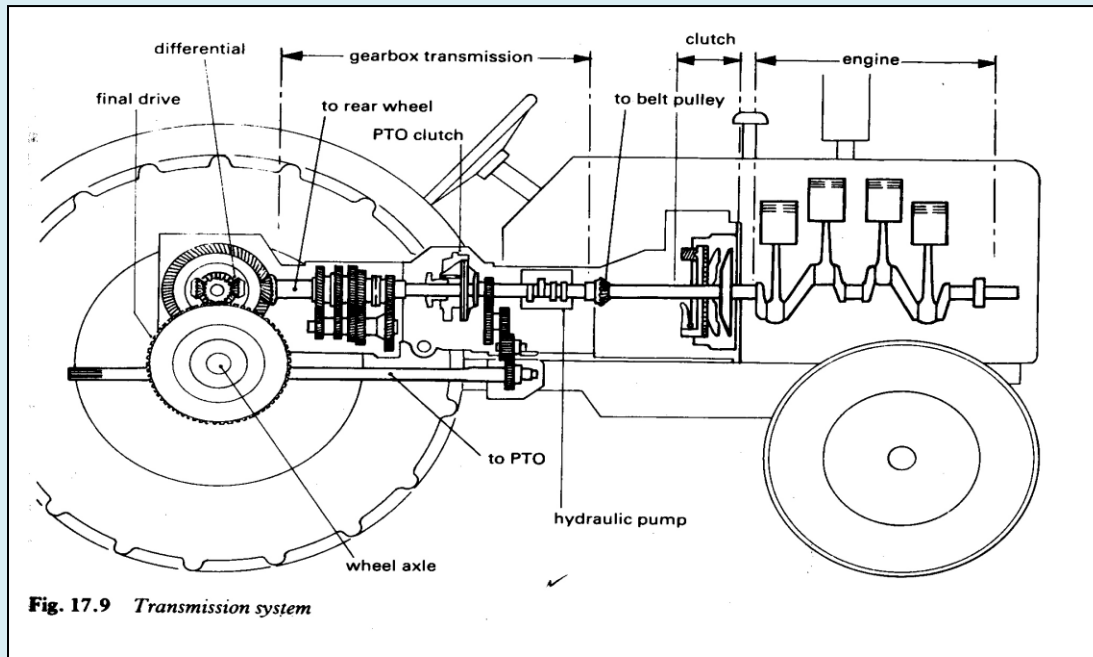
	<ul style="list-style-type: none"> <li>- Distributes electric current to each sparkplug at correct time</li> </ul>	<ul style="list-style-type: none"> <li>- Lubricate under rotor arm every 100hrs of work.</li> <li>- Adjust contacts every 3 days</li> </ul>
Sparkplug	<ul style="list-style-type: none"> <li>- Provides a spark to the ignition chamber</li> </ul>	<ul style="list-style-type: none"> <li>- Clean points at spark terminals using wire brush.</li> <li>- Reset the gaps regularly.</li> <li>-</li> </ul>
Starter motor	<ul style="list-style-type: none"> <li>- Uses electricity from the battery to turn the fly wheel which starts the engine.</li> </ul>	<ul style="list-style-type: none"> <li>- Keep it tightly fixed.</li> <li>- Fit new carbon bushes.</li> <li>- Clean the armature</li> </ul>
Dynamo/generator	<ul style="list-style-type: none"> <li>- Generates electricity for recharging the battery</li> </ul>	<ul style="list-style-type: none"> <li>- Lubricate the bearing using grease every 100 hours of work.</li> <li>- Check tightness of the fan belt within every 200hrs of operation.</li> </ul>
Voltage control box / cut out	<ul style="list-style-type: none"> <li>- Adjust the charge from generator to battery and disconnect it when the engine is not working</li> </ul>	<ul style="list-style-type: none"> <li>- Keep wires clean and tightly fixed.</li> </ul>
Contact breaker point	<ul style="list-style-type: none"> <li>- Stops</li> <li>- Interrupt the flow of current from primary to secondary circuit to raise voltage</li> </ul>	Ensure it is properly fixed

## **TRANSMISSION SYSTEM**

It is the system that transfers power from the engine to rear wheels so that the structure can move or perform some work.



Components of the transmission system include; clutch, gearbox, differential, tyres on the wheels, PTO (Power Take Off shaft)



### 1. Clutch

It is a device used to connect or disconnect the source of power to the rest of the transmission system. It consists of a disc-clutch plate. The clutch plate is aligned on both sides with friction surfaces

and drives other plates when in engaged position. When not engaged, the clutch plate is disengaged from other plates and no transfer of power takes place.

### Factions

- i) It connects or disconnects the engine from the rest of the transmission system.
- ii) It helps to provide power to the PTO
- iii) It helps the operator of the tractor to take off gradually and smoothly.
- iv) It allows the engine motion to be disconnected and connected to the differential and the gear box.
- v) It helps the tractor to be stopped without stopping the engine.

### 2. Gear Box

- i) It allows for selection of different speeds to the differential and the rear wheels.
- ii) Helps the driver to select forward or reverse gear to suit a given operation.
- iii) It enables power from the engines to be moved easily and applied to the work that the driver may be doing.
- iv) It enables the driver to stop the vehicle without suddenly stopping the engine.

### 3. Differential

- i) It changes the direction of the drive to right angles when power is transmitted to rear wheels.
- ii) It adjusts the speed of the engine so that the operation works at a lower speed than the engine speed.
- iii) It enables each of the rear wheels to travel at a different speed when turning a corner.

#### 4. **Wheels and tyres**

- i) They enable the tractor to move forward or backward so that it can do useful work.
- ii) Tyres allow maximum possible grip (traction) because they have a large surface area.

#### 5. **PTO**

- i) It is the part which permits tapping of power from the tractor engine to drive other machines like pumps, mowers and thrusters
- ii) It's a shaft found at the rear of the tractor body which provides power out from the tractor for driving stationary machines.
- iii) It is an extension of the shaft in the gear box.
- iv) It's operated by a separate clutch to make it independent in that it can be disengaged without affecting the forward motion.

Other transmission accessories include breaks, belt pullies, hydraulic system, and these works together with the system.

## **Breaks**

These are basically safety features although on a tractor they can be used for turning a wheel but the most common types are; disc breaks; breaks on a tractor operate independently of each wheel.

## **Tractor tyres and wheels**

Important features of the rear tyres.

- i) They are generally larger and wider in diameter.
- ii) Bars on tyres are arranged in a V pattern to improve grip and self cleaning property.

Important features of front tyres

- iii) They are generally narrow and smaller in diameter
- iv) The tyres are thin.
- v) They have a continuous band of rubber around the tyre to be able to support the weight.

## **Problems of under inflation (low pressure)**

- i) Damages the body of the tyre.
- ii) It tends to crack on the tyre wall.
- iii) reduces the tractor speed
- iv) wastes fuel

## **Problems of over inflation**

- i) Tyre punctures can easily occur
- ii) Loss of traction (grip)

## **Ways of improving traction**

- i) Ballasting the tyres (by adding water and pumping in pressure)
- ii) Use of metallic wheels this increases grip.
- iii) Twining of tyres (use double tyres)
- iv) Adding weights (heavy metal bars on the tractor) to increase stability by lowering the centre of gravity
- v) Reducing pressure of the tyres
- vi) Using 4wheel drive.
- vii) using flat tyres with high grip
- viii) using tyres with big treads

## **Factors that reduce the life span of a tractor tyre**

- i) Over or under inflating the tyres.
- ii) Driving over the sharp objects like nails, glasses and sharp stones exposing tube resulting into loss of pressure.
- iii) Over loading of the tractor beyond their capacity of the tyres
- iv) Pouring less corrosive chemicals on tyres like paraffin, acids.
- v) Careless driving through abrupt breaking and sliding over glasses that may cause tearing.
- vi) Increased/long hrs of operation increasing wear and tear of tyres.
- vii) Nature of the surface on which they are driven. Driving on rough surface increases wearing out of the tyres.
- viii) Quality of the tyres i.e. poor quality tyres wears out faster as they are made from poor quality material unlike those of good quality.

### **Daily Serving points of the tractor**

- i) Make sure the fuel tank is filled with the correct fuel reduce time wastage during work as a result of refilling.
- ii) Check the level of water in the radiator and fill with clean water if necessary.
- iii) Check on the tension of the fan belt and if not tight, it should be tightened for efficiency in the cooling system.
- iv) Clean fuel filter bowl to remove dirt.
- v) Check on the level of oil using a dipstick and add fresh oil if necessary.
- vi) Check on the battery to know the strength of electrolyte
- vii) Grease all greasing points using a greasing gun
- viii) Make sure that the tyres have the correct pressure.
- ix) Check on nuts and bolts and ensure that are tight prevent accidents.
- x) Run the tractor to check on break system and hydraulics before work.
- xi) Check on the oil level in air cleaner and top up if necessary.

### **TILLAGE IMPLEMENTS**

Tillage refers to cultivation (Ploughing) of soil

#### **Reasons for initial tillage (primary tillage)**

- i) Provides a good seed bed for proper seed germination and growth.
- ii) To provide sufficient depth of soil for good water percolation and retention.
- iii) To destroy insect pest, eggs and their breeding places

- iv) Control soil erosion as there is more water infiltration
- v) To kill weeds that is already in the field.
- vi) It breaks the hard soil surface to encourage proper establishment of the crops.

### **Types of tillage implements**

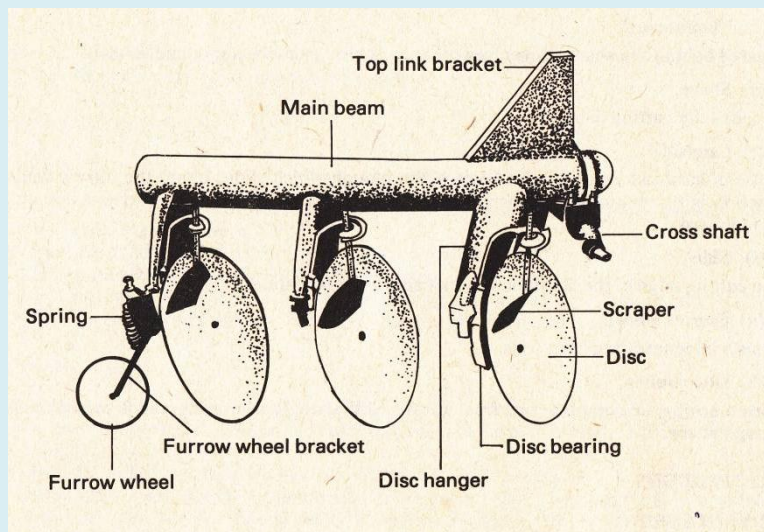
There are two types i.e. primary and secondary tillage implements.

### **Primary tillage implements**

These are mainly implements used for opening up land through bush clearing and first ploughing.

They are usually heavy and deep cultivating implements. They include disc ploughs, tractor mould board ploughs, ox-mould board plough subsoilers, rotary cultivators and chisel ploughs.

### **Disc plough**



### **Functions of parts**

#### **1 Beam;**

It supports the whole implement and provides attachment unit for all parts of the plough.

#### **2 Disc;**

They are connected to the beam by disc hangers and they cut, turn and invert furrow slice.

#### **3 Disc hangers;**

They support the discs and provide room for disc bearings

#### **4 Bearings;**

They facilitate the rotary motion of discs

**5 Scrappers**

They keep the discs clean by scraping soil that sticks on them. They also help in inverting furrow slices.

**6 Furrow wheel;**

Balances the plough in a steady condition during ploughing, it also determines the level of ploughing.

**7 Cross shaft;**

This is for attaching the plough to the tractor.

**8 Top link bracket**

Together with the cross shaft mount the plough on to the tractor

**Hitching a disc plough on a three point linkage of the tractor**

1. Start the engine of the tractor so that it can be moved near the implement and ensure that the hydraulic system is working
2. Reverse the tractor so that the linkage arms on the tractor are aligned correctly with the disc plough top link
3. Fix the left linkage point of the implement on to the attachment arm of the tractor
4. Fix the top linkage point of the implement on the tractor
5. Lastly, fix the right linkage on to the tractor
6. Use the adjustment gear to lower or raise the right linkage on the tractor so that it is well aligned with the implement
7. Fix bolts and nuts and tighten it using the required spanner
8. Carry out proper adjustments of the discs for proper ploughing in depth and width

**Advantages of using a disc plough**

- i) Its faster at doing work
- ii) Its discs ride over obstacles without damage due to their rolling action.
- iii) It can be used in hard dry soils which are too difficult for the mould board ploughs.
- iv) It works well in both light and sticky soils.
- v) It has low maintenance cost especially replacement of parts because most parts take long to be worn-out.
- vi) It has a poor ability to cover trash, which is a good condition for soil and water conservation.
- vii) It requires less tractor pull power as compared to mould board ploughs.
- viii) It has got a heavy beam which allows for deep ploughing.

## **Disadvantages**

- i) Does not cover trash properly which call for secondary cultivation increasing costs for cultivation.
- ii) Leaves the land or field rough calling for second ploughing.
- iii) It's heavier than the mould board ploughs thus requiring a high HP (horse power) tractor.

NB: Disc ploughs are used for

- i) Deep ploughing
- ii) Opening virgin land
- iii) Construction in water conservation practices.
- iv) Cultivation of loose soils

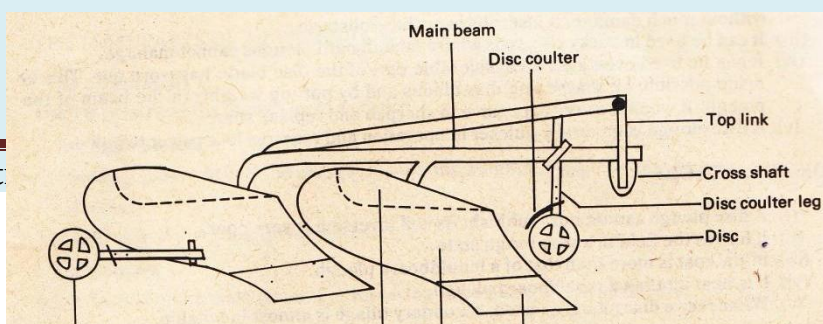
## **Care and maintenance**

- i) Lubricate the bearing regularly to facilitate proper rolling of the discs
- ii) Check regularly and tighten loose bolts and nuts to reduce loss of parts.
- iii) Clean the discs every after work to reduce rusting.
- iv) Repair damaged parts and replace worn out ones regularly to reduce further damage and improve efficiency.
- v) Smear the implement with oil to prevent rusting when not in use.

## **Reasons for poor disc plough penetration / ploughing**

- i) Bluntness of the cutting edge
- ii) Low Weight of the implement that cannot plough deep.
- iii) Poor adjustment of furrow wheel will not facilitate good cutting depth.
- iv) Inefficient hydraulic system which fails to lower the plough properly
- v) poor hitching of the implement making it difficult to achieve deep ploughing
- vi) driving the implement faster so that it cannot easily achieve the required level of ploughing
- vii) poor adjustments of the discs before ploughing reducing width and depth of ploughing
- viii) faulty disc scrappers that fail to remove soil and trash on the discs for efficiency
- ix) use of low power tractors that may fail to provide adequate pull for the implement during work

## **a) Tractor Mould board plough**

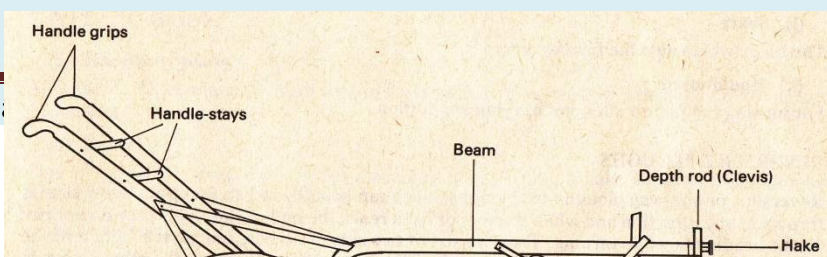




### Comparison between a mould board plough and disc plough

Disc	Mould board
<ul style="list-style-type: none"> <li>- Has disc that can rotate during ploughing</li> <li>- Disc cuts furrow slice but does not bury trash completely</li> <li>- Can ride over buried obstacles hence cannot be easily broken.</li> <li>- Can operate well in heavy sticky soils.</li> <li>- Can plough places with a lot of trash.</li> <li>- Has low maintenances costs since the disc blades are durable and do not require sharpening.</li> <li>- Requires less tractor pull for the implement.</li> <li>- Produce a rough field that requires secondary cultivation.</li> </ul>	<ul style="list-style-type: none"> <li>- Has a rigid mould board that cannot rotate</li> <li>- Cuts, inverts and buries trash completely</li> <li>- Very rigid hence cannot ride over buried obstacles therefore can easily break</li> <li>- Cannot easily work in heavy and sticky clay soils.</li> <li>- Does not plough easily in places with a lot of trash.</li> <li>- High maintenance cost due to frequent sharpening and repairing shares.</li> <li>- Requires more tractor power for pulling the implement.</li> <li>- Produces a fairly smooth field that may not require secondary cultivation.</li> </ul>

### b) Ox Mould Board plough (ox-drawn)





- 1      Beam;  
It holds other parts of the plough.
- 2      Mould board;  
Inverts the furrow slices and covers the vegetative materials
- 3      Share;  
It cuts the furrow slices and passes it to the mould board.
- 4      Land side;  
Presses against the furrow wall to separate furrow slices from un ploughed land and make the plough stable during ploughing.
- 5      Frog;  
It connects all parts of the mould board plough to the main frame.
- 6      Disc coulter;(for tractor mould board)  
It's a disc mounted above the plough. It makes a vertical cut separating the furrow slice from the unploughed land..
- 7      Land wheel (depth wheel);  
It helps to regulate the depth of ploughing and enables the operator to gauge a furrow slice within a reasonable distance from the previous furrow line.
- 8      Depth rod;  
It is used for Adjusting width and depth of operation.
- 9      Hake;

It provides an attachment on the beam for fixing the parts of the plough which are adjusted before and during ploughing.

- 10     Link;  
       It's for linking the plough onto chain pulled by oxen.
- 11     Handle braces;  
       They stabilize the plough.

### **Advantages of mould board plough**

- i)     It completely inverts the soil bringing up fresh soil to the surface.
- ii)    Planting can be done after first ploughing without the need for secondary cultivation.
- iii)   It buries surface trash completely.
- iv)    The furrows do not have deep depressions.
- v)     The depths of the furrows are uniformly the same.
- vi)    Its lighter than the disc plough
- vii)   It can be used for inter row weeding.

### **Disadvantages**

- i)     It cannot work in areas with obstacles since it be easily damaged.
- ii)    It is rigid hence can break easily.
- iii)   It cannot work in hard and waxy soils.
- iv)    It can easily create a hard soil pan due to uniform depth of ploughing.
- v)     It has a high maintenance costs than a disc plough.

### **Maintenance of a mould board ploughs**

- i)     Check on the conditions of the shares and tighten as required.
- ii)    Lubricate all moving parts e.g. land wheel.
- iii)   Clear the plough off soil and vegetation after work.
- iv)    At the end of ploughing session wash the mould board, shares and other soil touching surfaces and coat it with grease to prevent rusting.
- v)     Repair the damaged and replace worn out parts.
- vi)    regularly sharpen the shears for efficiency

### **TERMS USED IN PLOUGHING**

- i) Back furrow, these are raised ridges left behind after ploughing.
- ii) Furrow wall, it's a wall separating the cultivated area from uncultivated land.
- iii) Dead furrow; It's an open trench left after ploughing.
- iv) Furrow slice; It's the soil that is cut, lifted and inverted by the plough

### **CHISEL PLOUGH AND SUBSOILER**

These are deep tillage implements that are able to stir the top soil and sub soil without bringing the soil to the surface.

They are imported in that;

- i) They break hard pans in topsoil.
- ii) Facilitate breaking up deep rooted weeds.
- iii) They improve drainage and aeration of the soil.

A chisel plough is a tool with rigid tines points covered by shovel like points at the end. These at times are strong to withstand the stress when they are working at a depth and in hard soil conditions.

One disadvantage with a chisel plough is that it requires a lot of power to pull. Also the soil tilth produced is rough.

### **Maintenance of chisel ploughs**

1. Replace points on tines if they are blunt
2. Clean the implement by removing soil after work
3. Make sure the tines have the right curvature
4. Make sure the springs on the tines have the right tension
5. Paint the implement with waste oil to prevent rusting
6. Replace broken parts immediately to prevent further damage
7. Moving parts should be greased to control friction

### **ROTAVATORS /ROTARY CULTIVATOR:**

A rotavator consists of a series of L-shaped blades moulded on a horizontal shaft. The L-shaped blades rotate while cutting the soil.

The implement receives power from the tractor power take off shaft.

A rotor drive has a cushioning device that prevents direct damage to the implement in case the blades hit any obstacles.

It has an adjustable rear shield that protects the operator from flying stones and debris. The soil cut is thrown against the shield and cut down to a fine tilt.

Shattering of soil also depends on the speed of the tractor; the higher the speed the more soil is broken.

Parts of the implement

1. Gear box; It houses gears that get power from the engine from the tractor through the power take off shaft.
2. Chains casing; it contains chains and chain lubricating oil. The chain is moved for transmitting power from gear box through a connecting shaft to the rotor where the L-shaped blades are attached.
3. Rotor; this provides attachment for L-shaped blades and rotates with the blades
4. Blades; they are used for cutting and throwing up the soil. The direction to throw is usually upwards or backwards.
5. Hood; It is used as a shield to protect machine operators from flying stones.

### **Maintenance of a Rotavator**

- i) Keep correct level of oil in the chain casting and gear box.
- ii) Replace worn out blades.
- iii) Ensure that the rotavator shaft is covered
- iv) The forward speed should be related to the type of seed bed required.

### **Merits of using rotavators**

1. Provides a fine tilth one operation good for small seeds
2. Cuts vegetative material and mixes it with soil thoroughly
3. It can incorporate manures and pesticides into soil
4. Can improve soil aeration

### **Problems associated with the use rotavators**

1. Continuous use in the same area leads to destruction of soil structure
2. May cut rhizomes into tiny parts that may produce more weeds
3. Blades wear out quickly increasing maintenance costs
4. It requires very powerful tractors to provide power

## **SECONDARY TILLAGE IMPLEMENTS**

These are implements used for subsequent seed bed after primary cultivation.

### **Objects of secondary cultivation**

- i) To break soil clods to obtain a firm tilth
- ii) To turn vegetative material and crop residues and mix it with soil.
- iii) To control weeds they may have come up after primary cultivation
- iv) To improve soil aeration
- v) To control pest by destroying their habitats
- vi) To cover broadcasted seeds.
- vii) Facilitate application of fertilizers by mixing it with soil.
- viii) To level and firm top soil surface for easy planting.
- ix) To provide a conducive environment through which air and moisture accumulates and promote germination.

### **Examples of secondary tillage implements**

- 1 Disc harrow
  - Single action
  - Double action
  - Offset action
- 2 Spring-Tined harrow
- 3 Zigzag harrow
- 4 chain harrow
- 5 spike toothed harrow

### **Disc harrow**

- i) The most commonly used.
- ii) They have smooth and matched edges
- iii) Easy to maintain and can work in poor soil conditions
- iv) Disc harrow are composed of two or more sets (gangs) of disc mounted on a horizontal shaft
- v) Each disc is separated from the nearby disc by a spacer.

### **Parts of a disc harrow**

- 1      Discs; round smoothed edged or notched concave blade. Notched discs work where there is a lot of trash to be cut. Notched discs are mounted on the fore gang and rear gang.
- 2      Leveling gear; it levels the implement so that it can work at a good depth.
- 3      Harrow boxes; it provides attachment of the implement to the tractor.
- 4      Weight boxes; they provide added weight to assist the implement to penetrate deeper especially in hard ground.
- 5      Disc gang; it is a set of disc harrows set in a shaft varying from 13-15. The setting of the gangs can be done manually or by hydraulic
- 6      Scrappers; they keep the implement clear of soil which sticks on discs.

### **Uses of disc harrows**

- i) They chop up vegetative matter on the surface of soil by ploughing.
- ii) They are used for final seed bed preparation after ploughing.
- iii) They run over a seed bed in dry season to control weeds.
- iv) They cover up broadcasted seed on seed beds.

### **Penetration of the disc harrow depends;**

- 1 On the angle of the disc gang; the wider the angle the deeper the penetration.
- 2 Adjustment of the top link; the longer the top link the more the disc gang penetrates deeper; the front gang is raised and vice versa when the top link is too short.
- 3 Weight of the disc harrow; heavier harrows penetrate deeper.
- 4 Size of the discs; bigger disc may penetrate deeper
- 5 Soil conditions i.e. hardness, moisture or argument. Amount of trash on the ground.
- 6 Speed of harrowing; the faster the speed the slower it penetrates.

### **Maintenance of a disc harrow,**

- i) Lubricate and grease nipples and bearings.
- ii) Repair or replace damaged or worn out plates.
- iii) Tighten all bolts and nuts before and after work.
- iv) Oil and grease the implement after the working season to prevent rusting.

### **Advantages of a disc harrow**

- i) Produces good seed bed in good ploughing conditions
- ii) It works top soil without bringing vegetation to the top surface.
- iii) works well in heavy soils
- iv) has a good compacting cutting effect on soil
- v) good for preparing arable land where deep cultivation is not required
- vi) can prepare a good seed bed in one operation reducing loss of soil moisture

### **Disadvantages of a disc harrow**

- i) It multiplies the weed population of rhizomatous weeds e.g. coach grass, spear grass by cutting rhizomes into small parts.
- ii) can destroy soil structure
- iii) they are very expensive to buy
- iv) maintenance costs are very high

## **PLANTERS**

They are also called row crop planters

There are three types of planters

- 1 Drill type planters
- 2 Hill drop Planters
- 3 Check row

Row crop planters are designed to plant seeds in row far enough to permit other management practices of the crop. They can be used for planting crops like Sorghum, Soya beans, cotton etc.

### **Features of a good row planter**

- i) It should be able to handle a wide range of seed bed
- ii) Should be able to handle a wide range of seeds.
- iii) It should be able to plant seeds at a uniform depth and width
- iv) It should be able to plant seeds of the same quantity but not depending on the amount of seeds in the seed hopper / box.
- v) It should be able to work at a reasonable speed without damaging the seed.

### **Operation**

- i) The opening of furrows is done by a furrow opener.
- ii) Metering of seeds and fertilizers is done by seed metering and fertilizers metering unit respectively. This ensures correct seed rate and fertilizer application.
- iii) Seeds are placed to the ground through the delivery tube.
- iv) A press wheel ensures proper coverage of the seeds with soil.

### **Harvesting & processing implements**

Crop harvesting refers to the collection of crop in a crude form from the field. It could involve cutting with a knife or lifting for the case of cassava and other root crops.



## **FARM STRUCTURES**

Farm structure refers to a facility constructed on a farm for storing farm produce, tools or equipments, housing animals, human beings and handling animals for various treatments.

Examples of farm structures include;

- Fences
- Farm buildings such as farmer's house of residence, crop stores, poultry houses, zero grazing structures.
- Animal handling structures such as: -Plunge dips, Spray races, Crushes, Fences
- Water storage structures like tanks.
- Farm roads
- Irrigation structures like over head tanks sprinkler irrigation structures and dams
- Dairy units
- Zero-grazing units
- Poultry houses
- Rabbitry
- Fish ponds
- Bee hives
- Silos
- Green houses
- Pig stys
- Nurseries

### **FENCES**

A fence is an enclosed piece of land that forms an effective barrier to livestock movement and excludes intruders from the farm.

### **BENEFITS/IMPORTANCES OF FENCES OR FENCING LAND**

- Fences facilitate rotational grazing; fences can be used to divide the grazing land into paddock and this allows the farmer to practice rotational grazing.
- Fences help in controlling ticks and other internal parasites like liver flukes, tape worms. Double fencing eliminates/prevents ticks movement to the farm, because the area between the double fence is kept free of vegetation making it very difficult for ticks to cross over.
- Fences minimize spread of disease by restricting wondering animals from other farms.
- Fences enable grouping of animals according to their ages which makes feeding more easy.
- Fences help to avoid land disputes since they establish a farm boundary which gives clear demarcation of farmer's land.
- Fences enable mixed farming to be practiced easily.
- Fences improve security of the farmer i.e. offer protection to the farmer and his properties by keeping away thieves and trespassers/intruders.
- Fences reduce labour requirements on the farm i.e. animals can be left to graze on their own on the farm.
- Fences improve on the beauty of the farm hence make them attractive.
- Fences enables farmers to diversify their farming activities. E.g. when the farm is well fenced, the farmer can be able to carry out very many enterprises i.e. grow crops, rear animals, fish farming, e.t.c
- Fences allow separation of animals for different specific reasons. e.g. Isolating sick ones for disease control, parasite control, calving, mating, etc, according to sex, age, type.
- Live fences serves as wind breakers to guard against the harsh effects of strong winds on farm crops, animals and the soil.
- Fences safe guard water points, they protect areas around water points from being overgrazed and trampled upon by the animals.
- Fences help to control inbreeding on the farm.

#### **DISADVANTAGES OF FENCES/PROBLEMS ASSOCIATED WITH FENCING LAND.**

1. Fences encourage land fragmentation which makes use of machines difficult on the farm.
2. Fences deny animals chances of feeding freely to find the best feeds
3. Fencing requires a lot of capital per unit area
4. Fencing requires skilled labour to erect e.g. barbed wire fence, wooven wire fence
5. Fences like hedge fences harbor dangerous organisms like snakes.
6. Some fences e.g. shrubs like lantana are poisonous to animals.

#### **Types of fences**

Fences are usually classified according to the materials used to construct them. I.e.

- Dead fences
- Live fences

##### **a) Live fences**

These comprise of electric fences, trees and shrubs. Live fences are also collectively called Hedge fence.

Plants commonly used as hedges include:-

- Euphorbia spp
- Cypress spp
- Acacia spp
- Tick berry
- Ficus spp
- Sisal (Agave spp)
- Prickly pear cactus (Opuntia spp)
- Kiel apple

- Bougainvillea
- Mauritius thorn.

**Some of these plants used as live fences have the following features:-**

- They have sharp protruding structures e.g. thorns.
- Some Species have an irritating smell while others are poisonous to animals.
- Others produce latex.

N.B. These features make them somewhat repellent to animals and intruders.

**Advantages of hedge fence**

- Live fences are cheap to establish.
- Hedges act as wind breakers when fully established.
- When well trimmed, hedge plants, make the farm look beautiful.
- Hedges require less maintenance once established.
- Hedge fence gives a permanent demarcation to settle land disputes.
- Hedges act as a source of fire wood/fuel.

**Disadvantages of hedge fences**

- They take long to establish and make an effective fence.
- Gaps may occur when the hedge plants die.
- If the plants used are thorny, they can injure animals
- They can also act as hide out for vermines, thieves and wild animals, snakes etc.
- Hedge plants compete with crops for nutrients.
- Hedge plants require regular trimming because they have continuous growth.
- Some species of hedges are poisonous to livestock e.g. Ficus Spp, Lantana, Euphorbia, etc

**Electric fence.**

This type of fence is movable and widely used on dairy and beef farms. Electric fences are used where strip grazing is practiced. They are constructed using metallic posts, insulators, electric wires and a source of electricity e.g. Battery.

A piece of land is fenced with an electric wire and current is passed through the wire such that when the animal comes near the wire it receives a small shock enough to make it run away. Normally this electric fence is used on a temporary basis but not permanent basis.

**Structure of an electric fence**

**Advantages of electric fence.**

- Can be easily moved from one location to the next as required.
- They do not need a lot of labour to construct.
- They restrain animal movement very well.

**Disadvantages of electric fences**

- They require regular inspection and maintenance which makes them expensive.
- They are only applicable under highly productive enterprises.

**b) Dead fences**

These are made of non-living materials which include:-  
Wires, Blocks, Stones, Bricks.

- Wooden fence** made of wooden treated timber posts, poles and tree branches.

**Advantages of using wooden fence.**

- Cheap to construct especially in areas where wood is readily available.
- They are effective in restraining small animals such as goats, sheep, etc.

**Disadvantages of wooden fence.**

- Not durable especially when untreated.
- Require frequent repair and replacement

- Animals can easily break the fence.
- ii. **Trench fence.**  
Here trenches are dug along the boundaries of the farm. These trenches should be dug deep and wide enough to prevent animals from jumping over.

#### **Advantages of Trench fence.**

They are very effective in preventing animals from straying.

#### **Disadvantages of Trench fence.**

- Requires a lot of labour to dig the trenches
- Livestock and people may fall into the trench and get injured especially when vegetation over grows and covers them up.
- Trenches can trap water during the rainy season which acts as breeding grounds for parasites.
- Trenches occupy plenty of land that would otherwise support grazeable vegetation with a boundaries of trenches are bound to collapse inside, which makes it easy for animals to cross over them.

#### iii. **Wall/stone fences.**

Constructed using stones, concrete or clay bricks held together by mortar.

#### **Advantages of stone fences.**

- Act as wind breaker
- They are durable
- They offer full security as it is not easy for livestock to go through them.
- Low maintenance costs

#### **Disadvantages of stone fences**

- The cost of construction is high
- Their construction requires skilled labour.

#### iv. **Wire fences**

The components of wire fence are posts, wire and staples.

They are 3 groups namely:-

- Woven wire fence
- Plain wire fence
- Barbed wire fence

##### a) **Woven wire fence / chain link**

A plain gauge wire is woven into different patterns to make a sheet of wire mesh or net. It is some times referred as chicken wire or wire mesh or chain link.

It is not common on small scale farms for its very expensive.

It is used for enclosing poultry and pigsty run as well as fencing stone like rabbits, sheep and goats.

#### **ASSIGNMENT 1**

Draw a structure of a wooven wire fence

##### b) **Plain wire fence.**

This fence is the regular gauge wire without barbs. It's not commonly used on many farms but rather used in combination with barbed wire in single strands. Plain wire fences are only used for quiet animals (animals with a mild temperament)

#### **Advantages of using plain wires.**

Effective in restraining small sized animals e.g. goats

They do not cause injuries on animals skin like barbed wire fences.

### **Disadvantages of plain wire**

When used alone, they are not effective in restraining animals

#### **c) Barbed wire fence**

This type of fence is made of ordinary gauge wire with barbs on it located 8-15cm apart it is also made of tight stretched wire supported on upright posts in the ground.

The wire is fixed on the poles by means of staples (U-nails)

**N.B** Barbs discourage any animal attempts to jump over or find its way through the fence. However this creates damage on the hide and skins of the stubborn animals.

### **Structure of barbed wire fence**

### **Components of a barbed wire fence**

- Dropper
- Strainer posts/ corner/king post
- Standard post
- U-nails

### **Advantages of barbed wire fences**

- They are very effective in controlling movement of large animals such as cattle, Donkeys

### **Disadvantages of barbed wire fence**

- Barbs can easily cause damage to hides leading to loss of quality.
- Wounds inflicted on animals can as entry points for disease causing organisms.
- They are not effective in restraining small animals such as pigs, sheep and goats

### **Procedures of erecting the barbed wire fence.**

- Clear the land where the fence line is to pass to a width of about 2m to allow ample working space.
- Use pegs to set the position of posts in a straight line either by sighting or else a guide rope or cord.
- Using a sisal rope/string, establish straight line between adjacent pegs along which posts holes are to be dug.
- Using the recommended spacing, mark out the spots where post holes are to be dug.(spacing of posts depends on the type of livestock to be confined)
- Using the hole digger or post auger, dig holes to a depth of 90 cm for king posts and 60-75cm for intermediate posts.
- Erect the strain posts and support them with struts.
- Unroll the barbed wire from one corner post to the other beginning with the lower strand of wire.
- Fix the end of the to one corner posts.
- Move to the other corner post in the direction of the unrolled wire.
- Using the wire strainer, stretch the wire to the required tension.
- Attach the wire to the post using staples.
- Then erect the intermediate posts, making sure that they are all contact with the strand of wire already installed.
- Finally install the remaining strands of wire until the fence is complete

### **Tools used to construct a barbed wire fence include;**

#### **1. Post hole digger/earth auger.**

Is used to dig holes ranging from 15-40cm in diameter depending on soil conditions.

#### **2. Fencing pliers/ tin snip**

Used to cut wires

### 3. Wire strainer

Used to stretch or tighten the wires so that they do not sag or give way when pulled a part.

### 4. Rammer.

Used to ram soil around the post so that it holds the post firmly in the upright position.

### 5. Claw hammer

Used to hit and drive staples into the poles/ posts.

### 6. Had saw.

This is used to cut down posts to the required length.

### 7. Tape measure

It is used to measure the distance between posts and wire strands so that they can be correctly spaced.

### 8. Sisal string

It is used to ensure that the fence is straight.

### 9. Staples /U-nail

These are used to attach the wire on to the posts

### **The major components of barbed wire fences**

#### i. Strainer posts/king post

These are large posts fixed at the corners and gates to take strain of the wire. Strainers are 2.4m long and 16-18cm in diameter.

#### ii. Struts.

Are also called supporters and are used to support strainer / king post. They are 2.4m long .

#### iii. Standard posts.

These are used to hold wires between one corner and another. They pull the wire in both direction and so there is a less strain of them. Standards are 1.8m long and 5-15cm in diameter.

#### iv. Dropper.

They do not touch the ground. They are placed in between the standards which keeps the wires in position when being pushed apart by animals. Droppers help to stop the wires from sagging.

### **Fencing calculations.**

#### **Formulae**

$$\text{i. No. of posts} = \frac{\text{Perimeter}}{\text{Spacing}} + 1$$

$$\text{ii. No. of Rolls of barbed wire} = \frac{\text{Perimeter} \times \text{No. of Strands}}{\text{Length of 1 roll}}$$

$$\text{iii. No. of staples} = \text{No. of Poles} \times \text{No. of strands}$$

### **Example I**

A farmer wants to construct a 3-strand barbed wire fence on a rectangular piece of land measuring 800 by 500m.

Given that the length of 1 roll of barbed wire is 400cm and that the spacing between 1 post to another is 5m.

### **Calculate**

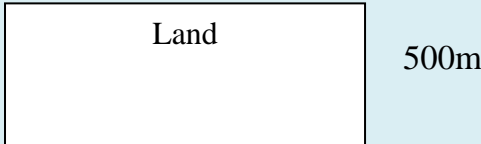
- i. No. of Posts.
- ii. No. of Rolls of barbed wire
- iii. No. of staples.

Solution

$$\text{No. of Post} = \frac{\text{Perimeter}}{\text{Spacing}}$$

But perimeter =  $2(L+W)$

Rectangular land



$$\text{Perimeter} = 2(800+500)$$

$$\text{But } L = 800\text{m}$$

$$W = 500\text{m}$$

$$P = 2(800 + 500)$$

$$= 2(1300)$$

$$\text{Perimeter} = 2600\text{m}$$

$$\text{Spacing} = 5\text{m}$$

$$= \frac{2600\text{m}}{5\text{m}}$$

$$= 520$$

$$= \underline{520 \text{ posts}}$$

$$\text{No. of Rolls} = \frac{\text{perimeter}}{\text{Length of 1 roll}} \times \text{No. of Strands}$$

$$\text{Length of 1 roll} = \text{perimeter} = 2600\text{m}$$

$$\text{Length of 1 roll of barbed wire} = 400\text{m}$$

$$\text{No. of strand} = 3$$

$$\text{No. of Rolls} = \frac{2600}{400} \times 3$$

$$= \frac{26}{4} \times 3$$

$$= 19.5$$

$$= \underline{20 \text{ Rolls of wire}}$$

$$\text{No. of staples} = \text{posts} \times \text{No. strands}$$

$$\text{Posts} = 520 \text{ posts}$$

$$\text{No. of strands} = 03 \text{ strands}$$

$$\text{No. of staples} = 520 \times 3 = \underline{1560 \text{ staples.}}$$

### **Exercises (1)**

1. Mr. Mukasa is a livestock farmer in Nkoko village where he would like make a fence as shown below.

- Size of land 260 by 70m
- Fence with 5 strand of wire
- 1 Roll of wire 200m long
- Distance between the fencing posts 8m.
- Cost of fencing wire = 125,000 per roll
- Cost of staples = 4500 per kg
- 1 Post costs 1800

**Calculate;**

- i. No. of posts
- ii. No. of Roll of wire



- iii. No. of kg of staples to use if 1 kg of staples contains 15 staples.
- iv. Total of cost of fencing materials to be used

### **Exercise II**

Your school farm has leased a piece of land measuring 500m by 300m. You are required to fence the perimeter using wooden poles and 48 strands of barbed wire. The poles are spaced 50m apart. A roll of wire measures 600m. a gate is 5m wide to be provided:-

- a) Outline the criterion followed when erecting a wire fence of such kind.
- b) Calculate;
  - i. The No. of posts required.
  - ii. The No. of Rolls of wire needed
  - iii. The No. of staples to be used.

### **Exercise III**

A farmer has a rectangular piece of land measuring 2000m by 900m around which a 3 strand perimeter barbed wire fence is to be constructed. Given that the length of 1 roll of fencing wire is 560m spacing between the fencing posts is 8m with 4 gates provided.

#### **Calculate;**

- i. No. of posts required.
- ii. No. of Rolls of wire to be used.
- iii. No. of kg of staples if 1 kg contains 10 staples
- b) Calculate the total cost of;
  - i. Fencing wire if 1 roll of fencing wire costs 90,000
  - ii. Staples if 1 kg of staples cost 6,000

#### **Treatment of fencing posts.**

Posts for fence construction are usually treated with chemicals and protected against fungi and insects before being used.

#### **Methods used when treating/preserving wooden posts are:-**

- Vacuum / pressure method
- Sap displacement / end diffusion method
- Soaking method i.e. hot soaking method and Cold soaking method.
- Surface painting / spraying.

#### **Examples of chemical used for treating wood/ wood preservatives include:-**

- |                            |   |                                  |
|----------------------------|---|----------------------------------|
| 1. Pentachlorophenol       | } | kills weevils and other insects. |
| 2. Old engine oil          |   |                                  |
| 3. Tributyl /tin oxide     |   |                                  |
| 4. $\text{CuSO}_4$         |   |                                  |
| 5. Dieldrine (16% of 10ml) | } | Termites                         |
| 6. Arsenic pentoxide       |   |                                  |
| 7. Sodium dichromate       |   |                                  |
|                            | } | fungi                            |
| 8. Tar                     |   |                                  |
| 9. Creosote                |   |                                  |
| 10. tarnex                 | } | Weather                          |
|                            |   |                                  |



a) **pressure / vacuum treatments**

Here freshly cut poles are peeled and packed into sealed cylinders where chemicals are forced into them under very high pressure.

**Procedure.**

- Poles are obtained from the source
- Poles are peeled to remove the bark and cut into desired sizes.
- Poles are immersed in chemical preservatives like creosote in cylinder.
- Poles immersed in preservative in cylinder and covered.
- Chemical is forced into poles under very high pressure.
- Poles are removed, chemical drips off and taken for use.

b) **Sap displacement /end diffusion method.**

Here poles are immersed in preservative for a given time and later removed and inserted upside down to enable complete coverage of the chemical.

**Procedure.**

- Freshly cut poles are obtained from the source
- Poles are cut into desirable sizes and peeled to remove the bark
- Poles are inserted into freshly prepared preservative for about 4-6 days.
- The sap in the poles evaporating up wards /diffuses up wards and is replaced by the preservatives.
- After 4-6days, poles are inserted upside down to enable the complete coverage by the preservative.
- After the poles are removed and taken for use.

c) **Hot soaking method,**

Poles are cut; the bark stripped off and then submerged in a tank containing the preservative. The container/ tank is then heated for about 2 hours until the preservative is about to boil. The chemical with posts still immersed and is allowed to cool which makes wood cells to expand and take in the preservative.

**Question 1** Describe the procedure followed when preserving wood using Hot and Cold soaking methods.

a) Describe the steps followed when carrying out of surface painting

d) **Cold soaking method**

Posts are cut and barks stripped off. Posts are then immersed in a preservative for a few days to allow the preservative to be drawn up into the conducting tubes of wood. Poles are removed and left to drip dry

**Surface painting**

Is where wood is painted /brushed with appropriate preservatives?

**Guiding questions,**

1. Explain why it is important to construct fence on the farm/
  - b. Describe various types fences found at the farm.
  - c. Name the tools which a farmer should have in order to make a barbed wire fence.
2. Describe how each of the following method of wood preservation is done.
  - i. sap displacement method.
  - ii. Pressure / vacuum method.
3. Describe the procedure followed when erecting a hedge fence on the farm.
4. Mention 5 precautions farmers should consider when seasoning wood at the farm.

### **Wood seasoning**

Seasoning is the removal /reduction of moisture from wood.

### **Reasons for wood seasoning.**

- Prevents /reduce warping of wood due to uneven expansion of wood.
- Prevents decay/ rotting of woods.
- Seasoning improves durability and strength of wood

### **Precautions taken when seasoning wood/ timber.**

- Provide a shade over wood to keep off rain and sun shine.
- Heap the stances above the ground so as to avoid absorption of moisture and allow an circulation.
- Piles of wood should be separated by wooden rods called stickers to allow passage of air into the stance.
- Supports and stickers should be spaced close together to avoid warping of wood.
- Piles of timber should be as much as possible be parallel to the ground to avoid bending

### **Animal handling structures.**

These are structures used by farmers to carry out routine livestock farm operations. They make it easy for farmers to handle and perform certain operations on farm animals.

They include;

- The plunge dip
- Spray race
- The crush

#### **a) The Crush**

Is a structure used to restrain farm animals when carrying out management operations on them?

It is made used timber poles or steel poles.

### **Structure of a crush (draw from lib)**

The length of a crush depends on the number of animals a farmer would like to handle at once. It constructed in such a way that it is narrow at the bottom and wider at the top.

N.B It should be narrow enough to prevent animals from turning once it has entered the crush.

### **Uses of the crush.**

The following operations can be carried out in the crush.

- Dehorning animals.
- Used for deworming/drenching the animals for spraying and hand dressing of ticks/ parasites.
- Used for artificial insemination.
- Carrying out pregnancy diagnosis to find out if cows are pregnant.
- For applying identification markers on animals e.g. Ear tagging, Tattooing and branding
- Vaccination against diseases.
- For trimming hooves of animals that have grown out of shape.
- Injecting sick animals with drugs.
- For clinical examination to find out if an animal is sick e.g. Taking body temperature.

- For taking blood samples from animals for nursing animals especially stubborn cows.

### **Advantages of a crush.**

- Can be used to serve / carry out a variety of farm operations unlike the dip, spray.
- It is cheap to construct especially when wood is used.
- It is easy to use / does not require skilled labour.

### **Disadvantages.**

- Can not be used to handle very many animals at once.
- It is not durable especially if wood is not well preserved./treated.

### **Procedure.**

Procedure of hand spraying of animals: use **BBBRH** for correct procedure

#### **b) Spray race.**

Is a farm structure designed to control external parasites like ticks, mites and biting flies on animals?

It is an enclosed space in which animals are exposed to spray delivered at high pressure through a system of well arranged nozzles/

In a spray race, animals walk through a confined area/race where pipes with nozzles at certain intervals and angles are fitted.

In the spray race, the acaricide (chemically) is pumped from the sump/reservoir and is forced to move along pipes at a high pressure.

- The spray chemical / acaricide emerge through nozzles which break it down into small droplets.
- The spray race is operated by use of power, diesel or petrol fuel or power take off shaft of tractor.
- The animals are allowed to walk through the race towards the drainage race in a liquid and fully covered with the acaricide.
- The discharged acaricide /used acaricide that drips from animals body drains back to the reservoir via filter pipes and is recirculated by the pump through the system

### **Stock management at the spray race / precaution taken when using spray race.**

- Cattle / animals should be arranged in a single file as they enter the race.
- Animals should lift their tails as they go through the race so that the under tail wetting takes place.
- Young calves being sprayed for the 1<sup>st</sup> time can be encouraged to go through the race in a group.
- When adult cattle are being sprayed for the 1<sup>st</sup> time, they should be run through the race once or twice without being sprayed to accustom them to it.
- After spraying the remaining quantity of dirty spray wash should be pumped out into a fenced off pit and the unit should be cleaned thoroughly.

### **Advantages of using a spray race.**

- It is cheaper to install than a dip tank.
- It uses a small quantity of acaricide
- The farmer is able to change the type of acaricide at every spraying without the expense of having to refill a large capacity tank.
- Many animals can be sprayed in a short time.

- Less labour is needed to operate a spray race e.g. one person can switch on and then drive the animals through the spray race.
- It can also be used to spray small animals such as goats and sheep.
- It can be used on calves and pregnant cows that are about to deliver since it causes fewer disturbances on to animals.
- Fresh acaricide is used always. This ensures good quality and effectiveness of the spray wash.
- It reduces wastage of acaricide.
- There is less risks of accidents during spraying than dips.

#### **Disadvantages of spray race use.**

- Nozzles can easily be blacked by dust in the spray even during wet season
- There are possibilities of certain parts of the animal's body not being covered by acaricide.
- Requires technical skills to operate the spray race
- It requires a reliable source of power to run the pump at the required speed.
- It is only economical with a very large herd.

#### **The cattle Dip (Plunge dip)**

This is a structure constructed basically for tick control. Here animals are totally submerged in the acaricide in the dip tank.

There are 2 types of dips

- Machakos dip - for small animals
- Plunge dip - cattle

Capacity of most dips is 14000-22000 liters.

#### **Structure of Dip diagram here**

#### **Functions of the components of the Dip (Features of Dip tank)**

##### **1) Collecting yard:**

This is where animals gather before the dipping process.

##### **2) Entrance race:**

It is a narrow passage that allows animals to move to the foot bath in a line

##### **3) Foot bath:**

Is a depression located in the entrance race and contains water to wash the hooves of animals before they enter the dip tank.

##### **4) Swim bath/ Dip tank**

Holds the dip wash in which the animals swim its side should be raised above the ground to prevent spilling of acaricide as animals jump into dip tank

##### **5) Exit ramp**

This enables animals to climb out of the swim bath.

##### **6) Drainage race.**

This holds animals as they leave the swim bath so that the excess dip wash can drip off their bodies and return to the swim bath.

##### **7) The Roof;**

To reduce excessive evaporation of water from dip wash due to the sun's heat and to prevent dilution of dip wash by rain water.

##### **8) Waste pit / soak a way pit;**

Is a pit where sediments from the farm are damped?

##### **9) Splash Wall.**

To allow acaricide to get back to the swim bath especially after splashing to the walls /roof.

## 10) Jump.

Where animals jump to the swim bath

### **Procedure of dipping animals**

- Assemble the animals in the collecting yard.
- Allow the animals to drink water before dipping starts.
- Check the level and concentration of the dip wash and replenish if necessary.
- Fill up the foot bath with clean water.
- Open the pipe that returns the dip wash from the drainage race to the tank
- Animals are allowed / forced to move through the entrance race in a single file and move into the swim bath where they are completely immersed in the dip wash.
- Animals then walk out of the swim bath using the exit ramp.
- They are held in the drainage race so that excess dip wash drains off their bodies.
- The 1<sup>st</sup> 10-20 animals to be dipped should be dipped again as they could have passed through the dip wash before it was well mixed.
- The animals are allowed to leave the drainage race.

**Qtn** Explain the factors considered when selecting the site for a dip tank

### **Precautions that should be taken before and after dipping.**

- Animals should be watered first, should be given water for drinking as thirsty animals are likely to take the acaricide.
- Dipping should be done in the morning of a bright sunny day.
- Pregnant animals should not be dipped to avoid collapsing in the swim bath.
- Sick animals should not be dipped
- Do not dip on a rainy day because the acaricide can be washed off.
- Ensure the footbath is filled with water before dipping starts to avoid contaminating dip.
- Ensure the concentration of acaricide this should be done through replenishing
- Ensure uniform mixing of acaricide by running 5-7 animals before dipping.

### **Factors that may change / alter the concentration of the dip wash.**

- Excess fouling and sedimentation
- Flooding
- Evaporation
- Leaking through poor construction / on poor soil
- Inefficient stirring / agitation.
- Prolonged use of dip wash
- Leaking roof leading to dilution of acaricide
- Weak concentration of acaricide
- Improper mixing of acaricide

### **Advantages of using the dip tank.**

- Many animals dipped on a single day
- Dip wash can be used a number of times before it is discarded / used for so long
- The animals are fully covered by the dip wash which effectively control ticks on their bodies
- If well maintained, it is durable and can serve for many years.
- Require little labour to use
- It requires less technique skills to use than the spray race
- Spoilage of chemicals / acaricide is minimal

- It is cheaper to run in the long run.

### **Disadvantages of using dip tank**

- Initial capital of installation is quite high for small scale farmers to afford
- Require some skilled labour to use e.g. When detecting construction and level after dipping
- Animals can get injured especially when level of dip wash falls below the lowest recommended level.
- It can not be used on calves, pregnant cows and sick animals.
- Dip wash can poison animals if poorly diluted or may not be effective if it is too dilute
- It is labour intensive and time consuming to empty and refill it.
- Diseases such as floor rot, foot and mouth can be introduced in the dip wash which affects other animals.
- It is not economical for farmers with few animals.

### **FARM BUILDINGS**

These are important structures commonly found on farms

Examples of farm buildings:-

- Crop stores
- Farmers residential house
- Green house
- Farm offices
- Pigsty
- Calf pens
- Rabbit hatch

### **Benefits / importance of farm buildings.**

- They provide comfort to humans and animals by acting as places of reluctance
- They protect animals from bad weather and attack by parasites and wild animals
- They are used to store farm produce / products e.g. maize grains, hides and skins
- They protect farm machinery from bad weather elements like sun, wind, rain.
- Farm buildings enables farmers to spend less on labour e.g. by reducing labour needed in drying of crop products.
- Farm buildings can be used in crop production to grow crops that can not withstand weather conditions e.g. green houses for planting roses,
- They protect vulnerable livestock e.g. poultry rabbits against thieves and predators which reduce stress and out puts.
- Some are used as office for management of farms hence increases efficiency.
- Farm buildings increase the quantity of farm produce e.g. yellow bananas and some other products are harvested in raw form and ripen in stores.
- They help to store farm produce when market prices are low so that they can sell when prices are high.
- Farm buildings increase real estate value of the farm.

### **Siting farm buildings.**

(Selecting a suitable site for farm buildings)

Farm buildings should be sited in strategic areas if they have to play their beneficial roles. The factors considered include;

#### **1) Accessibility**

Farm buildings should be sited close to main road. This enables farmer to transport farm produce to the market and bring in farm inputs from the market.



2) **Location**

Should be sited in the center of the farm, this facilitates easy supervision of the whole farm since all parts of the farm are equally accessible to the farmer.

3) **Topography**

Be located on high ground to avoid dampness especially during wet season to prevent sinking of the foundation.

4) **Soil type**

Be sited on least productive areas of the farm (infertile soils) while production areas should be reserved for crop production.

5) **Drainage**

Site should be well drained to prevent water logging. The site should be gently sloping for safe disposal of water after it has rained because they favour breeding of parasites.

6) **Water supply**

Should be sited where there's easy access to a reliable source of water, e.g. tap, well for use at farm.

7) **Power supply**

Where possible farm buildings should be sited near the source of power for easy processing of farm produce before being sold.

8) **Security**

Buildings for vulnerable/sensitive enterprises like rabbits, birds etc should be sited near farmer's house of residence for easy supervision.

9) **Orientation**

Such that high noon **sunrays** should not directly hit into the building.

The best site should be in such a way that day scorching winds/sunrays should not be allowed into the building because they affect the feeding activities and cause stress to birds.

10) **Panorama**

The view of the surrounding area should be pleasant to the observer.

11) **Future expansion**

Since the farm is expected to keep growing and expanding, space should be left and reserved a side for future expansion.

**FACTORS TO CONSIDER WHEN PLANNING AND DESIGNING FARM BUILDING.**

- Purpose/use of the building e.g. design of crop store should be different from that of the rabbit hatch or green house due to its intended use.
- **Construction and maintenance cost.**  
Farmer should use the materials depending on his income e.g. farmer cannot plan using expensive building materials like tiles when his limited cash.
- **Surrounding environment**  
E.g. in areas where there are strong winds, some walls in animal house should be raised up to roof.
- **Available constructional materials.**  
It's cheaper to use readily available materials than to transport them from far away.
- **Risks and uncertainties**  
E.g. outbreak of fire, thefts of produce for possibilities of fire outbreak, and an emergency door should be included.
- **Availability of labour for construction work.**

It's important for the labour to consider whether there's skilled labour to build using certain materials e.g. tiles, concrete etc.

- **Possibilities for future expansion.**

Consider possibilities for future adjustment on the buildings e.g. expanding it or modifying it so that it can be used for another.

## **FACTORS TO CONSIDER WHEN LAYING OUT FARM BUILDING**

- **Relationship of buildings to others.**

Buildings with closely related functions should be sited near each other to maximize planning efficiency.

- **Flexibility of the building.**

Buildings should be constructed in such a way that they can be able to serve many purposes. E.g. Using a cattle barn as a milking parlour.

- **Possibilities for future expansion**

An allowance of land should be left around each building so that in case of need to expand the enterprise, other buildings that are already set up are not demolished.

- **Fire risks**

Inflammable substance such as fuel, hay can catch fire easily and cause a lot of destruction. Therefore stores for such materials should be constructed at a reasonable distance away from other buildings.

- **Air pollution**

Certain enterprises like poultry and piggery that are likely to produce a lot of foul smell or bad odour should be sited down wind and at a distance away from farm offices and residential houses.

- **Building materials**

Farmer has to select the most suitable materials depending on the kind of building to be erected and for how long it is intended to serve.

## **BUILDING MATERIALS**

### **1. WOOD**

In construction work, wood may be used as timber for poles, risks, rafters and trusses, making floors, ceilings, Furniture and facial boards, doors, windows etc.

#### **Advantages of using wood as building materials**

- Wood is locally available in many parts of Uganda
- Wood is cheap to buy than concrete plastic.
- Wood is easy to shape into various forms using simple tools/does not require special skills.
- Wood is a poor conductor of heat and electricity.
- Wood can easily withstand shock and vibrators.
- Wood is easy to construct and dismantle.
- Wood is durable when properly treated.
- Wood is versatile i.e. can serve very many purposes.
- Wood is light material compared to metals.
- Wood has a good appearance.

#### **Disadvantages of using wood**

- Wood easily burns if not well protected from fire
- Wood is not strong like metals/concrete and can easily break if subjected to very heavy tasks/loads.
- Wood can easily be eaten by termites.



- Wood is susceptible to bad weather if not treated.
- Wood takes long to grow and become ready for use.
- Wood can easily develop some defects and can easily crack.

**QTN.** Give reasons why wood is considered to be a versatile material of construction at the farm?

## 2. CONCRETE

This is a mixture of sand, cement, aggregate and water in various proportions depending on the strength and type of work to be done.

Concrete is used for making blocks for building, for joining blocks, bricks and stones.

**TABLE SHOWING TYPICAL CONCRETE MIXTURES**

GRADE	TYPE OF CONCRETE	CEMENT	SAND	AGGREGATE	USE OF CONCRETE MIXTURE
1.	STRONG	1 part	1 ½	3 parts	Columns, walls, floors
2.	STANDARD	1 part	2 parts	4 parts	Foundation, floor, ceilings
3.	MEDIUM	1 part	2 ½ parts	5 parts	Foundations
4.	LEAN	1 part	3 parts	6 parts	Foundation and thick walls

## **NB**

The greater the proportion of cement the stronger the concrete

- When mixing concrete, make sure that each aggregate is covered by cement.
- The strength of concrete will also depend on the methods of curing/covering hence concrete should not be exposed to the sun directly.
- Although concrete is strong in compression, it is weak in tension and therefore it must be reinforced with iron bars or steel rods which takes tensional forces.

## 3. BLOCKS

They are made of sand, concrete, murrum or sun dried clay or anti hill soils.

They may be molded by use of simple wooden moulds or by sophisticated moulds made of Galvanized steel.

## 4. Bricks

A brick is hard /well shaped pieces of baked clay/anti hill earth

### Procedure of making Bricks

- Vegetation cover and a thin layer of top soil are scrapped off to expose clay.
- Clay, anti hill earth is mixed with water is worked well / pressed well to remove excess water.
- The materials are then left to ferment for a number of days in order for organic matter to decompose and form proper bonds with soil.

- It is then molded or shaped by putting it in a brick mould
- The brick should be dried under a shade to avoid cracking
- The bricks are then burnt in a brick kiln until they turn red to their strength and durability.
- Bricks are used for construction of walls and foundations.

## 5. **Plastics**

These are used in internal fitting such as water pipes, electricity pipes and fillers for insulations

**Advantages of plastics**

- It is a good insulator i.e. used in electric fitting
- It is cheap compared to mortar
- It is resistant to attack by weather conditions insects, fungi
- It requires no special treatment
- They are light in weight and size
- They do not rust

## 6. **mortar**

Is the mixture of sand, and cement with water usually with a ration of 4:1.

Mortar is used to bind brick together during construction.

Mortar is used for plastering walls and finishing floors

## 7. **Metals.**

Used in form of bars, metallic poles, pillars pipes steel rods for reinforcing concrete, Core netting etc depending on the purpose of the building

## 8. **Earth / soil**

Commonly used on peasant farm houses in the farm. It is used to make foundations and walls used to make mud blocks and bricks. However, houses made of these materials are not permanent but can last longer if walls are coated with cement, sand and mortar,

## 9. **Stones**

These are used to put up permanent structures especially to make their foundation, floors and walls stones are cheap to use but expensive if they are not locally available.

## 10. **Thatch**

Used for roofing instead of corrugated iron sheets or tiles

### **Parts of Typical Building –draw the structure of the farm building**

#### a) **Foundation**

Should be erected on well drained area to avoid sinking the building.

Foundation should be firm and is made using stoves, concrete and Damp proof course

### **Procedures of making the foundation.**

- Measure the site using a measuring tape, string and pegs
- Clear a way the surface vegetation.
- Dig the site to the required depth i.e. 35cm wide and not less than 50cm deep
- Remove all the organic matter until you reach sub soil
- Mark the foundation with pegs in the ground
- Use the spirit level to check horizontal level of excreted area of the foundation.
- Throw broken stones, bricks into the excreted site
- Pour concrete on top into the site to make hard core start at one end
- Ram gently to avoid concrete from coming out
- Lay final thin layers of concrete to the level which provides good surface
- Allow it to set
- If the building is for livestock allow rough finish

- A damp proof course (DPC) is inserted 15cm above the ground level. This is to reduce water movement by capillarity into the wall
- b) **Wall structure**  
The wall should be constructed in such away that it supports all vertical loads
- c) **Roof structure**  
Made by timber, blocks, metals and grass

### **Features of the roof**

- **Trusses.**  
These support the thatching material
- **Cross tie**  
Is the base of trusses?
- **Rafters**  
These are attached to the base to form a triangular structure
- **Struts**  
These are nailed diagonally onto the truss for attachment of the roofing materials
- Rafter batten / fascial board  
Holds the rafter in position
- NB.** If the roof is to be made of grass or tiles, the rise or pitch should be high to lead the water run off easily and so increase the durability of the roof.

### **Structural requirements of farm building**

- a) Features of a good live stock house
  - Floor made of concrete so that it is easy to clean and gently sloping so that urine can drain off easily
  - It should have a roof to protect the animals from rain and sunshine.
  - Walls should be high enough to protect animals from scotching winds and violent rains
  - Walls should be strong, plastered to seal off crevices that can act as living places for parasites
  - Animals house should be large enough in order to accommodate the animals
  - A large space should be left between the wall tops and the roof for good ventilation
  - Should have enough light system in order for animals to see each other which makes them active
  - Should have feed trough where water is put for feeding by animals
  - Should have water trough where water is put for draining by animals
  - Should have an adjacent store where the equipments such as feeds, drugs equipments are kept
- b) **Features of a good crop store**
  - Should have leak proof to avoid rain and sunshine from destroying crop produce
  - Should have smooth walls to prevent movement of pests on the walls where pests can not hide.
  - Should have strong lockable doors
  - Should have strong foundation raised to prevent/avoid dampness
  - Should be well ventilated to allow easy air circulation
  - Should have an supervisions floor for easy cleaning
  - Should be in close proximity to released structures
  - Should be large enough with races / stalls to accommodate the produce

- Should have pillars and posts that carry rat guards or deflectors to prevent rodents from destroying the crop produce
- Should be well fitted with racks so that crops should not directly be placed on the ground

#### **Assignment 4:**

- a) Outline the characteristics of:-
  - i a good crop store
  - ii a good calf pen
- b) Explain the considerations put in place before choosing a site for a building at the farm
- c) What do you understand by farm layout
- d) What do you consider when planning a layout of a farm?

### **FARM WATER SUPPLY**

Water is essential for the smooth running of farm activities. Crop, livestock and humans can not survive without water

#### **Importance of water on the farm**

- ❖ Water is used for drinking both man and livestock
- ❖ Water is used for mixing feeds like when feeding sows with maize bran, it is 1<sup>st</sup> mixed with water
- ❖ Water is solvent for mixing various solutions suspensions or even emulsions of farm chemicals e.g. pesticides, acaricide etc.
- ❖ Water acts as a coolant because the evaporation of water from a source leads to dispersion of latent heat of vaporization.
- ❖ Water is used for aquaculture/fish farming is carried out in ponds with water.
- ❖ Water is used for irrigation especially in drought periods to enable plants meet their water needs.
- ❖ Water is used as a source of power directly as a water mill for grinding cereals or conversion of hydro electric power.
- ❖ Water can also be used for washing around houses, floors, walls etc.
- ❖ Water is used for cleaning of utensils, farm tools and equipments.
- ❖ Water is used for preserving perishable farm products such as vegetables, fruits etc.
- ❖ Water is used for cooling farm machinery e.g. tractors, transport vehicles and millers.

#### **Problems associated with water on the farm.**

- ❖ Loss of soil fertility as a result of washing away of the fertile top soil/soil erosion and leaching.
- ❖ Stagnant water can act as a breeding place for parasites e.g. liver flukes and bilharzia worms and some vectors of disease causing organisms like mosquitoes and snails.
- ❖ Contaminated water can be a carrier of human disease such as typhoid and cholera.
- ❖ When water is excessive in the soil, it interferes with plant growth and development.
- ❖ Useful soil living organisms e.g. Nitrogen fixers and decomposers cannot live in water logged areas/soils because such areas lack air that is needed for respiration.
- ❖ Some livestock at the farm may drown in water bodies e.g. ponds, wells that are deep.

#### **However, water shortage on the farm may be due to:**

- ❖ Inadequate supply of water to the farm
- ❖ Deforestation which increases soil erosion, infiltration of water bodies that in turn interfere with the water cycle.

- ❖ Drainage e.g. sinking of boreholes which lower the water table.
- ❖ Pollution of water sources which may make water unsafe for farm purposes.

### **Sources of water at the farm**

Water may be obtained at the farm from:-

- ❖ Natural precipitation/rainfall
- ❖ Surface water bodies like streams, rivers, lakes, ponds and swamps.
- ❖ Underground water sources- when it rains, water sinks into the soil, soon meets an impervious layer of soil/rock it accumulates there, forming underground water.
- ❖ Underground water can be obtained from the soil through:-
- ❖ Springs
- ❖ Boreholes/wells
- ❖ Dams
- ❖ Weirs

### **Water storage**

- ❖ Water storage on the farm is necessary in order to keep it safe from contamination, avoid water wastages, to use it during time of shortages especially during the dry seasons.
- Water can be stored in the following ways:-

#### **a) By trapping rain water**

- ❖ Farmers can trap rain water from roofs of farm buildings and store it in containers, drums, barrels, tanks and reservoirs.

##### **1. Reservoirs**

These are open water storage structures made to trap and retain runoff water from roofs, compounds etc.

##### **2. Valley dams**

These are open water storage structures that are dug up to trap and runoff water from a catchment area.

##### **3. Drums, barrels**

##### **4. Tanks draw diagrams of:**

###### **(i) Roof tanks -**

###### **(ii) Under ground tank**

###### **(iii) Overhead tank**

Is usually made of galvanized steel to prevent rusting and is usually raised off the ground to ease water flow out of the tank due to gravity.

Water is pumped in through the tap of the tank under gravity. There's usually an overflow pipe to allow excess water to flow out of the tank.

###### **(iv) Valley tank**

Made with a silt trap from the pond along its floor from the streams or along an overflow of rain. Silt trap prevents excess sedimentation of the stream.

###### **(v) Earth dam**

A dam is a wall/bank built to keep back or reduce water flow and store much water.

###### **(vi) Weir**

Is a structural device designed to raise the water level of a stream or river to a point above which water begins to flow?

A weir may be made from loose stones or logs held together by a wire net.

### **Vertical section of an earth dam**

## **FARM WATER TREATMENT**

They include:-

- ❖ **Boiling:** - This kills germs especially if the water is to be drunk by the farmer should be boiled to avoid water borne diseases.
- ❖ **Filtration:-**  
Filtering removes foreign materials. This can be done using sand filter.
- ❖ **Storing water for long periods of time:-**  
This enables and allows sediments to settle at bottom while clean water can be decanted into another container.  
Storing water for so long helps to kill some germs and parasites like Bilhazia worms and liver flukes.
- ❖ **Addition of chemicals:-**  
Chemicals such as chlorine, sodium hypochlorite are used to kill bacterial and snails to control liver flukes.
- ❖ **Exposing water to sunlight:-**  
Ultra violet rays in sunlight can kill germs in water when the water is left to stand in an open container such as a trough.

## **Maintenance of water supply to the farm**

- ❖ The area around the water sources should be kept under grass cover to protect it from erosion. This is because the grasses trap soil that would otherwise be carried into the water source and silt it up.
- ❖ Water sources such as wells, ponds and springs should be fenced to keep animal away and avoid contamination of water.
- ❖ Water tanks, walls, pipes and all supporting structures associated with water supply should be kept clean.
- ❖ Ponds must be desilted when necessary and water vegetation be removed.
- ❖ Grass planted around water sources should be kept short by slashing from time to time.
- ❖ Overhead tanks, roof tanks should be covered to avoid contamination from annual droppings dead annuals and dirt from winds.
- ❖ Drainage channels should be dug around water sources to carry away dirty water.
- ❖ Ensuring that pumps and pipelines functions properly by regularly servicing them. E.g. Tank leakages should be repaired as they lead to wastage of water.

## **GUIDING QUESTIONS**

- 1a) Explain why water is of great importance on a farm
- b) State the problems that are likely to be caused by water on a farm.
- 2a) Outline the sources of water used on the farm
- b) How can water intended for latter use be stored on the farm.
- c) Outline the maintenance requirements of water storage container.
- 3a) Describe how river water can be used in irrigating crop fields  
Suggest the benefits of irrigation.

## **AGRICULTURE ECONOMICS HAND OUT**

### **Agriculture economics;**

This is the study of how best to produce crops and animals to get maximum returns while using scarce resources. The resources needed in production are land, labour, capital, time and management.

### **Production**

It's the creation of goods and services in order to satisfy man's needs.

### **Factors of production**

This is an aggregate of free gifts of nature, human capacity and all sorts of man made aids that help in production. The factors of production include; **land, labour, capital, time and entrepreneurship/management.**

### **LAND**

Anything provided by nature under or over the earth's surface. Land can lead to development in several ways:-

1. Its where farm buildings are constructed.
2. It's a source of minerals used in manufacture of farm tools
3. It provides soil used in agriculture for crop growing
4. It can provide fuel in form of fire wood.
5. It's a source of all raw materials used in production
6. It can be taxed to provide revenue for the government
7. It can be mortgaged for loans.

### **Land tenure**

These are rules and conditions governing the ownership and use of land in a specific area.

### **Forms of land tenure**

1. Private ownership / free hold/ land lordship/ individual ownership.
2. State ownership
3. Communal ownership
4. Lease hold
5. Co-operative land tenure.



## **Private land ownership**

This is where an individual puts a claim on a piece of land as his personal property by getting a title deed after registering it with government.

### **Advantages**

1. Land owner can mortgage the land for a loan since he has a title deed.
2. The owner can use the land the way he likes for development.
3. Land consolidation and planning becomes easy since what is owned by the farmer is known including the value.
4. It avoids land disputes since the land is well demarcated.
5. It acts as an incentive to farmers to improve the land since they have security of tenure.
6. The land owner can sell the land or part of it easily incase of financial constraints.
7. It safeguards against the position of the local community if land is in short supply.

### **Disadvantages**

1. Tenants can easily be made landless when the owner sells the land in their absence.
2. It encourages Hoarding of land incase of absentee land lord.
3. It may lead to political upraising against land lords who have tough rules on land usage.

## **State ownership**

This is where land owned by the state on behalf of the citizens. People can be evicted from the land anytime without compensation when government wants to use the land.

### **Advantages:**

1. It allows fast decision making in the use of land by the state.
2. It encourages large investments on land by government like plantations, factories etc.
3. Government can rent out land to raise revenue for development

### **Disadvantages**

1. People have no security over the land occupied since they can be evicted any time.
2. Government can fail to utilize the land efficiently by awarding it to political allies.
3. It can be a source of political un-rest when people are sent away from government land.

## **Communal ownership**

This is where land is owned by the community that can be a tribe, clan or religious sect.

### **Characteristics of communal land ownership**

1. Its common in the pastoral communities of East Africa
2. Land is neither bought nor sold.
3. Every member of the community has a right to use land
4. Land is allocated to individuals by community leaders or village elders.

### **Advantages**

1. Every member of the community has access to land irrespective of his social and economic background.
2. There is efficient use of land since abandoned land can be given to members of the community.
3. Each person can cultivate or graze on the communal land with no restriction.



4. There are no cases of landlessness.

#### **Disadvantages**

1. It doesn't give any incentives for improvement of land by the farmer.
2. There is a tendency of over stocking and over grazing leading to erosion.
3. Its difficult for a farmer to use the land to get a loan since he has no title deed as an individual.
4. Increasing population leads to land fragmentation which reduces agriculture production.
5. Continuous cropping may lead to destruction of soil structure.
6. Its difficult to improve livestock since controlled breeding is hard to practice on such land due to communal grazing.
7. Pest and disease control is very difficult since farmers are difficult to mobilize under such a system.

#### **Lease hold**

Here land is given to the tenant by the state or the landlord for a specific period of time like 49years, 99 years and 999years.

#### **Advantages**

1. The tenant has security of tenure therefore can use land for development without fear
2. The tenant can use the title secured to acquire a loan for development.
3. The tenant can rent out the land to get extra income.
4. It minimizes land disputes because of proper land demarcation
5. It encourages the growing of perennial crops with a long lease period.
6. The tenant is encouraged to carryout land conservation measures.

#### **.Co-operative land tenure**

This is where land is owned by individuals who organize themselves into a Co-operative.

#### **Advantages**

1. The land is used efficiently for productive purposes.
2. The co-operative organization can use the land as security to acquire a loan
3. Group ownership of land is a source of security.
4. There is collective work on the land which leads to high production.
5. Members can share profits and losses that are made.

#### **Disadvantages**

1. Individuals cannot easily get loans for production
2. Decision making is difficult as far as usage of land is concerned.

### **LAND REFORMS**

This is an organized action designed to improve the structure of land tenure and use.

#### **Examples of land reforms**

1. Land consolidation
2. Land registration
3. Land re-distribution

4. Settlement and resettlement schemes.

### **Objectives of land reform**

1. Achieving high levels of land output through security, incentives and investments.
2. Achieving flexibility of farming patterns to meet changing natural market demand.
3. Increasing productivity of both land and labour.
4. Achieving effective utilization of national land resources which can include settlement of people on un used land and introduction of irrigation.
5. Encouraging production for the market through large scale production as opposed to subsistence
6. Encouraging conservation and improvement of land by preserving forests and wetlands.
7. Reducing land conflicts in a population through land registration

### **Settlement and resettlement schemes**

**Settlement;** first time establishment on land which was previously undeveloped

**Resettlement;** planned and controlled population transfer from one area to another

### **Reasons for setting up**

1. To ease population pressure by removing people from highly populated places to those with sparse population.
2. To prevent pest and disease attack by removing people from places infested with tsetse flies.
3. Increase land for agricultural production by removing less productive people from the land.
4. To facilitate mechanization by availing more land to farmers.
5. To settle the land less people who may become a problem within the population.
6. To resettle displaced people who might have been displaced by natural calamities and political insurgencies.
7. To encourage self employment to people after being given land.
8. To resettle unemployed people so as to reduce rural-urban migration and unemployment.
9. To carryout research in agriculture activities in resettlement schemes.
10. Train youth in improved methods of farming so as to improve their welfare.

### **Land registration**

This is where a farmer comes to an agreement with government over the ownership and use of land through the acquisition of land title deed.

### **Importance:**

1. The land owner has security of tenure hence can develop the land.
2. He can use the land title as security to obtain loans.
3. Land owner can easily rent out land to get extra income.
4. It minimizes land disputes because of proper land demarcation
5. It encourages land development through establishment of perennial crops
6. Land owner is encouraged to carryout soil conservation measures in order to protect his land.
7. It is easy to sale or transfer the ownership of land.

### **Land consolidation**

This is the pooling of small pieces of land to form a large and more productive land when put together under one management.

### **Steps in land consolidation**

1. Establish land ownership
2. Measurement of the plot to be consolidated in order to establish their size.
3. Describing the nature of the fragment
4. Valuing the fragments to be consolidated
5. Recording each fragment of land for further consideration
6. Issuing of the title for the consolidated land or fragments.

### **Advantages**

1. Saves time that could have been wasted moving from plot to plot during farm operations.
2. Makes supervision of farm operations easy and less costly since they are in one place.
3. It encourages mechanization on a farm since the land is big enough which makes the practice economical.
4. Agricultural production is increased due to large scale production.
5. It's easier to provide extension services on the consolidated land.
6. Theft of farm produce is reduced due to improved supervision.
7. Transport costs of the produce from the garden are reduced since all products are in one place.
8. It's easier to control pests and diseases on the farm since the big portion of land is under one management.
9. It's easier to carry out soil and water conservation measures.

### **Disadvantages**

1. It may make people land less.
2. It may cause political unrest among the population as people lose land during consolidation
3. It's a very costly exercise since each fragment is of a different value.

## **LAND FRAGMENTATION**

This is where agricultural farm land is split into small plots in different places belonging to one farmer.

### **Causes of land fragmentation**

1. An increasing population in the country making land to be scarce
2. Traditional system of land inheritance where sons share the fathers' land upon his death.
3. Limited income among the farmers which forces them to buy small affordable plots.
4. Farming systems like shifting cultivation which allows farmers to move from place to place.
5. polygamy which forces the family head to own pieces of land in different places
6. communal land ownership where people divide up land continuously amongst them selves

### **Effects of land fragmentation**

1. It's difficult to supervise all plots effectively leading to loss of produce.
2. A lot of time is wasted in moving from plot to plot.
3. Farm planning is difficult due to the small size of the fragments.
4. It encourages low agriculture production due to subsistence production.

5. Theft of farm produce is common due to reduced supervision.
6. Agricultural mechanization is difficult due to the small size of the plots which are scattered.
7. It's difficult to offer agricultural extension services on such scattered plots.
8. It's difficult to carry out soil conservation measures due to the distance involved.
9. Pest and disease control on the fragments is difficult.
10. It's difficult to control grazing since farmers have small plots that are prone to overstocking and overgrazing.

***Mention ways of land acquisition in Uganda***

**CAPITAL**

It's a stock of assets which are meant for the production of other assets.

**Types of capital**

**1. Fixed capital / Real capital**

This includes land, building, fences, and machines, Tools, livestock and crops in the garden. Fixed capital stays in the business for a long time

**2. Working capital**

This is money or materials used in day to day running of the farm business e.g. fertilizers, fuel, seed etc.

**3. Private capital** These are assets owned by individuals

**4. Social capital** These are assets that are owned by the state on behalf of the citizens e.g. roads, schools, hospitals, government farms etc.

**AGRICULTURE CREDIT**

This is money or resources which farmers borrow from various institutions or individuals to improve their production and development.

**Importance of agriculture credit.**

1. It allows farmers to finance profitable activities on the farm.
2. It encourages the farmer to develop a sense of saving.
3. It increases capital development on the farm in form of buildings, fences etc.
4. It allows a farmer to finance big investments beyond his income.
5. It encourages better farming techniques in agriculture through the use of improved breeds and varieties
6. It can lead to improvement of the standard of living amongst farmers.

**Sources of agriculture credit.**

1. Commercial banks like stanbic, DFCU
2. Co-operative organizations like BCU
3. Individual money lenders like baypot.
4. Farmers organizations i.e. Uganda National Farmers Federation (UNAFF)
5. International bodies like International Fund for Agriculture Development, Food and Agriculture Organization, International Monetary fund.
6. Development banks like UDB, EADB.
7. Marketing board e.g. Uganda Tea Board

8. Government through various bodies like central bank

### **MEASURES THAT ENSURE EFFECTIVENESS OF AGRICULTURE CREDIT**

1. Provision of extension services / education to farmers on how to use loans.
2. Improvement of loan supervision to ensure prompt payment.
3. Improving loan recovery programme by encouraging part repayment over a period of time.
4. Improving staff training for effective co-ordination with farmers.
5. Provide farmers with inputs at fair prices so that they can earn profits for easy repayment of the loans.
6. Provide farmers with loans in kind like fertilizers, pesticides, improved seeds etc.
7. Organize marketing of farmers' produce at fair prices so that farmers can get profit early to pay back credit.
8. Give loans to farmers in time or at the correct time to reduce risks.
9. Give adequate grace period to allow loan payment to take place easily.
10. Charge fair interest rates that can be met by the farmers.
11. Help farmers to identify viable projects for investment.

### **PROBLEMS ASSOCIATED WITH LOAN REPAYMENT**

1. High interest rates which may be difficult to be met by a farmer to pay during loan repayment.
2. Short grace period which doesn't allow the farmer to realize the borrowed money.
3. Risks and uncertainties that cause severe losses to farmers making it hard to pay back loans.
4. Poor loan supervision among the loan providers giving room for defection.
5. Credit unworthiness of some farmers who may not want to pay back the loan.
6. Death of the farmer leaving no body to pay back the loan.
7. Political interference where a farmer may take the loan advanced to be a political payment or reward.
8. Inadequate knowledge of a farmer on how to use loans effectively

### **Types of agricultural credit**

**Short term credit-** this is given for a period of 1 to 2 years and can be used to purchase inputs like fertilizers, seeds, pesticides feeds and employing casual labour

**Medium term credit-** this is given for a period of 2-5 years and can be used for building farm structures and purchasing machinery

**Long term credit-** this can be given for a period of 20 years and can be used for financing long term projects like purchase of livestock and erecting buildings

### **LABOUR**

This is human effort both manual and intellectual directed towards the process of production.

#### **Classification of labour**

Labour can be classified as;

##### **a) Skilled labour.**

This is where people perform jobs in which they have training e.g. teachers teaching and doctors treating

##### **b) Semiskilled.**

This is where a person performs a particular job where he has no training but has some knowledge about it.

##### **c) Unskilled labour** This is labour provided by people who are not trained at all in such a field.

#### **d) Family labour**

This is labour provided by family members like children and wives in agriculture work.

#### **Efficiency of labour**

This is the measure of output per person per hour / time

It's affected by

1. Education / training ease ways of doing work.
2. Health; poor health reduces labour efficiency
3. Incentives i.e. attractions to work e.g. salary.
4. Climatic conditions; poor climate reduces efficiency of labour
5. Supervision; poor supervision reduces efficiency
6. Organizations of people for work; poor organization reduces efficiency
7. Experience of the workers; low experience reduces efficiency
8. Provision of good tools for work; lack of tools for use during work reduces efficiency

#### **LABOUR FORCE**

This refers to economically active people between 15-65yrs of age excluding students, house wives and disabled.

#### **Labour supply.**

This is the number of hours worked per period of time.

#### **Factors affecting labour supply.**

1. Health conditions of the workers.
2. Motivation in terms of salaries and allowances.
3. Working conditions.
4. Population size a high population leads to provision of more Labour e.g. china
5. Retirement age, a high retirement age guarantees a high labour supply.
6. Immigration which increases labour supply
7. Emigration which decreases labour supply as workers leave a place
8. Labour mobility, a high labour mobility leads to high labour supply.
9. Working time, as number of working time increases supply of labour also increases.
10. Strength of trade unions. These can reduce the number of people employed to maintain the wage by fixing a high minimum wage.

#### **Labour mobility**

This is the ease with which labour can move from one place to another (geographical mobility) or from one job to another (occupation mobility)

#### **Factors affecting labour mobility**

1. **Limitations in skills;** it's hard for a sweeper to do doctors work.
2. **Time required for training;** along training period reduces the rate at which such people can join that occupation.
3. **Racial differences;** in some countries certain jobs are reserved for a particular race.

4. **Trade unions**; workers can we collective effort to bargain for higher wages and reduce entry of others in employment.
5. **Transport**; poor transport resists movement of people from place to place.
6. **Security**; poor security can affect the acquisition of jobs in particular areas.

## **MANAGEMENT / ENTREPRENEURSHIP**

An entrepreneur is a person who undertakes the task and risk of organizing other factors of production so as to earn profits. The reward for the entrepreneur is profit or loss depending on performance of the business.

**Management**; the art and science of organizing and operating a farm business or this is the organization of factors of production by minimizing costs and maximizing profit.

### **Functions of a manager**

1. Purchasing farm inputs
2. Mobilizing resources for the farm
3. Combining factors of production to earn profits
4. Bearing risks and uncertainties of the farm
5. Organizing and supervising factor inputs like labour
6. Making final decision in the farm business to foster growth
7. To event new ideas that are useful for development
8. To find market for farm produce and sale it
9. Keep up-to-date farm records for reference purposes
10. To motivate labour at the farm for better performance
11. To coordinate and plan farm activities as required

### **Factors that determine the farmers' choice of an enterprise**

- i. Climate; good climate favours crop and animal production more especially where farmers have to depend on nature
- ii. Soil factors; in agriculture, good soils are necessary for crop production
- iii. Pests and diseases; their presence limits agriculture since they attack crops and animals leading to losses
- iv. Farmer's interests; this influences their zeal for work of a particular nature and level of production
- v. Market; whatever farmers produce must be taken to the market for sale. Good market encourages farmers to venture in an enterprise
- vi. Social and religious factor; Moslem cannot invest in pig enterprise since their religion bars them from that practice.
- vii. Government policy; government can prohibit some enterprise which may discourage farmers from such work e.g. production of tobacco.
- viii. farmers' experience and skill in an enterprise
- ix. level of capital needed in investment
- x. availability of power needed in production

**Production efficiency**-this is the measure of the farmer's ability to use low costs to obtain maximum output in quality and quantity.

**Efficiency standard**-this is a mathematical formulae that a farmer uses to assess his success or failure in business

### **Types of efficiency standards**

**Partial efficiency standards** – it's a measure of the efficiency of carrying out a particular farm enterprise. It can be carried out in two ways



a) **Yield index** – the percentage ratio of actual yield to expected yield i.e  $\text{yield index} = \frac{\text{actual yield}}{100} \times$

Expected yield

b) **System index** – the percentage yield index between two different farms under comparison

**Economic efficiency**-measure of the economic contribution of each factor used in p[roduction with an aim of establishing maximum average output per unit input.

**Technical efficiency**-this measures the ability of a factor of production to perform its job properly within the required time to contribute effectively to economic returns of a business.

**Improving farm efficiency**

- proper weed control
- proper pest and disease control
- use of improved breeds and varieties
- mechanization of farm activities
- careful planning
- proper crop spacing
- use of manures and fertilizers
- early planting
- supplementary feeding of livestock
- proper record management

**Farm planning and budgeting**

**Farm planning** is the designing of a careful arrangement through setting objectives and defining means and procedure of achieving the objectives set.

**Process of decision making**

Problem recognition

Collection of information

Analyzing alternatives

Making a decision

Taking action

**Forms of planning**

- 1) Simple planning- this involves budgeting for cash received and expenses while ignoring minor expenses
- 2) Intermediate planning-this is full budgeting for input-output ,receipts ,investments and credits
- 3) Advanced planning-involves intermediate planning, budgeting for receipts, expenditure, borrowing and repayment on an annual basis
- 4) Informal planning-these are plans mentally borne without anything written
- 5) Partial planning- this is where a section of the farm is planned leaving the other part

**Importance of farm planning**

- a. A farmer can set targets of how much produce he expects to get
- b. Enables allocation of scarce resources in relation to costs and markets
- c. Allows the farmer to fully control the farm other than being controlled
- d. Guides the farmer in choosing the enterprise to maximize profits
- e. Enables a farmer to separate items for sale, saving and domestic use
- f. Enables the farmer to assess the progress of the farm towards the set goals
- g. Allows the farmer to focus ahead to see the future of the farm
- h. Allows the farmer to perfume farm duties on time
- i. Allows a farmer to identify reasons for his success

**Aims of planning**

- i. To achieve maximum revenue returns
- ii. Identify least cost combinations
- iii. Determine nature of weakness in the use of resources



- iv. Indicate the most profitable combination

### Methods of planning

1. Comparison between different farms
2. Budgeting using elementary economics
3. Linear programming using computers

### Methods of increasing profits in Agriculture

1. choosing correct business with less risks and uncertainties
2. Selling produce when prices are high i.e. having good storage facilities
3. Timely planting of crops so as to benefit from the high prices that are offered at the beginning of the harvesting season.
4. Use of better techniques of production i.e. improved seeds, good breeds.
5. Processing agriculture products so as to add value hence more profits.
6. Advertising your produce so that buyers are aware
7. Grading the produce to allow fair prices for each product.
8. Packing of the produce so as to reduce transport costs and increase the profit margin.
9. Proper control of pests and diseases i.e. increase quality.
10. Proper allocation of resources to avoid over spending and under spending.

### Economics basic principles

These explain fundamental economic problems of man and they are;

**Scarcity** – this means that all commodities are relatively less than people's desires for them

- Scarce goods are called economic goods
- Abundant goods are called free goods

**Choice** – Taking of the right decision.

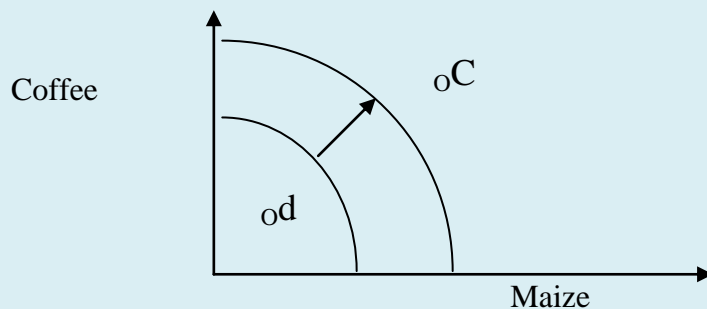
**Opportunity cost**; It's the value of the alternative foregone in making a decision e.g. if you forego buying a car and build a house. The cost of the car is the opportunity cost.

### Opportunity cost, curve / production possibility.

- It's a locus of points showing the combinations of commodities that may be produced when all resources are fully utilized..

#### ❖ Economic growth

This is the shift of the production possibility frontier curve outwards (to right)



It shows an increase in resource and hence an increase in commodities produced.

### Economic system

This refers to the organization of ownership, allocation and distribution of resources in an economy.

- **Free enterprise economy** (unplanned / competitive / capitalization ) ‘Laissez faire” leave us alone (French) – All resources are owned by private individuals who are free to take all decisions.
  - **Centrally planned economy / planned / command economy / socialism.** All resources are owned by the state on behalf of the citizens. The extreme of socialism is communism
  - **Mixed economy; It’s** where some resources are owned by government and others by individuals.
- NB:** In practice, there is no pure capitalization or socialism

### PRICE THEORY

**Market** An arrangement in which buyers and sellers negotiate the exchange of a well defined commodity

#### TYPES OF MARKET

- Competitive market-** This is a market where there is perfect competition i.e. many sellers, free entry and exit, perfect knowledge, Non government regulation, profit and utility maximization.
- Imperfect market** -There is limited competitions in this market.
- Commodity market** -where goods and services are traded
- Factor market** -where factors of production are traded.
- Controlled market** Where authorities exert a degree of control e.g. by fixing prices, setting quotas, etc.
- Spot market** It’s where the commodity or a currency is traded for immediate delivery.
- Future market** Where contracts for delivery at some future date are traded.

#### DETERMINATION OF PRICES IN MARKET

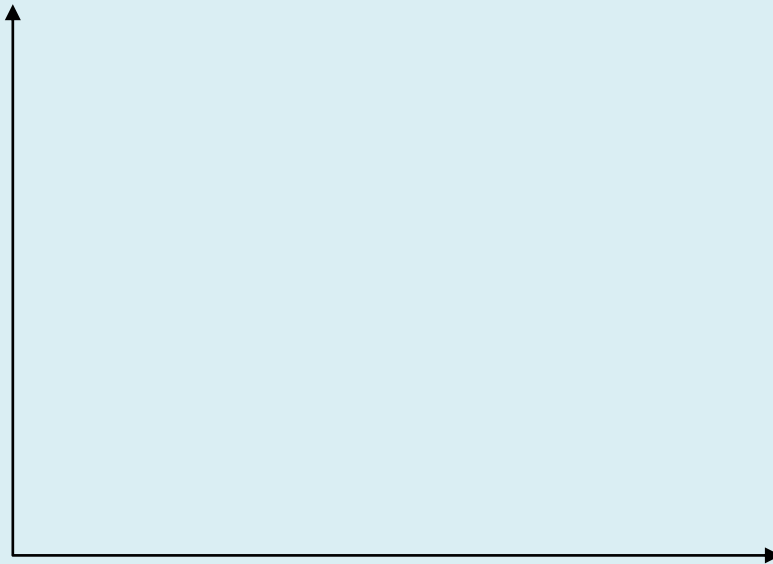
- ❖ **Haggling**  
It refers to the bargaining process taking place between one buyer and one seller. The process of bargaining continues until the buyer and the seller agree on the same price.
- ❖ **Fixing by treaties**  
Here buyers and sellers come together to fix the price of a commodity. The price can be revised by amending the treaty.
- ❖ **Sales auction**  
Takes place between one seller and many buyers where buyer competes for the commodity by fixing high prices. Commodity is taken by one who pays the highest price.
- ❖ **Forces of demand and supply.** These two act to form an equilibrium or market price
- ❖ **Retail price maintenance;** here manufacturers provide retail recommended price inscribe on the commodities
- ❖ **Fixing prices by government;** here a maximum price is set by the government to reduce exploitation of the sellers and buyers
- ❖ **Contract agreement;** here a supplier agrees with the consumer on the price before commencement of the business
- ❖ **cartel;** producers agree on the price of their product

#### Equilibrium Price

In the process of buying and selling (demand and supply ) there comes a time when quantity supplied is equal to quantity demanded i.e. demand = supply. Such a price is called the equilibrium price **e.g.**

Price(shs)	Demand (Kg)	Supply (Kg)
200	12	4
300	10	6
<b>400</b>	<b>08</b>	<b>08</b>
500	06	10
600	04	12

## DETERMINATION OF PRICE USING DEMAND AND SUPPLY



- i. In a competitive market, prices are determined by price mechanism i.e. forces of demand and supply
- ii. If supply increases (excess supply) at constant demand, price falls
- iii. Increase in demand at constant supply will lead to increase in prices
- iv. At equilibrium, demand is equal to supply
- v. At low prices, demand is high and supply is low
- vi. When equilibrium price is stable for some time, it is called the normal price or natural price.
- vii. Equilibrium price is the market price where what is brought to market is bought without leaving excess.
- viii. Excess demand implies a shortage of supply/ low supply

### DEMAND

The desire backed by the ability and willingness to have the commodity desired.

**Effective demand** - it's the actual buying of the commodity.

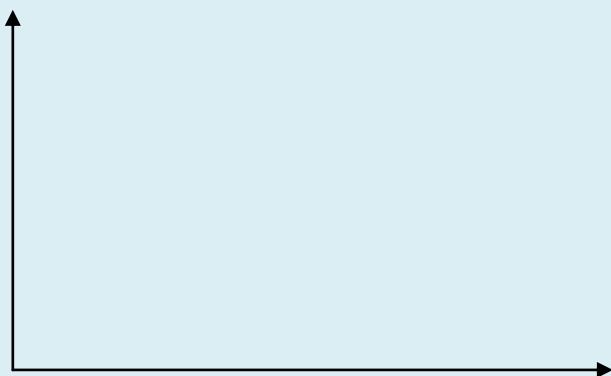
**Quantity demanded** - This refers to the amount of a commodity buyers are willing and able to purchase in the market at various prices for period of time

**Demand schedule** -Data expressing the quantity of goods buyers are willing to buy at various prices.

#### Demand for maize flour in Naalya market

Price (shs)	Quantity (Kg) demanded
1000	20
900	40
800	60
700	80
600	100
500	140

## Demand Curve



### Law of demand

The law of demand states that the higher the price, the lower the quantity demanded and vice versa.  
**Ceteris paribus (Keeping other factors constant)**

### Factors influencing market demand for agriculture products

- ❖ **Price;** When the price falls, consumers buy more because they leave substitutes and buy more of the cheaper commodity i.e. more consumers join market to buy cheap commodity.
- ❖ **Price of other commodities** e.g. substitutes and complements.
  - a) **Substitutes** are two commodities that can be used to satisfy the same demand e.g. Beans and peas – increase in price for beans will lead to low demand for bean and high demand for peas supposing their price is constant.
  - b) **Complementary Commodities** are jointly demanded e.g. petrol and cars, shoe polish and shoes. Increase in demand for cars will lead to an increase in demand for petrol.
- ❖ **Incomes** - consumers with higher income buy more than the poor hence command a high demand
- ❖ **Size of population;** Increase in population increases demand for commodities more especially necessities.
- ❖ **Population composition in terms of age and sex;** A population full of aged people is less productive hence has a low purchasing power and demand
- ❖ **Tastes and preferences** ;If people lose taste for one commodity in preference for another then demand for such commodity will be low.
- ❖ **Future expectation;** when prices are expected to rise in future due to anticipated shortage, buyers will buy more and stock increasing demand at that time.
- ❖ **Change in savings;** a family wishing to increase savings will reduce consumption expenditure lowering demand.
- ❖ **Advertisement;** Increasing advertisement will increase the awareness of such a commodity hence increased demand.
- ❖ **Taxation;** increased taxes on goods by government increases the prices hence reduced demand.
- ❖ **Inflation** ;A lot of money in circulation increases the demand as there is a lot of money to spend yet the commodities are limited.
- ❖ **Depreciation** Depreciated goods are not on high demand e.g. old hoes are not highly demanded since cannot do the best job.
- ❖ **Taboos** Some communities and religions forbid consumption of certain items e.g. pork by Moslems and Seventh Day Adventist. this lowers demand for such items in the community
- ❖ **State of the economy;** A booming economy will experience a high demand for commodities as people have money to spend.

## Types of demand

**Joint / complementary demand.** Demand for commodities that are used together such that increase in demand for one increases demand for the other e.g. demand for fuel and cars

**Competitive demand** This refers to the demand for commodities which serve almost the same purpose such increase in demand for one reduces the demand for another e.g. block and bricks, beans and peas, coffee and tea.

**Composite Demand** Demand for a commodity which serves several uses such that its total demand is got by adding up quantity demanded of it by those several uses.

## Derived demand

This refers to demand for a commodity not for its own sake but as a result of demand for another e.g. demand for factors of production is derived from demand for commodities which such factors of production are used to make.

## Independent demand

Demand for a commodity does not affect the demand for other commodities

## PRODUCT COMBINATION

**Competitive products;** products that compete for the same resource during production like crops and livestock using the same land. Increase in area of crop cultivation will reduce grazing land available for livestock production hence less animals produced.

**Joint products;** products produced from a single line of production like meat and hides or skins. Increase in meat production increases supply of hides or skins

**Complementary products;** products that support each other in the line of production like pasture legumes and grasses, livestock and crops in mixed farming

**Supplementary products;** two products that have no effect on the output of the other like keeping dairy cattle and pigs in the court yard

## INPUT COMBINATIONS

**Diminishing rate of substitution;** two inputs substitute each other as one may be used more than the other to effect the same change

**Varying rate of substitution;** two inputs can form a combination to give the best results once mixed in different ratios

## Elasticity of Demand

This refers to the degree of responsiveness of change in quantity demanded to a change in factors which influence quantity demanded like price, income and price of other commodities.

Price elasticity of demand -this is the measure of responsiveness of change in quantity demanded to changes in the commodity's own price.

$$ED = \frac{\% \Delta \text{Quantity demanded}}{\% \Delta \text{Price}}$$

E.g. when the price of maize was 100shs/kg, quantity demanded was 1000kg when the price was increased to 200shs / Kg quantity demanded was 400kg.

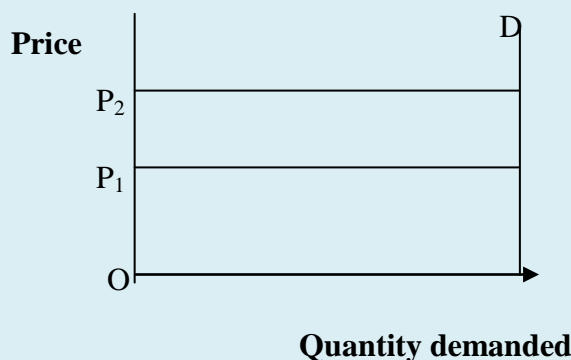
$$ED = \% \Delta \text{ in demand} = \frac{1000 - 400}{1000} \times 100\% = \frac{600}{10} = 60$$

$$\% \Delta \text{ Price} = \frac{200 - 100}{100} \times 100 = 100$$

$$ED = \frac{60}{100} = 0.6$$

### Interpretation of price elasticity of demand

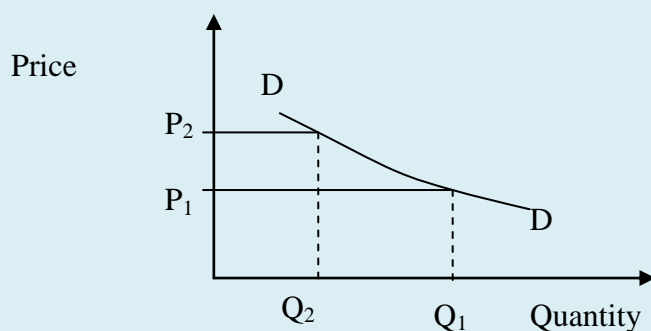
- **Perfectly or completely inelastic** – when price Ed is zero. Quantity demanded does not respond to changes in price at all.
- 



- **Inelastic demand** Ed is greater than zero but less than 1 – smaller change in quantity demand resulting from a change of price .

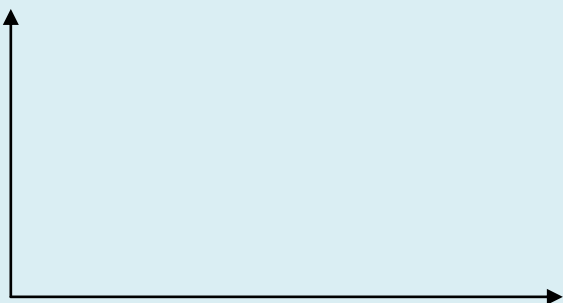


- **Elastic demand** Ed is greater than 1 but less than infinity. Here % change in quantity is greater than change in price.



### Unit elasticity of demand

This is when price elasticity of demand is equal to one i.e. quantity demanded changes exactly as price change.



**Perfectly elastic;** When price elasticity is equal to infinity meaning that buyers are prepared to buy all they can at below the same price and not at all slightly higher

**Determinants of price elasticity of demand**

- ❖ Availability of substitutes  
Commodity with many substitutes has elastic demand since consumers shift from it when cost is increased.
- ❖ Degree of necessity                      Price tends to be inelastic since they indispensable e.g. when the price of salt increases the quantity demanded is the same. Luxuries have elastic demand.
- ❖ Consumers income  
When consumers are of low income (poor) Ed. Tends to be elastic as price increase it reduces their demand since they cannot afford.
- ❖ Cost of the commodity    If a commodity takes a small fraction of the consumer’s income, its demand tends to be price inelastic e.g. match box, salt.
- ❖ Habit in use of the commodity    This makes the demand to be inelastic e.g. Demand for alcohol and cigarettes, drugs may not be affected easily by change in price for the addicts.
- ❖ Durability of the commodity        Durable commodities like radios, cars have low price elasticity of demand. Even when price is lowered, one cannot buy one if he / she has one.
- ❖ Price expectation  
If prices are expected to increase in future, demand will be inelastic as people would buy and stock and vice versa.
- ❖ Several uses of the commodity    A commodity with several uses (composite) has elastic demand for example Electricity when price is increased people use less of it.
- ❖ Time lag                      Consumers take time to respond to price changes. Elasticity tends to be Inelastic in the short run and elastic in the long run.
- ❖ Time of the year                      Towards and during public holidays, demands tends to be inelastic since even when the price is increased people still buy more
- ❖ Consumers ignorance                Consumers may buy commodities a high price when they don’t know where such commodities or their substitutes are sold.

**SUPPLY THOERY**

**Quantity supplied**    -the amount of a commodity producers are willing to bring to the market at various prices per period of time.

**SUPPLY SCHEDULE**

Price (shs)	Quantity supplied (Kg)
200	50
300	100
400	150

500	200
600	250
800	350

### Supply Curve



#### Law of supply

The higher, the price, the higher the quantity supplied and vice versa **ceteris paribus**.

#### Determinants of quantity supplied for agricultural products

**Price;** According to the law of supply, the higher the price, the higher the Quantity supplied.

**Weather** For agriculture products, good weather with adequate rainfall and a sunny Harvesting period is necessary for high yields and high supply.

#### Technology of production

Farmers using tractors and other machines in production produce more than those using traditional implements like panga hence higher supply.

#### Managerial efficiency

A well organized farm enterprise yields more than a poorly organized one since activities are done on time and as required.

#### Costs of production

If the costs of inputs like fertilizers and seeds are low then it's easy for farmers to buy them and produce more increasing supply.

#### Number of sellers / producers

If many sellers bring more produce to the market then supply will be high.

#### Government policy

If the government levies a high tax on a particular good more especially agriculture inputs, then this automatically increases the price of such a good and will reduce supply of agriculture products due to increased costs of production.

#### Transport

Improved and efficient transport facilities facilitates the delivery of farm produce to the market increasing supply.



### **Prices of other (substitutes) products,**

Increase in the price of one will increase the demand for the product whose price has not been increased

### **Political stability -**

Enough security will encourage production hence increasing supply of products to the market.

### **Aims of producers**

If a producer's objective is to produce large quantities of a product for the market then this will increase production.

### **Future price expectation**

If the prices are expected to increase in future, suppliers will hoard / store the product for the future good prices reducing supply.

### **Availability of factors of production**

When the prices for labour, land and capital are low then it becomes more profitable to produce more for the market increasing supply.

### **Demand**

High demand for any commodity calls for increased production and supply as well and low demand calls for low supply.

### **Gestation period**

This refers to the period of maturity. If the gestation period of a commodity is short the production / supply can be increased in the shortest time possible.

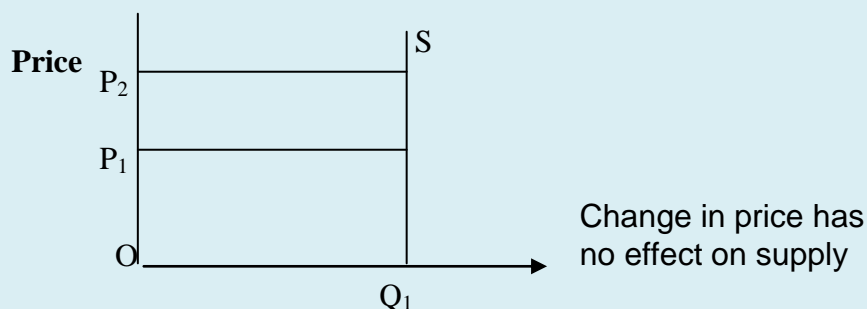
## **ELASTICITY OF SUPPLY (ES)**

**Price ES** – is the measure of responsiveness of changes in the quantity supplied due to relative changes in price of the good.

$$ES = \frac{\% \Delta \text{ in quantity}}{\% \Delta \text{ in price}}$$

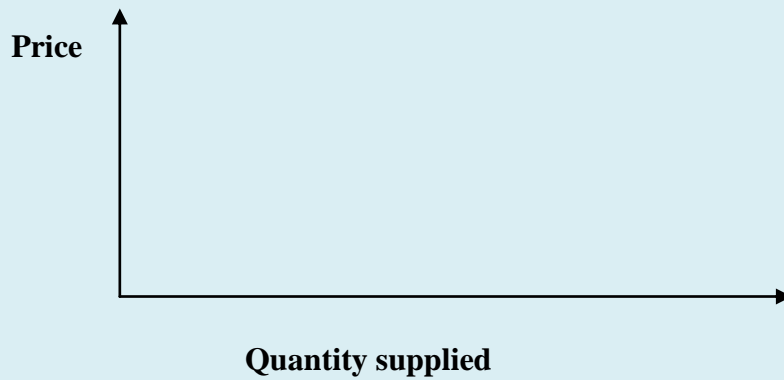
### **Types of $E_s$**

**Perfectly / completely inelastic** - Elasticity of supply is = 0 (zero)



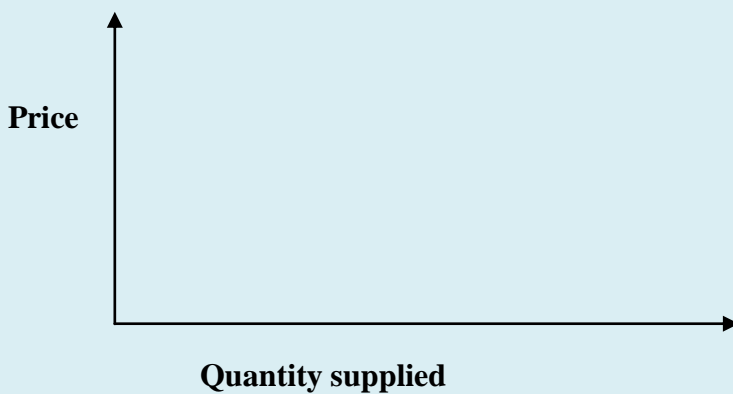
### **Inelastic**

ES is greater than Zero but less than one (1) i.e. %age change in Price is greater than %age changes in quantity supplied.



### **Unit elasticity of supply**

This is when ES is equal to 1. Percentage change in quantity is equal to percentage change in price.



### **Perfectly elastic**

When at or above a certain price suppliers supply all they can but nothing below that price

### **Elastic supply**

Elasticity of supply is greater than 1 but less than infinity.i.e.Percentage change in quantity is greater than percentage change in price

### **Factors influencing price elasticity of supply**

#### **Nature of product**

Durable commodities have high Es since they can be stored for a long time as compared to perishables.

#### **Gestation period**

When a commodity has a short gestation period its elasticity of supply is higher than that with a long gestations period since take a short period to change.

#### **Time**

In a short time the Es of supply is small but can be big in the long run. For instance it takes some time for suppliers to get used to the new price after a change.

#### **Method of production (technology)**

Products produced with sample technology have a high elasticity of supply because they can easily be produced when the price increases.

### **Government policy**

Elasticity of supply may be low when government restricts importation of certain commodities.

### **Ease of entry of new firms in the market**

When new firms are restricted from entering the market supply is likely to be inelastic /low.

### **Price expectations**

When producers expect prices to change, the price  $E_s$  will be low until they are fully sure of the new price.

### **Factor mobility**

When factors of production are easily reallocated from one line of production to another, elasticity of supply is high and vice versa.

### **Characteristics of agricultural products**

- i. They are perishable
- ii. They are bulky
- iii. They are seasonal in production
- iv. They have inelastic demand
- v. They have synthetic substitutes
- vi. They are of mixed quality
- vii. They have a long gestation period

### **Problems of marketing Agriculture products**

- a. Divergence of production; it's difficult to plan exactly what to produce and get the same quantity due to the many risks and uncertainties involved.
- b. Inelastic demand ; agriculture products have inelastic demand since even when prices are lowered the demand doesn't change distinctly.
- c. Perishability - most agriculture products are perishable therefore difficult to store hence need exposure very fast.
- d. Availability of synthetic substitutes; this has replaced a number of products like sisal, cotton rubber
- e. Seasonality of production –;products like crops have specific periods in which they are production therefore scarce at planting and abundant at harvesting
- f. Bulkiness agricultural products weigh much in relation to their value. This makes the transportation of such products more difficult and costly.
- g. Mixed quality; agriculture products are always a mixture which calls for sorting
- h. Price fluctuation; this affects farmers income more especially where prices reduce
- i. High taxation; this reduces the profit margin for the farmers
- j. Long gestation; this make change in supply at short notice difficult
- k. Poor roads; this makes transportation of produce to the market difficult and costly.
- l. Large number of small scale produce; these make control of production difficult hence farmer cannot get better prices
- m. Insecurity; this will impede movement of products to the market due to fear for robbery and destruction of property.

### **MARKETING AGENCIES, INSTITUTIONS AND ORGANIZATIONS.**

**These are bodies involved in one or more marketing functions**

- a. Itinerant traders- These move from place to place buying agriculture produce of various types from farmers.
- b. Processors- these are individuals or organizations who undertake the task of processing agriculture product into a usable form to satisfy consumers.
- c. Wholesalers- these buy in bulk from manufacturers and sell to small sellers (retailers).
- d. Retailers- these buy from wholesalers and rarely from producers selling to consumers.
- e. Brokers- these bring the sellers and buyers together without the broker handling the actual good
- f. Commission agents- they receive goods and sell them on behalf of their principles for a cost (commission).
- g. Cooperatives.
- h. Marketing boards.

**Marketing functions.**

*These are essential and recognizable activities which are performed in the marketing process*

They include the following;-

1. Buying-this involves purchasing in small amounts for producers and bulking up the commodity.
2. Assembling- this is where commodities are pooled up into large quantities ready for the next operations.
3. Transport- it's the movement of goods from the place of production to the centers of consumption or demand.
4. Selling- this is the presentation of the commodity in an acceptable and attractive manner.
5. Storage-it involves storing products to reduce loss in value as most of the agriculture products are perishable.
6. Processing- it's the changing of the products from raw form to a more acceptable form to increase value.
7. Grading- it's the sorting up of products in a uniform way especially quality wise.
8. Standardization- measurements are applied more especially quantitatively for easy pricing.
9. Financing- the process of turning raw materials into finished goods requires money resource to finance it.
10. Risk bearing- in between buying and selling, a number of risks are encountered like theft, fire, e.t.c.
11. Collecting and analyzing market information- efficient marketing depends on the availability of market information like prices, taxes, risks, e.t.c.

**Importance of processing agricultural produce**

- adds value to produce hence good prices at selling
- increases the shelf life of produce/reduces perishability
- increases the number of products from a single item hence profit margin
- makes an item more suitable for consumption/improves quality of products
- reduces the bulkiness of items making transportation and packing easy
- creates avenues for increased youth employment in processing units

**Importance of grading**

- makes pricing of products easy and reasonable
- makes distribution of products more effective
- proper grading increases profit making
- it minimizes spoilage of produce by separating the spoilt produce out
- facilitates buying and selling due to reduced inspection

**Importance of packaging**

- it reduces bulkiness of produce
- reduces adulteration of produce
- controls spoilage of produce from the environmental factors

- makes handling of produce easy
- may assist in advertisement of produce
- may aid branding of produce

### **Importance of prices in Agriculture**

1. They indicate to the farmer what commodity to produce.
2. Prices determine the level of output.
3. They act as a guide to economic activity and allocation of scarce resources.
4. Prices allocate the workers to the right jobs where they are most efficient.
5. Prices coordinate consumption levels of agricultural produce through forces of demand and supply.
6. Prices reward the factors of production and leave freedom of choice among producers and consumers.
7. They enhance better and efficient methods of production more especially when prices of a certain commodity increase.

### **CAUSES OF PRICE FLUCTUATION IN AGRICULTURE**

- a. Risks and uncertainties; these are cardinal bottle necks in agriculture since they greatly affect the quality and quantity of production on farms
- b. Climate; the production of crop and animals is affected by rainfall, temperature
- c. Most agriculture products are perishable and therefore difficult to store hence must be sold soon after harvesting.
- d. Agriculture products; have inelastic demand so that excess production is difficult to absorb while maintaining price.
- e. There is divergence between planned and actual output which at times is less than planned and at times, more than planned.
- f. Seasonality of production more especially crop products that are excess during harvesting period and scarce at planting.
- g. Stiff competition from synthetics like polyethene plastics and other petroleum products for rubber and sisal.
- h. Long gestation period ; when prices for the products are high, producers plan to produce more which takes a long time before production is realized.
- i. Bulkiness; most agriculture products are bulky which makes transportation difficult from places of plenty to scarcity.
- j. Agricultural products form a small part of manufactured production hence the excess supply cannot be absorbed in the manufacturing industry.
- k. Large number of producers ;this makes it very difficult to plan and make actual productions giving room to peasant to sell at any price.
- l. Protectionism by developed nations.; It's difficult to export surplus agricultural products to developed countries because of heavy regulations and tariffs imposed on agricultural imports.
- m. Low level of industrialization ; Most LDC's don't process their agricultural products to final products which reduces the value of such items.
- n. Changing technologies; more technologies are being discovered which use less raw materials like cloth made of polyester and less cotton. This reduces the demand for agriculture products.

### **EFFECTS OF PRICE FLUCTUATIONS ON FARMERS**

- ❖ Lead to fluctuations of farmers' incomes and hence low standard of living.

- ❖ Revenue for government from agriculture products declines when prices are low affecting the country's development.
- ❖ Employment in agricultural sector fluctuates with fluctuating prices.
- ❖ Foreign exchange earning for the state fluctuates affecting Balance of payments (B.O.P.)
- ❖ Makes planning by governments and farmers difficult because of uncertain future income.
- ❖ The country experiences balance of payment problem and unfavorable terms of trade when prices are low.
- ❖ Agriculture mechanization becomes difficult because of low income.
- ❖ Makes farm budgeting and planning very difficult due to unstable incomes

### REDUCING PRICE FLUCTUATIONS

1. **Fixing prices** by government i.e. maximum or minimum price legislation so that the sellers are not exploited over price.
2. **Diversification** which means growing many types of crop and rearing animals which guards against total loss.
3. **Improving storage facilities** more especially for the Perishables so that supply can be regulated to meet demand.
4. **Increase research** so that good quality crops resistant to drought and pests, short gestation period are grown to reduce risks.
5. **Processing of agriculture products** like cotton and coffee before being sold to increase their shelf life and value for higher prices.
6. **Improving technology** in agriculture production through the use of irrigation, fertilization etc. This increases production and reduces scarcity.
7. **International commodity agreements** -these fix quotas and prices for both buyers and sellers of commodities to reduce exploitation.
8. **Improving transport** so that products can be moved to places where there is shortage to control price fluctuations.
9. **Price support** -here farmers sale their commodities at market price and present their receipts for government to top up to a realistic price.
10. **Buffer stocks** -Here the surplus during plenty is bought by marketing boards and sold during scarcity.
11. **Forming farmers' organizations and commodity agreements** to negotiate for better prices.
12. **Barter trade** -this helps in disposing off the surplus, but there are problems of transport.
13. **Fixing quotas** for farmers so that over production is checked that can result into reduced prices.

### Question; Show how the cob-web theory can be used in explaining price fluctuation in agriculture AGRICULTURAL DEVELOPMENT

**Agricultural development** is the transformation of agriculture from traditional subsistence farming to commercial or business orientated agriculture or **Is the transformation of agriculture** from low productivity to higher productivity i.e. Increasing output per unit input.

#### Role of Agriculture in development

- ❖ Agriculture requires less capital than industrialization and it can be carried out by people of all levels.
- ❖ It's a sole source of food for the growing rural and certain population.
- ❖ Agriculture requires less skilled labour as compared to industrialization.
- ❖ It's a good source of capital for the development of on the sectors in LDCs like industry.
- ❖ Agriculture provides market for industrial products like fertilizers, drugs, implements.
- ❖ Agriculture provides employment to many people in LDC e.g. 80% of Ugandans are employed directly and indirectly in Agriculture (2002 population census).
- ❖ Agriculture products constitutes 85% of export earning for Uganda therefore a good source of foreign exchange.
- ❖ It's a source of income for the rural poor used in buying other items.



- ❖ It produces raw material for industries like cotton, vanilla, hides, skins etc.
- ❖ It provides labour as people will move from rural areas to cities for employment in industries.

## LIMITATION OF AGRICULTURE DEVELOPMENT

- a. Lack of land both in quality and quantity -as the population increase the quality and quantity of land declines due to exhaustion and land fragmentation.
- b. Lack of capital -In Uganda today 38% of the population is below the Poverty line therefore cannot purchase inputs needed in agriculture production.
- c. Poor infrastructure -There is problem poor roads which impedes the movement of many products to the market from the places of production.
- d. Lack of skilled labour - a defective education system which emphasis theory and does not prepare products to work in rural areas discourages agricultural development.
- e. Inadequate extension services - Most farmers do not have enough knowledge as regards to agricultural production since extension services are inadequate.
- f. Limited market-information about available market is still lacking and the fact that most rural dwellers are all engaged in agricultural there is no body to buy from others
- g. Risks and uncertain - agricultural products have a lot of risks and uncertainties which limit their production leading to a lot of price fluctuation.
- h. Poor pricing policies - Farmers are scattered and most of them are subsistence producers. This makes it difficult for such producers to bargain for better prices in the market.
- i. Political instabilities -this insecurity has discouraged agricultural production as farmers are always in the run more especially in places with wars.
- j. Social factors- some farmers are very conservative and will resist any development put forward by authorities.

## POLICY RECOMMENDATION FOR AGRICULTURE DEVELOPMENT.

- ❖ **Cooperative development**-government should change her policy on cooperatives so the development of these bodies can take place as before.
- ❖ **Manpower for agriculture development**- training of researchers in agriculture and making the subject compulsory at primary is another step forward that will increase manpower,
- ❖ **Land policy**-reforms that agitate for the redistribution of land and correcting land ownership is yet another step forward in developing agriculture.
- ❖ **Credit policy**-micro finance organizations should be encouraged to lend money to the peasants even when they have no security.
- ❖ **Technology development**-better breeds of both crops and animals should be availed to the farmers to increase their production. Machines should also be used in production.
- ❖ **Extension education**-farmer need to be taught about new methods farming and equip them with other necessary skills through education.
- ❖ **Development of infrastructure**-better roads and other communication channel are needed more especially in the marketing agriculture products.
- ❖ **Marketing and pricing policy**-government should support the prices of agriculture products through subsidizing inputs or price support for the products.
- ❖ **Processing of agriculture products**-more investment is needed in setting up agro-processing industries so that the products produced are of a higher value.
- ❖ **Taxation policy**-after abolition of taxes on agriculture exports, the government should remove taxes on imported agriculture inputs like fertilizers, pesticides, herbicides, e.t.c.
- ❖ **Fund allocation**-government should allocate more funds towards agriculture development in the budget since the sector employs more than 80% of the population.
- ❖ **Political stability** this is very crucial in the development of any nation. Place where instability still looms have lagged behind in development.

- ❖ **Transformation of society**-traditions that hinder development should be discarded through compulsory primary education and adult learning.
- ❖ **Agriculture research**; this will increase production through the invention of highly productive breeds of animal and crop varieties.

**Mention the role played by agriculture research stations in agriculture production.**

- a. improve existing crop varieties to suit environment
- b. develop new breeds of animals and crop varieties
- c. testing new technologies of production
- d. comparing performance of different varieties and breeds
- e. finding the best method of controlling pests and diseases
- f. carrying out soil sampling for different fields
- g. developing new farming tools and equipment
- h. testing and evaluating the performance of chemicals

**problems faced by research stations**

- i. lack of enough qualified research scientists
- ii. limited funding to research stations by government
- iii. varying soil and climatic conditions in the different regions of Uganda
- iv. poor remuneration to researchers forcing many to leave research
- v. low numbers of research stations for the whole country
- vi. poor infrastructure at research centres making work difficult
- vii. ignorance amongst farmers on use of improved technology
- viii. changing climatic conditions in the world

**FARM MANAGEMENT.**

**Farm records.-**

Farming is business and involves many activities. The farmer must keep concise and clear records so as not to forget the many things done.

**Importance of farm records.**

1. They clearly show the success of a farmer by revealing the profit and losses made in a specified time.
2. They stipulate the physical performance of the different enterprises on the farm like poultry, piggery, dairy, e.t.c.
3. Records help in decision making regards the future of the farm enterprise.
4. Records can be used as a reference when a farmer wants to get loans from financial institutions
5. They can be a guide in comparing different farm enterprises and performance of farms with in a region.
6. Tax assessment can be done basing on farm records which leads to accurate assessment.
7. With the use of records, the sharing of dividends in cooperatives is made easy.
8. They help a farmer in drawing up plans in terms of organizing rotations, formulating policies and selecting farm enterprises.
9. Records can be used in animal breeding especially pedigree selection where the history of the animals' relatives is crucial.
10. Records are very important in solving disputes more especially at the death of senior member of the family and any other organization.
11. To have good inventory of farm property that can reduce the chances of property loss.
12. Proper assessment of labour on the farm can be done basing on the records like master roll.

**CATEGORIES OF FARM RECORDS**

These are of two categories; Production records and farm accounts



**Production records include;** these include; labour, crop production and animal production records.

**Animal production records;** feeding, breeding, health, birth, death and milk production records

**Farm accounts include;** these include; financial documents, financial books and financial statements.

**Financial documents** are invoices, receipts, delivery notes, purchase order and statements

- i. Invoice this is issued to the farmer when he orders for farm inputs and it shows the quantity, price and cost of delivered goods.
- ii. Receipt; it's a financial document issued by the seller to the buyer as a proof that the items bought have been paid for.
- iii. Delivery note; its is prepared by the seller to the buyer showing the items included in the order and supplied to the buyer.
- iv. Purchase order; this is prepared by the buyer to the seller on the goods he wants to obtain
- v. Statement ; this is a bill showing details of various orders over a period of time after receiving several supplies
- vi.

**Financial books** are inventories and cash books.

- i. Inventory ; this is where a farmer records everything he owns on the farm
- ii. Cash book; this shows the receipts and expenses on the farm over a specified period

**Financial statements;** These are budgets, trading account, profit and loss account and balance sheet

### **Budget**

This is a financial statement outlining the anticipated farm revenue and expenditure for the forth coming financial period.

### **Types of budgets**

- i. Partial budget- this is financial statement outlining the anticipated revenue and expenditure for an enterprise or a part of the whole farm in forth coming financial period.
- ii. Complete budget- this is financial statement outlining the anticipated revenue and expenditure for the whole farm in the forth coming financial period.

### **Importance of farm budgeting**

- a. Enable the farmer to achieve the set farm objectives
- b. Acts as a guide for the farmer in executing financial decision
- c. Motivates the farmer to work hard to achieve the set goals for the budget
- d. Helps a farmer in forecasting profits and losses i.e. estimating profitability of the farm
- e. Used in decision making when comparing enterprises
- f. Helps a farmer to control production on the farm
- g. Helps the farmer in making effective changes in the organization
- h. Helps the farmer in estimating the required resources in terms of labor, capital, e.t.c.
- i. Guides and helps a farmer in soliciting for funds to run the farm
- j. Can be used as a reference during future planning

### **Procedure of making a budget**

- a. State the objectives of the farming business so that the budget can answer such objectives
- b. List all the enterprises found on the farm
- c. List all the available resources that can be used in production
- d. List the anticipated profit and their source
- e. Calculate the fixed costs in the next trading year or period
- f. Work out the costs that would occur in the year's business directly as a result of changes

- g. Calculate the opportunity cost of any input so as to make the right decision
- h. Consider the difference between total credit and total debit as the change in the net income

### Points considered in budgeting

- a) Least combination of the factors used on the farm
- b) Farmer's expectations through time
- c) Opportunity cost for factors of production

### Important information in budgeting

- a. Results from research stations-these can show the expected production of an enterprise
- b. Data on input-output relationships i.e. production function
- c. Cost of input and output information so as to forecast losses and profits
- d. Farm records on operations of the farm

### Constraints in budgeting

- a) Failure to see or identify supplementary or complementary enterprises
- b) Inadequate knowledge about budgeting
- c) Inadequate technical information needed in budgeting
- d) Bias in choosing enterprises instead of aiming at optimizing profits
- e) Inadequate market information on prices of inputs and outputs
- f) Price fluctuations in agriculture that make anticipations to be unachievable

**Profit and loss account-this is a financial statement drawn by the farmer to find out the net profit of his farm business. Net profit = gross profit - fixed costs.**

**Gross profit** is the difference between **total revenue** and **variable expenses** i.e **Gross Profit = Total Revenue – Variable expenses.**

**Example.** Given the following information, draw up a profit and account to find the Net profit or loss as at 31<sup>st</sup> July 2009

Fertilizer purchase-	200,000
Heifer sales	1,500,000
Milk sales-	400,000.
Crop sales-	700,000
Seed purchase-	180,000.
Depreciation	200,000
Closing valuation-	1,800,000.
Salary	1,000,000
Opening valuation-	750,000.
Rent	300,000
Feed purchase-	150,000
Interest on loan	200,000
Casual labour-	150,000
Drug purchase-	10,000

### Profit and loss account as at 31<sup>st</sup> July 2009

<b>Purchases and Expenses</b>	<b>Cost</b>	<b>Sales and Receipts</b>	<b>Cost</b>
Fertilizer purchase	200,000	Heifer sales	1,500,000
Seed purchase	180,000	Crop sales	700,000
Feed	150,000	Milk	400,000
Drug	10,000	Eggs	350,000
Casual labour	150,000	Closing valuation	1,800,000
Opening valuation	750,000		
Salary	1,000,000		
	200,000		
Depreciation			
Rent	300,000		
Interest on loan	200,000		
<b>TOTAL EXPENSES AND PURCHASES</b>	<b>3,140,000</b>		
<b>Net profit</b>	<b>1,610,000</b>		
<b>TOTAL</b>	<b>4,750,000</b>		<b>4,750,000</b>

**Closing valuation-** this is the value of assets a farm has at the end of a financial period e.g. feeds in store.

**Opening valuation-** This is the value of assets a farm has at the beginning of a financial period e.g. feeds in store

### BALANCE SHEET

This is a financial statement produced at the **end of a financial year** showing the **assets** and **liabilities** of a farm. A farmer draws up a balance sheet to find out the Net profit or loss.

Example. Given the following information about kuluse's farm, draw a balance sheet for the year of 2004.

Cattle value	700,000.		
Bank overdraft	1,000,000	Value of tractor	2,000,000
Value of crops	1,500,000	Depreciation of buildings	700,000

Closing valuation	2,500,000	Salary	3,000,000
Hotel bookings	800,000	Interest on loan	80,000
Milk sales	1,000,000	Debts payable	100,000.
Opening valuation	2,020,00		

**Balance sheet for kuluse's farm as at 31<sup>st</sup> December 2004**

<b>Liabilities</b>	<b>Cost</b>	<b>Assets</b>	<b>Cost</b>
Bank Overdraft	1,000,000	Crop value	1,500,000
Depreciation	700,000	Tractor value	2,000,000
Debts payable	100,000	Cattle value	700,000
Interest on loan	80,000	Milk Sales	1,000,000
Salary	3,000,000	Hotel booking	800,000
Opening valuation	2,020,000	Closing valuation	2,500,000
<b>Total liabilities</b>	<b>6,900,000</b>		
<b>Net Capital</b>	<b>1,600,000</b>		
<b>TOTAL</b>	<b>8,500,000</b>		<b>8,500,000</b>

**Assets;** this is money or items that belong to the business

Types of assets

- Fixed/long term/non current/permanent assets;** these stay in the business for a long time while being used e.g. land, farm machinery, buildings, furniture, fixtures and fittings.
- Current/short term/liquid assets;** these are assets that can be easily converted into cash e.g. stock (meat, milk, eggs, crop produce, feeds, e.t.c.), cash at bank, cash at hand, prepaid expenses, e.t.c.

**Liability;** this is a claim against the farm by outsiders

Types of liabilities

- Current liabilities;** these are claims that must be paid in a short time not exceeding a year e.g. rent, wages, bank overdraft, creditors, e.t.c.

- b. **Long term liabilities**; these are claims that must be paid within a long period of time exceeding a year e.g. capital shares, development loan, treasury bills and bonds.

### **COSTS OF PRODUCTION**

1. Fixed costs / overhead costs / Un avoidable costs.

These are expenses that a farmer has to meet whether in production or not. They include; Interest on loans, rent, depreciation, salaries for permanent workers.

2. Variable costs / prime costs.

These are expenses that depend on the level of output or vary with out put e.g. costs for inputs (pesticides, seeds), wages for casual workers increase with output.

3. Implicit cost. These are expenses that are indirect or non cash costs of owned resources e.g. own labour, family labour etc. They are valued using their opportunity cost.

N.B. They are not included in the calculations of profits of the farm of accounting.

4. Explicit costs

These are direct costs paid for resources bought or hired.

5. Opportunity cost This is a cost for the best alternative foregone in making a decision e.g. if a farmer foregoes poultry farming and takes on dairy then the opportunity cost is that one for poultry.

6. Total variable cost (TVC)

This is the total of the cost of all variable resources used in production (price X quantity)

7. Total fixed cost

This is the value of all the direct cost of fixed resources used in production. Its constant at all levels of output.

8. Total costs It's the sum of all the fixed and variable costs at each level of output i.e. total cost will = total variable cost + total fixed cost.

9. Average variable cost It's the amount spent on variable inputs per unit of output.

I.e.  $AVC = \frac{TVC}{Y}$

(Out put)

10. Average fixed cost. It's the cost of the fixed resources per unit of output.

$AFC = \frac{TFC}{Y}$

(Out put)

11. Average total cost

It's the total cost of all resources (Fixed and variable) per unit of out put

i.e.  $ATC = AVC + AFC$

Y (Out put)

12. Marginal cost

This is the change in total cost resulting from a change in one unit of output i.e. it's the cost of producing an additional unit of output.

13. Marginal product.

This is output created by using one additional unit of a factor of production.

14. Normal cost; cost of production converted into monetary terms e.g. wage for workers. As production increases, cost of production increase.

15. Real cost; real pain and sacrifice of labour given by labour in the process of production.

16. Reduced cost; this is money saved when carrying out farm activities e.g. transporting milk to the market and eggs on the same truck save transport costs for one of the products

17. Added cost; these are expenses as a result of investment in a field e.g. construction of a farm building may involve expenses of clearing obstacles from the site

18. Added receipts; money got by a farmer unexpectedly.

## **COST OUTPUT RELATIONSHIPS**

### **Production function**

This is a mathematical relationship between input and output

1. **Total product, TP**

This refers to the total output resulting from all the factors of production (both fixed and variable)

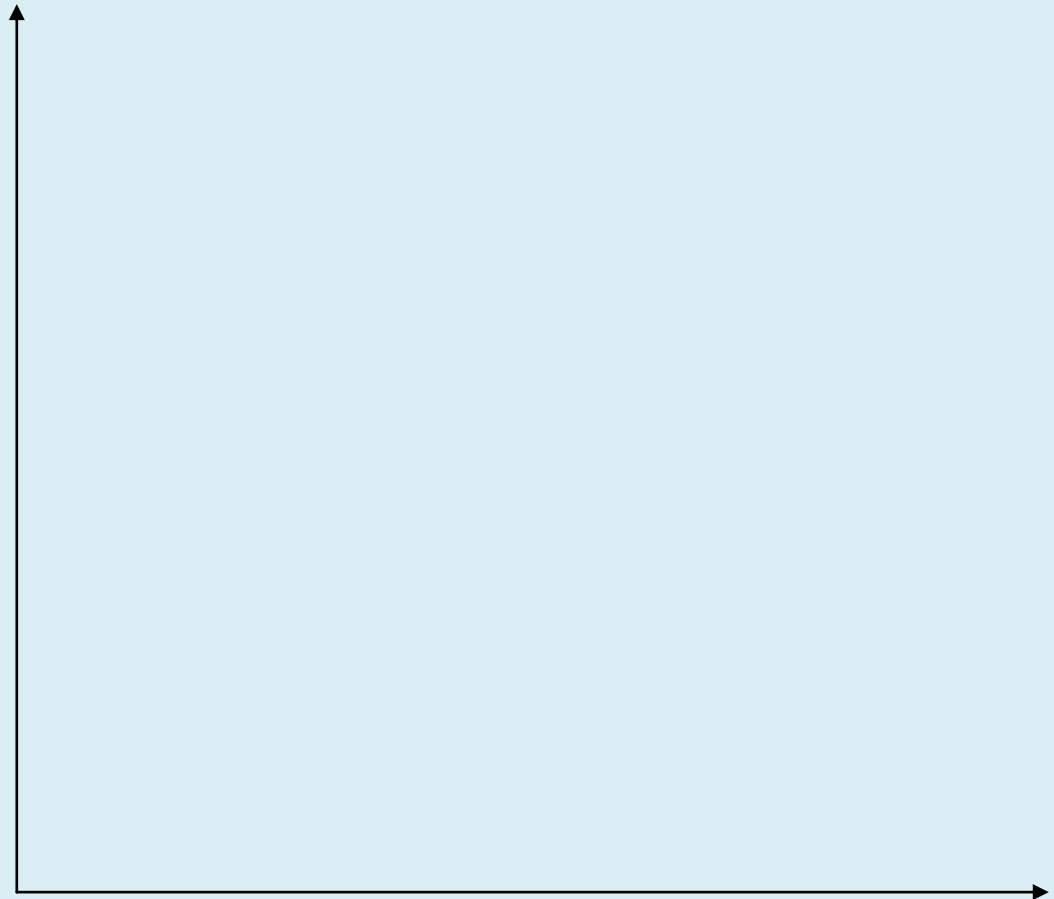
2. **Average product AP**

This is the output per unit of variable factors.

An example of r/s between output and inputs.

<b>Fixed factors (land)</b>	<b>Quantity of fertilizers used (input)x</b>	<b>Total maize TP output (Kg) Y</b>	<b>Marginal product (MP)</b>	<b>Average product (AP) y/x</b>
1	1	8	8	8
1	2	18	10	9
1	3	30	12	10
1	4	38	8	9.5
1	5	44	6	8.8
1	6	48	4	8
1	7	48	0	6.9

1	8	46	-2	5.7
1	9	42	-4	5.5



### **Stage 1: Irrational stage / increasing returns**

- Production is not yet maximum
- Increase in variable input increases output.
- Most farmers in Uganda operate at this stage since they have little knowledge about maximization of profits or lack capital.
- This relationship doesn't continue for long because the soil becomes over saturated with fertilizers causing harmful effects.
- Marginal product increases more than average product
- When average product is maximum, its equal to marginal product

## **Stage 2:        Decreasing returns / rational stage**

- The total product increases but at a decreasing rate
- Marginal product decreases until it reaches zero at the end of the region.
- A farmer operating in this region with proper advice from qualified staff would benefit much.
- This type of production function is the most common type in agriculture production.
- Average product decreases throughout the region
- Decision to increase or decrease variable factor should come at the end of the stage where marginal product is zero

## **Stage 3:        Region of no returns / irrational**

- It starts when marginal product is zero
- It's an irrational region and this situation can arise as a result of using too much fertilizers in this case.
- Advice is that the farmer should not over use variable inputs but seek advice from extension staff.

### **Recommendations about input use**

- More inputs must be added until stage 2 is reached because the physical efficiency measured by average products increases throughout stage 1.
- Even if the inputs are free, it should not be used in stage 3

### **Law of diminishing returns:**

*As you add more and more successive units of a variable factor to a fixed factor while holding other factors constant (ceteris paribus), total production increases but beyond a certain point (point of inflection / bliss point) the resulting increase will become smaller and smaller.*

## **RISKS AND UNCERTAINTIES**

A risk is an avoidable and unforeseeable circumstance or hazard that affects the outcome of an investment and can be **measured** in an **empirical** and **quantitative** manner. Since the risks are measurable, they can be insured against.



Uncertainty, this is unforeseeable and unavoidable circumstances or hazard that affects the outcome of an investment but **cannot** be measured in an empirical and **quantitative** manner hence cannot be insured against.

### **Examples of risks**

1. Change in weather or bad weather which causes destruction to crops, building and animals.
2. Pest and diseases.  
This can cause losses in both plants and animals.
3. Fire outbreak  
This can cause destruction to property and life.
4. Theft  
This can be of farm produce and machinery yet it's hard to predict when it will happen.
5. Strikes of workers.  
Some of the strikes are very destructive and lead to loss of property and life at the extreme cases.
6. Ill health  
The farmer, members of his family, all the workers can fall sick which can greatly affect the production level of the farm.
7. Low crop yields.  
This may be caused by many factors like poor soils, natural hazards, pests and diseases, poor management etc.
8. Death of the farmer. This is unpredictable and may be a source of management problems on the farm.

### **Guarding against risks.**

1. Insurance.  
This is the most common method of guarding against risks where the farmer insures his property with an insurance company against risks. The company can compensate the loss once it occurs as prior agreed
2. Building owners' equity.  
This is where a farmer saves some money that can be used in case there is a risk (net worth)
3. Input rationing.

- Here a farmer uses less than optimum quantities of inputs to save on the amount spent on input.
- Improving storage facilities i.e. one can lead produce and sale later
4. choosing an enterprise with less or limited risks hence helping a farmer to easily escape risks.
  5. Diversification.  
This is where a farmer engages in more than one enterprise so that incase one fails the other may succeed and compensate the loss made.
  6. Production flexibility  
This is where a farmer invests inflexible enterprises that easily allow a change e.g keeping duo purpose breeds of cattle and poultry.

## **UNCERTAINTIES**

### **Examples**

1. Price fluctuations  
It's very difficult to know when the prices will fluctuate and the loss which will come out of this is extremely difficult to calculate.
2. Change in demand.  
The demand for agricultural products keep on changing yet the loss as a result of this is difficult to measure.
3. Change in technology.  
Because of rapid technological changes, machinery and farm techniques quickly become outdated.
4. Change in government policies.  
The government may reduce prices of commodities by covering taxes and vise versa.
5. Bleach of contract  
This can happen anytime without notice and may cause immeasurable loss depending on the commodities.
6. Unavailability of labour.  
This may happen during planting and harvesting time yet the losses in causes it's immeasurable. This change in labour supply is due to a number of factors affecting it.
7. Unavailability of agriculture inputs.

The supply of such inputs is affected by a number of factors therefore their scarcity once experienced can cause uncertainty.

### **Control of uncertainties**

1. producing on contract
2. building owners equity
3. diversification
4. Input rationing to guard against loss as a result of price fluctuation.
5. Flexibility i.e. easily change from one type of production to another
6. Improving storage facilities.
7. Adding value of agriculture products through processing.

### **SPECIALIZATION**

This is where one engages in the production of one item where he can feature best.

#### **Forms of specialization**

1. specialization by craft

This is where families specialize in different activities like farming, iron smith, witch craft etc.

2. Specialization by process

This is where every stage of production in a factory or an industry is carried out by a different person.

3. Regional specialization

This is where each region produces the best it can and the changes it with what it can't produce.

4. International Specialization

This is where each country produces what it can do best and exchanges it with what is produced by other countries.

#### **Advantages of specialization**

1. Its time saving

There is no wastage of time in moving from job to job or training for different jobs.

2. High efficiency in production since the workers gains a lot of experience and skills in doing one type of work.
3. It enables the farmers to exploit their natural talents by concentrating on the work they can do best.
4. It encourages the use of machines at various production levels which increases production.

5. Regional and international specialization enables countries to exploit their natural resources and get what they cannot produce.
6. It encourages farms to employ specialists at different stages of production leading to efficiency.
7. It increases production which helps farmers to gain from the economy scale.

### **Disadvantages**

1. Large scale production may be limited by a low market for the produce.
2. It may lead to unemployment incase of change in technology and fashion.
3. It may lead to over dependence incase of international specialization
4. It may lead to boredom to repetition of the same work.
5. It encourages the use of specialized machines which cannot serve more-than one purpose.
6. It encourages loss of craftsmanship since workers depend on machines to do the work.

### **DIVERSIFICATION**

In Agriculture, diversification is the raising of the variety of crops or animals as opposed to one enterprise.

### **Advantages**

1. Resources are effectively utilized in the production process
2. It reduces risks that are associated in producing one type of crop or animal.
3. It increases a variety of products produced in a country.
4. It encourages the participation of many people in the production process to produce the different goods.
5. It reduces over dependence on products from one place or country.

### **Disadvantages**

1. The practice is limited by inadequate capital to engage in different enterprises.
2. Limited market for a variety of products may affect diversification
3. Limited farm implements may discourage diversification
4. Its very difficult to carry out research on a variety of crops and animals to increase their production.
5. Climate may not favour the production of various products.
6. It encourages subsistence farming which is less profitable.

### **CO-OPERATIVES**

This is a registered organization of people who decide to work together for mutual economic benefits.

### **Types of co-operatives:**

#### **1. Transport co-operatives**

These deal with the transport of produce either for the members or for profit from other organizations e.g. Uganda Co-operative transport union.

#### **2. Credit savings co-operatives.**

These deal with savings of member's money and provision of small loans e.g. Uganda Women Credit and trust fund.

#### **3. Consumer Co-operative**

These stock and sell commodities to members at subsidized prices and can also give financial assistance to members.

#### **4. Producer co-operatives.**

These are concerned with the marketing of the farmer /members produce e.g. the former Busoga grower's co-operative union, Masaka co-operative union.

#### **5. Trade and craft co-operatives.**

These are mainly concerned with building and construction work.

### **Principles of co—operatives**

These are the basic guidelines on which the formation and day to day running of co-operatives is based.

#### *1. Open and voluntary membership.*

All people are free to join or leave the co-operative without hindrance or restriction of any kind.

#### *2. Democracy*

Co-operatives are run on democratic principles even when elections are held for the leaders i.e. one man one vote.

#### *3. Interest and profit.*

The rate of return on borrowed capital should be low since the organization is not a profit making one.

#### *4. Capital shares*

The financial capital for co-operatives is raised through the selling of shares to the members.

#### *5. Co-operation*

Co-operatives must work together with other co-operative organizations in order to learn from each other.

*6. Neutrality*

Co-operatives must be neutral in politics, religion or any other bias that can affect their operation.

*7. Promotion of members*

All promotions to places of high responsibility must be based on merit.

*8. Education*

Co-operatives must promote education for their members in order to reduce the rate of illiteracy and also increase the skills needed in running of the co-operative.

*9. Continuous expansion*

A co-operative must have continuous expansion in terms of members and physical facilities i.e. building machinery.

*10. Share of dividends*

There is share of dividends after calculating how much members have contributed to the co-operatives.

**Importance of co-operatives**

- a. Can provide loans to members for development
- b. Bring together many farmers to achieve large scale farming
- c. Promote education and training for member to achieve high levels of management
- d. Provide market for farmers produce by buying commodities from farmers
- e. Store farmers produce before selling reducing risks to farmers
- f. Can provide employment to members as accountant and managers
- g. Can provide transport for produce from farms to the market
- h. Can provide inputs to farmers at subsidized prices to increase profits
- i. Some produce can process produce to add value before selling
- j. Co-operatives can mobilize prices for agricultural products by buying produce during periods of abundant supply and selling it at times of scarcity.
- k. They can increase investments for the members by buying buildings, estates, factories on behalf of the co-operators.
- l. They eliminate wasteful competition and exploitation of farmers by middle men hence increasing the farmer's profit margins.
- m. They increase the bargaining power of members in the market and protect the weak ones.

**Problems of co-operatives**

1. Inadequate skills of management amongst farmers which makes them incompetent in organizing co-operatives.
2. Inadequate funds to finance the work for co-operatives which limit the investments and expansion of the co-operatives.
3. Embezzlement and corruption by managers has reduced the growth of most co-operatives in Uganda.
4. Inadequate transport; some co-operatives do not have trucks that can easily transport produce to places where there is enough market.
5. Shortage of storage facilities; most co-operatives in rural areas do not have enough stores with facilities like freezers that can help in storing produce.
6. Fluctuating prices for agriculture produce; the fluctuation in prices more especially at the world market has affected the income for co-operatives hence their operations hindered.
7. High risks and uncertainties in agriculture; these reduce the profit margin for cooperatives which greatly discourages the farmers.
8. Political interference; some politicians in government have influenced the decision in co-operatives which greatly affects their performance.
9. Political Instabilities; in places where there is insurgency it's been very difficult for co-operatives to operate.
10. Dishonesty of members who refuse to pay back the loans or sell their produce to other co-operatives.
11. A high competition from private sector which has affected the amounts of profits that can be made.

**Solutions**

1. More centers for training managers should be set up to equip managers with skills.
2. Co-operatives should access loans from banks and other lending institutions in case of lack of funds.
3. Constant auditing should be done so that the managers are made to be more accountable to the losses made hence reduce embezzlement.
4. Self discipline of politicians should be encouraged to reduce political interference in cooperatives.

5. Government should support co-operatives by operating the price stabilization funds in case of low prices.
6. Members borrowing money from co-operatives should present security in order to reduce defaulting.
7. Government should maintain political stability in all parts of the country
8. Agricultural insurance facility should be adopted to help cooperatives overcome risks
9. Agro processing should be encouraged in rural areas by setting up factories to add value to produce
10. Rural road network should be improved to make transportation of produce easy

### **MARKETING BOARDS.**

These are public bodies set up by government to assist farmers in the production, processing and marketing of agriculture products.

#### **Specific aims of marketing boards.**

1. To help farmers in order to produce high quality agriculture products.
2. To provide essential storage facilities for agricultural products
3. To assist farmers by improving efficiency in marketing processes to reduce competition amongst them.
4. To ensure steady supply of agricultural goods to the final consumers and processors.
5. To set and guarantee prices for the goods produced by farmers.

#### **Types of marketing boards.**

1. produce marketing boards
2. Specialized industry boards.
3. advisory boards
4. Monopoly export boards.

#### **Examples of marketing boards in Uganda**

1. Coffee marketing board
2. Lint Marketing Board
3. Produce Marketing Board
4. Dairy Board
5. Uganda Tea Growers co-operation



**Functions of marketing boards.**

1. They buy produce from farmers in large quantities at fair prices.
2. They advise government when fixing prices for agricultural produce
3. They collect agriculture products from farmers and transport them to the market.
4. They ensure that produce from farmers is of high quality to meet the market standards.
5. Marketing boards can store agriculture produce on behalf of the farmer more especially during periods of surplus when prices are low.
6. they can offer credit to farmers in form of loans and inputs
7. Marketing boards can finance research in the development of best quality agriculture products.
8. They can control production by fixing quotas or limitations licenses to producers.
9. They can sell produce to local processors or export it to the world market.
10. Marketing boards can enforce quarantine measures against pest and diseases within a particular area.
11. They can also disseminate research information to the farmers in villages.
12. Marketing boards can also invest money in public services like housing projects, hospitals etc.

**Problems of marketing boards.**

1. political interference

Politicians through government interfere with activities of marketing boards by influencing management and acquisition of financial support.

2. Smuggling

This introduces cheap products on the market therefore reducing profit margins for marketing boards.

3. Price fixing

Marketing boards fix prices before harvesting and sometimes surplus production may come with problems of purchase.

4. Inadequate storage facilities that can cause losses to the boards hence low development.

5. Excessive production

Production in agriculture depends on weather hence favourable conditions cause over production leading to low market prices.

6. Delayed payment of farmers

This discourages farmers from selling their produce to marketing boards.

7. Poor road network in rural areas makes transportation of agriculture products more expensive and difficult for the marketing boards.

8. Loan defaulting

Some farmers fail to pay back the loan given to them by marketing boards which affects the performance of the marketing boards.

9. competition with private individual which may reduce profits for marketing boards