

# AGRICULTURE AND ENVIRONMENT

## PHYSICAL PROPERTIES OF THE SOIL

These are the properties of the soil that can be seen or felt between the thumb and finger.

### Soil Texture

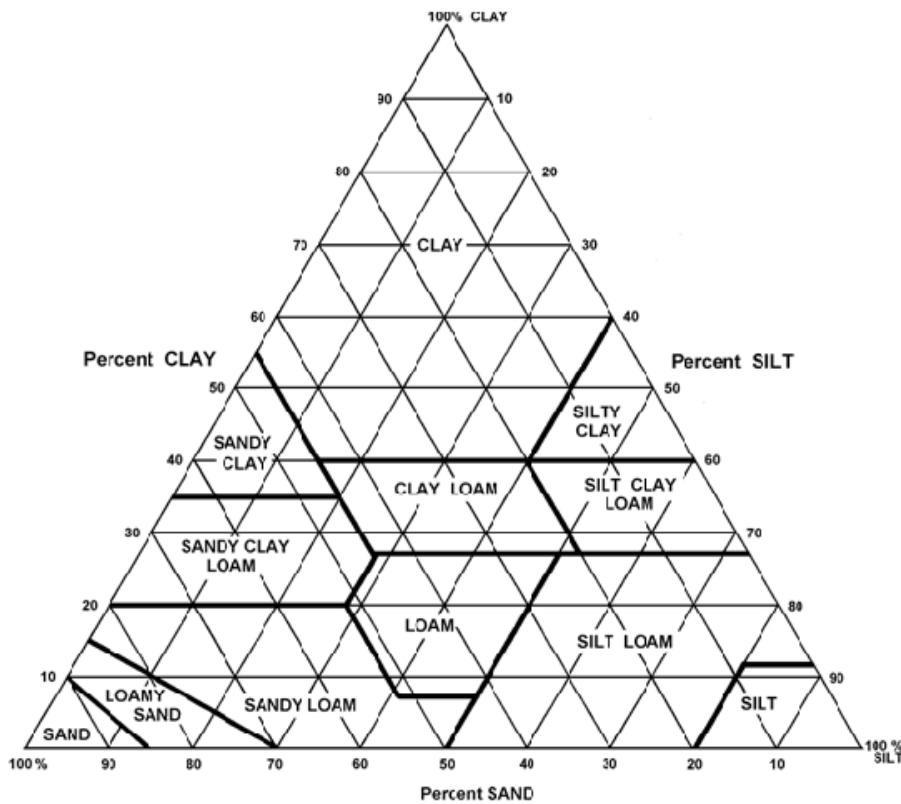
It refers to the relative amounts of differently sized soil particles or fineness/ coarseness of mineral particles in the soil.

### Textural Classes Of The Soil

How to determine textural classes of soil

### Soil Triangle Method

1. Collect soil sample of about 15-20g and grind it finely
2. Separate gravel and sand from silt and clay through sieving and stuck the separated soil particle
3. Weight the amount of gravel and sand separately and express the mass and a percentage
4. Separate silt and clay by sedimentation process in water.
5. Weight the mass of sand and silt and express the percentage using the amount of dry soil.
6. Use the soil triangle to classify the soil.



Example: Find the type of the soil that is composed of the following 20% silt, 30% clay and 50% sand

The name of soil is sandy clay soil

### Feel method

Collect fresh garden soil

Add water to the soil so that it is wet

Try to feel the soil between the thumb and first finger.

Identify the soil sample

### Results

Sand is gritty, clay is smooth and slippery while loam is between the two

### Rolling the soil on the board

Collect soil samples and try to roll it on the board and observe what happens

## **Results**

Sand failed to make a ribbon, loam soil make ribbons that break easily while clay makes ribbons that can be made into shape without breaking easily

### **Comparing textual classes of the soil**

Experiment: find out which soil hold more water and drain water better

#### **Procedure**

1. Set the measuring cylinders with funnels on top as shown below
2. Weight 20 grams of sandy, clay and loam soils separately
3. Add each soil sample on separate funnel and label A, B and C
4. Put 50ml of water on each funnel on the same time
5. Observe the soil which will drain a lot of water

### **Structural classes of soil and their properties**

#### **Characteristics of Clay soil**

1. It has fine soil particles and is smooth when felt
2. It is sticky when wet
3. It makes good ribbon, it can be made into any shape without breaking
4. It drains water very slowly because it has small size of soil particle
5. It has difficult workability
6. It has low aeration
7. It has high water holding capacity
8. It has high nutrient holding capacity

#### **Characteristics of Loam soil**

1. It has moderate drainage
2. Have moderate aeration
3. Have moderate water holding capacity
4. Have moderate workability

5. It has moderate nutrient holding capacity
6. It forms short ribbon that easily break

#### Characteristics of Sand soil

1. It is gritty when felt between thumb and first finger due large particle size
2. It is not sticky
3. Cannot form a ribbon
4. It has high drainage
5. Have low nutrient holding capacity
6. Have good root penetration
7. It has low water holding capacity
8. It has easy workability

#### The effects of soil texture of crop production

1. It affect water content and holding capacity
2. It affect ease with which the soil is cultivated
3. It affect the drainage of the soil
4. It affects the aeration of the soil
5. It affects the ease which the root can penetrate the soil
6. It affect the resistance of the soil to soil erosion
7. It affect nutrient holding capacity of the soil

#### Characteristic of good soil texture

1. It retain water for plant growth
2. It is well drained and aerated
3. It is able to supply nutrients to growing plants
4. It allows easy penetration of root
5. It is easy to cultivate at different moisture content
6. It is difficult to be eroded

#### Example of soil textures and their suitable crops

Crop	Textural class of soil that it do better
Tobacco	Well drained sandy/clay loam soil
Maize	Well drained loam soil
Cassava	Well rich drained sandy loam soil
Cotton	Rich sandy loam soil
Groundnuts	Sandy or light loam soil
Rice	Heavy clay soil which retains a lot of water

### Soil structure

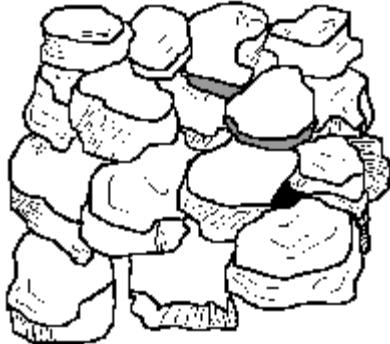
It is how the soil individual soil [particle are arranged or packed in the soil to form aggregates.

#### Types of soil structure

##### 1. Blocky or cubical structure

Particle is arranged like cubes.

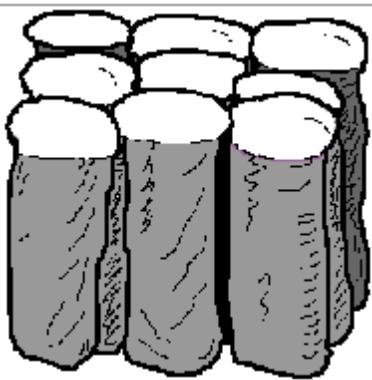
The are hexagonal appearance and have sharp edges



##### 2. Columnar structure

Aggregates form column like structure which are 15cmm or more in diameter.

It is commonly found in semiarid and arid zones



### 3. Platy or plate like structure

Soils are laid in groups one above the other in thin layers

Platy structure is most noticeable in the surface layers of virgin soils but may be present in the subsoil.



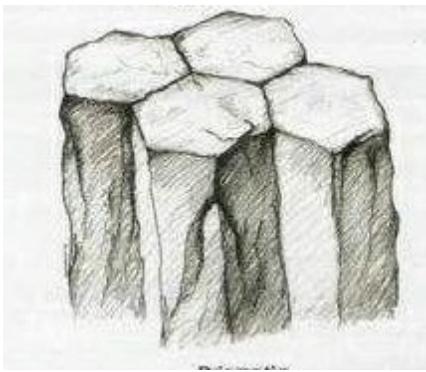
### 4. Granular structure and Crumb structure

The soil particles around at a central point



### 5. Prism- structure

The soil is prism like and are arranged vertically



## 6. Single grained

Soils are broken into individual particles that do not stick together.



### Effects of soil structure on crop production

1. It affects the flow of water and air in the soil which in turn affect the microbial and root growth in the soil
2. It affects water retaining capability of the soil like soils with small pores space retain more water than others
3. It affects heat transfer in the soil which affect seed germination and root development
4. It affects the soil consistency which in turn affect the soil workability
5. It affects nutrient holding capacity of the soil.

### How to maintain and improve soil structure

1. Cultivating the soil at right moisture content or consistency to avoid breaking the soil aggregate
2. Protecting the soil from raindrop impact by planting vegetative cover
3. Using machinery properly
4. Adding manure and other organic matter which can produce binding effect on the soil

5. Avoiding overgrazing
6. Practicing crop rotation

## **Soil colour**

### **Factor that affect soil colour**

#### **1. Parent material**

Soils that are from rocks that contain iron tend to be red because when iron reacts with oxygen it forms iron oxide which is reddish in colour.

Soil that contain mica has glittering appearance

Soils that contain silica (quartz) are whitish in colour

#### **2. Organic matter content**

Soils that have a lot of organic matter are blackish in colour while with no organic matter are reddish in colour due to humus

#### **3. Drainage of the soil**

Soils that are found in water logged area is greyish in colour due to accumulation of un decomposed materials. Well drained soils are red in colour while with moderate drainage has yellowish in colour.

#### **4. Age of the soil ( maturity)**

Young soil tend to be reddish in colour because they have little hums compared to well-developed soils

## **How soil colour affect crop production**

- i It affect the soil temperature the soil which in turn affect root development

## **Soil temperature**

It is the hotness or coldness of the soil

### **Factors that affect soil temperature**

## **1. Slope of the land**

Land that face the north in the southern hemisphere tend to have high temperature because there is direct heating from the sun compared land facing the south in the southern hemisphere

## **2. Soil colour**

Black soil tend to have high temperatures than other colour because black colour absorb a lot of heat

## **3. Vegetative cover**

Soil under vegetative cover its temperature does not fluctuate than soil that are bare and the temperature always fluctuate

## **4. Drainage of the soil**

Soil which tends to have a lot of water tends to have low temperature than soil which is well drained

### **How soil temperature affect crop production**

1. It affects seed germination
2. It affects transpiration and evaporation of plants
3. It affects root development and growth
4. It affects microbial activities in the soil like low and high temperature affect decomposition of organic matter by microbial
5. It affects chemical reaction in the soil which affect plant growth

### **How to maintain and improve soil temperature**

1. Planting vegetative cover
2. Mulching
3. Draining excess water
4. Irrigation
5. Adding organic matter

### **Soil consistency**

It is the state of the soil under different moisture condition

### How soil consistency affect crop production

1. It affects workability of the soil which affect crop production
2. It affects soil structure.

### How to modify soil structure

1. Draining the soil
2. Adding organic manure
3. Using appropriate farming equipments.

## Soil depth

### Factors that affect soil depth

- i. Maturity of the soil

Well matured soils are deeper than soil that under development

- ii. Parent material

Soils that are formed from soft rock tend to be deep enough than soil that are formed from hard rock that resist weathering

- iii. Vegetative cover

Soils that are under vegetative cover tend to be deep enough because of decomposing and reduced soil erosion while bare ground tend to have shallow soils because of high soil erosion

- iv. Slope of the land

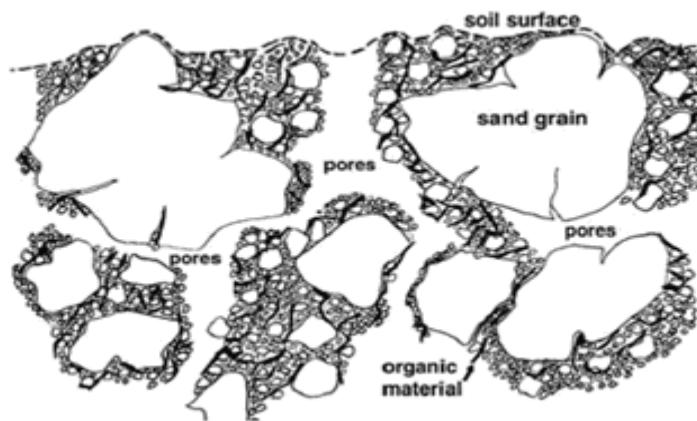
Soil depth increases as we go down the slope because of reduction in soil erosion and increase in soil deposition

### How does soil depth affect crop development?

1. It affects the root development in the soil
2. It affects water holding capacity of the soil

## Soil Porosity

**Soil Porosity** is ability of the soil to allow water and air to pass through it



**Soil porosity** is affected by soil texture and soil structure

Porosity is the proportion of the volume of the soil that is taken up the pore spaces.

**Bulk density**

It is the total sum of the pore spaces and solid particles

Bulk density = weight of woven dried soil / Volume of woven dried soil

I.e.  $BD = W/V$

Therefore

$\% \text{porosity} = \frac{100 - \text{bulk density}}{\text{bulk density}} \times 100$

Particle density

**How it affect crop production**

It affects air and water movement in the soil

**How to maintain and improve soil porosity**

Adding organic material

Cultivating the soil

## **CHEMICAL PROPERTY OF THE SOIL**

**Soil pH**

It the degree acidity or alkalinity of the soil.

When the soil has high concentration of hydrogen ions the soil tend to acidic and if it contain high concentration of hydroxyl ion the soil is said to be basic

### How to measure soil pH

1. Collect about 5 to 10 g of fresh soil sample
2. Grind the soil finely
3. Place the ground soil sample in a test tube
4. Add barium sulphate to break the soil particle further
5. Add distilled water to the sample followed by few drop of universal indicator
6. Close the test tube and shake vigorously
7. Leave the content to settle for half to an hour
8. Compare the colour of the solution with universal colour chart to find the pH of the soil.

### Factors That Affect Soil pH

#### 1. Leaching

Some soil nutrients like magnesium, sodium, calcium and potassium they easily leach in heavy rainfall area and are replaced by hydrogen ion which increase soil pH

#### 2. Use of acid forming fertiliser

Some fertilisers like sulphate of ammonia tend to form acid in the soil. The component of sulphate in the fertiliser when react with water to form sulphuric acid which increase soil pH

#### 3. Microbial activities

Microbial releases carbon dioxide which when reacted with water it form carbonic acid which increases the acidity of the soil

#### 4. Weathering of parent materials

Soil that come from rock that contain sulphate to be acid because the sulphate react with water and form sulphuric acid which increases soil pH while soils that come from rocks that contain limestone of calcium tend to be basic

#### 5. Nutrient uptake by plants

The nutrient absorbed are harvested together with plants and are replaced by hydrogen ions which increase soil pH

## 6. Poor drainage

Soil that drain a lot of water like sand tend to be acid because of high rate of leaching

## 7. Types of vegetation

Soil under forest tend acidic because of high leaching that soil under grassland tend to be basic because there is minimal rate of leaching.

## How Soil pH Affect Crop Production

1. It affect availability of plant nutrient in the soil like: zinc , iron , manganese , copper and cobalt becomes less available above pH of 5.5 while nitrogen, phosphorus , sulphur because available above pH 5.5 . Calcium and magnesium is available between the pH of 6 to 8.5.
2. It affects microbial activities in the soil for example nitrifying bacteria fix better nitrogen at pH of 5.5

## Modification of soil PH

1. Adding lime or fertiliser like CAN to neutralise acidity
2. Adding acid forming fertilisers to increase soil acidity

## Factors that affect chemical properties of the soil

### 1. The composition of the soil

It affects how the soil can retain and release soil nutrients

### 2. Soil structure and texture

It affect nutrient capacity of the soil by influencing the chemical, physical and biological properties of the soil.

### 3. Farming practices

Use of bush fires destroys organic content of the soil which in turn affects nutrient holding capacity of the soil

Mono cropping exhausts certain elements from the soil

Use of heavy machinery destroys soil structure and overgrazing

### 4. Soil acidity

It affects release and microbial activities in the soil

## 5. Crop removal

It contribute to loss of plant n nutrients as they harvested

## 6. Leaching

Soluble salt like nitrates are washed down the soil profile

## 7. Soil erosion

It contribute to loss of soil nutrients through loss of top soil

## 8. The use of chemical fertiliser

It increase the fertility of the soil but use of acid forming fertiliser affect availability of other nutrients

## Cat ion Exchange Capacity (CEC)

It refers the ability of the soil to exchange cat ions.

## The importance of cat ion exchange capacity to plant growth

It affects the release and availability of plant elements vital for plant growth

## Soil salinity

Salinity is the condition of the soil to associate with the accumulation of soluble salts in the soil

## Saline soils

It is soil that have high concentration of soluble salts

## Cause of soil salinity

1. Irrigating virgin land with poor quality irrigation water like with high concentration of salts
2. Excess use and application fertiliser which lead to salt build up
3. Parent material which release some salt to the soil because it contain a lot of salt
4. Low rain and high evaporation , salt rise due to capillary action and become accumulated due to limited leaching
5. Poor drainage which lead to build up of salts

## **Sodic soils**

Are soils that have high concentration of sodium?

## **Saline sodic soils**

Are soils that contain both soluble salts and sodium salts and the levels are toxic to plants

### **The effect of salt accumulation**

1. It increase soil pH which affect availability of some plant nutrients
2. It affect seed germination and plant growth because of high osmotic pressure which reduces ability of plant to suck in water and also broken down of aggregates due to excess sodium in the soil
3. It make the soil to be toxic to plants

### **Managing saline soils**

1. Irrigating the soil by flooding to remove excess salts
2. Draining excess water since the removed water carry together some salts
3. Applying gypsum to convert insoluble salts like carbonated and sulphate to soluble form so that they can easily leach
4. Preventing or reducing evaporation to reduce capillary action
5. Growth salt tolerant crops like cotton, spinach, rape barley and sugar beets to remove excess salts

### **How to maintain and improve chemical properties of the soil**

1. Liming to reduce acidity
2. Applying organic matter to improve soil structure
3. Applying fertiliser correctly
4. Practising crop rotation
5. Planting close growing crops to reduce raindrop impact
6. Mulching crops to reduce raindrop impact
7. Irrigating land by flooding to remove excess salts

8. Practising mixed cropping
9. Irrigating land by flooding to remove excess salts

## SOIL DEGRADATION

### SOIL DEGRADATION

It is loss in value or quality of soil

Form of soil degradation

There are five forms of soil degradations and those are

1. Physical degradation

This is the type of soil degradation that happens due to physical force. This happen through:

- a. Water erosion

Running water carried top soil causing some gullies and deposit it somewhere else

- b. Wind erosion

Wind blow off soil from unprotected dry land causing a damage to soil

- c. Physical erosion

It is the destruction of soil structure due to action of water or heavy machine and making it prone to be eroded by either wind or rain water.

2. Chemical degradation

It happens when there is excess use if fertilisers and pesticide.

3. Biological degradation

It the soil degradation that is cause by action of living organism.

People and animals break down the soil making it easily eroded my wind or water

Microbial like earthworm and termites destroys the soil structure making the soil susceptible to erosion

4. Loss of soil fertility

It happen when the soil nutrients have been lost either by action of soil erosion or continuous cropping

5. Accumulation of salt (excess salts )

It the build up of soluble salt in the soil that makes the soil o be toxic

## Cause of soil degradation

The following are cause of soil degradation

- a. Cultivating along steep slope and along river banks which encourage soil erosion
- b. Constructing ridges along the slope
- c. Using heavy machine which destroy soil structure
- d. Continuous cropping which exhaust soil nutrients
- e. Cultivating soil when too dry or too wet which damages soil structure
- f. Deforestation which leaves the land bare
- g. Uncontrolled fires when clearing the bush which encourage soil erosion and destroys humus
- h. Overgrazing and overstocking
- i. High human population which put high pressure on natural resources

## Effects of soil degradation

1. Loss of soil fertility which eventually reduced yield
2. There is reduction in infiltration and increases in runoff
3. Silting of water reservoirs due to sedimentation
4. Pollution of water resources
5. Scarcity of water due to drying of water reservoirs
6. Increase in incidence of flooding
7. Loss of arable land due to gullies
8. Loss of arable land
9. Low ground water due to increase runoff

## How to control soil degradation

1. Afforestation
2. Mulching
3. Controlling bush fire
4. Avoid overgrazing and over stocking

5. Practising family planning method to reduce human population
6. Practising strip cropping to reduce run off
7. Maintain soil cover to reduce soil erosion

## Exercise

**2003 (ii)**

3. The table below show the results from soil science laboratory from meteorological observation of the extension planning area

Characteristics	Soil A	Soil B	Soil C
Percentage sand	40	42	20
Percentage silt	8	6	10
Percentage clay	50	47	60
Soil colour	Red	Brown	Black
Effective depth (metres)	4	1	1.5
Percentage organic matter	2	5	10
Rain fall (mm per year)	2000	1500	1000
Annual rainfall distribution	More even distribution	Uneven distribution	Un even distribution
Temperature	Medium	Medium	high
Soil pH	5.1	6.2	7.4

- a. (i). Which soil is likely to have highest water holding capacity
    - ii. Explain two reasons for your answer to question a i.
  - b. Which soil would be good for tree crops?
  - c. Give a reason for your answer to question 3 c above
  - d. Explain any two possible reasons for acidity in Soil A
  - e. From which soil the results show the highest population count of micro organisms
  - f. Explain one reason for you answer to question d (i)
  - g. State any three ways of improving soil A
- 9e. Describe any two ways in which good soil structure contribute to increases in crop

production.

2004.

2005

1. (a). Define the term soil degradation

b. State any two ways in which people contribute to soil degradation

c. explain any one biological way in which a farmer can control soil degradation in a vegetable garden

3(a). What does each of the following soil colours indicates in term of the composition of the parent materials

i. Greyish colour

ii. Reddish colour

b. Explain how soil colour affects soil temperature

c. State any two ways in which soil temperature can be modified.

2006

11 (a) Describe any five types of soil structure

b. Explain any five characteristics of soil that make it suitable for crop production

2007

1 (a) Define soil acidity

b. Explain one way in which irrigation can cause soil salinity

3b. Explain how leaching affect the nutrients status of the soil

2009

6. (a). Name the textural classes of the soil

b.) Classify molybdenum , sulphur, boron into micro and micro nutrients

2010

6a.Explain any one way in which Soil pH can be modified

b. Explain any one way in which soil pH affects plant growth

13. A teacher brought a sample of soil to a form four class. Using sieve method describes how

the percentage of grave, sand, silt and clay could be determined.

2011.

7c. Give any two advantages of soil structure

9. Explain one way in which each of the following practices can help to prevent land degradation

- a. strip cropping
- b. tie ridging

13. Explain any five factors that affect the nutrient status of the soil

2012.

1. (a). Give any one farming activity that can destroy soil structure

b. State any two effects of good soil structure on crop production

12. Describe an experiment to determine the texture of the soil sample using sedimentation method

**2013**

1. You are provide with groundnuts flour( Nsinjiro) labelled Z and fertiliser labelled Z

- a. Which of the two specimen is a crop product
- b. Give any two marketing function that have been taken place in order to obtain the specimen labelled Y
- c. Explain any one way in which each of the specimen labelled y and Z can support the growing population
- d. Write down any three limitation of using the specimen labelled Y to the smallholder farmers

# CROP PRODUCTION

## SEED AND PLATING MATERIALS

Panting propagation is the way in which the new plants arise from the existing ones

Type of plant propagation

There are two types of plant propagation and these are

1. Sexual propagation

The production of young one is done through seeds where the female and male gametes fuse to produce a young one

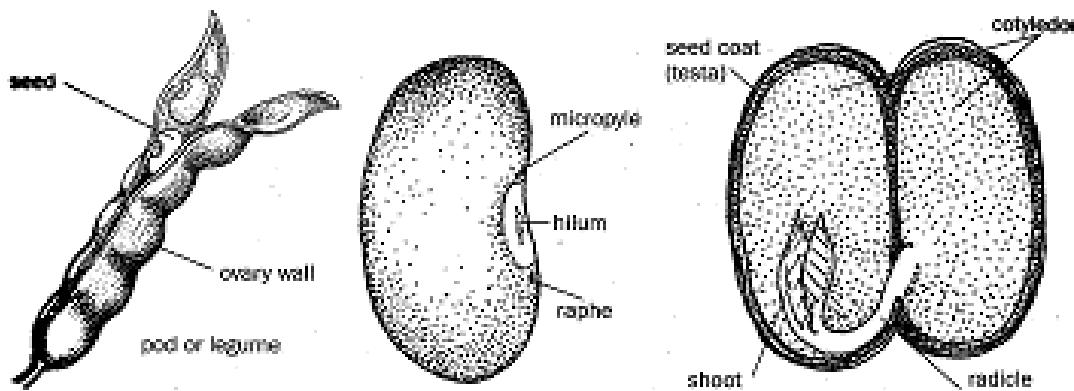
2. Asexual propagation ( vegetative propagation

This is the type of propagation where by part of the parent is used to produces a young ones

**Seed**

It is fertilised ovules

**The structure of a legume seed**



## Parts and function of bean seed

### **Finical**

It is the short slack which attaches the bean seed to inside pod

### **Function**

It where food passes during embryo development

### **Hilum:**

It a black scar where the finical attaches the seed

### **Tester**

It is the eternal covering of a seed

### **Function**

1. It protect the embryo from external mechanical injuries
2. It prevent the entry of pathogens

### **Micro Pyle**

It is a tiny hole on the seed

### **Function**

It allows air to pass through for respiration of the embryo

### **Cotyledons**

It is the seed leaves

### **Function**

It store the food for embryo development

### **Radicle**

It is the part of the embryo which forms the primary roots

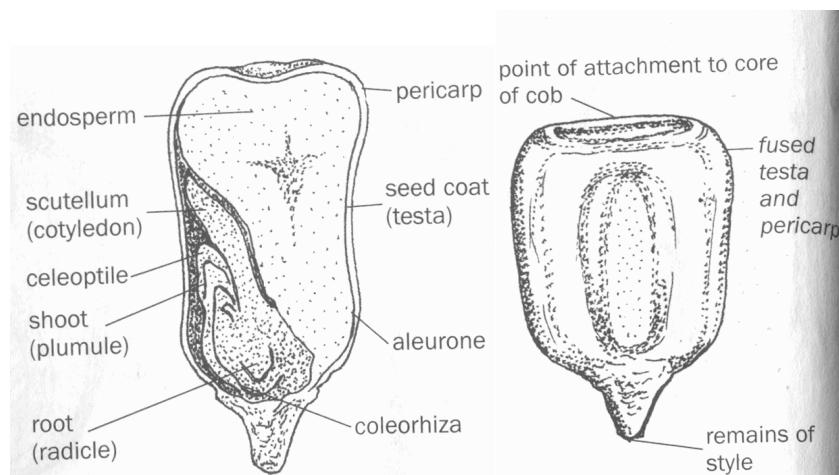
## Plumes

It the part of the embryo that develops into young shoot

## Hypocotyls

The middle part of the embryo that forms the stem

## The structure of a cereal seed



## Function of the parts of cereal seed

### 1. Fused testa and pericarp

It is the united fruit wall and the seed coat

#### Function

It protects the delicate internal parts of the grain.

### 2. Silk scar

It is a creased or depression showing the point of attachment to silk

### 3. Point of attachment of the cob

It is the remaining stalk at the base of the grain surrounding the embryo

#### Function

It attaches the grain to the cob

### 4. Endosperm

It is the floury part of the grain

#### Function

It supplies food for energy for germination seed and developing embryo

## **5. Radicle**

It develops into primary roots

## **6. Hypocotyls**

It develops into stem

## **7. Plumule**

It develops into the first leaves

## **8. Coleorhizae**

If forms the protective sheath

### **Function**

It fit protect the roots during development

## **9. Coleoptiles**

It a sheath that surrounds the plumule in the grain

### **Function**

It protect the shoot as it pushes through the soil during seed germination and seed emergency

## **10. Scutellum**

It is a flatten, flashy shield shaped which form the outer rim of the embryo.

### **Function**

It separates the embryo from endosperm

## **Advantages of sexual propagation**

- a. Seeds are relatively cheap
- b. Seed is easy to sow and prepare for planting
- c. Seed are easy to store without significant loss of quality and quantity
- d. Seed can remain viable for long period of time
- e. Seed can be sown mechanically
- f. It minimises the risk of transferring disease and pest from parent to offspring
- g. it can produce new plant that differ from their parent

## **Disadvantages of sexual propagation**

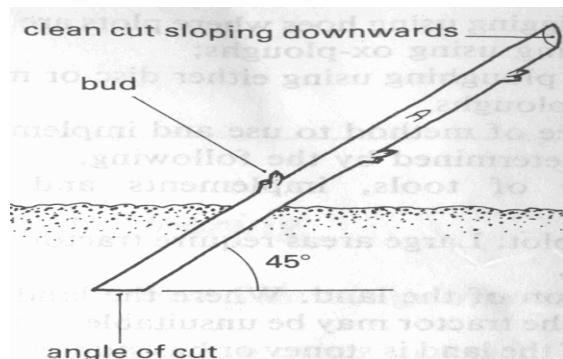
- a. It produces serious variation and off -types among the off spring
- b. It requires a long juvenile period before fruits or seed
- c. It requires elaborated seed bed

## **Vegetative planting material**

### **Cuttings**

Stem cutting (setts) are used for propagation. The stem that is used for propagation should have buds at each node and that develop adventitious roots.

The cutting can be sometime planted in nurseries and later transplanted to field or it is planted directly to the field



Example of crops that are propagated by use of cutting

Sugar cane, nippier grass, cassava

### **Runners**

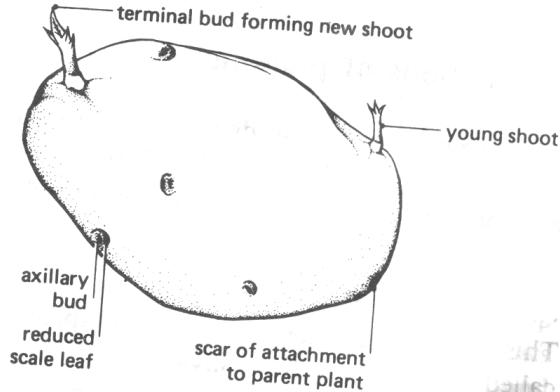
It is a stem which grows horizontal along the ground. The runner is cut into pieces that have nodes from which roots can develop.

Example of crops that are propagated using runner

Straw berries, sweet potatoes

### **Stem tubers**

It is the underground swollen portion of the plant which acts as storage organ and has bud where root system and new shoot develops

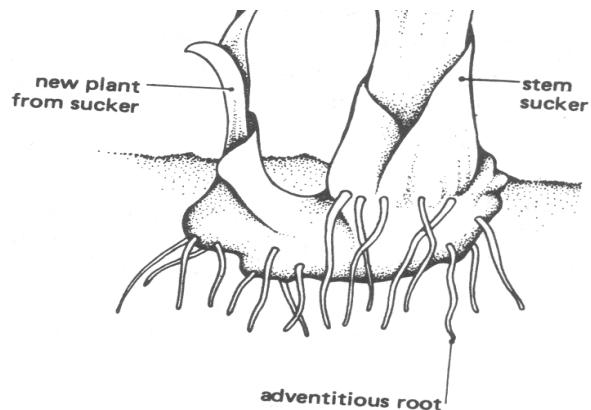


### Examples of crops that propagated in this way

Irish potatoes

Suckers

It is a shoot that rises from auxiliary bud at the base of the parent plant the sucker is cut and planted somewhere else.

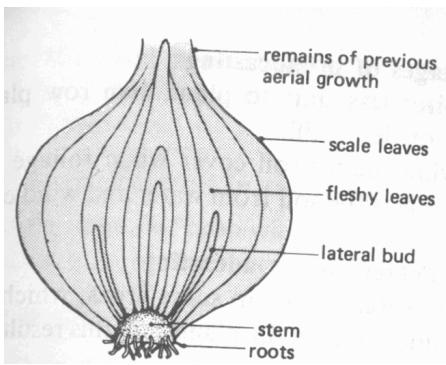


### Example of crops

Bananas and pineapples

Bulbs

It is a storage organ which is made up of modified fleshy leaves. Young shoot develops from the buds on the sides of the parent fleshy leaves o the bulb.

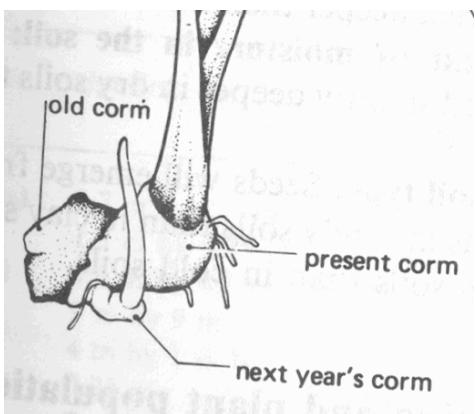


### Example of crops

Onion, garlic, tulip

Corns

It is enlarged base of the underground stem in which food is stored. The new shoot develops from the buds on side of parents



### Example of crop

Yam

Rhizomes

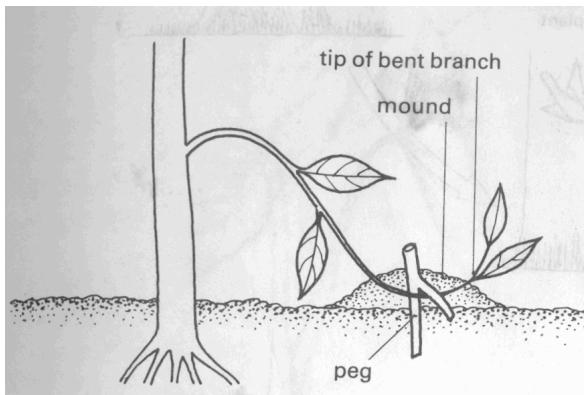
It is a horizontal underground stem. The shoot develop from buds on the rhizome

### Examples of crops

Banana, bamboo

Layering

A branch of the fruit tree or a shrub is pegged down the ground so that it grows roots while attached to parent plants and later is detached and planted some elsewhere



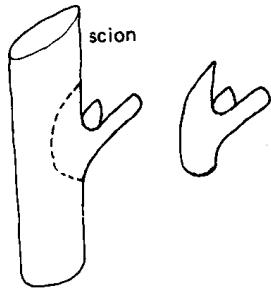
## Budding

It is also called bud grafting.

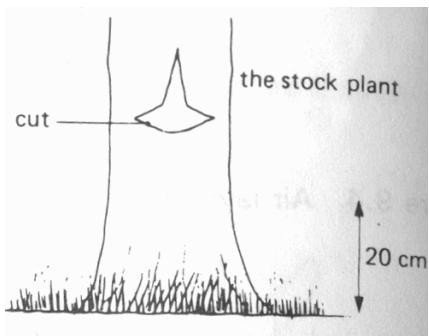
It is the propagation method where a vegetative bud from one plant is transferred and joined to the stem of other plants where it develops into a new shoot.

### Process of budding

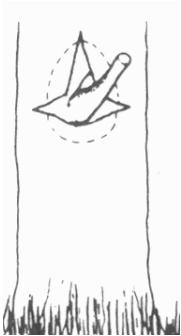
1. A bud shield is removed from a plant



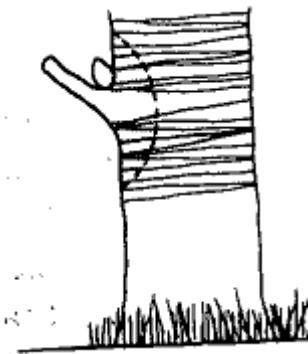
2. A T cut is made on a stock plant



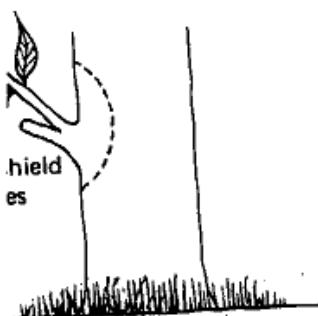
3. The bud shield is carefully inserted into the cut in the stock plant



4. The wound is taped around the stock plant



5. The bud shield germinates the stock plant is cut above the bud and all suckers are removed

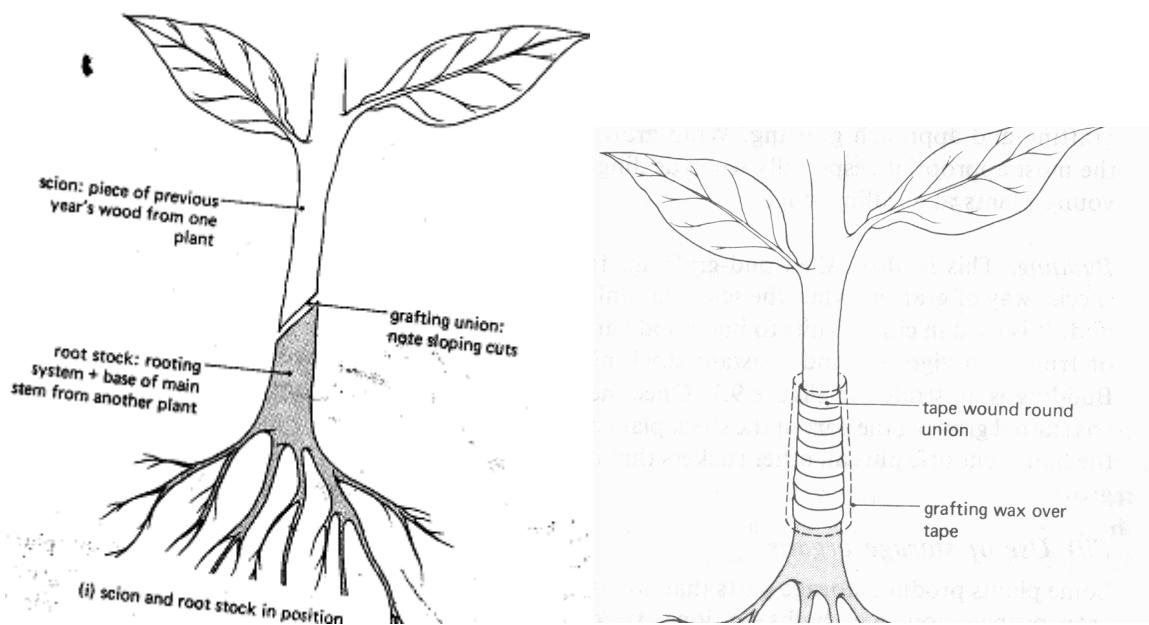


## Grafting

It is the joining of a part of one plant to another plant so that one can have the good quality of two different parents

The two parents come from the same species and must have the same thickness for easy matching of cambium layers is matched.

The cut must be slant or V shaped and the union must be neatly fitted and rapped



### Advantage of asexual propagation

1. It reduces the juvenile period of the plant because vegetative propagated material assume the age of the parent
2. It eliminates the problem of seed dormancy which need seed treatments like scarification
3. It ensure uniformity among the plants which reduce the need for grading since all off spring resemble the parents
4. It is the only way of propagating plants with no viable seeds
5. They have high food reserves that help the young shoot to become established
6. It readily available from previous stock and reduces the risk of buying expensive seed

### Disadvantages

1. There is high risk of transferring diseases to new plants if the material used are diseased
2. It is difficult to bring variation among plants
3. They are bulky compared to seed
4. Some procedure requires special skills and expertise unlike in seed

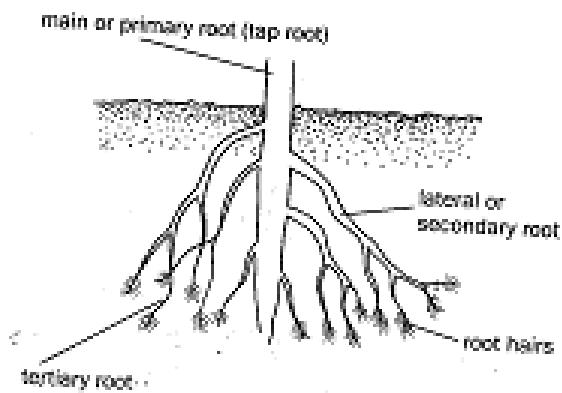
## PLANTS PART AND THEIR FUNCTIONS

### Root system

There two types of root system and these are tap roots and fibrous roots.

### Tap roots

It has well defined main root and other roots develop from it. The root that develop from main root re called secondary root and that develop fro secondary roots are call tertiary roots

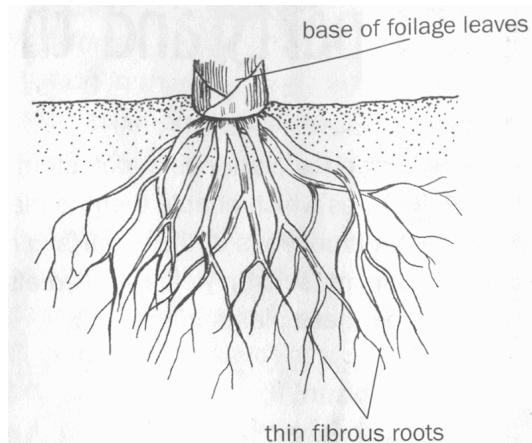


### Example of crops with tap root system

Tobacco, cotton, tomato cabbage, carrots and legumes

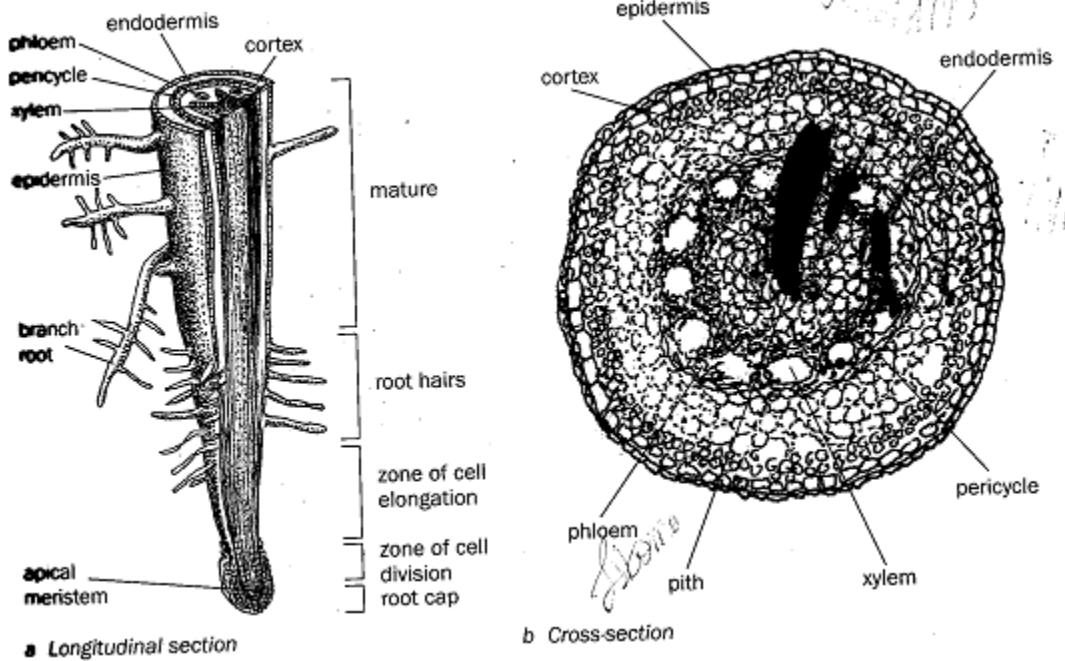
### Fibrous roots

It has no defined root system and all roots develops from the base of the stem



All grasses and cereal crops have fibrous root system

### The internal structure of the root



### The root cap

It is the thin layer of cell on the tip of the root

#### Function

It protect the apical meristem

#### Apical meristem

It is bundle of meristem tic tissues in the root tip

#### Function

It is the growing part of the root that gives raises into other parts of the roots

#### Epidermis

It is the outer layer of cells

#### Function

It protect the internal parts root

#### Roots hairs

The are hair like structure found on the tip of the roots and are elongation of epidermal cells

#### Function

They absorb water and mineral salt from the soil

#### Cortex

It is a group of cell for food storage

## **Endodermis**

It is inlayer of cells

### **Function**

It separates cortex from the vascular bundles

## **Phloem**

Are cells or tubes which transport products of photosynthesis from roots respiration and storage

## **Xylem**

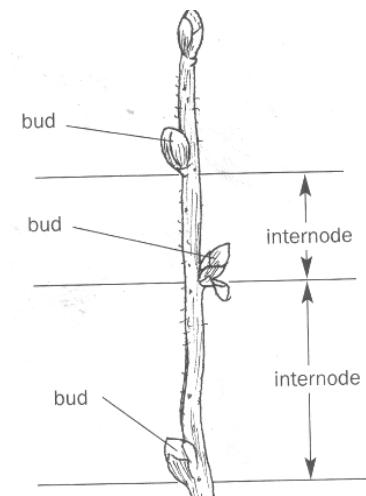
Are cell or tubes that is responsible transportation of mineral salts and water absorption by root air

### **Function of roots**

1. The anchor plants preventing the plant from lodging
2. They absorb minerals salts from the soil needed for growth and reproduction
3. They store food that are made from leaves

## **Stem**

### **Structure of the stem**

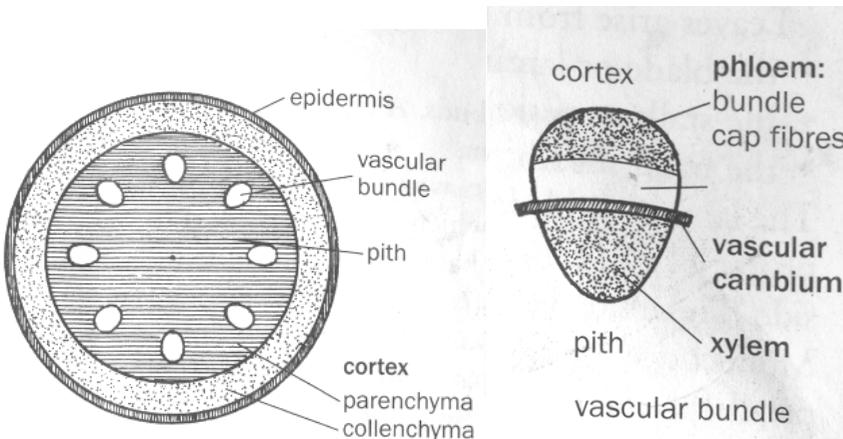


A stem contain internodes and node

A node is a swollen are along the stem

Internodes are distance between two successful nodes

### **Internal structure of the stem**



### **Epidermis.**

It is the outer layer that covers the surface of stem

#### **Function**

It surrounds the vascular tissue, phloem and xylem tissue

### **Phloem**

Are cells or tubes which transport products of photosynthesis from roots respiration and storage

### **Xylem**

Are cells or tubes that are responsible for transportation of mineral salts and water absorption by root hair

#### **Function of the stem**

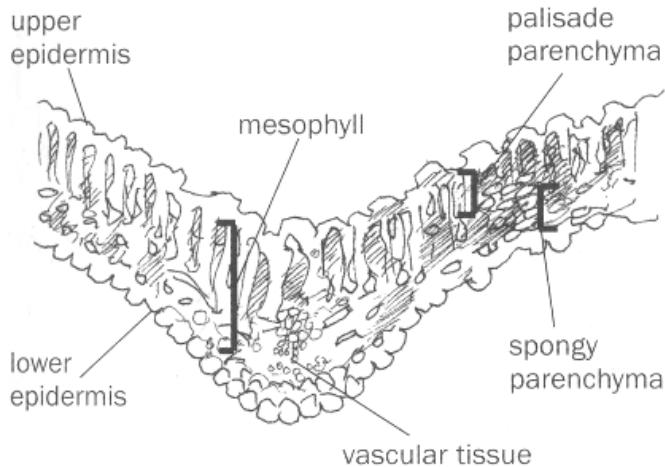
1. To conduct food and water mineral salts from roots
2. To support and protect the upper parts of the plant
3. To display leaves and flowers so that they are well exposed to sunlight for photosynthesis
4. To store food
5. To manufacture plant food it contains chlorophyll mainly in young stems

### **Leaves**

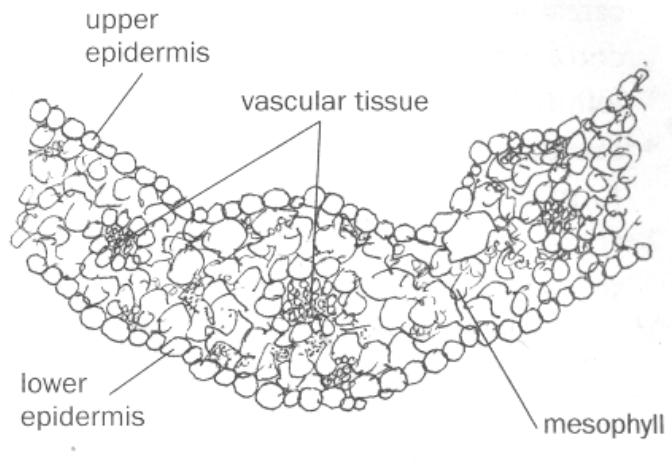
A typical leaf has a blade or lamina, a stalk or petiole which holds the blades and the basal sheath which connects the leaf to the stem in the cereal plants

In dicot plants the leaves have net veins while in cereals have parallel veins

#### **Internal structure of a leaf**



a Legume leaf



b Cereal leaf

## Upper and lower epidermis

It is the lower part or the leave which affect the palatability of feed of animals

### Guard cell:

It is the pair of special cells that control the opening and closing of stomata

### Stomata

It is the opening on the leave which air entry of water, carbon dioxide needed in the process of photosynthesis. It also release water and oxygen to the atmosphere

### Palisade cell

They are elongated cell and closely packed and contain chlorophyll for photosynthesis.

### Spongy cell

They loosely cell and have irregular shape and it is where the products of photosynthesis are first stored.

### Vascular bundle

It consist of midrib and veins that transport manufacture food to all part of plants and transport water, minerals salts to the rest of the leave.

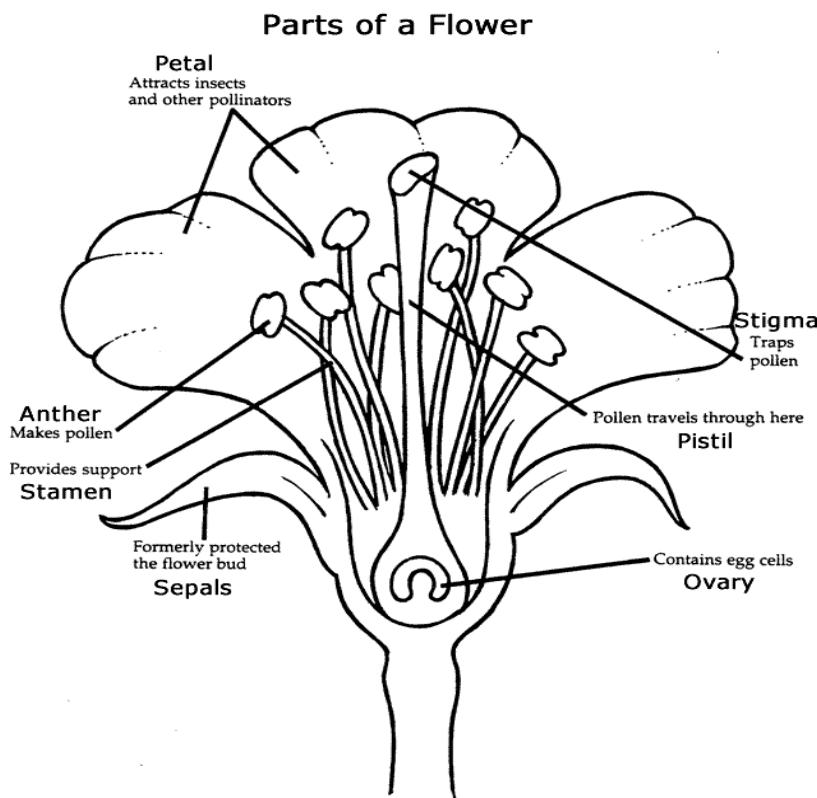
### Function of the leaves

1. They contain chlorophyll which absorb light energy to be used for photosynthesis
2. They releases excess water into the atmosphere through the stomata through transpiration
3. They are for respiration through stomata which allows gas exchange

### Flowers

It is the reproductive part of the plant

The structure of flower



It is the greenish leaves at the bottom of flower. It protect upper part of the flower

Receptacles

It the part that carries all the other upper part of the flower

Corolla

It is made up of petals which attract insect for pollination

Stamen

It is a ring that forms the male part of the flower.

Pistil

It is the female part of the flower

## ESSENTIAL PLANT NUTRIENTS

Nitrogen

It is absorbed in form of nitrate ions and ammonium ions

Functions

1. It used in formation of protein in plants
2. It is part of chlorophyll molecule
3. It encourages rapid vegetative growth
4. It regulate availability of phosphorus and potassium,
5. It makes plants succulent with deep green colour
6. It increases the sizes and yield of cereal seed

Source of nitrogen

1. Farm yard manure
2. Inorganic fertiliser like Can , urea
3. Fixation by nitrification bacteria
4. Fixation by lightning

How is lost from the soil

1. Soil erosion
2. Drainage (leaching)
3. Volatilisation
4. Plant absorption
5. Use by microorganism to build their bodies

Deficiency signs

1. Leave loses chlorophyll and become yellow
2. Slow plant growth
3. Premature leaf fall in severe cases
4. Production of other pigment

Sign and symptoms Excess nitrogen

1. Excess succulence
2. Weakening of stems and fruits
3. Scorching of leaves
4. Delayed plant maturity

Phosphorus

It is absorbed in form of primary orthophosphate ion ( $H_2PO_4^-$ ) in low pH and secondary orthophosphate ion in higher pH ( $H_2PO_4^{2-}$ )

### Function of phosphorous

1. It encourages the formation of the secondary roots
2. It is important in various metabolic processes such as photosynthesis, cell division, amino acid metabolism.
3. It speeds up plant maturity
4. It imparts disease resistance to certain crops
5. It improves plant quality especially in forage and cereals
6. It prevents plant lodging by strengthening the straw in cereal crops
7. It is a component of nucleic acid which stimulates blooming and seed formation

### Sources

1. Soil organic matter
2. Commercial fertilisers like single phosphate, double phosphate
3. Organic manure
4. Weathering of phosphate rocks

### Deficiency signs

1. Lack of branching in roots
2. Lateral buds remain dominant
3. Tubers of crops are small and few
4. Stunted growth
5. Dead areas on fruits and leaves
6. Leaves have purplish colour
7. Delayed maturity of crops

### Fate

1. Soil erosion
2. Leaching
3. Crop removal, Fixation by iron and aluminium oxide

### Potassium

It is absorbed in form of potassium ion

#### Uses

1. It is used in metabolism of nitrogen and synthesis of protein
2. It reduces lodging of plants brought by excess nitrogen in the soil by strengthening the cellulose
3. It is necessary for the formation of both chlorophyll and starch
4. It regulates the use of other essential plant nutrients
5. It helps plant to resist diseases like powdery mildew and root rot
6. It regulates the opening and closing of stomata
7. Promotes the growth of meristematic tissues
8. It improves the quality of crops especially fruits and vegetables soil

#### Sources

1. Inorganic fertilisers like muriate of potash, potassium sulphate and potassium nitrate
2. Organic manure
3. Potash rock

#### Factors that affect availability of potassium in the soil

1. Temperature: increase in temperature increases the exchange of potassium
2. Soil moisture: increases in moisture content affect the exchange of potassium
3. Soil pH: increase in soil pH makes potassium to be fixed
4. Type of soil colloids: it is fixed in clay soils

#### Fate

1. Leaching
2. Adsorption
3. Soil erosion
4. Absorption by plants soil erosion

#### Deficiency signs

1. Scorching (burnt) of leaf margin
2. The leaves have small dots

3. Weak stalk resulting in high plant lodging
4. Leaves may curl
5. Small fruits and tubers
6. Premature leave fall
7. Leaves may turn yellow and lose chlorophyll

## Calcium

It is absorbed in form of calcium ions

## Uses

1. It is necessary in the synthesis of protein
2. It is a component of the cell wall
3. It makes potassium and phosphorus to be available in the soil since it raises soil pH
4. Necessary for cell division and elongation of apical tips and shoot system
5. It is used in formation of middle lamellae and increase the protein content in mitochondria

## Sources

1. Inorganic fertiliser like CAN
2. Agriculture lime
3. Weathering of calcium rock
4. Organic manure
5. Crop residues

## Fate

1. Crop removal
2. Leaching
3. Soil erosion
4. Leaching

## Deficiency sign

1. Terminal bud and root tips fail to grow
2. In maize the funnel fail to unfold

3. Terminal bud die
4. Premature shedding of flower and buds

## Magnesium

It is absorbed in form of magnesium ion

### Uses

1. It is a component of chlorophyll
2. Activate enzyme in the metabolism of carbohydrates and nitrogen
3. Increase oil content in groundnuts and soya beans

### Sources

1. Inorganic fertilisers
2. Organic manure
3. Dolomitic lime
4. Weathering of magnesium rock

### Fate

1. Plant absorption
2. Soil erosion
3. Leaching

### Deficiency sign

1. Intervene chlorosis of leaves
2. Later leave become pale yellow and eventually die
3. In some crops like cotton leave develops a reddish purple colour

## Sulphur

It is absorbed in form of sulphate ions

### Uses

1. Increases the oil content of oil crop
2. It constituent of amino acid or nitrogen fixation
3. It activate photolytic enzymes e.g. papain

4. Used in nodule formation in legumes roots fixation
5. It use in protein synthesis

### Sources

1. In organic fertiliser
2. Oxidation of sulphide in soil mineral
3. Rainwater
4. Atmospheric sulphur from industries

### Fate

1. Plant absorption
2. Soil erosion
3. Vitalisations in form of hydrogen sulphide gas
4. Leaching

### Deficiency signs

1. Leaves turn light green starting with young leaves
2. Small and short plant with thin stems
3. Reduced nodulation in legumes

### Iron

It is absorbed by plants root as ferrous ions or as ferric ion

### Function

1. Necessary for formation of chlorophyll
2. Activate various respiratory enzymes

### Sources

1. Inorganic fertiliser
2. Organic matter

### Fate

1. Soil erosion
2. Leaching in acidic soil
3. Fixation into insoluble form

## Deficiency sign

1. Interveinal chlorosis
2. Young leaves can turn completely white in severe cases
3. Twigs stop growing

## Boron

It is absorbed as borate ions

## Function

1. Essential for cell division in meristematic tissues
2. Regulates carbohydrates metabolism
3. Important in transfer of sugar within plants

## Sources

Inorganic fertiliser like NPK

Organic manure

## Fate

Soil erosion

Leaching

## Deficiency signs

1. Poor growth and sometimes terminal bud die
2. Shortening of internodes
3. Poor grain filling on maize cobs
4. Soft or necrotic spot on fruits or tubers

## Manganese

It is absorbed in form of manganese ion

## Function

Activates and acts as a catalysts in formation of chlorophyll

## Sources

Organic fertiliser like manganese sulphate and organic manure

Fate

Soil erosion

Leaching in acidic soils

Fixation in alkaline soil

Deficiency

1. Mottled interveinal chlorosis
2. Interveinal white /brown specks in some cereals

Molybdenum

Absorbed as moly date ion

It is used to promote symbiotic fixation in legumes and also to increase nitrogen utilisation

Reason for depletion

1. Soil erosion
2. Leaching in Alkane soil
3. Fixation into soluble forms by ferrous oxide in acidic soil.

Deficiency

1. Whip tail in brassica crops such as cauliflower and broccoli
2. Failure of legumes

## WEEDS AND WEEDING

Weed are unwanted plants or plants growing in a place where they are in competition with another plant that is need

### Economic importance of weeds

1. The are source of manure when rotten
2. Some weeds are source of vegetable like blackjack
3. The minimises soil erosion by providing total ground cover
4. The source of food for wild animals
5. It is a home of wild animals

## **Disadvantages of weeds**

1. They decrease the quantity of crop yields by competing with plants for mineral nutrients, water, spaces and light reducing plant yield
2. They reduce the quality of crop yields by spoiling and contaminating crop yields which lowers the grade and value of produce
3. They harbour pest and pathogens since some of weed are secondary host of pest and disease e.g. guinea grass harbour stalk borers and root knot nematodes
4. They smoother crops through suppressing the growth of plants by getting established faster and aggressive than crops
5. Increases the production cost where the farmer need to spend a lot of money to weed the garden
6. It reduces the value of agricultural land where heavy feeder weeds lower nutrient status in the soil.
7. It poisons livestock even people since other weeds are poisonous for example thorn apple, fireball.
8. It increases cost of water management where they block the flow of water channels, cover the surfaces of fish ponds and also choke Rivers.

## **Classification of weed**

### **a. Leaf shape**

They are grouped into narrow leaved where the leaves are narrow and long with parallel veins and broad leaved where the leaves are broad and have net veins

### **b. Lifespan**

They are grouped depending on the period taken to complete their life cycle

#### **1. Annual**

They complete their life cycle with one growing season

#### **2. Biennials**

They complete their lifecycle within two growing seasons, first year they grow vegetative and complete their vegetative growth in the second year and produces seed and dies

#### **3. Perennials**

The live for more than two years. They store their food in their tubers , corns , rhizomes, stolon's

**c. Feeding habit**

**1. Non parasitic weed**

They manufacture their own food through photosynthesis

**2. Parasitic weeds**

They obtain their food from the host crop plant for example witch weed from maize, dodder from plantation trees, mistletoe from citrus fruits tree

**d. Preferred habit**

They are group to aquatic or non-aquatic weed

**e. Seed type**

They are classified as monocots and dicots

## METHOD OF CONTROLLING WEED

### Physical control

It uses human effort to remove weeds. It involve uprooting weed by hands

#### Advantages

1. Efficient for removing weeds on planting stations without any injury to crops
2. Requires little or no investment in farm, tool
3. Requires no specific skill n
4. It cheap where labour is abundant
5. it the best way of killing weed if entire roots system is removed

#### Disadvantages

1. it is very slow and cannot be completed fast enough on large farm
2. it is tedious , tiresome battle
3. may not be effective if the weeds break up leaving roots to produce new shoot
4. it may result in transplanting if uprooted weed is placed on moist soil in the garden to recover
5. allows weeds to rob the plants the food and water since uprooting need weeds that is tall enough to be gripped

## CULTURAL CONTROL

This involve use of crop husbandry practices to control weed

### 1. Burning the bush

This destroys the weed ad weed seed

### 2. Deep tillage

It buries weed seed deep in the group and they fail to germinate or they germinate when crop is already established

### 3. Flooding

This kill aquatic weed since they suffocate due to lack of oxygen

### 4. Crop rotation

This help to break the life cycle of host specific weeds for example witch weed in maize

### 5. Early planting

This makes the crop to be established before the weeds get established. This makes the crop to suppress the growth of weeds

### 6. Correct plant spacing

This ensures adequate ground cover which suppress the growth of weed

### 7. Correct fertiliser application

It ensure that crops grow faster than weeds so that they smoother weeds

### 8. Mulching

It covers the soil and denies weed light

## Advantage of cultural control of weeds

1. Easy to use
2. Cheap
3. Does not require extra effort

## Disadvantages

1. Does not control all weeds

## **MECHANICAL CONTROL**

It involve use of farm machinery including farm tool and implements to control weed

### **Example of mechanical weed control**

1. Slashing
2. Hoeing out weed
3. Using a sickle and lawn mowers
4. Using ox-drawn or tractor drawn implements

### **Advantages**

1. It is faster so large plot can be weeded in time
2. Less tiring than physical control
3. Reduces drudgery especially when tractor is used

### **Disadvantage**

1. It is expensive since it requires implements
2. May not completely eliminate weed
3. May require some skill to use some implements
4. May result in some crops plants being cut down
5. Cannot weed with the row of crops

## **Biological weed control**

It involve use of natural enemies of weeds to keep weed in population in check. The organism use can be pathogen or pest of weed

### **Advantages**

1. Make full use of natural enemies
2. It does not require a lot of labour other than introducing the pest

### **Disadvantages**

1. It requires careful attention to maintain balance between the pest and weed
2. It is difficult to breed host specific pest to control weed
3. Cannot use to eradicate weeds

## **CHEMICAL WEED CONTROL**

It involve use of substance or compound that are lethal to unwanted plants but are harmfulness to crop plants

### **Classification of herbicides**

#### **1. Classification according to use**

##### **a. Selective weeding**

They destroy plants of a particular group without harming other plants in mixed population. This control weed without harming the crops being grown.

#### **2. Mode of action non selective herbicide**

They kill any type of weed. Sometimes non selective herbicide kills together with crops

#### **3. Classification according to time of application**

##### **a. Contact herbicide**

The kill weed when they are in direct contact with weed

##### **b. Translocation herbicides**

The kill, through when they are absorbed in leave or roots and trans located to vascular system and the weed is killed

##### **c. Soil sterilises**

They are applied to the soil to prevent the growth of weeds

#### **4. Time of application**

##### **a. Pre planting herbicide**

They are applied before planting the crops and before weed appear

##### **b. Pre-emergency herbicide:**

The applied after the crops are planted but before the crops emerge

##### **c. Post –emergence herbicide :**

They are applied after the crops has emerged

### **Advantages of chemical weed control**

- i. Reduces the early wed competition through the use of pre emergence herbicide
- ii. It reduces labour demanding for weeding

- iii. Enables the cultivation of large hectare without any fear of weed.
- iv. Ensure timely weed control of weed
- v. Harvesting is relatively easy because of less interference without weeds
- vi. They need for tilling the land is reduced and therefore it is possible to maintain a good soil structure

### **Disadvantages**

- 1. It can cause damage to crops if high concentration is used
- 2. It is expensive
- 3. Some herbicide are harmful to people and can lead to loss of life
- 4. It may be diluted by rain hence less effective
- 5. Requires proper training to handle and apply chemicals
- 6. They pollute water and soil
- 7. Some herbicide has persistent effect as result they may injure the crop to be grown in the next season.

### **Legislative weed control**

This involves passing law to control weed and their spread.

The law such law may include

- 1. Inspection measure at any entry point to certify that any goods is weed free
- 2. Quarantine where the suspected goods are kept for verification for a certain period to certify that the free from weed
- 3. Mechanisms to report and control all noxious weeds

### **Advantages**

- 1. It prevent strange weed to enter into new land
- 2. It is free to farmers

### **Disadvantages**

- 1. It does not control weed on individual farm
- 2. It is difficult to enforce because it need cooperation among people
- 3. It is not effective due smuggling of goods

## CROP PROTECTION AGAINST PEST AND DISEASES

It is the keeping of plants safe from organism that could cause damage and reduction in crop yield, quality and farms income

### Pest

It is a n organism that cause damage to other organism like crops or animals.

### Common pest

Mammals: this include monkey, rats and mice

Birds: guineas fowl, ducks, redhead quell

Nematodes:such as earthworms

### Insects

**They are common damaging pest**

#### Types of insect

Insect are categorised depending on kind of the mouth part they have and damage it cause

#### Biting insects

Their mouthpart has strong mandibles for cutting and chewing the plants parts.

Example include, grass hoppers, cutworms, locust, termites, armyworms, bud worms

#### Piercing and sucking insects

Their mouth parts have a sharp needle like sty let which penetrate plant tissues to suck juice

Example include aphids, fruit flies, cotton strainers and mealy bugs

#### Boring insects

Their mouth part is adapted for biting and chewing. They cause a tunnel into stem, fruit, or seed and remain in the tissue and eat it

Example include the stalk borers and maize weevils.

### Harmful effects of pests

#### 1. Transmitting diseases

Pest acts as vectors thereby transmitting and spread disease from one plant to another

They inject toxic saliva that kills the plants.

They also encourages secondary infection when they pierce and cause wound on tissues

#### 2. Lowering quality of yields

The cause punctures on fruits and grains making them undesirable and unmarketable

They contaminate with their excreta

#### 3. Reducing the quantity of yield

They disturb the absorption of mineral salt through eating root and causing root rot

They interfere manufacturing of food and also transportation of mineral salt through damage of stem

The feed on flowers and interfere with pollination and also eating of fruits and grain

#### 4. Increases cost of production

It force the farmer to buy and use pesticide to control pest and the farmer spend more time to grading produce

## Diseases

It is a physiological or anatomical disorder or abnormality in plant which can be identified through characteristic symptoms on the plant.

### Effects of disease

The following are effects of disease on plants

1. It damages the roots through root rot which increase the incidence of plant lodging
2. It injures the root which reduces the root capacity to absorb mineral salts and water from the soil
3. It disturb the flow of nutrients through the stem to other parts e.g. canker and gummosis.
4. Leaf disease interferes with photosynthesis

5. It interference with the pollination of flowers
6. It reduces the quality and quantity of fruits and seed and become less marketable

## DISEASE AND PEST CONTROL

### Physical Control

This involves direct human effort to control pest and disease.

#### 1. Hand picking

Large pest and pest eggs are picked by hands and crushed or destroyed

#### 2. Fencing

The garden has an enclosure to protect the crop from pest mainly the mammalian pest.

#### 3. Frightening off pest

The pest are scared by sound, human shape devices or plastic paper that are set to fly in the garden

#### 4. UPainting sticky band

The trees of crop are smeared with sticky substances to prevent crawling insects to climb the crop so that they should not damage upper plant parts.

#### 5. Erecting concrete floor

This help to keep away termite so that it should not damage stored crops

#### 6. Flooding the field

This deprive oxygen from pest and they die due to suffocation

#### 7. Using rat guards

This prevent rats and other vermin from crawling up into the food stores

#### 8. Trapping

The pests are collected after being trapped and destroyed easily

#### 9. Using air tight storages facilities

This prevent the entry of oxygen into the storage and the pest die due to lack of oxygen and build-up of carbon dioxide

#### 10. Chilling and heating

It prevents multiplication and developing of pest and pathogens. It also help to kill some pest and pathogen like burning crop remain after harvesting.

## CULTURAL CONTROL

This is the use of normal husbandry practices to implication reduce multiplication and control pest and diseases

### **1. Tilling the land**

This help to prevent soil borne disease or pests by exposing them to surface where they can be picked by birds or die due sun's heat

### **2. Rotating crops**

It helps to crop host specific pests that are not mobile and diseases by breaking their life cycles.

### **3. Planting early**

This helps the crop to establish early before pest and diseases become dangerous. It also help crop to escape late pest and diseases attack

### **4. Planting clean and healthy seed**

It help to control seed borne diseases a and also it help to come up with healthy plant that can grow faster and escape pest and diseases attack

### **5. Removing volunteer plants**

This help to breaks the life cycle of pest and disease totally by removing the plant that could harbour the pest and pathogens

### **6. Weeding early**

It help to remove weed that harbour pest by acting as second host.

### **7. Maintaining a recommended spacing**

It helps to controls diseases because plants are healthy and uniform and grow faster.

### **8. Applying manure or fertilisers properly**

This help crop to be strong that can resist pest and disease attack.

### **9. Destroying crop residues**

This prevents the carry-over of pests and disease from one season to another.

### **10. Intercropping or mixed cropping**

One crop act a barrier against pest or acting as secondary host which divert the pest and disease from susceptible crops

### **Legislative control**

This is the use of laws and regulation to prevent dangerous pest and disease from being imported into the country to be transferred to another part of the **country**

### **1. Prohibition**

This use laws to forbid the introduction of specific agricultural material that may be source of infection in an area.

### **2. Quarantine**

The suspected crops or planting materials are kept isolated from a certain period to check if they are free from pest and diseases in sealed compartments until sign and symptom appear.

### **3. Notification order**

This is use to control notorious pest and diseases whereby people are advised to report any notorious disease or pest to authorities so that the pests and disease can be controlled.

### **4. Closed season**

This a law that enforces farmers to remove some crop remain or residue to prevent multiplication and infection of crop in the next season.

### **5. Seed certification**

This law ensures that seed sold to farmers should be free from pest and diseases.

#### **Biological control**

These involve use of living organism to control or to keep the population pest and disease on check.

##### **1. Predators**

Natural predator of pest is used to control or keep the population of pest on check

##### **2. Parasites**

Parasite of some pest is introduced to keep the population of the pest on check.

##### **3. Pathogens**

The pathogen of pest are introduce so that it cause disease in pests to keep their population on check

#### **Chemical control**

This is the use of substances that are lethal to crop pest, parasites or pathogens.

#### **Pesticides**

It is the chemical that are lethal or harmful to crop pest and pathogens

## **Types of pesticides**

Pesticide is group depending on use, mode of action

### **Method of application**

#### **1. Dusting powder**

The pesticide is inform of powder at applied by dusting and spread either on the base or the whole plant or planting poles

#### **2. Fumigants**

They are applied inform of a fume or a gas n in silos to control pest.

#### **3. Sprays**

The pesticides are inform of liquid which is diluted and spared around the crop plant.

### **Mode of action**

#### **1. Contact poisons**

Pest are killed when they come in touches the pesticide. The poison enters through the cuticle.

#### **2. Stomach poisoning**

The pest is killed when it eat treated crop and it destroys the elementary canal

#### **3. Respiratory poisoning**

They in vapour form and it interferes with respiration killing the pest instantly

#### **4. Systematic poisoning**

The pesticides are applied to soil or leaves where it is absorbed by plants and translocate to all plants part and the pest is killed one it eat the treated plant

## **Advantages of chemical control**

- 1. It can be completed quickly**
- 2. It produces results quickly**
- 3. It is used only when necessary to avoid wasting money and time**
- 4. Individual farmer can control pest and diseases on large farm**
- 5. It is more dependable than legislative and biological control**
- 6. It is easy to use since instruction are always clearly labelled on the packages**

## **Disadvantages**

1. It is very expensive
2. It kills beneficial organism
3. It pollutes environment
4. It requires repetitive application to kill larvae or adults in subsequent cycles
5. Some pest develops resistance to pesticide
6. It is harmful to people and can lead to death of people

## **CROPPING SYSTEMS**

It refers to patterns techniques, producers or practices followed in cultivation and production of plants

### **Shifting cultivation**

This is the cropping system where land is cultivated for several years until crop yields become too low due to soil exhaustion. The farmer abandons the exhausted land and opens new plots

#### **Advantages**

1. It is cheap since it does not require fertilisers, ashes from burnt trees act as fertiliser
2. It is simple since operations are generally done by hand tools
3. It controls pests and weeds effectively through burning of bushes

#### **Disadvantages**

1. It requires a lot of land for shifting
2. It results in low yield due to low input levels
3. The burning of bushes destroys organic matter and some nutrients
4. It exposes the soil to soil erosion

### **Bush fallowing**

This is the farming system where a farming plot is temporarily abandoned after becoming exhausted so that it regains fertility and returns to it later

#### **Advantages**

1. It is cheap as it does not require a lot of capital
2. It maintains soil fertility during fallow period

## **Disadvantages**

1. It encourages deforestation as the bush is cleared for another
2. It increases the rate of soil erosion through cutting down trees and setting of bush fires
3. It requires a lot of land

## **Mono cropping**

This is the growing of one crop that is suitable for the area every year.

## **Advantages**

1. It produces the highest possible profit for the farmer since he/she grow the crop that is suitable in the area
2. It simplifies farm management
3. It facilitate farm mechanisation since large area is cultivated
4. It save the cost since farm inputs are bought in bulk since the crop is grown on large area
5. It reduces the amount of starting capital
6. It makes the farmer to become an expert and manage it better for higher profits

## **Disadvantage**

1. It lead to pests and diseases build up since one crop is grown which lead to multiplication of pest and diseases
2. The risk of disappointment is high in case risk and certainties
3. The soil become exhausted quickly which lead to low yield

## **Monoculture**

It is the growing of one crop on a piece of land. A farmer may grow several crops but in separate plots. Each crop in each own plot.

## **Advantages**

1. It facilitate the use of farm machinery since adjustments can be made easily to suit one crop in the pure stand
2. It eliminates the possibility of any competitions from other crops and the crops fully utilise the resources available on that plot
3. It is easy to use chemical and fertilisers without risking other crops which is difficult in mixed stand

## **Disadvantages**

It increases the rate at which pest and diseases spread since there is no any barrier to check or slow the spread of pest and diseases

## **Mixed cropping**

It is the practice of growing two or, more crops on the same piece of land.

### **Ways of doing mixed cropping**

#### **Intra-row mixed cropping**

Crops are sown on the same on the same planting stations

#### **Inter-row mixed cropping**

Crops are sown on the same ridges but different planting stations or on different ridges

#### **Relay cropping**

The second crop is grown after the first crop has already established or even maturing.

## **Advantages**

1. It save labour since some operations are done once for the two crops
2. It save land since the same land is used for more than one crop
3. It increases total yield per hectare
4. If legumes are included the crop benefit each other like cereal crop obtain nitrogen fixed by legumes while legumes find cereal as stakes
5. It reduces the risk of total crop failure since the farmer may rely on other crop
6. It reduces the spread of pest and disease by acting as barriers
7. It provide total soil cover which reduces soil erosion due rain drop impact

## **Disadvantages**

1. Mechanisation is difficult since it crop has different requirements
2. Requires large capital to get different machine and farm inputs
3. It is difficult to use chemical because it may affect the other crop
4. Require wide range of knowledge to handle and manage different crops
5. Crop may shade one another reducing the rate of photosynthesis which affect crop yield

## **Continuous cropping**

It is the growing crops on the same piece of land every year without fallowing or resting

### **Advantages**

1. Ensures maximum utilisation of land resources available
2. It conserves soil since it is always under cover
3. Ensures food security since the farmer harvest

### **Disadvantages**

1. It leads to exhaustion of soil fertility since nutrients are removed by crop every year
2. Results in over-cultivating or over cropping which destroys the soil structure
3. It may result in multiplication of pest and diseases and some parasite weeds.

### **Crop Rotation**

It is the practice of growing crops on the piece of land in a particular sequence every year.

### **Factors that affect crop rotation**

1. Land shortage due to population
2. Introduction of perennial crops that takes long period
3. Permanent building which would be expensive to replace

### **Principle of crop rotation**

1. Crops with deep roots should follow with shallow rooted crops
2. Leguminous crops should follow with non leguminous crops
3. Heavy feeders should follow with light feeders
4. Crops with resistance to certain disease should follow with susceptible crops to that disease
5. Crop which provides total soil cover should follow with little soil cover.

#### **Example of crop rotation:**

Plan a five year crop rotation for the farmer who wants to grow the following crops maize, cassava, cotton, millet, groundnuts and ground beans

Year	Plots					
1	Maize	Cassava	Cotton	g/nuts	Millet	g/beans
2	Cassava	Cotton	g/nuts	Millet	g/beans	Maize

3	Cotton	G/nuts	Millet	G/beans	Maize	Cassava
4	g/nuts	Millets	G/beans	Maize	Cassava	Cotton
5	Millets	G/nuts	Maize	Cassava	Cotton	G/nuts

### Advantages

1. Ensures that plants make full use of soil nutrients from different layers in the soil
2. Maintains or even improves soil fertility if legumes are included
3. It help to control pest and disease by breaking their life cycles
4. It help to control parasitic weeds by depriving them from their host in some years
5. Reduces soil erosion when cover crop is include in the rotation
6. It ensure even distribution labour thought the year and this reduces peak labour peak
7. Spreads out financial risk over several crops

### Disadvantages

1. Results in less farm income compared to monoculture since
2. Requires more land to accommodation various crops
3. Requires skill in the management of various crops
4. It can not be done where the family need more land for steeple food

### No-till cropping

This is the system where land is left undisturbed like it is not tilled or ridged

### Advantages

1. Conserves the soil since it is not loosened by tillage which can be easily eroded by wind or water
2. Save labour since ploughing and ridging is not required
3. It ensures that various crop husbandry practices are done and completed in time
4. It maintain soil structure since it is not damages by cultivation
5. It save money therefore increasing profits
6. It can be used effectively on hilly areas where machinery could not used

## **Disadvantages**

1. It may not improve productivity of clays soil which requires opening
2. Herbicide are expensive

## **Biological farming**

It is the cropping system of growing crop using organic inputs rather inorganic inputs.

Soils are fertilisers using organic manures instead of chemical fertilisers or pesticides.

## **Advantages**

1. It prevent rivers and lakes from being polluted with fertilisers that could destroy aquatic life
2. It protect useful insect which could be destroyed by pesticides
3. It improves soil structure through the use of manures
4. It is cheaper to make and apply manures than to buy fertiliser.
5. It reduces the chances of poisoning
6. It keeps the ecosystem in the state of balance since it does not environment friendly

## **Disadvantages**

Organic inputs may not be quick as inorganic ones in producing results

## **CROP IMPROVEMENT**

It is increasing the productivity of cultivated plants by developing better cultivars (cultivated varieties) which poses superior characteristics

Aim and object of crop improvement

1. **To increases the average crop yield**

The following are objects related to increasing yield quantity

- a. To increase biomass by increasing growth rate, greater plant vigour or fast recovery after cutting in case of forage crops
- b. To improve partition of harvestable parts of the plants such as roots, seed, and fruits .
- c. To increase the resistance to pest and diseases by increasing the capacity for plant to withstand pathogens and insect pests.
- d. To improve season adaptability by matching the growth rate and maturity of a crop length

of growing season in order the crops to full utilise growing season

- e. To increase the tolerance to adverse environmental condition by increasing the capacity of crop to withstand poor environment so that they still give reasonable yield

## 2. To increase quality of crops

Objective related to quality of yield

- a. To increase the marketability or market value of crop products by developing products of better colour, texture and taste and demanded by consumers
- b. To improve the processing qualities of crop products as required by processors in industries with high oil content, high fibre strength, and sugar content
- c. To promote dwarfness in crop by producing shorter varieties in order to reduce plant lodging
- d. To increase the nutritive value of crop products so that crops have high protein and vitamins content so that the food stuff of human and livestock is improved

## Methods of crop improvement

### 1. Introduction

Crop varieties with superior productivity is imported for breeding or propagation in anew area.

For successfully establishment of the crop the two areas should have similar climatic conditions

Example of crops that was introduced in Malawi

### Maize:

- a. Ukaruguru composite A from Tanzania

### Rice :

- a. Blue bonnet from USA
- b. Changu (IR1561-250-2-2) from Philippines
- c. Senga (IET 4094) from India

### Ground nuts

- a. Malimba from Gamiba
- b. Chitedze groundnuts 7 (CG7 or ICGMS42) developed by Chitedze research station through ICRISAT
- c. Manipinter and Mawanga from Bolivia and come to Malawi from Bolivia

## **2. Selection**

This involves choosing plants with superior or desirable characteristics for propagation or for breeding.

It is based on the scientific knowledge that plants inherit quality qualities from parents. This method improves quality of the plants and does not bring new species

### **Example of crop that was improved by selection**

Chalimbana groundnuts

Faya 14-m-69 developed from several strain of Faya rice.

Ways of selecting plants

#### **1. Mass selection**

A large number of plants showing desirable qualities are selected for seed. The plants are selected naturally by survival of the fittest where by weak plant are wept out leaving the strong which are **taken as seed until pure strand is produced**

#### **2. Single selection**

Individual are selected which show desirable qualities for breeding. Seeds from superior plants are taken for breeding

#### **3. Hybridisation**

It is the process of cross –pollinating varieties with different characteristics, in order to produce a new variety with combined good qualities from both parents

Steps followed when doing hybridisation

##### **1. Choosing the parents**

This involve choosing parent with superior qualities for breeding which complement each other

##### **2. Self pollinating the parental lines**

The chosen parents are self pollinated for several years for about 5 -6 generation in order to obtain pure lines.

##### **3. Cross pollinating the pure lines (crossing the pure line)**

This involve cross pollinating the pure line to obtain new variety with qualities from the two parents. The pollen from pure lines (inbred) is collected and transferred manually to the stigma of the flower

In bred A X Inbred B



Inbred C x Inbred D



Single cross (AxB)

Single cross (CxD)

Single cross plants (AxB) x Single cross (C X D )



Double cross seed (A x B) X (C X D )

Produced in isolated field

## PASTURES

Pasture is a grass land use for grazing animals

Importance of pastures

1. It help to check soil erosion by
  - a. Providing total soil cover which reduce raindrop impact and wind erosion
  - b. By reducing run off and increase infiltration
  - c. Binging soil particles by their root
2. Source of feed for animals
3. It help to improve soil nutrient by

- a. Circulating of soil nutrients
  - b. Through fixation of nitrogen if legumes are included in the rotation
  - c. Bring soil nutrient on top the soil
4. It help to control pest and disease for example Rhodes grass is use to control eel worm in tobacco estates
  5. They are feed for animals

## Types of pastures

### Natural pastures

It is uncultivated grass land in which indigenous species are dominant.

The advantage of natural pastures is that they are commonly found and have disease resistance but they are less palatable and digestible even young or mature and have low nutrient content

### Cultivate pasture (exotic pastures)

It is the grass lands that is cultivated and contain improved species of grasses and legumes

#### Classification of cultivated pastures

They are classified depending on the length of the pasture will stand

##### 1. Temporary pastures

They are cultivated pastures that last for three to five years

They contain pure stand of grasses or legume or combination of the two

##### 2. Permanent pasture

It's a cultivated pasture that contains one improved species of grass or legumes and is managed for ten to fifteen years.

### Importance of Cultivated Pasture over Natural Pastures

1. They have high dry matter content yield than natural pastures
2. If includes legumes which has the following advantages
  - a. The combination of pasture and legume give a high yield than in pure stand
  - b. Nitrates fixed by legumes are used by grasses
  - c. Legumes are more digestible even when they are mature
  - d. Legumes have high protein content which improves feed quality

- e. Legumes have high nutritive value even when mature
- 3. They have high protein content if they retain it even if they are mature
- 4. They have high digestibility even if they are mature and they tend to attain that juvenile period for a long period than natural pasture

## Pasture Establishment

It is the process of sowing pasture

### METHOD OF PASTURE MANAGEMENT

#### 1. Broadcasting

It is the process of sowing pasture where seed are spread on the surface of the soil using hand or fertiliser spreader and then raked into the soil

The seed are first mixed with diluents made up saw dust or fertiliser for even distribution

#### Advantages

- a. It is the easiest way of sowing tiny seed
- b. It does not require special skill
- c. It saves time since it is most quickest way of sowing seed

#### Disadvantages

- a. Some seed may land on surface and may be picked by birds or running water
- b. Some of the seed may fail to germinate because they have been buried deep in the soil on the surface due to lack of moisture
- c. It leads to uneven distribution of seed as a result in overcrowding and scramble for sunlight, water and soil nutrients
- d. It requires a lot of seed hence it is expensive
- e. It is difficult to apply or weed in the broadcasted field

#### 2. Drilling

It is the method of sowing seed in trenches made by holes, sticks or machines and covered by soil

#### Advantages

- a. It is more efficient than broadcasting since seed are placed at right depth and covered adequately

- b. Weeding and fertiliser application is more efficient

#### **Disadvantages**

- a. It is tiresome and time consuming
- b. It is expensive if done mechanically

### **3. Overstocking**

It is the sowing of pasture seed in already established pasture or natural pasture

For successful establishment of pasture the already existing pastures are burnt or overgrazed

#### **Advantages**

- a. It improves the quality of existing pasture by introducing some desirable species
- b. It improves the dry matter of pastures
- c. It improves the quality of natural pastures in term of protein content

#### **Disadvantages**

- a. The introduced species may face competition for sunlight, air and moisture with existing pastures if the original is not reduced

### **4. Under sowing**

The pastures seed are sown under growing arable crops such as maize

#### **Advantages**

- a. It enables pasture to get established a year earlier
- b. It enables the farmer to harvest an extra arable crop from the same plot
- c. It eliminates the cost of land preparation since weeding for arable crops act as land preparation for pasture
- d. It ensures that young pastures are protected from adverse weather condition by already established arable crop
- e. It enables the farmer to get total higher yields

#### **Disadvantages**

- a. Yields of each crop is lower than in the pure stand

### **5. Vegetative planting**

It is the planting of pasture using stem cutting and root cutting (splits )

### **Advantages**

- a. It reduces the juvenile period of the plant because vegetative propagated material assume the age of the parent
- b. It eliminates the problem of seed dormancy which need seed treatments like scarification
- c. It ensure uniformity among the plants which reduce the need for grading since all off spring resemble the parents
- d. It is the only way of propagating plants with no viable seeds
- e. They have high food reserves that help the young shoot to become established
- f. It readily available from previous stock and reduces the risk of buying expensive seed

### **Disadvantages**

- a. They is high risk of transferring diseases to new plants if the material used are diseased
- b. It is difficult to bring variation among plants
- c. They are bulky compared to seed
- d. Some procedure requires special skills and expertise unlike in seed

## **Pasture Establishment Procedures**

### **Sowing pasture**

Pasture should be sown during early season for successful establishment

## **FACTOR TO CONSIDER WHEN SELECTING PASTURE GRASS OR LEGUMES**

### **1. Adaptation to local environment**

The species chosen should thrive the local soil/climatic condition and give a reasonable high yield

### **2. High overall dry matter production per unit area**

Pastures species chosen should give high yield per unit area and respond quickly to pasture management like fertiliser application

### **3. High feeding value**

The species chosen should have high protein content and maintain it even if they are mature

#### **4. Proposed duration of pasture**

The species of pastures will depend on fact that the farmer want to do with the pasture and should withstand the period the pasture will stand

#### **5. Compatibility with desired species**

The chosen species of grass or legume should successfully grow together with each other since the combination of legumes and grass provide better pasture

#### **6. Proposed method of utilisation**

The choice of the species will depend on whether they will be used for grazing, hay silage or cut and carry

#### **7. Continued digestibility of grass or legumes**

The grass or legumes chosen should maintain it juvenile period or remain green even if in dry season so that their digestibility can not change

#### **8. Resistance to pest and disease**

The species should withstand the attack from pest and diseases in order to obtain high yield or control the pest and diseases

#### **9. High tolerance of water logged condition**

The chosen pastures should withstand water logging condition if it will be planted in dambo area

#### **10. Role of the pasture in the rotation**

The species chosen should achieve the purpose in the rotation like if used to control pest or diseases. It should be resistant to such diseases or pests

#### **Selecting seed for pasture**

For successful establishment the seed should be of high quality and certified

Seed quality is expressed as pure line seed content (PLSC)

PLSC= Purity % X Germination%

100

#### **Calculating seed rate**

Seed rate is the amount of seed required per unit area

Seed rate = expected plant population /Seed size /purity %/Germination %

= Expected plant population

Seed size x purity % x germination %

= expected plant population x 100 x 100

Seed size x purity % x germination %

**Example** calculate the seed rate of Rhodes grass with expected plant population of 1200000 with seed size of 600000 seed per kg , purity % 90% and germination % of 80 %

Seed rate = 1200000x 100 x 100

600000 x 90 x 80

Seed size = 40/9

= 4.44kg

### Factors that affect seed rate

a. Purity of the seed

Seed with a lot of trash need high seed rate compared to high quality seed

b. Germination percentage

Seed with high germination percentage need low seed rate to achieve desired population

c. Seed size

Species with small seed need lower seed rate compared to large seed

d. Pure or mixed stand

In mixed stand the seed rate of each species is reduced to reduce inter plant competition

e. Soil tilth

Well prepared seed bed reduces seed rate

f. Growth habit of the species

Species with large vegetative growth requires lower seed rate in order to achieve mutual shading

g. Method of sowing

Some of methods like broad casting need a lot of seed compare to drilling method

### Seed treatment

It is the process /handling of planting materials in order to improve germination and improve successful establishment

### Hulling

It is the removal of seed from the pod to speed up germination

### **Importance of hulling**

1. It increase rate of seed germination
2. It makes pelleting easy
3. It ensure even distribution of seed in case of broadcasting method

### **Scarification**

It is the process of softening hard testa of some seed to speed up germination

The seeds may be immersed in hot water or scarified mechanically.

### **Inoculation**

It is the process of mixing legume seed with right type of Rhizobium bacteria for successfully nodulation and nitrogen fixation

### **Pelting**

It is the process of sticking a thin layer of material such as lime, gypsum or rock phosphate around each seed to maintain soil pH or correct soil deficiency.

Inoculated seed should not be mixed with gypsum it increases soil acidity which kill Rhizobium bacteria

## **PASTURE MANAGEMENT AND UTILISATION**

### **Fertiliser Application**

During the first years of establishment apply 220kg/ha of 20:20:0 and 110kg/kg of super phosphate to pure grass sward

55kg/ha of CAN and 220kg/ha of superphosphates to legume sward only

For maintenance of the pasture apply 23:21:0 +4s at the beginning of each rainy season.

Apply CAN after each cut or grazing

Superphosphate should be applied to legumes to promote nodulation and nitrogen fixation

To cut and carry pasture apply potash after each cut since potash is depleted from the soil

### **Controlling Weed**

Weeds can be controlled by hand picking, selective weeding and mowing

In pure grass sward herbicide can be used to control weeds

Weeds in pasture should be controlled early because it causes serious reduction in population of pasture species and some are poisonous to animals e.g Lantana , fireball, thorn apple

## Controlling pest and diseases

Pest can be controlled by applying pesticide mainly during a year of establishment. Disease can best controlled by rogueing (uprooting all infected plant and destroy them either by burning or burning in the soil)

## GRAZING MANAGMENTS

It is the way of obtaining high level of livestock production per unit area without causing sward degeneration

### Way of grazing management

#### 1. Controlled stocking rate pasture

It is the number of animals a specific type grazing type on unit area at any time

The pasture should be matched with the number of animals in order to achieve desirable results since under stocking result in selective grazing leaving unpalatable species while overgrazing result in overgrazing and soil erosion and loss of sward vigour.

#### 2. Matching grazing to pasture carrying capacity

It is the maximum number of animals of specific type which can be feed on a given area of pasture through the year without deceasing productivity of the pasture and livestock

#### 3. Providing sufficient grazing intervals (rest periods)

Grazing interval is the period between two successive grazing period and cut in the pasture or paddock

The grazing interval should not be too long to allow animals to graze young and tender juicy and palatable grasses and should not too short to allow pastures to generate

## GRAZING SYSTEMS

### 1. Rotation grazing

It is the system of grazing in which animals move at regular intervals around a series of paddock so that each paddock has a period of resting to recover.

#### Advantages

- a. It help control parasite a diseases by reducing their multiplication and concentration and even breaking life cycle
- b. It provide enough time for the pasture to recover

- c. It ensures that palatable species are not grazed out leaving unpalatable species to dominate
- d. It ensures sufficient feed to be available throughout the year
- e. It helps to control soil erosion since overgrazing is avoided
- f. It ensures even distribution of urine and dung which increases pasture productivity.

#### **Disadvantages**

- a. It requires a lot of capital to fence and watering the pasture

### **2. Strip grazing**

It is a type of rotational grazing where animals are confined in a small fenced strip of pasture for a day or two and forced to graze all herbages present before being moved to another strip

#### **Advantages**

- a. It allows pasture to be used completely
- b. It ensures high quality pasture every day

#### **Disadvantages**

- a. It is expensive to fence small strip

### **3. Continuous grazing**

It is the system of grazing in which animals are placed on a pasture for prolonged (without stop) period without allowing pasture to rest

#### **Advantages**

- a. It is cheap since it does not require fencing
- b. It does not require moving animals regularly from one to graze

#### **Disadvantages**

- a. It encourages build up of parasite and diseases in the pasture
- b. It does not give time for pasture to recover
- c. It leads to overgrazing due to overstocking

### **4. Zero grazing**

It is the system of pasture utilisation where pastures are cut daily to stall feed animals.

#### **Advantage**

- a. It ensures maximum utilisation of pastures since all that are cut is eaten up
- b. It avoids selective feeding of palatable species of pasture leaving unpalatable species.
- c. It controls disease and parasite since animals do not move elsewhere to graze where they can be infected by diseases
- d. It eliminates the risk of overgrazing
- e. Animals gain weight faster since there is no trekking of animals that may lead to loss of weight
- f. It requires less capital since it does not require fencing

#### **Disadvantages**

- a. It requires a lot of labour to harvest and give animals in pans at right intervals and quantities

### **5. Deferred grazing**

It is the system of grazing where pasture is kept standing to be grazed during dry season

#### **Advantages**

- a. It ensures availability of some feeds during season

#### **Disadvantages**

- a. It allows some pastures to mature and become less palatable, fibrous and indigestible.

### **Burning pasture**

It is the controlled burning of natural pastures during the dry season

#### **Advantages**

- a. It allows growing of fresh pastures freely by removing dry and indigestible
- b. It controls pest and disease by burning pest, infected pastures and sterilising the soil
- c. It reduces the competition between ungrazed unpalatable species with grazed palatable species
- d. It reduces bush encroachment by burning of shrubs

#### **Disadvantages**

- a. It destroys legumes pasture since legumes are easily destroyed by severe heat
- b. It reduces sward vigour due to severe heat

### Pasture conservation

It is a practice of preserving abundant herbages during wet season to be used during dry season

### Ways of preserving pastures

#### A. HAY

It is herbage that is cut and cured by partially drying it for later use as livestock feeds

Qualities of good hay

- ✓ It should have 20% moisture content
- ✓ It should be clean free from foreign materials
- ✓ It should have green tinge
- ✓ It has pliable texture
- ✓ It has pleasant smell

Importance of hay to a farmer

1. It can be kept for relative long period without loss in nutritive value
2. It provide the cheapest source of feed for animal in dry season
3. It supplies most needed energy, vitamins, minerals and proteins to livestock in the dry season
4. It provide the animals with fibre which is required to satisfy the animal hunger and facilitate peristalsis

### Hay Making Process

#### 1. Cutting

Forages is cut just before the plant flowers in order to obtain the most nutritious and palatable products.

It should be cut when dews is dried about 8 to 10am

#### 2. Drying

It should be partially dried for about three to four days to a moisture content of 20%. The forage should not over dried because it reduces carotene content and lower the quality of hay while under drying cause the forages / hay to grow some turn mouldy

### **3. Stacking**

The dried hay should be stacked n a leak proof house for storage

## **FACTORS THAT AFFECT QUALITY OF HAY**

### **1. Pasture species in the hay**

Hay with a lot of legumes have high quality than that of grasses only

### **2. Stage of growth during cutting**

Mature pasture tend to fibrous and low crude protein content

### **3. Degree of turning**

Well dried hay have good quality than poor dried hay because it tends to turn mouldy

### **4. Leafiness of herbage**

Forages with a lot of leaves form better hay than forages without leaves because leaves tend to have high proteins

### **5. Presences of foreign materials**

Some foreign material like poisonous weed, wires, and weeds lowers the quality of hay

### **6. Weather during harvesting and drying**

Rain weather or showers lengthen the period of drying the hay which in turn affects hay quality

### **7. Storage of hay**

Leakage storages lower the nutritive value of hay

## **B. SILAGE**

It is the green forage that is preserved by fermentation

### **Advantages of silage to a farmer**

1. It makes wide range of forage including those that can not be made into hay eg Napier, maize stalks
2. It preserves a higher percentage of proteins than in hay

3. It maintains succulent of the green fresh forage so that it is highly digestible
4. It is more palatable than hay and have good smell
5. Less vitamins A is lost than in sun dried hay
6. It is free of weeds seed since seed are killed by the heat in the silos
7. It is better preserved and they can be kept for longer period

### **Disadvantages**

1. It is more expensive to make and requires a lot of labour
2. It has moisture content which makes dry matter not available to animals

## **SILAGE MAKING PROCESS**

### **1. Cutting**

Grass is cut before flowering and legumes forage is cut at podding stage.

### **2. Partial drying**

The forage is partially dried to a moisture content of 65% to maintain its succulence

### **3. Chopping**

The forage is cut into small pieces to ease compression / compaction

### **4. Stacking**

The chopped forage is stack inn silos or pits

Stacking should be done very fast and compactly as possible to help to eliminate air.

Each layer must be mixed with readily available carbohydrates concentrates such as molasses to provide energy for bacteria

Other additive should be added to improve the quality of pastures e.g. mineral

### **5. Compression**

The forages should be pressed firmly to eliminate excess oxygen in the silos

The silos should be covered by soil or plastic paper to avoid entry of oxygen.

### **6. Fermentation**

The anaerobic bacteria produce lactic acid and heat which improves the pleasant smell and also help to preserve the silage by lowering the pH to 4 which retard multiplication of anaerobic bacteria

### **Factors that affect silage quality**

1. Type of plant used
2. Additive placed in the silos
3. Availability of carbohydrate to provide energy to anaerobic bacteria
4. Speed of filling the silos
5. Fineness or coarseness of chopped material
6. Tightness of air seals
7. Amount of protein broken down during fermentation
8. Water content of herbages
9. Age of crops harvests for silage
10. pH value of silage

### **C. FOGGAGE**

It is the standing hay left ungrazed to be used in dry season

#### **Advantage**

It the cheapest way of storing pasture

#### **Disadvantage**

It makes pasture to mature with low protein content, high fibre content and low digestibility

### **Factors that affect the pasture quality**

1. Pasture species
2. Ration of legumes and grasses in the pasture
3. Palatability of the pasture
4. Digestibility of pastures
5. Crude protein content of the pasture
6. Regeneration ability of the pasture
7. Persistence of species
8. Leafiness of pasture

9. Resistance of the pasture to pest and diseases attack
10. Tolerance of pasture species
11. Presence of weeds
12. Pasture utilisation

## Crop Processing and Storages

Processing is the handling of crops and preparing them for consumption or storage by changing them form to another for that consumers can use.

### Processing and storage of maize

#### 1. Stripping the maize cob sheath

This involves removing the husks of the maize cob.

#### Advantages of stripping maize cob sheath

- a. It makes the grain to be exposed to air so that it dry faster and thorough drying
- b. It ensures that storage pesticide can be readily reach and protect the grain

#### Disadvantages of storing maize with husks

- a. The husk prevents air from reaching it and trapping moisture inside the cob preventing maize to dry thoroughly.
- b. The husks contains moisture which slow drying of maize and spoil the grain through encouraging moulds
- c. It is difficult to apply pesticide to the grain for protection against pest during storage

#### 2. Shelling maize

It involve removing the grain from the cob .

#### Importance of shelling

- a. It speed up drying
- b. It help to reduce storage space

#### 3. Drying the grains

Maize can be sun dried or air dried.

#### Importance of drying maize

- a. It prevents moulds from developing on the pericarp /testa
- b. It makes the fused pericarp to be strong and resist some storage pest attack
- c. It reduces the respiration rate in the grain that keeps the temperature of the grain lower which preserve the grain
- d. It prevents sprouting of the grain while in storage.

#### **4. Cleaning**

Cleaning it is cleaned by winnowing to remove chaff

#### **5. Storage**

It can store in bag while unshelled maize can be stored in nkhokwe.

#### **Qualities of good storage for grain**

- a. It should be dry and leak proof to prevent moulds
- b. It should be cool to prevent grain from heated and increase respiration rate which spoils grains
- c. It should be clean to prevent multiplication of pest and pathogens
- d. It should be airtight to prevent pathogen rats and insect pest to enter the storage.

#### **Processing and storing groundnuts**

Shelled groundnuts can be store in bag while unshelled groundnuts can be best storred in Nkhokwe.

It should be well dried and cleaned and store in good storage facility

#### **Processing and storing sweet potatoes**

##### **Cleaning**

This involve removing all debris from tubers that may harbour pathogen and pest since the live in debris

##### **Selection**

Only potatoes free from bruises cut and free from pest and disease attack should be selected to be stored since bad tuber spoils others.

## **Curing**

it the spreading out tubers in cool dry, shaded ate a relative humidity of 80% to 90 % for about five day to make the skin thicker and tougher so that the tuber can be stored well. It also promote the healing of wounds in the tubers which help to prevent fungal attack

## **Piling**

Potatoes should be piled on soft bed made up of banana leaves at the base to cushion them.

## **Processing and storing sweet potatoes**

It should be stored in cool, dry dark placed since multiplication of fungal. It should be covered grass or leaves and ventilation hole should be made to prevent build up of moisture

## **Processing and storing sweet potatoes**

It is stored in processed form because it reduces toxicity of tubers, improve the palatability and make the perishabilty stable enough for storage.

Cassava can be processed by peeling, sun dried and stored in sacks

## **Processing mangoes for storage**

It best stored in form of juice and chutney or atjar which can be canned or bottled.

How to store fresh mangoes.

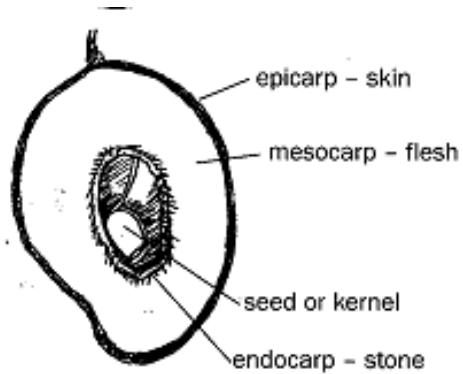
- a. Wipe off latex form mangoes to prevent damages damage to skin
- b. Select fruits that are in good condition
- c. Cool mangoes to 7-10 °C
- d. Disinfect the fruits to prevent the spread of fruit flies
- e. Maintain high humidity of 90% - 95%

# **Fruit Production: Mangoes**

## **Importance of fruits**

- a. They are source of raw material to local industries
- b. They are source income
- c. It is source of valuable food nutrients like proteins, carbohydrates and oils.
- d. They are source of employment
- e. They are source of foreign currency if they are exported to another country.

## Parts of mango fruits



## Varieties of mangoes

### Local varieties

Examples include Boloma, Domasi, Dodo , Waka, Kalisere

They are relatively small, have good flavour but have too much fibrous.

They are best for cooking and making juice and chutney

### Exotic breeds

Characteristic of some exotic breeds

#### 1. Haden

It is large about 400 to 700g

It matures during early season

It is suitable in hot dry area

It is well colored with excellent flavor

Susceptible to anthracnose

#### 2. Zill

It is medium about 300 to 400g

It is mature during early season

It is scarlet to dark red when ripe

It is suitable for all typical mango area

It has excellent internal quality and can be kept well

3. Irwin

It is medium in size about up to 450g and is 12cm long

It mature during early season

It is suitable for most areas

It has elongated fruits and slightly flattened

It has excellent internal and external quality

4. Davis Haden

It large up to 900g and mature during mid season

It is resistance to anthracnose

5. Palmer

It is large and the size ranges from 600g to 700g and mature during late season.

It produces elongated fruits

It susceptible to bacterial black spot

6. Kent

It is large up to 900 g and mature during late season

It has high yielding fruits

It is suitable for hot area

7. Keitt

It is large up to 900g and mature during very late season

It bares plump thick fruits

8. Anderson

It large up to 1kg and 28 cm long and mature during very late season

It is suitable for canning

## **Factors to Consider when Establishing an Orchard**

The fruits should be resistance to local diseases and pests

Fruits should have good internal and external quality

It should mature early while other should be late maturity to extend mango period

It should have high yield

## **Cultivating Mangoes**

Mangoes requires deep fertile soil , well drained sandy loam soil with soil pH of 5.5 to 7.5.

It do better in area with altitude of 600m with a minimum rainfall of 650mm

### **Land preparation**

Planting hole should be 90cmx90cm x90cm

The filling soil should be mixed with 5-10kg of well decomposed manure

Planting hole should be 9m x 9m to 12m x 12 depending of the variety and fertility of the soil

### **Planting**

It should be done between December and January. The transplanted seedling should be covered until the collar mark and a basin should be making around the tree to hold water.

### **Mulching**

The soil around the seedling should be covered with dry grass to conserve moisture .

### **Weeding**

Weeds around the basin are should be cleared and outside should be regularly slashed

### **Fertiliser application**

Apply 5 to 10kg of manure at the beginning of rainy season. Mix CAN, triple phosphate and muriate of potash depending on the age of the trees and fertility of the soil.

### **Harvesting mangoes**

Mangoes should be harvested when they are physiological mature. When harvesting avoid the fruit to fall to ground to avoid mangoes to bruise. Pick one by one by hand .

### **Pest of mangoes**

#### **Mangoes stone weevils**

It is afresh white grub

It enters the fruit during early stages of fruit development, leaving no external signs of entry.

**It damages the stone**

Fruits fall early or rot or may have hard whit parts inside

To control collect and burry dropped mangoes and keep the orchard clean

### **Mango scales**

They are small flat oval insects which attack the leaves, stem and fruits

The produces honey dew

To control spray dimethoate 20wp at 85g in 14 litres of water.

### **Fruit flies**

They lay eggs on fruits which hatches to white maggots and enters the fruit

The fruit changes colour before they ripe and some fresh part become liquid

To control collect and burry fallen fruits

Spray fenthion 50EC at 1ml per litre of water

Harvest mangoes before ripening

### **Disease of mangoes**

#### **Anthracnose**

#### **Sign and Symptoms**

Discolouring of young leaves

Premature ripening of fruits

Black spots on fruits

Rotting of fruits

#### **Control**

Spray Benomyl 50WP at 15g in 10 litre of water

#### **Powdery mildew**

#### **Sign and symptom**

Shedding of flowers and immature fruits

White substances appears on flowers

#### **Control**

Spray Benomyl 50WP at 15g in 10 litre of water

2003

2. You are provided with two root systems labelled R (grass roots) and R (Bonongwe roots)
  - a. Identify the root system labelled Q and R
  - b. Draw the root system of Q and label any three parts
  - c. Draw the root system of R and label any two parts
  - d. Explain how the rooting depth of Q affects:
    - 1) Amount of irrigation
    - 2) Frequency of irrigation
  - e. Why is the root system labelled R important in conservation of soil
  - f. Explain any two advantages of rotating crops with the two root systems identified in question 2 a
1. a). Define micronutrients
  - b. Differentiate the yellowing of maize leaves caused by nitrogen deficiency from that caused by potassium deficiency.
  - c. Explain two losses of nitrogen from the soil through microorganisms
6. Explain any two ways in which early weeding is important in crop production
7. Explain the importance of each of the following process in pasture establishment
  - I. Inoculation
  - II. Pelleting
- 9a. Explain two factors that may cause seed dormancy
- b. Explain two reasons for testing seed before making them available to farmers for planting
- c. Explain any two ways in which depth of sowing may affect seed germination
- d. Explain one way in which of the following affects seed germination
  - i. moisture
  - ii. oxygen

2004.

- 12a. Explain any five ways in which fruits are important
- b. Describe any five husbandry practices which should be followed when establishing a mango orchard

2005

6. Figure below is a diagram of vascular bundle of a maize plant. Use it to answer question that follow
    - a. Name the parts labelled A and B
    - b. Explain one function of the part labelled B
  7. (a) Explain any two ways in which maize weevil damages stored maize
    - b. State any two ways of controlling weevils in maize
- 10a. Explain any two in which pasture help to prevent soil erosion
- b. Explain two advantage of improved pasture over natural pasture?
- c. Explain any two disadvantages of broadcasting as a method of sowing pasture
- d. describe the following criteria when selecting improved grasses and legumes
  - i. Compatibility with desired species
  - ii. Proposed method of utilisation
- e. Explain any two ways in which hay can be useful on a farm

12 .(a) Describe any five effects of weeds on crop production

- b. Describe any five ways of controlling weeds

2006.

1a. Name one sucking insect of mangoes

b. Explain one way in which the insect pest named in 1 a can damage mangoes. 2007

2. Describe one way in which each of the following legislative measures can help to control pest and diseases:

prohibition and notification order

6a. Explain any two function of sulphur in crops

b. Describe any two deficiency symptoms of sulphur

c. name any one inorganic fertiliser that can be applied to soil to correct sulphur deficiency in crops

13. With an aid of well labelled diagram describe the procedure of grafting S

2007

2. Describe one way in which each of the following legislative measure can help to control pest and diseases : prohibition and notification order

13. Using the aid of the diagrams describe the procedure of grafting

2009

5. The two tables below show design of cropping system labelled X and Y> use them to answer question that follow

	Year 1	Year 2	Year 3
Plot 1	Beans	Maize	Tobacco
Plot 2	Maize	Tobacco	G/nuts
Plot 3	Tobacco	G/nuts	Beans
Plot 4	G/nuts	Beans	Maize

	Year 1	Year 2	Year 3
Plot 1	maize	maize	Maize
Plot 2	maize	Maize	Maize
Plot3	maize	maize	Maize
Plot 4	Maize	maize	maize

- Name the cropping system represented by X and Y
- Which cropping system would a farmer would control witch weed
- Explain your answer in b.
- Which cropping system would allow a farmer to attain specialisation of crop production
- Explain you answer to question d above

9a. State two ways in which processing of mangoes is important

11. Explain any five ways in which aphids can affects vegetable production

12. A farmer was provided with four inbred maize with the following characteristics

Inbred W: early maturity

Inbred X: high resistance against maize streak virus

Inbred Y: short height that resist plant lodging

Inbred Z: high yield per unit area.

With an aid of well labelled diagram describe how the farmer would develop a new variety that would retain all characteristics from the four inbreds

2010

1b. A crop showed signs of inter venal chlorosis . Use this information to answer the question that follows

- i. Name the plant nutrient that is deficient
  - ii. State two ways of correcting the deficiency
- 3a. Give any three example of exotic grass pastures in Malawi
- b. The figure below show one of the systems of grazing animal. Use it to answer the question that follows
- i. Name the system of grazing animals
  - ii. Explain any two advantages of the system of grazing animals
  - iii. Why is the system of grazing not commonly used in Malawi
- 9a. Give two pests of mangoes
- c. Explain how each of the following practices on the a farm can reduce pest attack
- i. closed season
  - ii. storing in airtight facilities
11. Explain any five ways in which organic farming would ensure food security
- 2011
- 3b. Describe any two disadvantage of chemical weed control
- 8a. i. Name the parasitic weed of maize
- ii. Explain why growing maize in rotation with sorghum would not control the parasitic weed in 8a. i.
- b. State on advantage of classifying weeds
- c. Explain one way in which single plant selection can improve crop production
12. With an aid of a diagram, describe how a farmer can produce oranges and lemons from the same tree using buds
- 2012

## AGRICULTURAL EXPERIMENTATION

Experiment is the trial or investigation to test an idea using some known facts that is carried out on something to find out the effect, results or truth about it.

Agricultural experimentation is the practice of carrying out experiments or trials in agriculture to find out the fact or truth about something

### **Importance of agriculture experimentation**

It help researcher to come up with recommendation on improved farming techniques which will help farmers to improve crop and animal production .

### **The scientific approach**

It is the method of testing a hypothesis inured to find out the truth through observation and draw conclusion through induction (comparing two quantities)

### **Step in scientific approach**

#### **1. Identifying the problem**

This involve coming up with the area of study or the identifying the problem at hand

#### **2. Identifying aims:**

This step involve coming up with hypothesis or objective of the experiment. In this step the researcher attempt to solve the problem by giving trial answers that can be tested

#### **3. Setting up experiments to test the hypothesis**

This involve designing and laying experiments in the field

#### **4. Collecting information**

This involve taking results by direct measuring and observation

#### **5. Analysing information**

This include calculating average/means of measurements, ranges or percentages

#### **6. Evaluating the results**

This involves judging by comparing the averages of measurements, or observation. It also involve coming up with the discussion on why thing what they did

#### **7. Drawing conclusion**

This involve coming with statement summarising the results by identifying the best and the recommendation based on results of the experiments.

## **EXPERIMENTAL DESIGN**

It is the plan of layout of experiment in the field.

## Factors to consider when design a filed experiment

### 1. Choice of treatments

Treatments are variable that are test and compared in an experiments

The number of treatment should two or more for easy comparison. One the treatment should be a control where the treatments can be compared. A control treatment is a treatment that has the variable being test is absent or is commonly used in the area.

The control treatment should be familiar to the researcher. Or commonly used in the area.

### 2. Randomisation

It is the allocation of treatments in blocks to plots by chance

Importance of randomisation

It help to avoid personal prejudice against a particular treatments , or biasness toward certain treatments

It helps to avoid environmental interference in treatments

#### Method of randomisation

##### a. Tossing a coin

This is used to allocate up to two treatments

##### b. Throwing a dice

It is used to allocate up to be compared

##### c. Using numbered pieces of papers

All treatments are written on pieces on papers a placed in a box and one paper are picked at random. The first paper to be picked is allocated to plot 1

##### d. Using random numbers tables

A number is picked on random table without looking on it. On the number picked, numbers that are not required is omitted leaving the ones that are required. For example if a number 293671854 is picked and the experiments has five treatments number that exceed five will be excluded leaving 1 to 5 like 23154 which mean that treatment 2 will be in plot 1, 3 in plot 2 and so on.

### 3. Replication

It is the repetition of experiment by doing it for several times by doing it twice or more in different blocks.

## Importance of replication

- a. It help to minimise environmental interference on results
- b. It help to obtain more reliable results that can no be questioned

## TYPES OF EXPERIMENTAL DESIGN

### 1. Randomised block design

It has two more blocks

Each treatment is randomised

Each treatment appears in every block

Example : Design an experiment plan to test six maize varieties , Local maize, Kanyani, Njobvu, Mkango , DK8071, MH18 with four block

	Block I	Block II	Block III	Block IV
Plot 1	Kanyani	MH18	DkK8071	Mkango
Plot 2	Local maize	Kanyani	MH18	DkK8071
Plot 3	Njobvu	Local maize	Kanyani	MH18
Plot 4	Mkango	Njobvu	Local maize	Kanyani
Plot 5	DkK8071	Mkango	Njobvu	Local maize
Plot 6	MH18	DkK8071	Mkango	Njobvu

### 2. Latin square design

Each treatment is present once in a block

Each treatment is present once in the horizontal plots

The number of treatments is equal to the number of block

Randomisation is followed except in the same treatment being present in a block or plots

Example: Using Latin square design an experiment that to test varieties of ground nuts Manipinter, Chalimbana , Mawanga, CG7, Malimba, Kalisere

	Block I	Block II	Block III	Block IV	Block V	Block VI
This Plot 1 Plot 2 2	Manipinter	Chalimbana	Mawanga	CG7	Malimba	Kalisere

belongs to \_\_\_\_\_

Manipinter	Mawanga	Kalisere	CG7	Malimba	Chalimban a
Chalimban a	Manipinter	Mawanga	Kalisere	CG7	Malimba
Malimba	Chalimban a	Manipinter	Mawanga	Kalisere	CG7
CG7	Malimba	Chalimban a	Manipinter	Mawanga	Kalisere
Kalisere	CG7	Malimba	Chalimban a	Manipinter	Mawanga
Mawanga	Kalisere	CG7	Malimba	Chalimban a	Manipinter

### Conducting experiments

This involve carrying out operation, collecting data, analysing data and drawing conclusion

### Carrying Out Operations

In this step it involves carrying husbandry practices such as planting, weeding, fertiliser application, pesticide application and harvesting.

All managements should be carried equally the treatment being tested. The one that should change is the variable that will be used in comparison

Field operation should be randomised because operator improves as they carry operation making later operation better than the first one and also the operator get tired as time goes on which affect the quality of the work. It also help to reduce favouring one treatment making other to be handicapped

### Collecting data

Data can be collected by :

#### 1. Direct observations

Accurate observations are done in order to get true picture of characteristics to be compared in different treatments. It also involve looking and counting

Examples of plant characteristic that can be directly observed

- a. Leaf colour
- b. Germination percentages
- c. Survival rates
- d. Pest damage
- e. Plant lodging

## 2. Direct measurement

This involve measure plants using a ruler or a scale

Example of plant characteristics that can be direct measured

- a. Plant yield
- b. Leaf area
- c. Plant height

## The net plot and sample plants

It is the area of focus during observation and making measure since not all plants can be observed or measured

### The net plants

Are inner plants that are picked for observation. In this observation the out plants are excluded because of the following reason:

- a. External plant tend to grow under external influence from neighbouring such as pest attack, disease, alluvial deposits, encroached weeds
- b. The inner plot are less infected by border insects are true representatives in the plots

### Sample plants

The plant to be observed are chosen randomly because it difficult to measure all plants even in net plot.

## Recording data

Data can be recorded in form of table, pie charts, line graph or bar graph.

Collected information should be recorded in note book not in palms or scraps

## Analysing data

This involve calculating percentages, means /averages of figure and also ranges .

Percentages, averages figure and ranges are used to compare and evaluate various treatments

## **REPORT WRITING FOR AGRICULTURAL EXPERIMENTS**

### **Importance of an experimental report**

1. It acts a communication with other scientists who may comment or question the results or wish to build on the findings.
2. It help to inform farmers of results and recommendations on how they increase there yields
3. It act a further reference

### **Format of Experimental Report**

The report include the following

#### **A. The title**

It is the heading of the experiment. It explains the nature of experiment and should be short

#### **B. An introduction**

It is a statement that contain the following, subject, purpose of experiment , and plant of development.

##### **Statement of subject (topic)**

It defines the title and words to be used in the experiment, the theory associated with the topic and the brief history of the title.

##### **Statement of scope**

It explains what the experiment will cover.

##### **Statement of plan of development**

It is an outline of various parts of the report and how they will be sequenced.

#### **C. Aim a/objectives**

It is statements that explain precisely with the experiment seeks to find out. It must be clearly and specific

#### **D. Materials and methods**

It includes all equipment and input used their type, quantity and how they were used.

It was include the type of experimental design that has been used, choice or treatments and the husbandry practices

#### **Choice of treatments**

It explains the treatments that have been compared in the experiment including control treatment.

#### **Design of the experiment**

It shows the design used, how treatments were randomised, number of blocks, why randomised was done and why replication was done.

You need to draw the experimental design used

#### **Husbandry practices**

It indicate various husbandry practices that was carried in the field, the date when was done and other relevant detail (remark)

### **E. Data collection , data analysis and results**

This involves categorising data and making accurate description of each observation.

All numerical information should be properly analysed by calculating mean, percentages, and range for easy comparison of treatments.

Result can be reported inform of table, graphs, pie charts or bar graphs and should be followed by brief description of the main issued observed

### **F. Discussion or interpretation of results**

This section each observation, measurement and results are interpreted by giving a reason or interpretation why things happen as it was observed

### **G. Conclusion**

It is final statement of results and finding which summarises the results by identifying the best treatments and describe its performance

### **H. Recommendation**

It is the suggestion or advice offered in order to pursue the reader to take a particular action.

Qualities of good recommendation

1. It is justified by the evidence of results,
2. It is supported by interpretation of data or results
3. It based on facts not mere opinion
4. Based on conclusion

## **Guidelines for Writing Report on an Experiment**

### **a. Scientific attitude**

It involve emphasising facts rather than personalising facts

Avoid using first personal pronouns but use the third personal pronouns active voices or third person passive voice.

### **b. Expressing facts accurately**

It involves explaining as it supposed to be expressed. This can be done by avoiding words that are vague., leaving unnecessary words, avoiding technical jargon rather use simple familiar words.

### **c. Sentence structure and length**

Use simple and short sentence that can easily attract the readers to read more and should always vary to avoid monotony.

### **d. Paragraph structure and length**

Each paragraph should contain one idea. The first sentence in the paragraph should carry the main idea followed by supporting ideas to clarify the idea.

It should be short.

### **e. Use of graphics**

This includes use of table, graphs, charts and drawings.

A table should be used when presenting a large quantitative data and large information.

Graphs and charts should be used when presenting information what need comparison and can be easily viewed and understand

#### **Guideline for effective use of graphs**

- a. It must have a title above it
- b. Should be used to communicate a specific idea or one idea not many ideas
- c. It should be appropriate for the purpose.
- d. It should clear relationship between the graphic and the text or points in the paragraph

- e. It should be placed on appropriate place in the report
- f. It should be followed by important comment written briefly in text
- g. It should be large enough with clear labels

### Exercise

2003

4. Form four students would like to find out the effects of four different crop spacing ( 30cm, 60cm, 90cm and 120cm on maize yield in their school garden.

- a) Design an experiment in three block using randomised block design
  - b) Describe how the experiment would be conducted using the following guidelines
    - i. Carrying out the experiment
    - ii. Collecting of data
    - iii. Recording data
    - iv. Analysis of data
  - c) Give one reason for repeating an experiment
  - d) In your opinion, which of the above spacings would you say is the control? Give a reason for your answer.
12. In agricultural production, farmers have to face variables which are outside their control and such variables are known as risk and uncertainties.
- a. Describe any five risk and uncertainties that farmers may face in Malawi
  - b. Explain any five ways in which farmers in Malawi may adjust to risk and uncertainties.

2004

2005

5. Table 2 shows growth rate of bean seedlings. Use it to answer questions that follow.

	Days	1	2	3	4	5	6	7	8
Growth rate (mm)	Seedling ling from plump seed	1 7	25	30	36	50	64	82	96
	Seedling from shrunken seeds	1 4	16	22	25	30	33	49	56

- a. Draw a line graph with two curves , one of seedling from plump seed and the other from shrunken seed

- b. From the graph
- Give the mean shoot growth of each set of seedlings after 5  $\frac{1}{2}$  days of germination
  - Describe the growth rate of seedling from plump and shrunken within the first day of germination
  - Explain why there is a difference in the curves on the graph after day 4
- c. State any three conditions which should have been held constant during the experiment.
- d. State one conclusion you would make from the results to show why it is necessary to select seeds before planting

2006

- Form four students conducted an agricultural experiment to find out the effect of different rate of fertiliser application on maize yield
  - What is the variable in this experiment
  - What was the control of the experiment
  - Explain any one observation that could have been recorded during this experiment
- Paper II.

Table below shows a wrong randomised block design of experiment on maize variety trial conducted by student at certain secondary school. Use it to answer the questions that follow.

	Block 1	Block 2	Block 3
Plot 1	NSCM 41	MH 16	NSCM 41
Plot 2	Local Maize	MH12	Local Maize
Plot 3	MH 16	Local Maize	MH12
Plot 4	MH12	MH 16	NSCM 41

- Mention four mistakes in the experiment design
- Using the information in the table above, lay out the correct field plan for randomised block design
- Apart from randomisation, explain two other ways in which the student could have made the results of the experiment more reliable
- Explain two main methods which the students could have used to collect data in the experiment
- Explain any two ways in which the results from this experiment could have been analysed

2007

10a. State any two ways in which agricultural experimentation can help to improve agricultural production

b). Explain any one role of each of the following principles in agricultural experimentation

i. replication

ii. use of control

2009

3.(a). What does evaluation of fertiliser trail on maize involve

b. Explain any one way in which fertiliser trail on maize would contribute to food security

2010

13. Farmers in a certain area have serious problems of weeds in maize. Describe the scientific approach to experimentation that should be followed in order to overcome the problem.

2011

3(a). The table below shows results of an experiment

Plot	Method of weeding	Yield in maize (Kg)
1	Chemical	120
2	Mechanical	100

i. What is the aim of experiment

ii. Give a reason why the results would be unreliable

9. Explain two ways in which agricultural experimentation can help to improve beef production in Malawi

2012

2013

## ANIMAL PRODUCTION

### Livestock feeds and feeding

#### Classes of feeds

##### 1. Roughages

They are feedstuff from plants which has high fibre content

They can not be digested by mono gastric animals eg ground nut haulm, grasses

## 2. Concentrates

Are food stuff with low fibre content, low moisture, high protein and carbohydrates content. They are easily digested by mono gastric

### Classes of concentrates

#### Energy concentrates

They have high concentration of glucose which provides energy or growth. Example includes cereal and their by products

#### Protein concentrates

Is food stuff which is easily digested to give amino acid for growth.

Example: legume grain and their by products

3. Succulents: These are food stuff with high moisture content low fibre content and are easily digested. Example include Young grasses and cabbages
4. Additives : they are vitamin and mineral that are added to animal feed to prevent or correct deficiency diseases e. g mineral leaks , oxy-vit,

### The composition of feeds and the functions of nutrients

#### Carbohydrates

They are made up simple sugars and starch

They provide energy to the body and excess carbohydrates is stored in form of fats

Source include: cereals, potatoes, potato vine, grass and root tubers

#### Proteins

They are made up of amino acids

They are essential for body building and repair of worn up tissues, as a component of enzymes, hormones and antibodies.

Excess protein are converted into energy .

#### Fats and oils

They provide energy.

The sources include oils seed, soya beans, milk, eggs, meat, fish meal and bone meal

#### Calcium and phosphorus

They are used in bone formation, milk production and strong egg shells

Sources include milk, cereal grains and lime

## Magnesium

Used for healthy bones and teeth and metabolism of carbohydrates

Source includes milk, cereal grain , leafy vegetables.

## Iron

It is part of haemoglobin and prevents anaemia

An egg yolk is main source

## Iodine

It is essential for growth of thyroid glands which produces thyroxine and prevents goitre

Sources include iodised salt

Copper and cobalt

It has the following function

1. Form part of haemoglobin and enzymes
2. Improves appetite in ruminants
3. Prevent anaemia
4. Maintains blood pressure
5. Essential for bile production

Sources

1. Salt containing copper
2. Most vegetables

Sodium

It maintains blood pressure and essential for bile formation

Its source is common salt and rock salt.

## Manganese

### Function

1. Help in bone formation and enzymatic function
2. Essential for metabolism of protein and carbohydrates

Most food contain manganese

## **Chlorine**

### **Function**

Part of gastric juice

Aid digestion

Main source is common salt and rock salt

## **Potassium**

### **Function**

- a. It helps in the functioning of the muscles and heart
- b. It activates enzymes

Sources

Potassium chloride and grasses

## **Zinc**

It helps in enzymatic reaction

Sources: most feed

## **Feeds ration**

It is the amount of feed given to animal per day.

### **Types of rations**

#### **1. Maintenance ration**

It is the amount of feed that are required by animal to keep it live without gaining or losing weight.

The feeds are used to for maintenance of bodily process.

It is important in young animals and lactating animals

#### **2. Production ration**

It is the mount of feed required that contain all essential food nutrients in addition to production ration

### **Formulating rations**

It is the process of making animal feeds

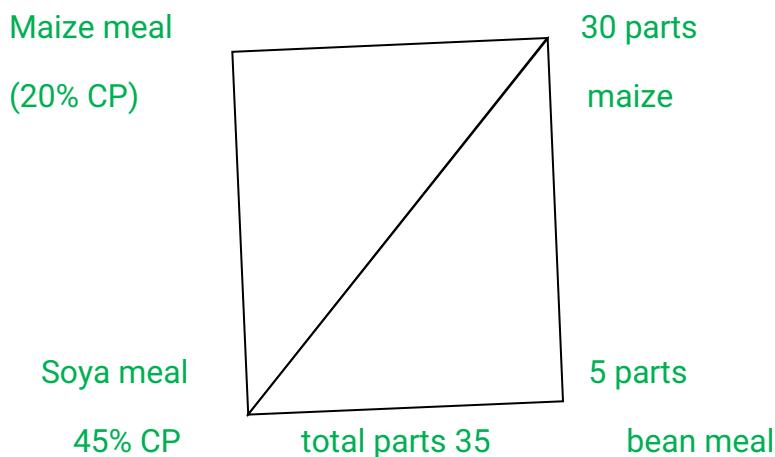
## Pearson squares

It is used to compute a ration

How to use Pearson square

1. Draw the square and place desired percentages on the centre of the square
2. Place the percentage of each feed stuff to be mixed at the left corners
3. Subtract the figure diagonally across the square. Subtract small number from large ones
4. Place the numbers obtained on the right corners giving required parts of each feed stuff.

Examples: Formulate a 70kg feeds with 20% protein feed from maize that contains 15% protein and soya beans that contains 45% protein content.



Mix 5 parts of soya bean with 30 parts of maize meal to get 15% protein content feeds

To make a 70kg feed

Mass of soya bean meal required =  $5 \times 70/35 = 10\text{kg}$

Mass of maize meal required =  $30 \times 70/35 = 60\text{kg}$

To make a 70kg, 15% protein feed mix 10kg of soya bean meal and 60 kg of maize meal.

## Factors to consider when feeding animals

### a. The age of animals

Young animals need small amount of feeds and rich in proteins since the digestive system is still developing while large animals need a lot of feeds and should be solid since their digestive system are developed

### b. Type of animal

Ruminants require roughages because they are capable to digest while non ruminant

need concentrates and succulents

**c. Purpose of keeping animals**

Milk , eggs and meat animal needs concentrates while draught animals need high energy feeds

**d. The condition of the animal**

Sick animals need a lot of proteins to repair worn out tissues while healthy animals need feed just to maintain body process

**e. The quality of the feeds**

The feed should be easy to digest and ingest

**f. Palatability**

**The feed should be appetising and should make animals to look for more**

**g. Digestibility**

The feeds so me easily digestible to releases nutrient to animals body

**h. The amount of feed**

Animals should be given feed the animal can eat without remaining and satisfy the animal hunger.

**i. Texture**

Animals like chicken need course feeds for easy picking with beak

**j. Cost of feeds**

Animals should be give right amount of feeds to reduce loses.

## **PRODUCTION OF SMALL RUMINANTS**

### **Sheep and goat production**

#### **Importance of sheep and goats**

The following are importance of sheep

- a. They are source of wool
- b. They are source of meat
- c. They are source of skin

- d. Source of income
- e. Sources of employments

### Goats

- a. They are source of meat
- b. They are source of milk
- c. They are source of skin
- d. Source of income
- e. Sources of employments

### Type and breed

#### Goats

#### Examples of local breed

- 1. Malawian goats
- 2. Small east African goats

#### Exotic breeds

- a. Toggenburg for milk
- b. British Saanen for milk
- c. British alpine for milk and meat
- d. Angora for mohair
- e. Boer goats for meat for milk
- f. Anglo Nubian goats f

### Sheep

#### Malawi sheep with fat tail

#### Exotic breeds

- a. Black head Persian for mutton
- b. Dorper for matton
- c. Merino for wool
- d. Karakul for skin

#### Criteria (Factor) used when selecting breed for sheep

## **1 The primary use or product**

The breed selected should produce high quality mutton, pelt (skin) or wool

### **Qualities of good mutton sheep**

- a. Should have good mothering ability
- b. Should be fast growing and mature early
- c. Good body shape
- d. Should have high body weight
- e. Should produce good mutton

## **2 Adaptation for climatic condition and local condition**

The breed selected should be adapted to local climatic conditions

### **Example of breed and where they are adapted**

- a. Local Malawi breeds are hard and quite adapted to Malawian local conditions
- b. Black Persian is hardy and like karakul is adapted to desert condition
- c. Merino thrive in dry condition
- d. Hampshire down survive in poor pasture

## **Sheep Management**

### **Breeding sheep**

#### **Qualities of good ewes and rams**

1. Should come from mothers that have reared healthy lambs
2. Should be those who have gave birth to best alms during previous years

Unselected ewes and rams should be fattened and sold for meat

### **Castration**

It is the removal of essential sex organ of male animal in order to make the animal incapable of fertilising a female animal.

#### **Reason for castration**

- a. To prevent undesirable males from breeding which enable a farmer to use proven bulls or ram which prevent transferring of undesired characteristics
- b. It make animal docile and easy handle

- c. It makes animal to easily suited to work since it quitters
- d. Castrated animal grow faster since it easily been fattened than uncastrated animals
- e. It helps to improve the quality by removing a bad dour.

### **Method of castration**

#### **a. Open operation**

This methods use a sharp knife to make a slit by cutting the scrotum vertically to remove testicles. The wound is disinfected by using disinfectant e.g. Dettol to prevent infection

#### **b. Closed operation**

This involves the use of Burdizzo to crush the spermatic cords, blood vessels and the spermatic nerve. This method used when the animal is about two to three months old

#### **c. Use of loop**

A strong rubber is used to squeeze testicles or break the spermatic cord and the blood vessel so that the testes should shrink and fall down after few weeks

It is used on animals that are one week old.

Breeding should be properly done so that ewe should give birth when there are plenty of fresh grasses.

Two weeks before mating ewes should be given some concentrate to improve their health and fertility.

NB the process of giving extra feeds to ewe to improve its fertility and healthy is called flushing

### **Gestation period**

It last for five months

Ewes should be regularly dosed or drenched against internal parasites also vaccinated against diseases.

They should give high quality pastures and some concentrates one to two months before lambing

The process of giving extra concentrates few month before an ewe gives birth is called steaming up.

## **Lambing and caring of calves**

### **Signs of lambing**

- a. An ewe become restless and leave flock to look for quitter places
- b. The vulva become red
- c. There is frequent bleating

Lamb should be help to suckle from their mother up to the age of six month.

Lamb should be introduced to solid food once the milk starts to decline.

They should be vaccinated and drenched against parasite and disease.

Castration should be done after two months and should be fatten for six month so that they can be slaughtered.

### **Docking**

It is the processing of cutting the tail. It is done when the animal is about four to five week old

### **Advantages of docking**

- a. It prevent dirt and dung from collecting under the tail which can be source of infection
- b. It help to control parasite
- c. It fat-tailed sheep it help to improve quality of the carcass
- d. It help the animals to mate easily

### **Trimming**

It is the process of cutting overgrown hooves

It helps to prevent lameness of animals

### **Housing sheep**

Sheep room ranges from simple thatched to elaborated house for intensive management system.

### **Characteristics of a good house for sheep**

1. Strongly built because sheep are prone to predators
2. Should have more spaces
3. Should be well ventilated and well lit
4. It should be dry and warm
5. It should be easy to clean
6. Should be easy and cheap to construct

### **Feeding sheep**

Sheep should be provided with concentrates in addition to pasture or grass like Madeya and some minerals like bone meals sulphur and salt.

They also need plenty of clean water.

Ewes should be given extra feed or concentrate two week before mating to prepare them for mating and to improve fertility and also two month before lambing to allows the embryo to develops properly in the womb.

Fattening lamb needs high energy concentrates.

Lamb should be given mother milk mainly during three week since it contains a lot of antibodies that protect the lamb from diseases.

The lamb should gradually introduce to creep to improve their digestive system.

### **Factor to consider when selecting breed of goats**

1. Primary use of the products

The breed chosen should fit the purpose of keeping it like; it should have ability to produce high yields of milk, high quality of meat and hides.

#### **Qualities of good meat goat**

- a. It should grow fast
- b. It should be from nannies with good mothering ability
- c. Should have good body shape

2. Suitability of local and economic environment

It should be suited to local environmental factors of the area and to local parasite and diseases and should have high potential to produce high yield under such situations.

3. Personal preference

Different people prefer certain breeds of goats due to their preference.

## The management of goats

It is the system of keeping goats

### 1. Tethering

It is done where there is limited grazing land in order to protect crops. The animals are around a restricted area

### 2. Extensive

Goats are allowed to graze and browse natural pastures, trees and shrubs under the supervision. Care should be taken since goats are heavy browsers and grazers.

### 3. Semi -Intensive

Goats are allowed to graze and also given some sheep in stall. The feeds include concentrates of maize meal, ground nuts and Madeya.

They are also given plenty of clean water.

### 4. Intensive

They are kept in a house and feed is brought to them. It is commonly used for milk to meat production.

## Breeding goats

Nannies are ready to be served when 15-18 month old so that they can give birth when two years old

Billy goats are can be used when nine month ol.

## The oestrus cycle

It takes 18 – 21 days and last for one to three days

## Sign of heat in goats

- a. The doe or nanny frequently wags or twitches her tail
- b. She shows sign of excitements
- c. The vulva become red and thick
- d. Mucous is discharged from the vulva

## Gestation period

It is last for 150 days and it can kid twice a year. The goats should be given extra to forage and concentrates steam up one month before giving birth

### **Signs of kidding**

- a. The udder swells
- b. The animal become restless
- c. There is mucus discharge from the vulva
- d. The animal bleat

### **How to care for kids**

They should be allowed to suck from their mother to get colostrums which is rich in antibodies.

If the goats are keeping for milk production, the kids should be bottle feed.

The kids should slowly introduced to pasture about three week after birth and males should be castrated.

The kid should be weaned after six month of age.

### **Housing goats**

Characteristics of goat house

- a. It should well ventilated
- b. It should be well sited
- c. It should be constructed from cheap materials
- d. It should be roomy
- e. It should be well ventilated
- f. It should well thatched
- g. It should have hard floor made of concrete or harden earthed.

### **Feeding goats**

Should be given extra concentrates in addition to roughages.

They also need a lot of plenty clean water

### **Common disease of goats and sheep**

#### **Pneumonia**

It is caused by bacteria or viruses

Sign and symptoms

- a. Loss of appetite
- b. Coughing
- c. Difficult in breathing
- d. Basal discharge

Control

- a. Treat with antibiotics
- b. Keep animals in clean warm and well ventilated place
- c. Provide the animal with plenty of water and palatable feed

### **Enterotoxaemia (pulpy kidney or lamb dysentery)**

It is cause by bacteria

Symptoms

- a. Staring eyes
- b. Tiredness
- c. Brownish and blood and stained diarrhoea
- d. Convulsion and sudden in severe cases

To control vaccinate animals

**Heart water**

It is caused by protozoa transmitted by ticks

Sign and symptoms

- a. Loss of appetite
- b. High fever
- c. Nervousness /restless
- d. Twitching of the eyes
- e. Animals tend to walk in circles or hit against objects
- f. High mortality rate in exotic breeds

## **Control**

- a. Deep animal to control ticks
- b. Treat with antibiotics such a tetracycline if the disease is detected early

## **Brucellosis (contagious abortion )**

It is caused by bacteria

## **Sign and symptoms**

- a. Uterus is infected and the foetus dies
- b. Abortion of foetus in the late of pregnancy
- c. Yellowish discharge from the vagina

## **Control**

- a. Slaughter all infected animals
- b. Vaccination with strain 19 especially in young animals
- c. Use of health male animals

## **Foot root**

It is caused by fungi and bacterial

## **Sign and symptoms**

- a. Feet swell and animals have difficulty in walking
- b. Feet have pus and bad smell
- c. Animals may become lame

## **Treatment or control**

- a. Treat the feet with antibiotics or disinfectants
- b. Trimming of hooves

## **Foot and mouth disease**

It is caused by virus

## **Sign and symptoms**

- a. High fever
- b. Animals become dull and stop grazing due to blister
- c. Animals may become lame

### **Control**

- a. Restricting animals from movement
- b. Vaccine animals
- c. Slaughter all infected animals

## **Mastitis**

It is caused by bacterial

### **Sign and symptoms**

- a. Swollen udder
- b. Clots of blood and pus in milk

### **Control**

- a. Treat with antibiotics
- b. Observe cleanliness and hygiene when milking
- c. Use disinfectants
- d. Vaccine

## **Sheep pox**

It is caused by virus

### **Sign and symptom**

- a. High fever
- b. Dark red pimples /lesion
- c. Some lamb die

External parasite of goat and sheep

## **Ticks**

They attack the ears, tails, udder.

They suck blood and transmit tick-borne disease like heart water and red water

**Control**

Dip animals regularly

**Scaly mites**

The attack the skin and cause itching

Can be controlled by dipping

**Lice**

The attack the skin and suck blood

It can be controlled by dipping

**Internal parasite of goat and sheep**

**Round worms**

They attack the wall of intestines and animals have potted bellies

**Control**

Dosing or drenching with drugs such as phenothiazine

Rotational grazing

**Liver fluke**

It attack the liver

**Control**

Kill snail with copper sulphate since they are alternate host

Graze animals away fro wet Dambo's and marshy area

**Tapeworm**

It attack the muscles, lungs, liver brain and intestines

They feed on digested feed when the are in intestines

**Control**

Dosing with suitable drugs

Rotational grazing

## BEEF PRODUCTION

Breed of Beef animals

**Malawi zebu**

It has mixed colours

It is the indigenous breed

**Afrikander**

It is black in colour 333

It is from south Africa

**Boran**

From Kenya and has mixed colour like, red, white, white - grey or brown

**Charolais**

White in colour from France

**Hereford**

From unite kingdom and it is deep red with white face and legs

**Braham**

From India and it is white or greyish

**Simmental**

From Switzerland and it is light red with white patches and white head

### **Characteristics of beef breeds**

- a. It is rectangular or square shaped
- b. It has compacted body and deep
- c. It has short legs
- d. They are good converter of forage to high quality beef
- e. They grow fast and mature quickly
- f. They have heavy bodies with lot of flesh

### **Managing beef cattle**

Cattle are managed using the following systems

- a. **Extensive system**

Animals are allowed to graze on communal land under the guidance of herdsman or are kept in ranches.

### **Advantages of extensive system**

- a. It is cheap since animals are kept on communal land

### **Disadvantages**

- ✓ It leads to overgrazing and overstocking which cause land degradation
- ✓ It is difficult to control diseases
- ✓ Animals takes long time to reach slaughter weight since energy is lost as it move from one place to another searching for pasture

### **b. Intensive system**

Animals are confined in the same place and feed and water is provided in stalls

Some time animals may graze in paddocks or feed lots

### **Advantages**

- a. Animals fattens quickly since movement is restricted
- b. It is easy to control pest and diseases since it is easily noticed

### **Disadvantages**

- a. It is expensive
- b. It needs a lot of labour to provide water in right quantities to animals in stalls

### **Qualities of stall feed animals**

- a. It should be well ventilated and roomy
- b. It should be sited on high well drained ground
- c. It should be well thatched
- d. They should be enough beddings on the floor

### **Breeding beef animals**

Bull can be used for mating when they are 18 months old while a heifer is two years

Calving should be done two months before rain season start so that calves get plenty of fresh grasses

### Caring for calves

#### a. Castration

It is the removal of testicles

Importance of castration

- ✓ it prevents inbreeding
- ✓ it makes the animal docile
- ✓ animals fatten quickly and improve quality of meat

How to castrate animals

1. using the knife
2. using burdizzo

It should be done when the animal is six months

#### b. Disbudding

It is the process of stopping the growth of horns

Advantages of dehorning

- a. Animals without horns are easier to handle
- b. It prevents animals hurting each other and the people looking after them

How to do dehorning

- a. Caustic soda to stop growth of horns
- b. Dehorning iron

Anaesthesia should be

Applied to minimise pain

#### c. Dehorning

It is the process of removing horns from the cattle

### Advantages

- a. It protect the animals
- b. It prevent animals hurting each other and the people looking for them

Hot iron is used or a saw to removal the horns

#### **d. Branding**

It is the process of placing an identification mark or number on the animals

It makes easy to identify the animal

Cold frozen or hot branding iron is used to make identification

#### **Marketing beef animals**

It is advisable to sell animal in government establish market so that a farmer should get a lot of profit

#### **Grades in cattle markets**

##### **Feeder grade**

It is given animals weighing up to 225kg and are fit for further intensive feeding

##### **Standard grade**

It is given to cows, steers and bulls that look well fleshed and in good conditions

##### **Commercial grade**

It given to animals that is fairly in good condition

##### **Inferior grade**

Are give to animal below all grades

How selling animals is done

Once the grade is given to animals and is given minimum price and people bids and the one that over highest price buys the cattle.

Remaining animals are bought buy cold storage at minimal price

## **DAIRY PRODUCTION**

#### **Importance of dairy production**

- a. It is nutritious since it contains water, carbohydrates, proteins and vitamins
- b. It source of reliable income

- c. It source of manure , hide bone and hides
- d. It source of employment
- e. It is source of raw material

## Dairy breeds

### Characteristics of dairy breeds

- a. They are lean and angular
- b. The body is wedge shaped , it deeper are the back than the front
- c. It has large udders with teats which are evenly spaced
- d. They have short legs and strong

#### Example of dairy breeds

##### Friesian

It originated from Holland and it is black and white

It produces up to 500 kg of milk

##### Guernsey

It originates from England and it has fawn colour

It produces up to 4300kg of milk

##### Jersey

It originates from England and is brownish in colour

It produce up to 3500kg of milk

##### Ayrshire

It originates from Scotland and are red or white in colour

It produces 4500 kg of milk

### Factors that affect milk yield

#### a. Age of the animal

Milk yield increase up to fifth lactation. Older animals produce a lot of milk with low butter than young animals.

#### b. Nutrition or feeding

Good supply of feed ensure high production of milk of high quality

**c. Character of the animal**

Irritable animals give less milk than quite temperament animals

**d. Health of the animal**

Disease lower production of milk and also affect the quality of the milk

**e. Season of the year**

Animals produce alot of milk because there is plenty of pasture than in dry season when there is a shortage of feeds

**f. Treatment of the animal**

Gentle handling of animals during milking ensures high yields.

**g. Milking techniques**

It should be completed within eight to ten minutes since it coincides the milk letdown.

## **Managing dairy cattle**

It needs housing similar to stall feed beef cattle since it need moderate amount of exercises

It should have bedding and should be replaced with fresh one regularly

It should have a spate area for storing feed, drug and utensils

A neck yoking to restraining animals during milking

Milk hygiene

- a. Wash hands with soap before milking
- b. Wash the udder with warm water and mild disinfectants
- c. Wash the milking with warm water
- d. Milking parlour or shed should be cleaned before milking
- e. Milker should be clean with clean cloth
- f. Filter the milk to remove impurities and some dirties
- g. Milking should be down within eight to ten minutes
- h. Wash milking equipments after milking thoroughly and disinfect it
- i. Pour milk in cooler to slow the growth of bacteria

j. Draw milk from each teats to check for mastitis

## Breeding dairy cows

The following are factors to consider when arranging bulls.

- a. A bull come on heat every 21 days
- b. The gestation period is about 283 days
- c. Lactation last for 10 months and it dries up the last 2 months before calving
- d. Milk letdown the first the first to threes to four days.

### Calf rearing

Calves should be allowed to suck from the mother during the first three to four because it is rich in nutrients and in the antibodies that are needed to build calf's immunity.

After four days they should feed on whole milk or milk substitute from the bucket up to three month when the can be weaned.

### Feeding dairy animals

For maintenance provide roughages at 2-4 per 100kg per live weight

For milk production supplement with 3 kg of concentrates per 1 kg of milk produced

## Diseases and parasite control in cattle

### Milk fever

It is caused by low levels of calcium in blood and excess production of milk after calving

### Sign and symptoms

Paralysis and unconsciousness

The animal lies down and has difficulties in getting up

Death may occur in severe cases

### Control

Provide animals with feed rich in calcium

Call for veterinary office to administer calcium phosphorus solution in jugular vein

## A. Bacterial diseases

Are disease that are caused by bacteria

### Example of such diseases

a.

Gall sickness

It is spread by blue ticks

Sign and symptoms

- a. High temperature
- b. Lack of appetite
- c. Pale mucous membrane
- d. Staring coat
- e. Death animals

Control

Treat with antibiotics eg tetracycline

Control ticks by dipping cattle

Mastitis

It is spread through teak canal

Symptoms

- a. High fever
- b. Swollen udder and teats
- c. Blood /pus stained milk

Control

- a. Treat with antibiotics like tetracycline
- b. Practice hygiene when milking

Tuberculosis

It is spread through close contact with other infected animals

Sign and symptoms

- a. Temperature fluctuation

- b. The animal loses weight and get diarrhoea
- c. Persistent coughing
- d. Thick white vaginal discharge
- e. Animal may become sterile

Black quarter

It is spread through ingestion of spores

Sign and symptoms high fever

- a. Loss of appetite
- b. Lameness
- c. Sudden death
- d. One of the legs become swollen and stiff

Anthrax

It is spread through contact and can also attack humans

Sign and symptoms

- a. Abortion
- b. Genitals organs in cows are inflamed
- c. Swollen testicles in bulls

Control

- a. No treatments
- b. Destroy and burry dead animals
- c. Vaccinate remaining animals

## B. Protozoa diseases

East cost fever

It is transmitted by brown ear ticks and red tick

**Signs and symptoms**

a. High body temperature

b. Loss of appetite

c. Excess salivation

d. Diarrhoea

Control

a. No treatment

b. Restrict movement of animals

c. Control tick by dipping

Red water

Spread by ticks

Sign and symptoms

High temperature and the animal produces red urine

Control

b. Treat with suitable drugs

c. Control ticks by dipping

d. Control movement of cattle

e. Vaccinate all suspected animals

### Trypanosomiasis (Nagana)

It is spread by tsetse fly

Sign and symptoms

a. Frequently fever

b. Dullness

c. Anaemia

d. Death may occur

Control

a. Treat animals with suitable drugs like berenil

b. Control ticks by spraying

- c. Slaughter badly infected animals

### C. Viral diseases

#### Foot and mouth disease

- a. High fever
- b. Blister on the tongue in the mouth and on the skin
- c. Lameness
- d. Difficulties in eating

#### Control

- a. No treatments
- b. Restrict movement of stock
- c. Slaughter and burn infected animals
- d. Vaccine all other animals

#### Cattle plague (Rinderpest )

#### Sign and symptoms

- a. High fevred urine
- b. Sore in the mouth and nostrils
- c. Excess salivation
- d. Diarrhoea
- e. Blood stained faeces

#### Control

- a. No treatment
- b. Slaughter all infected animals
- c. Quarantine all animals that may be affected
- d. Vaccine regularly about every six months

#### Parasites of cattle

#### External parasite

## Ticks

They are commonly found under the tail , around the scrotum and udder.

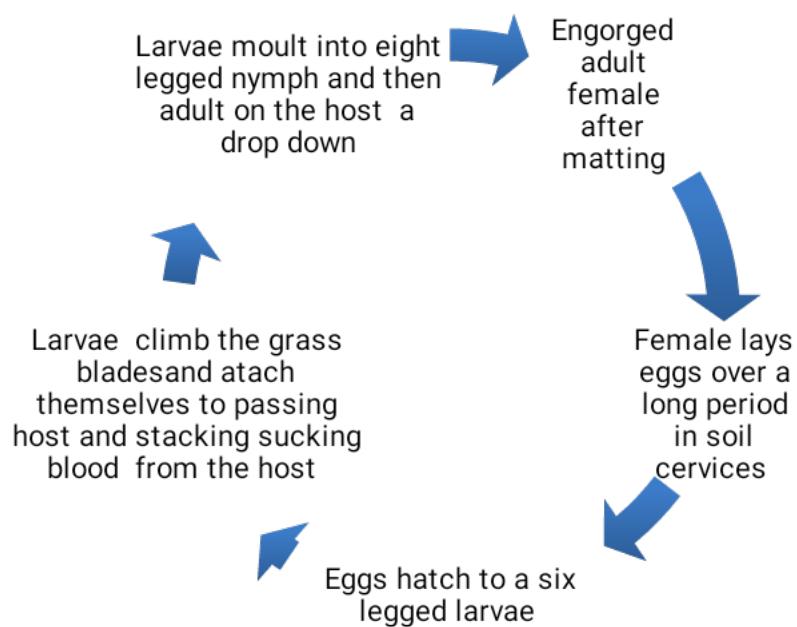
### Effect of ticks

- a. It feed on the cattle by sucking blood causing the cattle to become thinner
- b. They damage the hides through bite wounds
- c. The bite wound may become source of secondary infection
- d. It weaken the animal which affect production
- e. It transmit diseases like east coast fever, heart water, red water and gall sickness

### Type of ticks

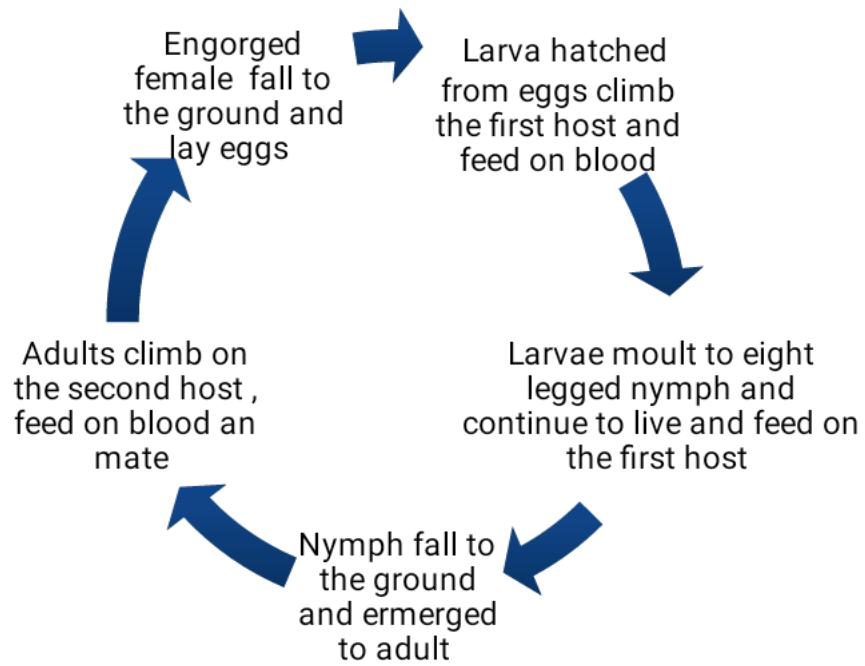
#### One host ticks

The complete their life cycle on one animal



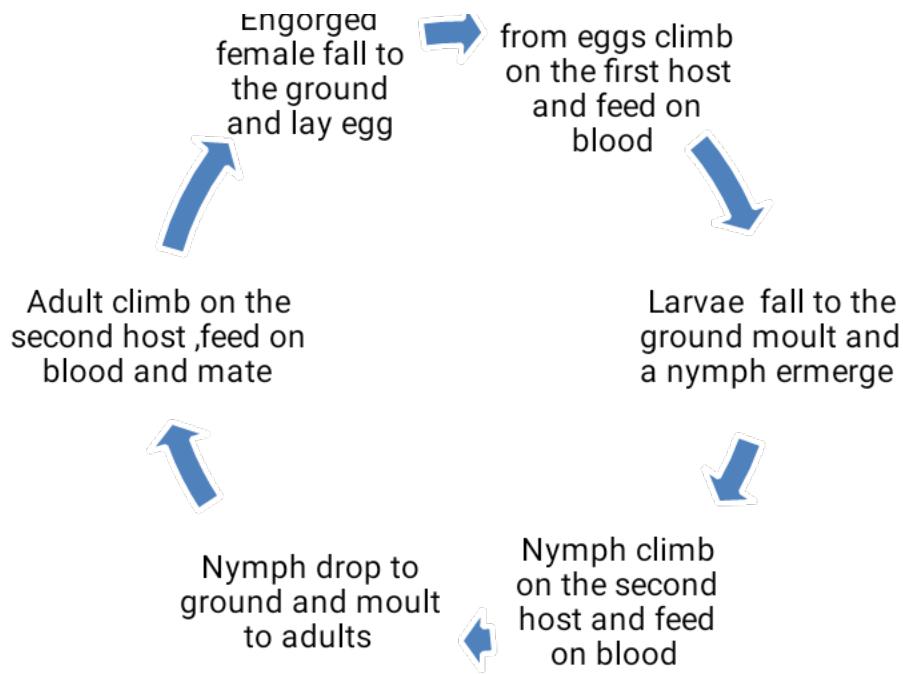
#### Two host ticks

They spend their life on two hosts. The larvae and the nymph are spent on first host while the adult is spent on another host.



### Three host ticks

The larvae, nymph and the adults spend the life on different host. They need three host to complete their life cycle



**Tick can best controlled by dipping animals**

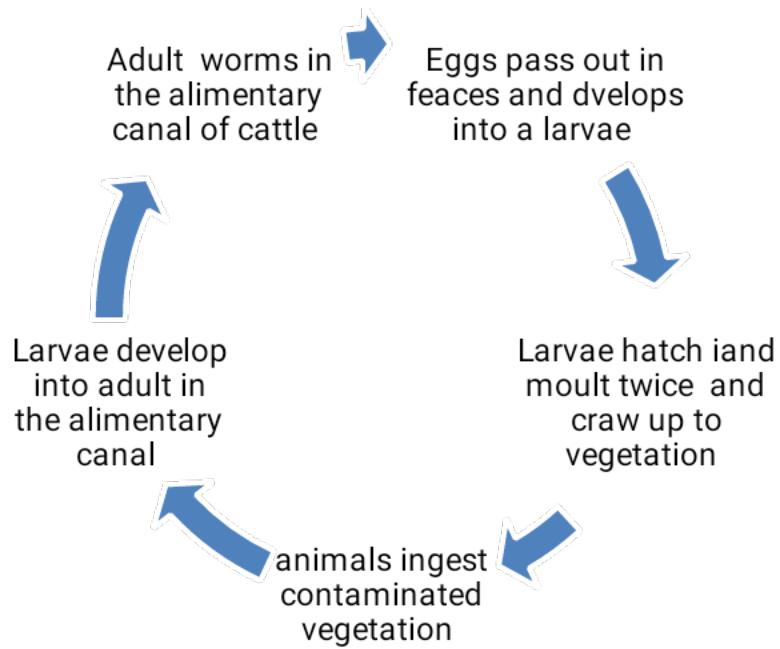
### Tsetse fly

**They cause irritation and transmit trypanosomiasis**

**It can be controlled by clearing bushes and spraying animals**

### Internal parasite

### Round worms



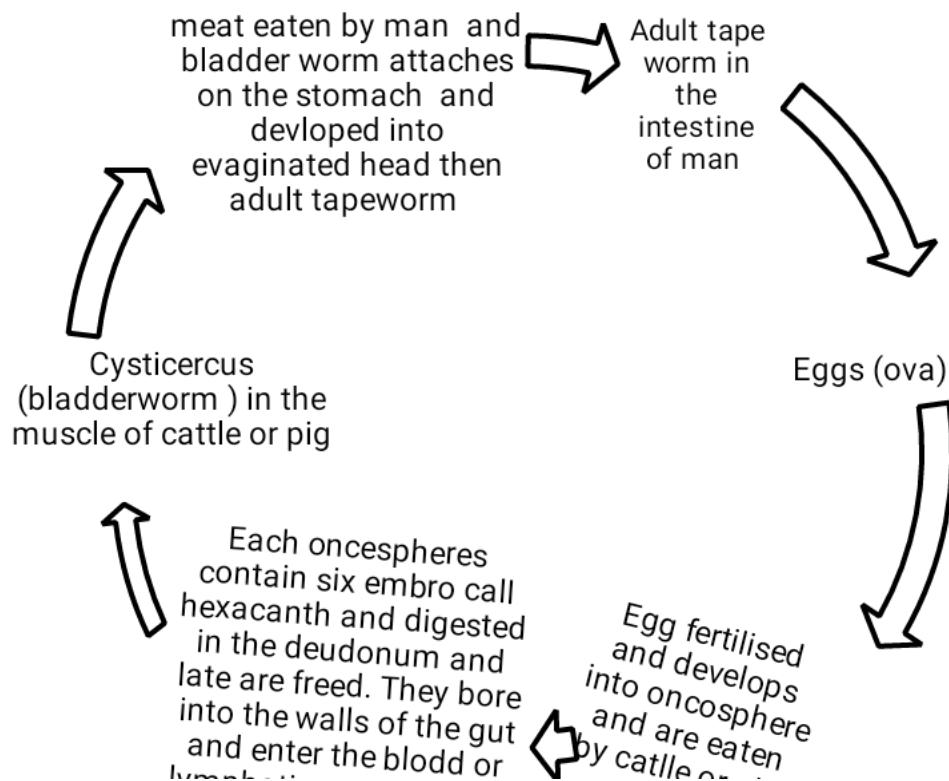
#### Sign of attack

- They attack the intestines and absorb digested feed from the animals
- The animal has pot belly mainly the calves
- Slow growth
- Continuous diarrhoea

#### Control

- Animals should be regularly dewormed regularly
- Avoid grazing animal in wet area, graze animals in well drained area
- Treat the animals with phenothiazine every 14 to 21 days

#### Tape worm



### Sign of attack

- a. It affect the small intestine and suck digested feed
- b. The larvae enter the blood stream and settle in the muscle making meat to look measly
- c. In human i can block small intestines

### Control of tape worms

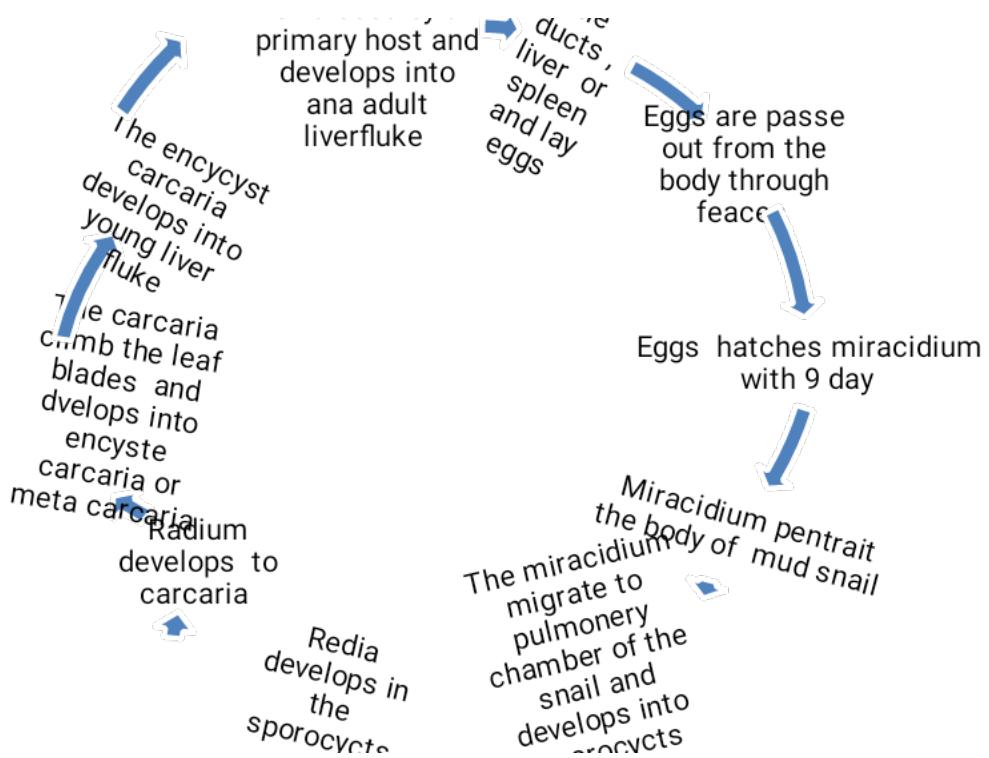
1. Dose the animals with copper sulphate and 40 percent nicotine at 6 week interval or combination of copper sulphate and arsenic at 4 times in a years , 3 month interval
2. Practice rotational grazing
3. Human faeces should be properly deposited
4. Meat should thorough cooked

### Liver fluke

#### Signs of attack

It attacks the liver and cause general weakness and internal bleeding in animals

#### Life cycle of liver fluke



## Control

- Destroy the snail with copper sulphate
- Avoid grazing animals in wet Dambos
- Practice rotational grazing

# LIVE STOCK IMPROVEMENT

It is the process of attempting to improve the genetic make up of livestock's and the environment in which they bare kept inured to increase production

## Aims of animal improvement

- To increase yields of milk, meat and eggs
- To increase the adaptability of animals to the local environment
- To increases the resistance of animals to parasite and diseases attack
- To increases the growth rat of animals so that they mature early

## Method of Animal Improvements

### SELECTION

It is the process of allowing animals which possess desirable traits (qualities) to have more offspring than other.

It is based on the scientific fact that offspring inherit good traits from their parents.

### Characteristics of animals to be selected for breeding

- a. It should have high yield production
- b. Should have good mothering ability
- c. Should be growth rate
- d. Should have high fertility
- e. Should produce high quality yield
- f. It should be efficient in converting feed to high quality yields
- g. Should be resistance to diseases
- h. Should be docile

### Breeding systems

#### a. Inbreeding

It is the mating of closely related animals for example mother and son

It helps to bring uniformity of animals by fixing desirable genes.

The only disadvantages is that there is loss of animal vigour and performances since some undesirable genes are also passed to off springs

#### b. Out breeding

It is the mating of unrelated animals. It may happen in form of cross breeding or line breeding

### Cross breeding

It is the mating of animals from different breeds like Malawian zebu and Friesian to produce a hybrid

### Line breeding

It is the mating of animals of the same breed that are not closely related e.g. Cousins

The advantages of out breeding is that help to introduce new blood in the herds which improve the performance of the animals

### Introduction

It is bringing of animals with desired qualities from one region to another region. For better

result the two areas should have similar climatic condition or should be properly managed to produce high yields.

### **Artificial inseminations**

It is the introduction of sperms into the reproductive tract of female animals without natural mating.

The semen is collected from the bull and diluted with a diluents made of egg yolk and glucose and stored in liquid nitrogen.

### **Advantages of artificial insemination**

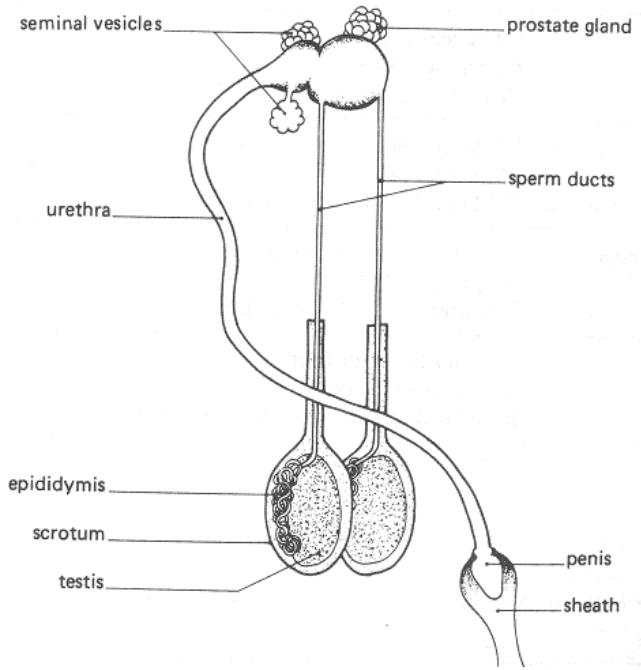
- a. It eliminates the cost of buying and keeping the bull
- b. It minimises the spread of sexual transmitted diseases since there is no physical or natural mating of animals
- c. Sperms can be stored for some time and used when required
- d. Semen from a single animal can be diluted and used to serve many animals
- e. It is easy to keep records on which particular cow was served
- f. Semen from heavy bull can be used to serve small animals
- g. It is easy to plan the breeding programme

### **Disadvantages**

- a. It is expensive to set up and maintain artificial insemination programme
- b. Timing of artificial insemination can be a problem since it is difficult to detect cows that are on heat
- c. The collection of semen requires trained and experienced personnel
- d. It does not achieve 100% results.

## **ANATOMY AND PHYSIOLOGY OF REPRODUCTIVE SYSTEM OF CATTLE AND CHICKEN**

### **Part and function of the reproduction system of the bull**



## **Testicles**

They are oval shaped and are contained in a sac called scrotum

Testicles are hanged outside the body because sperms are best produced at lower temperature than body's temperature

## **Function of testicles**

It produces sperms

## **Epididymis**

They are coiled tubules that surrounds each testes

## **Functions**

They store sperm so that they mature ready for ejaculation during

## **Sperm duct**

It is a tube that runs from the epididymis to the accessory gland

## **Function**

It carries sperm from the epididymis to seminal vesicles

## **Accessory glands**

They comprises of prostate gland, Cowper's gland and seminal vesicles

## **Function**

It produces semen which carry sperm and also provide energy to sperm since it contains

glucose which is used for respiration of sperms. It also helps to reduce the acidity in the urethra due to urine which could kill the sperms

### Urethra

It is a tube that leads from the bladder through the penis

### Function

It allows urine to leave the body

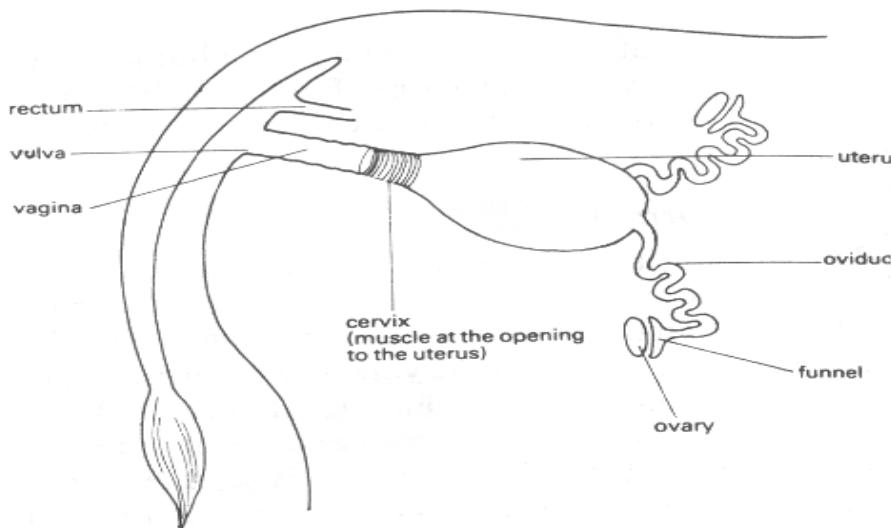
It allows sperms to leave the bull's body to vagina during mating

### Penis

It is a copulation organ that is used in mating

It is spongy when filled with blood it become larger and harder which make it easy to penetrate the vagina

### Part and function of the *reproduction system of the cow*



### Vulva

It is the external part of female genital organs

It covers the vagina

### The vagina

It is the tube that runs from the vulva to the cervix

### Function of the vagina

- a. It receives the penis during copulation

- b. It serves as birth canal
- c. It is a passage for urine

### Cervix

It consists of two thick muscles

It opens only during heat period and parturition (when the animal is giving birth)

### Function of the cervix

It separates the uterus from the vagina

### Uterus

It is where the fertilised egg gets implanted

It is where the embryo develops into young animals

### Oviduct

It has hair-like features that push the egg to move forward to the uterus

It is where fertilisation happens

### Ovaries

It is the part of the female reproductive organ that is responsible for production of eggs (ova)

### Functions

It produces ova

They produce sex hormones like oestrogen and progesterone

## Reproductive Process in Cattle

Cattle belong to viviparous animals

### Puberty

A bull reaches puberty when it is 8 months old while a heifer reaches puberty at the age of nine months

### Factors that affect the rate of puberty in animals

#### 1. Environment factors

Unfavourable conditions such as drought, may delay the animal to reach puberty

#### 2. General managements

Animals that are well managed reach puberty fast than animals that are poorly managed

### 3. Type and breed of animals

Some breed of animals reach puberty faster than other breeds

### 4. Mating

It may hasten (fastenmaturity)

## Oestrus Cycle (Heat Period)

It is the desire of female animal to mate

### Signs of heat period in cow

- a. The animals become restless
- b. The animals bellows
- c. It mounts other cows and stand still when mounted by other cows
- d. There is an increase in urination
- e. Milk production decline in lactating cow
- f. The vulva become reddened and enlarged
- g. There is a mucus discharge from the vulva

## Oestrus cycle

It is the interval between one heat period and the next heat period

### Oestrus phase

#### a. Proestrus

It last up for three days

The follicles grow and the ovary muscle develops

Vagina wall thickens and vulva swells under the influences of oestrogen

#### b. Oestrus

The anima has strong desire to mate and the follicles continue to grow to reach maturity

#### c. Metoestrus

The corpus luteum is formed. The body releases progesterone which suppress the

growth of follicles to release eggs

d. Dioestrus

The corpus luteum is retained if the animal retains pregnancy

### Fertilisation

It takes place when the female and male gametes fuse to form zygote.

The zygote takes 30 days after ovulation occurred to be implanted to walls of the uterus

### Gestation period

It is the period from the time of fertilisation to the birth of young animal. It takes 283 days

### Foetus Development

The embryo undergoes series of cell division resulting in formation of tissue and organs

The first organ to be developed is the heart followed by circulatory system.

The foetus is attached to the placenta through the umbilical cord where it gets oxygen and nutrients from the mother.

The foetus is surrounded by three sac membranes filled with amniotic fluid which cushion and protect the foetus from external injury and also keep the foetus warm.

It acts as lubricants when the animal is giving birth.

### Feeding

The foetus gets nutrients from their mother through the placenta

### Respiration

Foetus get oxygen from the mother through the placenta by diffusion.

### Excretion

Eliminates the waste products by diffusion from its blood system back into mother blood system.

### Parturition

It is the process that takes place when the animal gives birth to its young ones in a cow it takes nine months

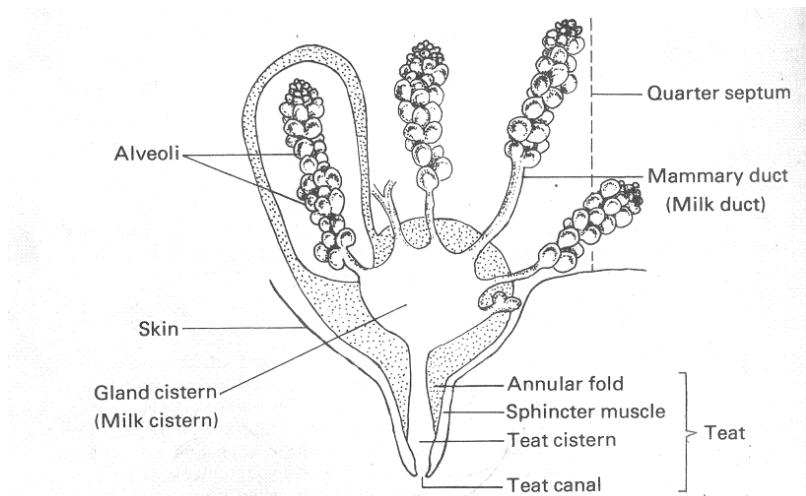
### Signs of parturition

- a. The sow becomes restless and looks for a quiet place
- b. The udder becomes large

- c. There is a mucus discharge from the vulva
- d. The pelvic ligament relaxes and become soft
- e. Colostrum can be drawn out from teats

## Milk production

Parts and function of the udder.



### Alveoli

They bare structure that are responsible for manufacturing of milk and secretion of milk

The alveoli are surrounded by several capillaries that supplies food nutrients responsible for milk secretion

### Mammary glands

It is the tube that runs from the alveoli to the gland cistern

They collect milk from alveolus to the gland cistern

### Gland cistern

It is where milk store before it is releases during sucking and milking

### Teat canal

It is the opening of the udder that releases the milk.

### Sphincter muscles

They are muscles that control the opening and closing of the teat canal.

### Milk secretion

The blood vessel brings raw material to secretion cell in the alveoli and the lining of milk ducts. The raw materials include: amino acids, vitamins, fats minerals, water and simple sugars

The manufactured milk is moved down the alveolar cavity to the ducts then to the gland cistern.

### Milk let down

It is the down flow of milk from the udder of cow

When the udder is stimulated, a message is sent to anterior pituitary gland in brain. The pituitary gland releases oxytocin that makes the muscle around the alveolus to contracts squeezing the milk ou the gland cistern through the duct.

The action of milking and sucking causes the milk to pass through the gland cistern to teats cistern through the annular folds.

The milk goes down and flow freely the teats canal. n

Hormones that affects milk letdown

### Oxytocin

It opens the constriction such of annular folds for milk to pass through

### Adrenaline

It helps in production of vasopression which increase the pressure in sphincter muscle and close the annular folds and sphincter muscle to stop the flow of milk

It counteract the action of oxytocin if there is an increase in excitement and nervous to cut the flow of milk.

## Hormones That Influence Reproduction Process

### A. Follicle stimulating hormones

It is produced in pituitary gland

#### Function

It stimulates the growth of follicles

It stimulates then development of ovaries

### B. Oestrogen

It is produced in the follicles and developing ovaries

#### Functions

- a. It brings onset of oestrus
- b. It influences the pituitary gland to produce luteinising hormones
- c. It influences the development of mammary glands

### C. Luteinising hormone

It is produced in pituitary gland

#### Functions

- a. It stimulates the rupture of follicles to release eggs
- b. It initiates the production of corpus luteum essential for maintenance of pregnancy

### D. Progesterone

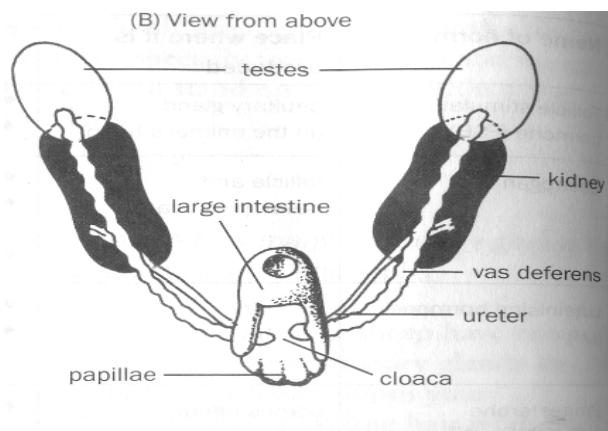
It is produced by corpus luteum and the placenta of pregnant animal

#### Functions

- a. It stimulates the follicle development
- b. It influences the development of mammary glands
- c. It influences the development of uterine walls
- d. Inhibits ova production in pregnant animals

## Reproductive System in Poultry

Part and function of a cock reproductive system



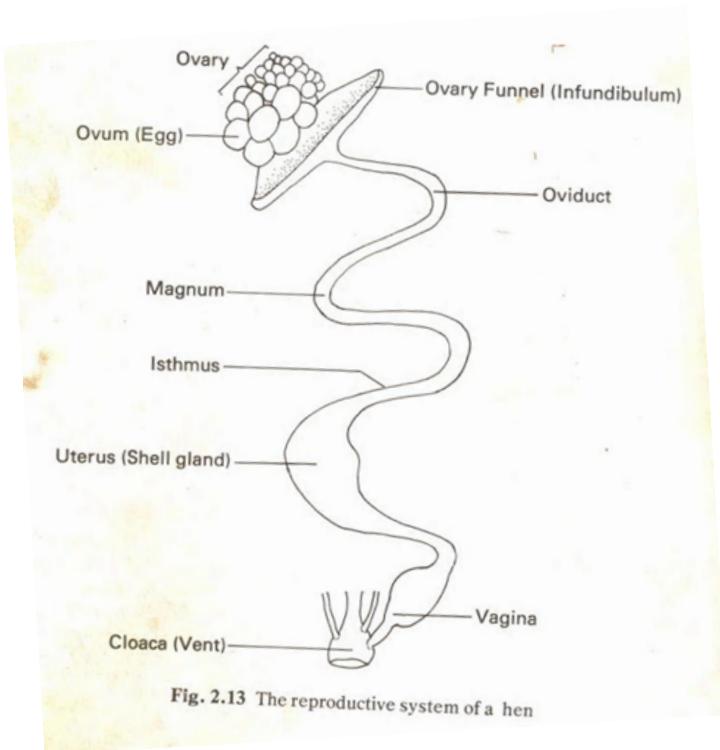
## Testicles

They are found inside above the kidneys

## Papillae

It serves as the copulation organ

## Parts and function of the reproductive organ of the hen



### Ovary

It form the yolk which is the ova

It secretes the male hormones endrogen which is responsible for the size and red colour of the comb

### Infundibulum

It receive the egg on its way from the ovaries

It is where the Chalazae is formed which keep the egg yolk in position.

### Magnum

It is 33.6 cm long

It secrete a thick layer of albumen which is added to the egg.

Isthmus the soft membrane that encloses the egg is added.

It is where the shape of the egg is determined

Water and minerals and thin outer albumen is also added here to the egg

### Uterus

It where the egg shell is added around the egg.

The colour of egg is done here and the albumen formation is completed

### Vagina

It where the egg is inverted and the vaginal fluid is secreted to reduce friction during egg laying

### Cloaca

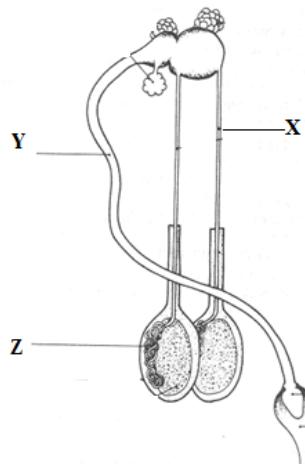
It is the outlet of the egg

Exercise

2003

Paper II

1. You are provided with samples of livestock feeds labelled X , Y and Z
  - a. Identify the feed labelled X, Y and Z
  - b. (i). Explain two reasons of giving sample Y to layers  
(ii). Explain any two reason for providing green vegetables to layers beside taking sample Y  
(iii). State any two reasons or providing a small amount sample X to layers
  - c. (i). Explain one problem a chicken feeding only on sample Z would eventually have  
(ii). How would you correct the problem inn Question c(i)
  - d. If you were to prepared a simple ration for chicken from maize , Madeya, and bean, describe how this could be done
3. Figure below is a diagram of reproductive system of the bull



- a. Name the parts labelled, X, Y and Z
  - b. State the function of each parts labelled X, Y and Z
  - c. Describe the bloodless method of castrating bull calves
- 10a. Explain any two feeds required of beef animals
  - b. describe characteristics of concentrates as live stock feeds
  - c. Explain any two problems of natural mating in cattle

d. Explain two problems faced by Malawi zebu when crossed with exotic breeds such as Brahman

e. Explain two benefits of dehorning in livestock production.

2004

2a. Differentiate between progeny testing and sib selecting as used in animal selection

b. State any two advantages of cross breeding a method of improving livestock.

3. The figure below ids a graph showing milk production of dairy cow. Use it to answer questions that follow.

a. (i). In which stage is milk yield increasing

b. Define the term dry off period in stage Z

4. Explain any two causes of difficulties experienced by a cow during parturition

5. a. State one importance of each of the following activities in livestock production

i. Flushing ii. Weaning

b. Describe any two factors that limit the use of artificial insemination by small holder farmers.

10a. Explain any two reason for keeping goats

b. Explain any two qualities of a good goat house

c. Explain two feeding habits of goats

d. State four symptoms of pneumonia in goats

e. Explain any two ways of controlling pneumonia in goats

2005

3 paper II

Table shows information on feeding of layers. Use it to answer question that follow.

Available feeds	Protein content
Maize meal	7%
Soya beans	40%

a. Using a Pearson square method, formulate a 990kg ration for layers containing 21% proteins. Show your calculation

b. Explain any three factors which should be considered when balancing a ration

c. Describe any two function of soya bean meal to layer

- d. Suggest any two types of nutrients which could be added to feeds in (a) to improve quality
4. (a). Name the activity that is done during docking  
(b). Explain any two advantages of docking in sheep
8. Explain any two advantages of extensive system of managing beef cattle.
9. (a). Describe any two harmful effects of internal parasite on farm animals  
(b). Describe the lifecycle of two host tick.  
c. Explain any two ways in which knowledge of two host ticks lifecycle can be of use in the prevention and control of the parasite.  
d. Explain how each of the following practices help to control livestock diseases  
i. Vaccination  
ii. Sanitation  
e. Explain any two ways in which diseases are spread among farm animals.
- 2006.
2. You are provided with specimen labelled W and X
- Identify the specimen labelled W and X
  - Explain any two roles of the specimen labelled X in live stock production
  - Explain two ways in which the specimen labelled W can be processed into livestock feed.
  - In which group of livestock feeds does each of following belong
    - Specimen X
    - Processed product from specimen W in 2 C
  - Explain any two situation in which a farmers would provide the group of livestock feed stated in d ii to beef cattle
  - If you were to sow a Stylo in pasture land containing specimen labelled X , describe how this could be done
- 2.
3. Table below show live weight gained for two exotic breed of cattle that were stall fed using same amount o silage for 40 days. Weighing was done at 5 day interval. use it to answer the question that follows

Days	Breed A ( Live weight gained in Kg)	Breed B ( Live weight gained in Kg)
5	1	1
10	3	7
15	4	10
20	6	13
25	8	16
30	10	19
35	12	22
40	14	25

- a. Draw two line graphs on the same axes to show the live weight gained in two cattle breeds
- b. What is the difference in live weight gained between the two cattle breeds on day 33?
- c. If you were a beef cattle farmer explain any two advantages you would get raising the breed B

10.a. Describe any two management practices a farmer should provide to a cow during gestation period

- b. Describe two characteristics of good dairy animals
- c. describe each of the following breeding system in a cattle
  - i. out breeding
  - ii. Cross breeding
    - d. State any four symptoms of mastitis in a cow
    - e. Explain any two ways of controlling mastitis in a cow

2007.

5. Explain any three ways in which a dairy farmer can ensure production of clean milk on a farm

12 . Explain any five characteristics of goats to be selected for breeding.

2009.

2a. A farmer observed the following signs of diseases attack in goats

- ✓ Swollen feet
  - ✓ Difficulty in walking
- I. Name the disease the goat was suffering
  - II. State one way of controlling the disease.
- b. Explain one way in which each of the following management practices can improve goats' production
- I. Keeping goats in a warm house
  - II. Providing protein concentrates to goats
  - III. Selecting an appropriate breed of goats
13. Explain any five factors to consider when feeding animals
- 2010
7. Classify the following livestock feeds into roughages and concentrates: silage, bone meal, hay, maize meal and cotton seed cake.
  10. (a) Give any two breeds of sheep suitable for meat production  
(b). Explain any two ways in which knowledge of gestation is important in sheep production.
12. With the aid of a well diagram, describe the reproductive system of bull.
- 2011.
- 1.a. (i). Define the term inbreeding
  - ii. State one advantage of inbreeding
  - b. Give any two breeds of cattle of dairy production
  - 4.a. (i). Name the organism that causes sheep pox  
(ii). Give any two symptoms of sheep pox
  - b. Explain one way in which each of the following practices is important in goat production
    - (i). Ear notching
    - ii. Deworming
  - 6 (a). List any two feed nutrients
  - b. Distinguish the term production ration and maintenance ration
- 2013

3. (a). The figure below is a diagram showing in livestock parasite labelled R and S. Use it to answer the question that follows.

- (i). Identify the parasite labelled R and S
- ii. State any two ways in which the parasite labelled S affects livestock production
- iii. Give any three ways of controlling the parasites labelled S.
- iv. Name a disease of livestock that is transmitted by the parasite labelled R.

## FARM BUSINESS MANAGEMENTS

### ENTERPRISE COMBINATION

Factors that affect enterprise combination

#### a. The availability of farming resources

The farming resource include land, capital, labour and managerial skills

##### Land

This affects the size of holding and type of crops or livestock enterprise that a farmer may engage in

It also affects the expansion of enterprise.

##### Labour

It affect hectarage of the of crop to be grown together since crop compete for labour during peak period.

Farmer need to engage in enterprise combination which will give the farmer high gross margin.

##### Capitals

It affects the type, number and size of the enterprise that the farmer can engage in

A farmer should use the available capita on enterprises that will bring most profit

##### Managerial skills

It involve decision making regarding to use of resource available

**b. The farmers food requirement**

The available resource are first allocated to food production before allocating to cash crops and other enterprises which affect the enterprise combination

**c. Profitability of enterprises**

Enterprises that give highest profit are first considered before considering other enterprise.

**d. Nature of enterprise**

Some of enterprises are compete for resources which result in decreasing the other enterprise for example flue cure tobacco and air dried compete for same resources as a result increasing the other may result in decreasing the other.

While some enterprises are supplementary as result they help one another and do not compete for available resources for example:

Legume and cereals

Duck or chicken with fish pond

Vegetables and livestock production

Some of enterprises are complementary to each other like they contribute to the production of the other.

For example cereals and legumes

**e. Opportunity cost**

It is the return that is given up. Farmer goes for the enterprises that will give him or her maximum profit or return. This may happen due to change in price of inputs or selling prices on the markets

**f. Comparative advantage**

Farmer concentrates on enterprise combination that is best produced in the area. Farmers always concentrate on enterprises for which they are suited in term of expertise, soil, climate and nearness to the market.

**g. Risk and uncertainty**

Risk is the difference between what one expect and the actual outcome while uncertainty is the state of unknowing what will happens in future.

Farmers tend to engage in enterprise that has low risk and uncertainty for fear of losses

Way of overcoming risk and uncertainty

- i. Selecting more reliable enterprises
- ii. By producing several crops (crop diversification ) in case one fail the other can act as surety
- iii. Be flexible in the method of production like changing from one crop for another in case of some risk and uncertainty
- iv. By practicing inputs substitution , farmers should go for cheap inputs rather than expensive one
- v. Keeping food reserves is one way of insuring food security during bad season
- vi. Ration inputs like using less input instead of more inputs
- vii. The insuring crop against crops
- viii. Growing crops on contract in case of price fluctuation

#### **h. Farmers ability**

Farmers always go for enterprise combination in which they have good economic principles and have skills and experience on how they manage them.

#### **i. Changes in prices and farming technology**

Farmers tend to first evaluate the technology before adopting it. This affects the choice of enterprises because farmers tend to go to technologies that they think they are profitable to them.

#### **j. Crop rotation**

Farmers always go for crop that can best be rotated in the field

#### **k. Expected yields**

Farmers tend to go for enterprises that they think they will get high yields always

#### **l. Input requirements**

Farmers tends to go for enterprises that need low inputs than enterprises that need expensive inputs.

#### **m. Quota system**

This affects the amount of yield to be produced as result farmer are limited on the amount of yields to produce which affect the combination of enterprises

## FARM RECORD AND ACCOUNTS

### Importance of farm records

- a. It help the farmer in timing of various activities
- b. It help the farmer to know the best when to breed animals
- c. It help the farmer when to cull unproductive animals
- d. It help the farmer in planning various activities
- e. It help the farmers to budget by forecasting the expenses and anticipated income on the farmer
- f. It help the farmers to keep accurate record of financial transactions
- g. It help the farmer to compare productive practices with the farm itself and also with other farms
- h. They provide history of farming activities and enable farmer to make comparison and choose profitable ones
- i. It help the farmer to obtain loans from commercial bank
- j. It help the farmer to select best livestock to keep
- k. It help the farmer to check their method of production

### Types of farm record

#### Inventory record

It is the record that shows the list of all properties or asset that the farmer has on the farm. This include: land, building structures, and produce in storage livestock, trees, machinery and inputs.

It is prepared at the end of farming season when there is no much work on the farm and all produces has been sold.

#### Step to follow when preparing inventory records

##### Count the items physically

##### Measure the size of land, mass of yields and others physically

##### Depreciation

It is loss in value of the commodity

It is used to estimate the value of machinery and equipment when preparing inventory record.

Depreciation is calculated using straight line or fixed rate.

## Straight line depreciation

The commodity loses its value by 10% per year

Example : calculate the value of a car worth MK2000000 after 2 years using straight line depreciation

The value of the car after a year will be less 10% which is 90%

$$\text{Value of a car after a year} = 90 \times 2000000/100$$

$$= \text{MK}1800000$$

$$\text{Value of the car after 2 years} = 90 \times 1800000/100$$

$$= \text{MK}1620000$$

## Fixed rate depreciation

The commodity loses its value by 20% per annum

Example: calculate the value of a tractor worth MK1600000 after 2 years using fixed rate depreciation

The value of the tractor will be less 20% every year like it will be valued at 80% of original price after a year

$$\text{Value of a tractor after year} = 80 \times 1600000/100$$

$$= \text{MK}1280000$$

$$\text{Value of the tractor after 2 years} = 80 \times 1280000/100$$

$$= \text{MK}1024000$$

## Example of inventory record

A farmer has the following assets at the end of August 2013

- ✓ 10 hectare of land valued at MK500000
- ✓ 100 bags of maize valued at K500000
- ✓ 200 broilers valued at K100000
- ✓ 20 goats valued at K160000
- ✓ 20 bags of feeds valued at K60000

Prepare the inventory record for the farmer

Date	Item	Quantity	Estimated value (MK)
------	------	----------	----------------------

01/09/2013	Land	10 ha	500,000
	Maize	100bags	500,000
	Broilers	200	100,000
	Goats	20	160,000
	Feeds	20bags	60,000
		Total	MK1320000

## Production record

It shows the operations or activities and the inputs used in the production of crops and animals and the produce produced

### Type of production record

#### Crop production record

It shows all activities done in the production of crops

It helps the farmers to know which crop is profitable or not

#### Live stock production record

It shows the number of animals kept, purchased or sold

It also shows the breeding cycles

## TYPES OF LIVESTOCK RECORD

### Live stock number records

It shows the number of livestock on the farm, sold, purchased , birth and death

### Milk production record

It is the record that shows the amount of milk or egg produces, weight gain by animals

### Breeding records

It show number of males and female used, breed of both female and males, date of service and number of services

### Health records

It shows the date of disease noticed, disease symptoms, drugs used to treat the disease cost of treatments and remarks

## **Feeding records**

It shows the details of animals feeds, type of feeds, and amount of feeds bought , used and balance in store

## **Birth records**

It shows the mother and the father, date of breeding service, date of birth, sex of offspring and birth weight.

## **Labour records**

The farmer should record the labour using man days

It shows the type labour used on production of crops or livestock and the amount of work done.

The amount of labour is calculated using man days

A woman does 0.7 of the work done by a man while child done 0.3 the work done by a man

### **Example**

Calculate the amount of work in man day if a farmer employs 5men, 3 women and 3 children to work for three days

Work done by men =  $3 \times 5 = 15$  manday

Work done by women =  $3 \times 3 \times 0.7 = 6.3$  man days

Work done by children =  $3 \times 0.3 \times 3 = 2.7$

Total work done = 24 man days

## **Financial records and accounts**

It is used to access if the farmer is making profit or not. It shows all business transactions like expenditure, and sale.

### **Example**

A farmer has one hectare of land and keep the following transactions

- ✓ Bought seed for K7500.00
- ✓ Bought fertiliser K16000.00
- ✓ Paid casual labour K15000.00
- ✓ Paid permanent labour K20000.00
- ✓ Sold 40 bags of maize at K2800.00 per bag
- ✓ Bought 6 hoes at K500.00 each

✓ Harvest 60 bag of maize

- a. Prepare the financial record
- b. Calculate the gross margin
- c. Calculate the profit of the farmer

Sale (receipt)		Expenditure (purchase)	
Sold 40 bag of maize @K2800 per bag	K112000.00	Casual labour	K15000
20 bags of maize @ K2800.00 each	K 56000.00	Bought seed	K7500
		Bought fertiliser	K16000
		Paid permanent labour	K20000.00
		Bough 6 hoes @K500.each	K3000.00
	K168000	Total	61500.00

Gross margin = total income – variable cost

$$= \text{K } 168000 - \text{K } 38500$$

$$= \text{K } 129500$$

Profit = Total income – Total expenditure

$$= \text{K } 168000 - \text{K } 61500$$

$$= \text{K } 106500.00$$

Example 2

Mr Kanyambita keep the following transaction in farming year of 2012/2013

06 September 2012 opening valuation K200000

30 August 2013 closing valuation K180000

4<sup>th</sup> October 2012 Depression K15000

16 October 2012 Fertiliser application K60000.00

3 January 2013 casual labour K20000.00

4 May 2013 fresh ground nuts sale K40000

12 June 2013 maize harvesting K15000.00

17 July maize sale K400000.00

17Aaugust pesticide application K7500.00

Prepare profit and loss account for Mr. Kanyambita

Sales and receipts			Purchases and expenses		
Date	Details	MK T	Date	Details	MK T
06/09/20 12	Opening valuation	200000 00	30/09/20 13	Closing valuation	180000 00
4/04/201 3	Fresh g/nuts sales	40000.00	4/10/201 2	Depression	15000 00
17/06/20 13	Maize sales	400000.00	16/10/20 12	Fertiliser application	60000.00
			3/01/201 3	Causal labour	20000.00
			12/06/20 13	Maize harvesting	15000.00
			17/08/20 13	Pesticide application	7500.00
	Total receipts	640,000.0 0		Total expenses	297500.00
				Profit	342500
		640000		To balance	640 000.00

Note: Produce to be used on the home should be estimated using the current price to get a true

profit

# FARM BUDGET

## Partial budget

It only affect part of the farming system and is used to evaluate or access a change to the part of the farming system.

It used to examine the effect of the change will have on the profitability of the farming enterprise.

Things to consider when preparing partial budget

- a. Extra cost that will be involved
- b. Present /existing income is to be given up.
- c. Extra income to be earned
- d. Existing /present cost to be saved

Factor a and b give the total cost while c and d give the total income

Uses of partial budget

It si used when a framer wants :

- a. Expands the existing enterprises or make some addition to existing enterprises
- b. Change from one enterprise to another
- c. Introduce a new enterprise without necessary changing the other enterprise
- d. Buy new farm machinery or equipment
- e. Adopt a change in the method of production for example from organic fertiliser to chemical fertiliser.

Example of partial budget:

Mr Kanyambita decide to change from commercial feed to home made feed. The layers are expected to produce the same number of egg f 35000 which will be sold at K50each.

He expected to do the following

To use seven bag of maize at K2000 per bag

To use 3 bag of soya beans at K4000 each

To spent K2000 for casual labour

Instead of

3 bag of layers mash at 5000 kwacha

2 bag of growing mash at 4500.00

Prepare the partial budget for Mr Kanyambita

Total	Total income from change
1. Extra cost  7 bag maize @2000 = K14000  2bag soya beans @ 4500 = K13500  Casual labour = K2000	Extra income  3500 egg@ 50 = 17500
Sub total =  K19500	17500
Present income scarified  3500 eggs at 50  K17500	Saved cost  3bag of layers mash at 5000 kwacha = 15000  2 bag of growing mash at 4500.00 = 9000
Total cost  K37500	Total income = 41500 -37500  = K4000.00

Complete budget

It is the type of budget that examine the effects of changes made to the whole farm

When to do complete budget

- a. When opening new farm
- b. When doing major maintenance or reorganization of the farm system

Farmers identify all the estimated items to be used in a particular year and the anticipated items of income for that year

### Step to follow when doing complete budget

- a. Make estimates of what it is possible to be produced bearing in mind limiting factor of production
  - b. Estimate the expected yields of the crops or animals
  - c. Estimate the inputs required for both crops and animals
  - d. Estimate the expected prices of the crops and animal inputs ( variable costs)
  - e. Estimates the fixed costs
  - f. Calculate the total cost
- .

### Example of complete budget

Yankho want to start poultry farming. She needs the following:

To construct a khola @ K30000

To buy 6 feeding trough @ K1000 each

10 buys of feed at K300 each

K2000 for casual labour

K7500 for drug

She expected to produce 10000 eggs that will be sold at K70 each

Prepare the complete budget for the complete budget for Yankho

Expected cost	Expected income
Khola 30000	10000 eggs @ 80 =
Fedding troughs 6000	K80000
Feeds 30000	
Casual labour 2000	
Drug 75000	
Total cost = 75500	Total = K80000

Gross margin	80000- 45000 =K 34500
Profit	80000-75500 = 4500.00

## AGRICULTURAL COOPERATIVES

A cooperative is an organisation or group of people who have joined together to pool their resources and services to achieve common goal.

Advantages of agricultural cooperative to farmers

- a. Farmers produce or market commodities cheaply because the resources available are shared expertise
- b. Farmers buy inputs in low prices since goods are bought in bulk at wholesale prices
- c. Farmers make use of expensive machinery which help farmers to overcome labour shortage
- d. Farmers benefit from shared overhead cost which can not be done by a single farmer
- e. Cooperatives have high bargaining power which makes farmers to sell their commodities at high prices
- f. Farmers transport easily their products to markets more easily
- g. It eliminates unnecessary profits made by middle men in the marketing chain
- h. Farmers easily adopt innovation in agriculture because of shared expertise and knowledge

Principles of cooperative formation

- a. It should be legally constituted with guiding rules and regulations
- b. It should be impartial and not based on political, or religion background
- c. People should be free to join or leave the group

- d. It should be run based on democratic principles
- e. It should have committee that is elected to run the affairs of the society and people should be voted basing on trust , and quality of leadership skills

Factors that makes cooperative to succeed

- a. Committee running the and controlling the organisation should be trustworthy and have expertise
- b. It should have enough funs or capital
- c. It should be efficiently and effectively organised
- d. Members running funds should be highly motivated, trustworthy and have skills
- e. Member should be committed to the success of the cooperation
- f. It should have adequate infrastructure , personnel ,transport, equipments and supplies
- g. Member should receive fresher course on productivity and marketing skills

## AGRICULTURAL MARKETING

### Marketing Forces – Elasticity of Supply And Demand

Price determination of the perfect market

The supply and demand determine the price of the commodity on an market

The increase in demand increase the price on the market and increase in supply reduces the price on the market .

The price that occur when the supply equal to demand is called **Market price**

Factors that affect market price

**a. Cost of production**

If the production cost is high the price tend too be high

**b. Competitors prices**

The price of the commodity can be raised or reduced followed what other are selling at or buying at.

**c. Commodity modification**

The price of the commodity can be raised basing on the modification of the commodity

as determined by the consumer

#### d. Attracting customers

Price can be reduced just to attract customers

#### Price elasticity of demand

It is how demand of commodity responds to change in price

It shows the ratio of price to demand

Elasticity price of demand = %change in demand / %change in price

Example

The price of mangoes ate Santhe trading centre from K10 to K12 resulting in change in number of demanded from 100 to 80. Calculate price elasticity of demand

% change in price =  $2 \times 100/10$

$$= 20\%$$

%change in demand =  $20 \times 100/100$

$$= 20\%$$

Elasticity price of demand =  $20/20$

$$= 1$$

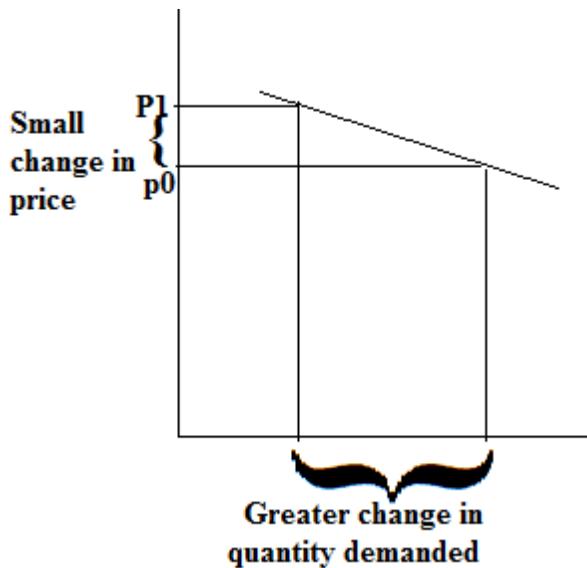
#### Degree of elasticity of demand

##### a. Elastic demand

The small change in price cause a greater change in quantity demanded

It commonly happens in commodities with a lot of substitute

The elasticity of demand is greater than 1

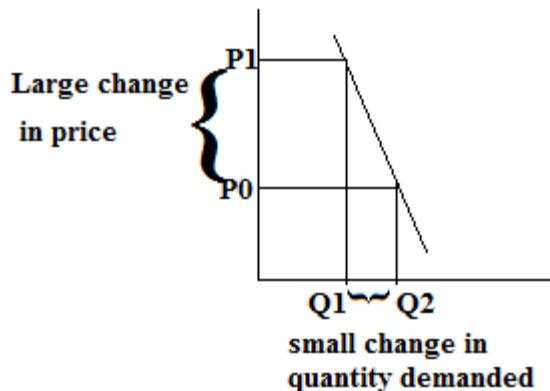


### b. Inelastic demand

A large change in price causes a small change in quantity demanded

It commonly happens in steeple food and commodities without substitute

The elasticity price of supply is less than 1

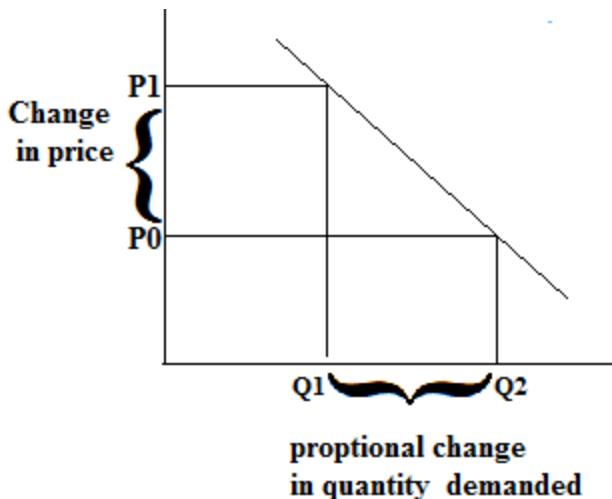


### c. Unitary demand

The change in prices cause proportional change in quantity demanded

It happen to good with little substitute

The elasticity is equal to one



### Price elasticity of supply

It is the extent at which supply changes as a result of change in prices

Elasticity of supply of price = %change in quantity supplied /%change in price of the commodity

Example: the price of tobacco changed from K20 per kg to K25 per kg resulting in a change in quantity supplied from 1000kg to 1200kg. Calculate the ESP

$$\% \text{ change in quantity supplied} = 200 \times 100 / 1200$$

$$= 16.67\%$$

$$\% \text{ change in price} = 5 \times 100 / 20$$

$$= 25\%$$

$$\text{ESP} = 16.7 / 25$$

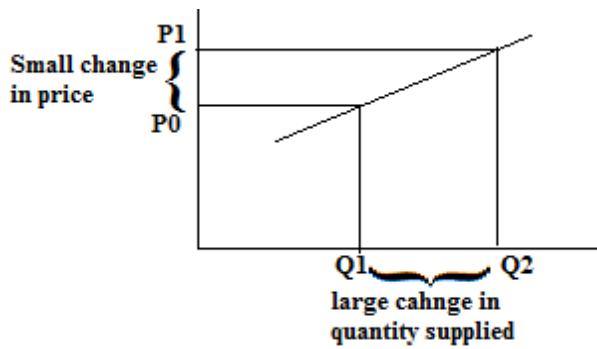
$$= 0.7$$

### Degree of elasticity of supply

#### Elastic supply

A small change in supply causes a large change in quantity supplied

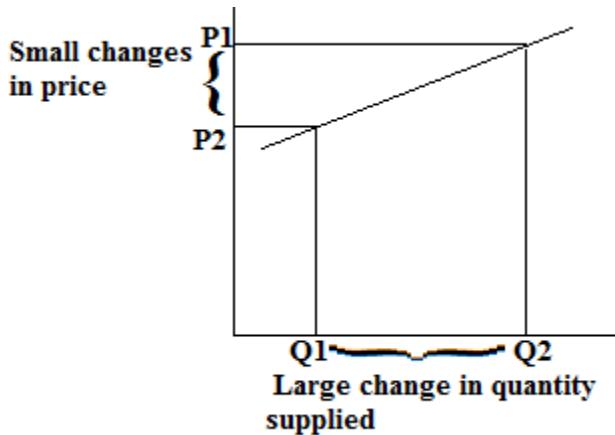
The elasticity of supply is greater than 1



### Inelastic supply

The change in price cause a small change in quantity supplied. This commonly happens in steeple food

The elasticity change in supply is less than one

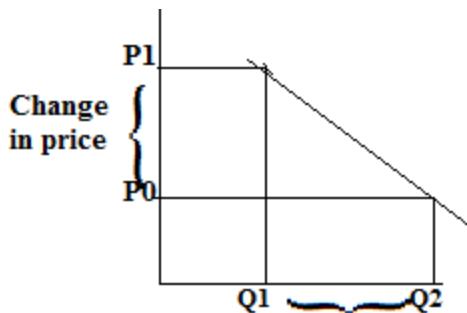


### Unitary supply

Change in price cause proportion change is quantity supplied

The ESP is equal to one

It happen to good with little substitute



## MARKET CHANNELS AND AGENCIES

Market channel is path of goods taken from the point of production to the point of consumption

(consumer)

## Type of market channels '

### a. Direct channel

The producer sells and delivers directly to the final consumer

It known as one to tier

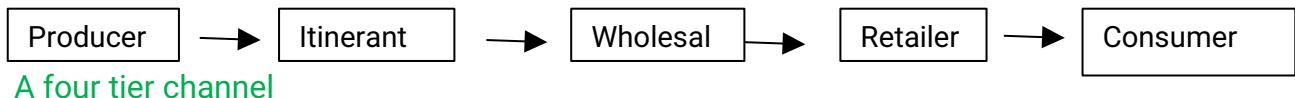


### b. Indirect channel

The producer uses intermediaries to take the good to the final consumer



A two tier channel



A four tier channel

## Market agencies

Are individuals, companies or organisation that carry various marketing function

## Examples of market agencies and their functions

### Producer

It is the string point of the market channel

### Function of the producer

- Producing commodities
- Grading commodities
- Transporting commodities
- Selling
- Storage
- Processing

The advantage of a farmer selling directly to the consumer is that the farmer and the producer exchange goods at the price that satisfy both

### **Itinerant trader**

It is the roving agent that moves in various farms to buy goods assembly them and then sell them to the wholesaler or to retailer or move door to door to sell to final consumer and the producer

### **Role of itinerant traders**

Buying

Selling

Assembling

### **Middle men**

Are people who link the final consumer and the producer

### **Roles of the middle men**

- a. They link the producer and the final consumer
- b. They assemble goods from the scattered farms into large quantity that can be transported to the wholesaler or retailer
- c. They buy farm produce from the farms
- d. They give loan for production (financing)
- e. They store goods for sale at later dates
- f. They do risk bearing by holding goods at great risk on the price fluctuation, deterioration due to bad weather, pest
- g. They supply market with information

### **Wholesaler**

They are market agencies that buy goods in bulk and sell it in bulk to the retailer

### **Roles of the wholesaler**

- a. Selling
- b. Market research
- c. Storage
- d. Transportation

- e. Financing
- f. Risk bearing , they are responsible for theft , deterioration of goods

### **Processing companies**

They are public or private companies which buy farm produces as raw materials from the farmers and process them into finished products required by consumers

#### **Roles played by processing companies**

- a. Buying
- b. Selling
- c. Processing
- d. Market research
- e. Advertising

### **Produce marketing cooperatives**

They are association of people formed to assembly farm produce from farmers and sell to the processing companies and wholesalers

They also buy farmer inputs farmers

### **Marketing companies**

Are marketing agencies that do marketing . e.g. admarc

#### **Roles**

- a. Pricing the agricultural commodities
- b. Buying
- c. Selling
- d. Transporting
- e. Risk bearing against loss or deterioration
- f. Disseminating market information

### **Retailer**

Are marketing agencies involved in the sales of commodities to the final consumers in small quantities for personal, family or household use.

### **Roles**

- a. Gathering variety of commodities
- b. Paying supplies '
- c. Storing commodities
- d. Providing information to consumers
- e. Conducting or participating in market research
- f. Transporting /delivery of commodities

### **Market Cost and Margin**

Are expenses incurred by market agencies or payment made to marketing agencies for their services in the market channel

### **Marketing margins**

It is the difference between the cost of the buying and selling it to the final consumer

Market margin = retail price – farm get price

### **Example**

An itinerant trader bought mangoes from Kanyambita farm at K 2300. Before selling it to the wholesaler he does the following

- a. Buy hessian at K150
- b. Transport it at K250
- c. His profit K500

Later the wholesaler dose the following before selling to final consumer

- a. Grading at accost of K100
- b. Packaging at a cost of K150
- c. Storage at a cost of K100
- d. Her commission was K250.

The retailer does the following before selling to final consumer

- a. Displaying at K100
- b. Transporting K250

- c. Storage at K150
- d. Advertising at K150
- e. His profit K350.

Calculate the market margin and the share of each agency

Market channel	Charge (MK)	Price (MK)	Share %
Farm get price		2300	48.42%
Itinerant	<ul style="list-style-type: none"> <li>• Hessian 150</li> <li>• Transport 250</li> <li>• Profit 500</li> </ul>	900	3200 18.95%
Wholesaler	<ul style="list-style-type: none"> <li>• Grading 100</li> <li>• Packaging 1500</li> <li>• Storage 100</li> <li>• Commission 250</li> </ul>	600	3800 12.6%
Retailer	<ul style="list-style-type: none"> <li>• Displaying 100</li> <li>• Transporting 250</li> <li>• Storage 150</li> <li>• Advertising 300</li> <li>• Profit 350</li> </ul>	950	4750 20%
Price receive by final consumer		4750	

Market margin = K4750 – 2300

$$= \text{K1550.00}$$

### Reducing marketing margin

Reducing market margin help to increase farmers share

Ways of reducing market margin

a. **Increasing the price of produce**

Farmers should be encouraged to sell market board where they can gain a better deal

b. **Performing some of the marketing function**

Farmers need to perform some of the marketing function like grading and processing to get a better price

c. **Eliminating some of the marketing functions**

Farmers need to grow crop that are 100% pure to eliminate the need for grading so that they can get a high price

d. **Skipping some agencies**

Farmers should sell the produce directly to the final consumer to reap all profit

e. **Selling through cooperative**

Cooperative has high bargaining power and produce are sold at high prices

f. **Reducing prices at the retail level**

Consumer should fight for lower prices at the retail level through consumer association.

## Population distribution and marketing

### The effect of population distribution on the market

a. **Place**

It affects the distribution of the products to reach the final consumer

- I. It affects the direction of flow of commodities. Good come from areas of low population to areas of high population because it is the central focus of market since there are a lot of consumers
- II. The length of market channels: Direct channels are common in low population areas while areas with high population tend to have long market channels because the farmer needs to use a lot of people for the commodities to reach the final consumer

consumer

### III. The method of transporting the produce to consumer

In highly populated area big mode of transport is commonly used since more people looking for commodities to buy rather in less populated areas where head load are common

#### b. Products

- a. It affect the quantity of products required : high populated need high supply of good that low populated area
- b. It affect the quality of the products offered in the market : high populated areas encouraged high quality of good that low populated area
- c. I affects the range and form of the products in the markets : high populated area encourages wide range of goods in various form which promote processing inoder to supply the requited form to final consumers

#### c. Price

It affect market in the following ways

- It affects demand and marketing services : high populated area are always sold at high prices because good are always on high demand
- It affects the supply of marketing services : the high prices cause the saturation of farm produce which result in low price in some cases

#### d. Promotion: It is the communication of the products to remind the consumer about it or to persuade consumer to buy it affect market in following ways:

- ✓ It affects the choice of the people on target. It affect the target group since they are more people in high populated area
- ✓ At affects type and advertising method used

In highly populated area mass media, trade fairs and exhibition or agricultural shows are common than in low populated area where personal selling is common

## Trading In Agricultural Commodities

### Trading

It is the buying and selling at a profit

### Marketing

It is the process that involves the identification of consumers need and then satisfaction of these need.

## Difference between marketing and trading

- ✓ Marketing cover wide range of activities while trading cover buying and selling only
- ✓ Stress on consumer analysis and satisfaction while trading stress selling
- ✓ Marketing is along term orientation while trading is a short term it begin and end with exchange function
- ✓ Market uses selling as a means of communication and understanding of consumers while trading uses selling s means and an end
- ✓ Marketing directs resources of farm to produce commodities that a consumer want while in trading resources is directed to bring sales/ purchase
- ✓ Marketing attempt to adapt to changes in consumer need characteristics while trading attempts to develop a stronger sale driver
- ✓ Marketing seek to anticipate , manage and satisfy demand while trading dispose of surplus at a profit

## Importance of trading at community level

- a. It encourages each members of the community to engage in enterprise that most reward to him or her
- b. It increases productivity of community since every body does what he do best
- c. It promote division of labour
- d. It promotes specialisation and develop expertise in the enterprises.
- e. It help to raise living standard of people in the community
- f. It create cooperation among member of the community since people rely one another on trade

2003.

## 5 paper II

. A farmer has two hectares of land on which he grow MH18 . He however plans to make the following changes.

- ✓ To apply 4 bags of urea instead of 6 bags per hectare at K1300.00 bag
- ✓ To sell 40 bags of maize at K1000.00 per bag to Chibuku products instead of K850.00 per bag to admarc
- ✓ To store maize in 50 sack at K30.00 each instead of storing in the nkhokwe
- ✓ To spend K500.00 instead of K300.00 On actellic

- ✓ To spend K600.00 per hectare instead of K300.00 per hectare on casual labour
    - a. Prepare a partial budget for the this farmer
    - b. Should the farmer proceed with his plan? Explain your answer
    - c. Explain any two main uses of the partial budget prepared in question 5a to a farmers
    - d. Explain the major weakness of the partial budget prepared in question 5 a.
  - 2. Explain any two ways in which a farmer can improve the profitability of an enterprise.
12. In agricultural production , farmers have to face many variables which are outside their control and such variables are known as risk and uncertainties
- a. describe any five risks and uncertainties that a farmers may face in Malawi
  - b. Explain any five ways in which farmers in Malawi may adjust to risk and uncertainties
- 2004
- 1. (a). Define marketing
    - b. Explain any two causes of an increase in marketing margin for a produce.
- 11a. Explain any five barriers to trading at international level
- b. Describe any five ways in which international trade in agricultural commodities is important
- 2005.
4. The figure below is a bar graph showing labour profile for cassava, rice and cassava. Use it to answer question that follow.
- a. (i). During which month was labour insufficient?
  - (ii). In which month was labour demand the lowest on the farms?
  - b. (i). Calculate the total amount of labour needed to meet demand in the month mentioned in a (i).
  - ii. Explain any two ways in which farmers could solve the problem in b (i).
  - c. Name one crop which had highest labour demand and another which had least labour demand during the year.
  - d. Explain any two ways in which knowledge of labour demand for different enterprises is important
  - e. (i). Give one point to explain that would happen to labour demand if all the labour on which cotton was grown was used for growing rice
  - ii. other than labour , state any two farming resources which are used in production 2

3. Describe the market situation in each of the following condition of demand for an agricultural commodity
- Elastic demand
  - Unitary demand

- 11a. Explain any five benefits agricultural cooperative to a small holder farmer  
 b. Explain any five factors that contribute to success of agricultural cooperatives

2006.

- 3d. Given that the following additional information on breed B

Total cost of feed – K10000

Veterinary costs – K 1500

Cost of khola - K5000

Income obtained - K40000

Calculate the gross margin for breed B. Show your working

5. The table below show the transaction that was recorded on a farm. Use it to answer the question s that follows

6/09/2003	Opening valuation	K8500.00
2/03/2004	Closing valuation	K10000.00
40/03/2004	Depreciation	K1000.00
5/04/2004	Fertiliser application	K7000.00
6/04/2004	Casual labour	K2000.00
16/05/2004	Tobacco sales	K24000.00

- Prepare a profit and los account for this farmer
- Calculate the farmer's profit or loss
- Describe any three uses of this type of record on a farm

- d. Explain the benefit of calculating depreciation on a farm
- 6. Describe any three effects of population distribution on the marketing of agricultural products

9e. Explain one way in which of the following agricultural principles increases crop production

- I. Substitution of inputs
- II. Comparative advantage

2007.

4a. Explain one way in which each of the following enterprises can benefit from fish farming:

- i. Crop production
- ii. Beef production

8a. State one way in which resources are used in each of the following agricultural activities

- (i). Trading
  - (ii). Marketing
- b. Explain any two ways of promoting trading at community level

9. A farmer had the following assets at the beginning of September 2006.

- ✓ 10 hectare of land valued at K50000
- ✓ 100 bags of maize valued at K500 000
- ✓ 200 broilers valued at K100 000
- ✓ 200 goats valued at K16 000
- ✓ 20 bags of feeds valued at K60 000

Prepare an inventory record for the farmer

2009

7a. State any two characteristics of land that would influence choice of crop enterprise

b. You are provided with the following information

- ✓ Farmer A had only enough money to buy either a bag of fertiliser or a bag of livestock feed
- ✓ Farmer B had only enough land on which to grow either pasture or mangoes
- ✓ Farmer A decided to buy a bag of a livestock feed while farmer B decided to grow pasture.

- i. State the opportunity cost for farmer A if the bag of Fertiliser would give him/her the highest profit
  - ii. Explain the opportunity cost of the farmer B if pasture had the lowest value
- 8a. Explain two ways in which trading of farm produce at community level is important
- b. Explain any one way in which each of the following activities carried out on a farm can reduce marketing margin and increases profit
- I. a farmer performing some of the marketing function
  - II. a farmer selling farm produce through cooperatives

14. Farmers in a certain area have the following resources at their disposal

- ✓ Small farm holding with clay soils
- ✓ A big river
- ✓ Livestock

Explain how the farmers can use the available resources to maximise production

2010

- 2a. Name any two marketing agencies that can take milk from the producer to consumer
- b. Describe any two effects of population on marketing
- 8a. Give any two examples of production records on sheep production
- b. Give any two reasons for keeping production records on sheep farms
- c. State any two factors to consider when selecting enterprise combination

2011

- 2a. Give any three ways in which trading of agricultural commodities is important at international level
- b. Explain any two ways that can facilitate trading of agricultural commodities from one district to another.

5. A farmer bought a machine worth K10 000.00 to be used for shelling groundnuts
- b. Using a reducing balance method, calculate the book value of the machine by the end of the year. Given that the depreciation provision is 12% per year.

14. A farmer in a certain village has the following resources at their disposal:

- Local chickens

- Mikolongwe chickens
- Fish pond
- Small scattered farm holding most of which are water logged.

Describe how the farmers can use the available resources to increase agricultural production in 2013.

4b. Table below shows an example of a marketing record for maize on a farm during 2011/12 farming season. Use it to answer the questions that follow.

Date	Amount sold (kg)	Price/kg	Income (Mk)	Market
20/04/2011	50	20	1000	A
25/04/2011	50	25	1250	B
02/12/2012	100	75	7500	A
07/12/2012	100	100	10000	B

- If the farmer spent K5000 during the 2011/12 farming season. How by calculation whether the farmer should continue with maize enterprise in 2012/13 farming season
- Calculate price elasticity of supply for maize enterprise at market A.
- Name the degree of price elasticity of supply in b(ii).

## AGRICULTURAL TECHNOLOGY

### Farm energy

Energy is ability to do work or the capacity to do work

Example of source of energy and their uses on a farm

#### Solar energy

It the energy supplied by the sun

Uses

- a. It is used by plants to manufacture food through photosynthesis
- b. Drying of crop

## **Water energy**

It is the energy produced by water

### **Uses**

- a. It is used in production of domestic electricity and industrial use

## **Fuel energy**

It is the energy that come from chemical that come from living thing e.g. charcoal and petroleum

### **Uses**

- a. Used in heating and cooking
- b. Used in locomotive operation e.g. diesel and petrol

## **Biogas**

It is the energy that come from gases that come from decay of organic matter for example manure

It si used for lighting and cooking

## **Animals**

Energy that is supplied by animals

Used in pulling implements and transportation

## **Human power**

Energy supplied by human being

### **Uses**

For cultivation and carrying domestic works and industrial use

## **Electricity**

It si used in lighting , heating , operating mills and irrigation

## **Wind**

Used in driving windmill to generate electricity and also to pump water for irrigation

### Mechanical power

Used to drive machines for tillage and ridging.

### How to keep energy safe

- a. Petroleum products should be handled with care
- b. Running engines should be switched off when refuelling
- c. Do not expose flammable fuels to naked fire
- d. Don't wear loose clothes when working with machines
- e. Keep all sources of fuel energy far from children
- f. Wear sun glasses when working on sun

## Land Drainage

### Selecting an irrigation system

#### Characteristics of irrigation systems

##### a. Furrow irrigation

###### Characteristics

- ✓ Water is led by gravity along furrows
- ✓ There are channels between plots and rows of crops
- ✓ It needs a lot of water
- ✓ It requires land which is sloping or with some gentle slope
- ✓ It does not use water effectively or there is a lot of water wastage

##### b. Flood irrigation

###### Characteristics

- ✓ Requires a lot of water
- ✓ Whole area is submerged in water or flooded
- ✓ Suitable for crops which grow in standing water
- ✓ The land needs to be levelled

##### c. Basin irrigation

- ✓ It a flooding irrigation where water is diverted to basins
- ✓ Suitable for orchards and paddy rice

#### d. Drip irrigation

##### Characteristics

- ✓ Water is conveyed in piped
- ✓ The pipe have small hole on an intervals
- ✓ Uses water economically
- ✓ Suitable for where water is scarce
- ✓ Risky in windy area and with fungal diseases
- ✓ Pipe may block easily
- ✓ It is expensive
- ✓ Can be used on sloping the land
- ✓ It doe not require labour once established

#### e. Overhead irrigation

##### Characteristics

- ✓ It doe not require labour once established
- ✓ Can be used on most soils and land with varying slopes
- ✓ Requires expensive equipments
- ✓ It controls amount of water applied
- ✓ It is less effective in windy days because there is uneven distribution of water.

#### Factors to consider when choosing irrigation system

##### a. Capital available

The capital available should much with irrigation system chosen

##### b. Source of water

The source of water should much with the type of irrigation chosen like flooding , furrow and overhead irrigation need a lot of water compared to drip

irrigation.

**c. Type of land**

Flat land need flooding irrigation while sloping land is best for furrow irrigation while drip and overhead can be done on any topography.

Size of the land should be also considered, like large land size need irrigation system that are economical since furrow and flooding lead to high seepage .

**d. Type of soil and crop to be grown**

Furrow and flooding irrigation need heavy soil where seepage is lower while drip irrigation can fit done on sandy soils since water is directly applied to base of the plant

Some crops need a lot of water while other not.

**e. Maintenance**

You need to have expertise on how you can easily maintain the irrigation system.

**f. Value of the crop**

The value of the crop should much with the type of irrigation and the crop should not make farmers to make some loses

## Managing irrigation unit

**a. Frequency and timing of watering**

**1. Amount of rainfall**

Irrigation should be done when they are inadequate rainfall and persistent drought

**2. Amount of water supplied during last irrigation.**

Avoid applied excess amount water since water is lost either through deep percolation and runoff

**3. Crop requirements**

Older plants requires a lot of water than young plants and plants should not reach on the stage of wilting due to lack of water or the soil should not be water logged.

**4. Weather condition**

Sunny day need a lot of water than humid weather where transpiration is reduced due

to humid condition.

They should be allowance of evaporation and transpiration when irrigation

## 5. Type of soil

Sandy soil need frequent irrigation than clay soil since it holds a lot of water.

## 6. Condition of the soil

Wet soil need small amount of water than dried soils

### b. Problems associated with irrigation

#### 1. Salt accumulation

The soil may become saline because of accumulation of salts as result of evaporation. The salt may come from irrigation water for example, chloride, sulphates and carbonates

#### 2. Soil erosion

This result due to excess application of water resulting in runoff which breaks the furrow due to overflows. The side of furrow and basin may be eaten up.

#### 3. Water logging

This result due to too much application of water which hampers the decomposition and plant dies

#### 4. Blocking of pipes

Soil in water and other debris in water may cause the small pipe to block mainly in drip irrigation and overhead irrigation

#### 5. Spread of disease

Some diseases may be easily spread by irrigation water

### How to overcome problem associated with irrigation

- a. Flooding salt free water to wash away excess soluble salts
- b. Applying gypsum to convert insoluble salt to soluble form so that they can easily washed away or leached and also correct alkalinity
- c. Maintenance of canal and furrows time to time

- d. Removing silt that may accumulate
- e. Controlling amount and frequency of irrigation
- f. Growing salt tolerant crops to reduce salt accumulation in crops

### **Drainage**

It is the method of removing excess water from the soil.

### **Importance of drainage**

- a. It help to improve aeration of the soil
- b. It help to raise soil temperature
- c. It help to improve soil structure
- d. It facilitates growth of certain crops by creating water table which does not fluctuate.
- e. It help to improve microbial activities
  - a. Water has poor aeration since air apace are occupied by water
  - b. It retard microbial activities since they do not respire
  - c. It lowers the soil temperature which affects plant growth

### **Tile method**

#### **Method of land drainage**

- a. Open ditch

#### **Effects of water logging**

Land is evacuated to make a ditch and water flow down the slope due to gravity.

The water table is lowered which facilitate cultivation

b.

Porous pipe or ceramic tiles are laid underground which drain water away from water logged area .

### **Farm Mechanisation**

#### **Advantages of mechanisation**

- a. Farm operation are done easily and faster

- b. It increases production
- c. Farmers can do jobs that are difficult to do.
- d. It releases farmers time for other tasks

### **Disadvantages**

- a. It leads to unemployment since machine takes places of people's labour
- b. Quality of work tends to be poor due to speed of operation
- c. It needs high capital
- d. Some spares may need to be imported
- e. It destroys the soil structure since soil becomes compacted
- f. It is difficult to mechanise other crops which affect the choice of crops to be grown
- g. It leads to high farm costs due to high cost of fuels
- h. It requires large land holdings

### **Factors to be considered when mechanising a farm**

- a. Size of land holding  
It requires large land holding
- b. Accessibility of the land  
It should be accessible to machines
- c. Topography of the land  
The land should be flat for easy mechanisation
- d. Availability of capital  
It needs a lot of capital to buy and run machines
- e. Technical know how  
There should be availability of skilled people to run machines
- f. Value of the crop  
The crop should have high value in order to recover the cost of mechanisation
- g. Market demand  
The crops to be grown should have high demand on the market
- h. Farmers attitude

Should have positive attitude towards mechanisation

- i. Availability of credit facilities to buy and maintain machines

## Types of farm machinery

### Ox-drawn implements

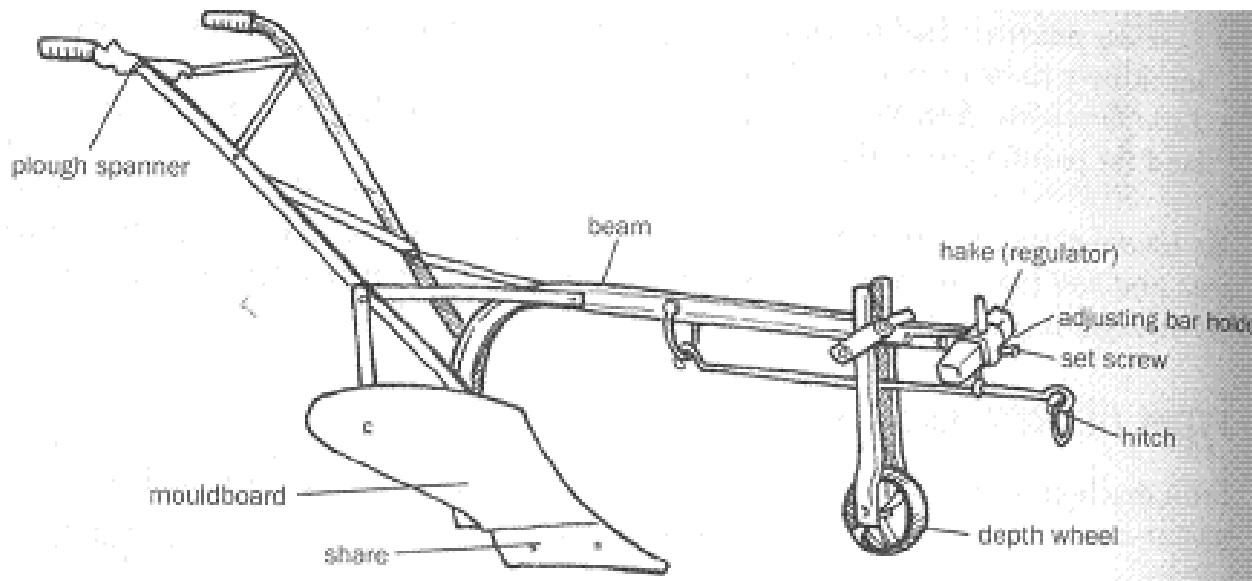
Examples include

Oxcart, mould board plough, Ridger adjustable cultivator disc plough , reversible ploughs

### Plough

It is used for ploughing; they are used to breaking up the land

### Parts of a plough



### Depth wheel

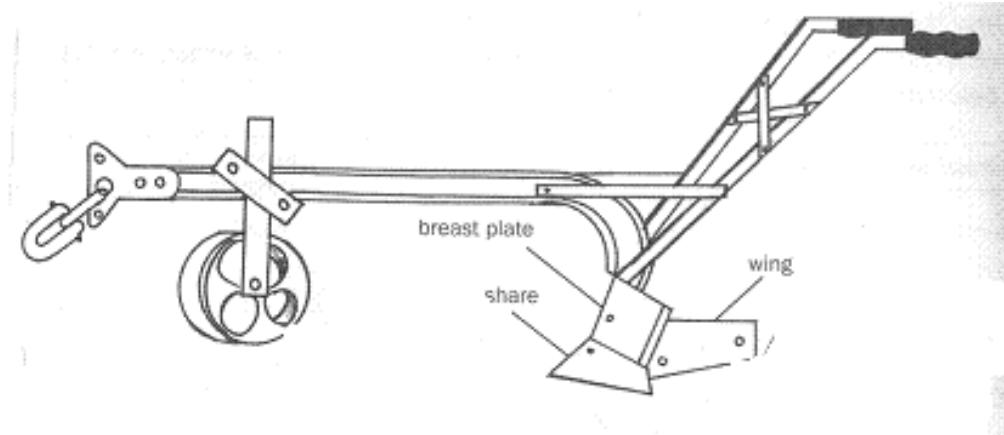
It control the depth of the share in the soil

### Mouldboard

It divides the soil into two parts

Share it cut the soil into two parts

### Ridger



## Sprayer

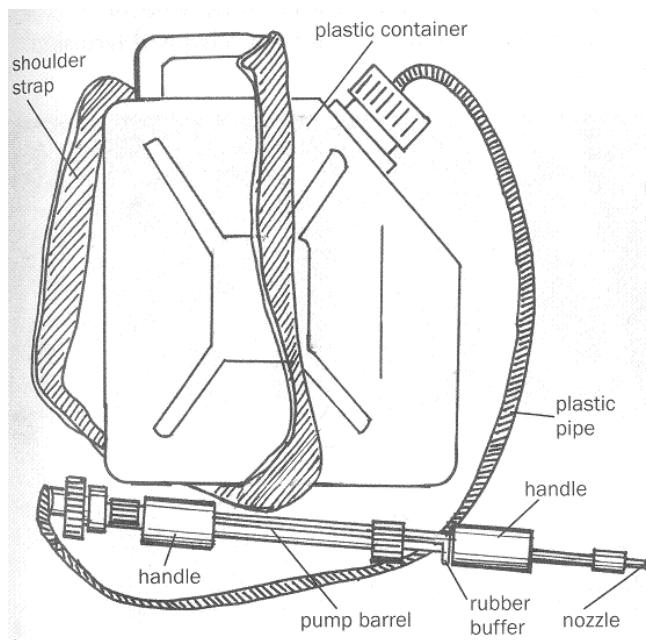


Figure 4.4.6 A knapsack sprayer

## Maintenance of machinery

### A HOE

- Check that the blade handle is in good condition
- Check the blade is not blunt
- Scrap off soil off the blade
- Apply oil and put in dry place

### Wheel barrow

Greases the wheel axle to reduce friction

Paint the barrow to prevent rusting

### Sprayers

- a. Clean the tank after use with lots of water to prevent corrosion
- b. Dismantle and clean the nozzle thoroughly
- c. Replace the piston cup and worn out nozzles
- d. Paint the knack sack sprayers during off season

### **Oxcart and ridger**

- a. Grease all axles and hake /regulator and hitch
- b. Tighten loose bolts and nuts
- c. Set the plough and ridger normally
- d. Do not drag the plough or ridger when transporting them to prevent wear and tear
- e. Replace worn out parts such as land side share

### **Oxcart**

- a. Grease wheel bearings
- b. Tighten loose bolts and nuts
- c. Replace worn out parts
- d. Check the tyres are in correct pressure
- e. Replace worn out tyres
- f. Don't over load the oxcart to prevent overturning
- g. Paint the oxcart and store in shed to prevent rusting

### **Mould board plough**

- a. Check share and coulter
- b. Sharpen the share if blunt
- c. Lubricate the coulter bearing daily
- d. Replace worn out parts
- e. Clean the plough by scraping off soil
- f. Tighten bolts and nuts
- g. Grease mouldboard , share, landslide to prevent rusting

h. Paint the beans

### Disc plough

- a. Grease the bearings
- b. Sharpen the disc if blunt
- c. Check and adjust the disc
- d. Replace worn out parts
- e. Clean the plough by scraping off soil
- f. Tighten bolts and nuts
- g. Grease disc plough to prevent rusting
- h. Paint the beams

### Harrows

- a. Sharpen the blunt tines or points
- b. Tighten nuts and bolts
- c. Check teeth and securely in place
- d. Tighten u bolts
- e. Sharpen the blunt tines or points
- f. Replace worn out parts
- g. Paint the harrow when not in use
- h. Greases the harrow if not in use

### Safety when using machines

- a. Don't over load to avoid overturn
- b. Wash the body after using chemicals
- c. Don't smoke or eat when spraying
- d. Keep away children from machine
- e. Dot wear loose clothes when using machine
- f. Switch off machines when refuelling
- g. Carry implement by facing the sharp blade face upwards o prevent accidents

- h. Empty chemical bottles should be properly deposited
- i. Don't smoke near flammable liquid fuels

2003

2004

- 6a. Name any two tillage implements which use human power
- b. Differentiate between mechanical and solar energy
- c. State any two uses of fuel energy

2005

- 5a. Explain any two problems that associate with surface irrigation
- b. State any one solution to each problem indicated in %

2006

- 12a. Describe any five factors that should be considered when mechanising a farm
- b. Explain any five advantages of mechanisation

2007

15. Low income farmers live in an area with the following characteristics\cs

- ✓ Moderate sloping land with clay soils
- ✓ A dam with plenty of water situated on the upper part of the farms
- ✓ Plenty of unskilled labour

If the area experiences a long dry spell every year, describe how a suitable irrigation system for maize production would be established and managed

2008

2009

- 10a. State two points to consider when selecting a water source for an irrigation system
- b. Explain two environmental problems that flood irrigation may cause

2010

- 4a. Give any sources of fuel energy on a smallholder farms
- b. State two environmental problems that may be caused by sources of fuel energy given in 4a

c. Explain each of the environmental problems stated in "b" on agricultural production

5a. Explain one way how in which each of the following practices would make a machine used shelling groundnuts to reach salvage value earlier.

i. storing it under tree

ii. Overloading

11. Explain any five advantages of farm mechanisation

## CHALLENGES IN AGRICULTURAL DEVELOPMENT

### Agro Based Industries

Are companies' films, factories or any manufacturing facility the uses raw material from the farming sector or produce or inputs needed in the farming sector

### Role of Agro-Based Industries In Supporting The Growing Population

#### a. Equipping Farmer With Inputs

It provide farmers with farm inputs which help to increase agricultural production which inturn increase food supply e

Agrimal it provide farm machinery eg hoes , ridgers, ploughs, pangas

Optichem provide fertiliser

Panna seed provide seed

Agricultuaral trading company , knapsack sprayers , hose pipes , pesticides

Rab processor animal feeds

#### b. Processing raw materials

It process the raw material to products that desired by consumers

For example

- ✓ Grain and milling company process maize to gramil maize flour
- ✓ Lever brothers g/nut, sunflower and cotton seed to cocking oil
- ✓ Illovo sugar cane to sugar

- ✓ David white head cotton to cloth
- ✓ Press food limited tea leaves to chombe tea , ground nuts to tambala ground nut and superstar cooking oil
- ✓ Rab processors rice to super rice, maize to snow ufa woyer

#### **c. Providing market for agricultural products**

They buy farm produce from farmer which enables farmers to convert their agricultural commodities into cash eg admarc

#### **d. Feeding and clothing the nation**

They process agricultural produce what can be readily used to a form that can be readily used in form of food

Example

- a. Grain and milling company maize to maize flour
- b. Tambala food products ground nut to peanuts butter

While Divid white head and sons (mapeto) produce clothes

#### **e. Providing employments**

All companies employ people who receive some income to help their families

### **Population Growth and Land Policy in Agriculture**

#### **Land Tenure**

It is the way in which land is owned or held or It indicates the right of the people to own , use and control the land and its resources.

#### **Types of land tenure**

#### **Public land**

It is the land the belong to the government

Example

- a. Land under government buildings and other infrastructure
- b. Forest reserves and national parks
- c. Roads

## **Communal Land or Customary Land**

The land is owned by a group of people , a tribe or a clan and is held under the control of tribal chief or village head

### **Characteristics of customary land**

- a. It held under customary title
- b. Land is distributed to every member of the community according to his/her needs by village chief or head of the clan
- c. Land is allocated free of charge as a result can not be sold or bought
- d. The community retain ownership of land and power to describe how to used the land

### **Advantages**

- a. Ensuring that every member has at least a land according to needs since it is allocated free of charge
- b. There is security of tenure since a member can be evicted

### **Disadvantages**

- a. Land can not be used as surety for loan since it is held under customary law
- b. There is little improvement on land to improve its value since land can not be sold
- c. It is difficult to increases farm holding in order to introduce advanced agricultural technology since it can not be sold
- d. It lead to land fragmentation
- e. It leads to overgrazing since there is no restriction upon the number of animals than can graze

## **Private land**

It is the land that is held under lease hold title or free hold title as it is registered under land act.

### **Leasehold title**

The land is held for fixed period of time for s specific purpose for a fee paid annually

### **Free hold title**

It is the absolute ownership of land that a farmer can farm the land in any way chosen as

profitable and no rent is paid

### **Advantages of private land**

- a. It can be used as a security for loan
- b. It can be sold or bought
- c. A farmer can invest on long term improvements

### **Disadvantages**

- a. If the owner is not interested in farming the land can stay idle
- b. Large land may stay idle while others are looking for land

## **Gender and Agricultural Development**

### **Cause of Gender Biases in Agricultural Technology**

#### **a. Lack of early socialisation to technology**

Boys are always exposed early to technological innovation than girls in the sense that boys are given car and aeroplane toy while girls are given dolls

#### **b. Lack of technological information**

Boys are favoured in education than girls which make boys exposed to information and also men are more mobile and tend to gain a lot of information than women

#### **c. Land of access to capital**

Most times money are controlled by men which put women at a disadvantage to use technological equipments

#### **d. Discriminatory attitudes and gender**

Lending institutions tend to deal with men than women and also there is prejudice that men are capable than women and can not do other jobs like driving tractors,

#### **e. Lack of confidence**

Many women lack confidence in technology because of their background

#### **f. Lack of exposure to role models**

There are few women in societies which young girls can copy their example compared to men

### **Implication of gender bias for agricultural developments**

- a. Low contribution from one gender to agricultural production since most women depend

- on low farm technology making their contribution to be low
- b. Low agricultural productivity because agricultural activities are not completed in time or may not be done properly with unimproved technology
  - c. Food insecurity, starvation and low energy output

Since there is low yields to use of low technologies it lead to hunger

## **How to Increase Women Involvement In Decision Making**

### **a. Social empowerment**

There is need to increase the women literacy levels so that women farmer can positively contribute to in decision making

### **b. Political empowerment**

Women should be given opportunity to participate in power structure and decision making in the society since most women occupy subordinate position and also are burden by domestic works from early age

It also keeps them illiterate and keeps them financially independent

### **c. Economic empowerment**

Women should own land so that they practice farming and also give them some capital to reduce dependence on their husband

### **d. Cultural empowerment**

Women should be given equal power as men and also should be able to control some resources

## **HIV /AIDS AND AGRICULTURAL DEVELOPMENT**

### **Impact of HIV/AIDS on agricultural development**

#### **a. Weakening labour forces**

Aids patients have low energy since it weakens the individual; and reduce his/her energy output which reduces agricultural production and slow down agricultural development

#### **b. Taking away time from farming**

Family member spend there time taking care the AIDS patients forcing themselves to neglect the farm in order to provide proper care to the patient which results in low yields and slow down agricultural development

- c. Killing the most reproductive farmers in the population

It kills people with reproductive group which reduces agricultural development faster.

- d. Depleting farm capital

Families spend a lot of money on medical drugs which could be used to buy farmer inputs which result in reduction and also a farmer must adjust budget to accommodate the orphans

- e. Disturbing the emotional balance of the farmer

It makes a farmer to experience terrible sense of despair and hopeless which result in mental breakdown reducing people ability to contribute meaningfully to agricultural development

## POPULATION GROWTH AND FOOD SECURITY

Food security is the ability to have enough food for every one at all times

Food self efficiency is the ability to produce one's own food in adequate quantities without depending on external supplies

### Ways of achieving self – sufficiency in food production

1. Improving farming technology

It means having improved seed better and scientific methods of growing crops and raising livestock. It increases food production in the following ways:

- a. Enabling timely completion of critical farm operation using farm machinery
- b. Developing more effective chemical to control pest and disease And weed effectively
- c. Enriching soil fertility by developing better fertilisers
- d. Developing and use better irrigation systems

2. Improved seed which are disease resistance , fast growth , early maturity and high yield which result in food sufficiency
3. Good land husbandry through using the land according to its capabilities and conserving land to ensures sustainable production
4. Fair land policy which should encourage equal land distribution to help small holder farmers to achieve food self sufficiency

5. Good crop husbandry which include early planting , timely weeding in order to have high yields
6. Irrigation crops which enable farmers to grow crop twice a years hence ensuring food self efficiency
7. Good livestock husbandry which encourages sufficient milk, meat or egg production for family and nation
8. Fair pricing policies : prices of inputs should encourage farmer to use farm inputs while food price should be fair to encourage farmer to grow more food crops
9. Crop diversification through mixed cropping, strip cropping , relay cropping of dimba gardening which reduces the risk of total crop failure in case of drought
10. Mixed farming which help to safeguard farmers from crop failure or animal perishing which makes the farmer to survive on the remaining enterprise and also giving farmers a more balanced diet and also spreading food supply.
11. Encouraging estate food production by allocating more land other resources to food security , training farmers in food production and providing tenants with farm inputs for food production
12. Proper food storages to reduce spoilage and ensuring availability of food through the year

2003

5. Explain one way in which HIV/AIDS has contributed to low agricultural production through each of the following at the farm
  - a. labour force
  - b. capital
8. Explain briefly how food security is affected by each of the following
  - (i). Storage facility
  - ii. Planting early maturing varieties
  - iii. Food processing technologies
11. (a). Explain any five ways in which Malawi's rapid population growth has led to environmental degradation
- b. Explain any five ways in which Malawi's environmental degradation can be reduced

2004

- 7.a State any two examples of gender biases on agricultural technology

- b. Describe any two implication of gender biased application of agricultural technology.
8. Explain one role of each of the following agro-based industries in supporting the growing population
- a. Grain and milling company
  - b. Malawi dairy industries
  - c. David white head and sons
9. (a). State any four scientific and technological innovations, in maize production from planting to harvesting which ensures food security
- (b). Explain any two ways in which drought resistant crops ensures food security
- c. Explain any two ways in which fish farming may be used to ensure food security for growing population
- d. Explain any two ways in which proper food storage ensures food security for the growing population
- e. Explain any two ways in which crop diversification promote food security

2006

- 7a. State any two ways of in which population policies in Malawi promote agricultural development
- b. Explain two ways how equitable land distribution is important in Malawi

2007

- 4b. Explain one way in which HIV and AIDS can limit contribution of women to agricultural production
7. Explain one way in which each of the following agricultural services ensures food security for growing population:
- a. seed technology
  - b. provision of farm inputs
11. Explain any five ways in which ADMARC contribute to food security

2008

2009

- 4a. Name any two examples of drought tolerant crops  
b. Explain any two ways in which drought resistant crops may ensure food security

2010

12. Explain any five ways in which organic farming ensure food security

2011

7a. Explain any one way in which of the following practices may ensure food security

I> Proper food storage

II> Agro forestry

b. Explain one advantage of land drainage in crop production

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