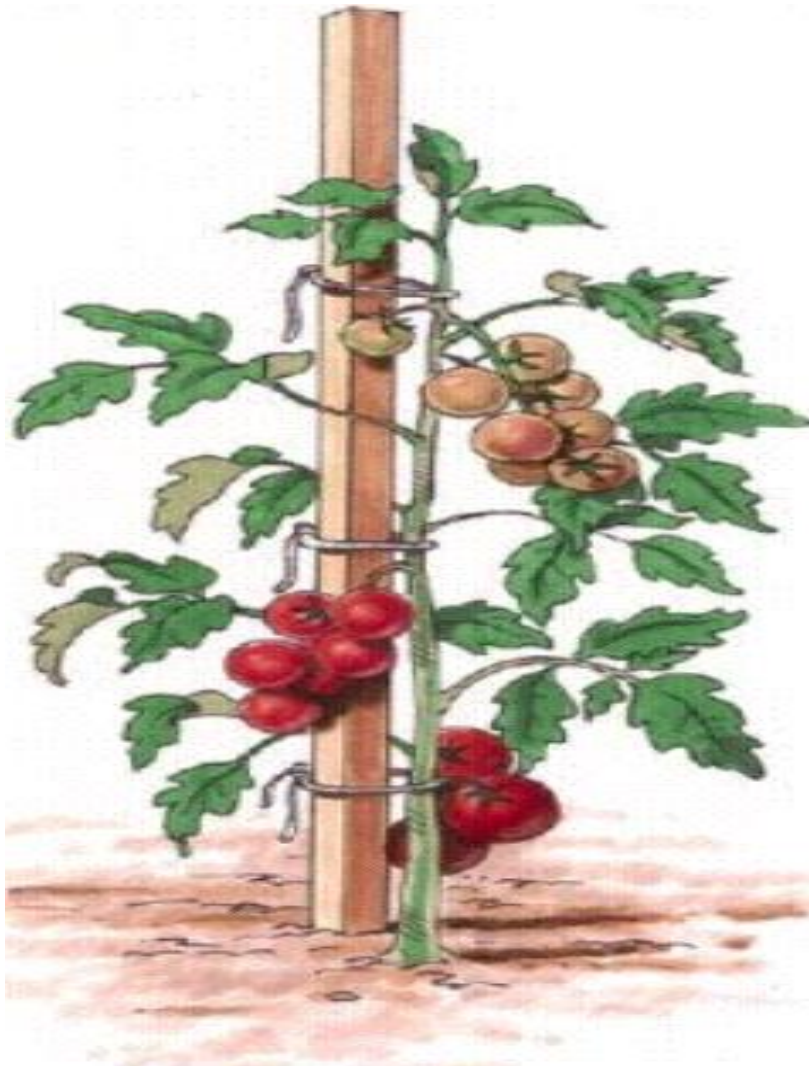


JUNIOR CERTIFICATE AGRICULTURE



Study Notes for Form 1 New Curriculum

Compiled by Holly, J.H.

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UNIT 1

NATURAL RESOURCES

Success Criteria

You must:

1. List the natural resources that influence agricultural production
2. Explain the importance of each of the natural resources in agricultural production
3. Identify ways in which natural resources that influence agricultural production can be depleted
4. Define conservation of natural resources
5. Describe ways of conserving soil, water, air and vegetation
6. Explain the effects of rapid population increase on natural resources and the environment

Natural resources are resources that occur naturally within the environment.

Natural resources are derived from the environment are called.

1. Water
2. Air/wind
3. Vegetation
4. Soil
5. Sunlight
6. Wildlife
7. Minerals

Water

There are three main sources of water such as:

- a. Rainfall
- b. Ground water, e.g. springs, boreholes, wells
- c. Surface water, e.g. rivers, dams and oceans.

Importance of water

1. Germination of seeds
2. Dissolving and uptake of plant nutrients or elements
3. Cooling and animals through transpiration and evaporation respectively
4. An agent of soil formation through physical and chemical weathering
5. Fishing farm
6. Generating hydro-electric power
7. Providing water transport

Problems of water

1. Water is an agent of soil erosion
2. Transmission of diseases to both plants and animals

3. Heavy rains cause floods which destroy crops, animals, land and people's houses
4. Spreading of waterborne diseases, such as cholera and bilharzia.
5. Crop logging
6. Hailstorm destroys crops like tobacco, fruits and flowers
7. Excess water leaches nutrients deep into the soil where plant roots cannot reach

Air/wind

Air is a mixture of gases such as oxygen, carbon dioxide, hydrogen and nitrogen.

How soil air (oxygen) is reduced

- Increased activities of aerobic bacteria
- Soil compaction when working with heavy machines
- Waterlogging due to poor drainage
- High content of clay

Effects of reduced air content in soil

- Reduced rate of decomposition which affect the formation of humus
- Retards root growth and development
- It negatively affects the absorption of water and nutrients by roots.
- Increased anaerobic organisms and activities in the soil.

Ways of improving soil air (oxygen)

- Draining excess water in waterlogged soil
- Ridging which removes excess water in furrows
- Deep tillage that loosens soil

Importance of wind

- Air provides oxygen for respiration in seed during germination; in plants, micro-organism and animals.
- Air is necessary for drying of crops such as air cured tobacco (burley)
- Soil air is good for the growth and development of roots
- Soil air facilitates microbial activities which helps to improve soil fertility
- Good soil air promotes absorption of essential plant nutrients in oxidized form such as iron (Fe^{3+}) and sulphate (SO_4^{2-}).
- Wind brings about rainfall
- Wind helps in pollination of some plants
- Winds helps in seed dispersal
- Wind is used for driving windmills

Problems of wind

1. Causes plant lodging.
2. Transmits diseases and pests.
3. Causes soil erosion.
4. Increases rate of evapo-transpiration (loss of water from water bodies, soil and plants).
5. Disturbs grazing animals.
6. Damages farm structures
7. Strong wind causes premature fall of fruits
8. It causes air pollution

Vegetation

This is a term used to describe plants such as trees, shrubs, herbs and grass.

- Protects the soil from forces of raindrop impact which causes erosion.
- Traps runoff water so that it sinks into the soil without causing soil erosion.
- It helps to reduce effects of climate change by maintaining the balance of gasses in the air.
- It provides fuel wood for cooking and tobacco curing.
- Medicinal purpose.
- Trees provide materials for building.
- Provide shelter in time of intense heat.

Soil

Soil means loose fine material covering the earth's surface.

The main components of soil

1. **Mineral matter** (it includes sand, silt and clay) that occupies 45% of soil volume.
2. **Organic matter** or humus occupies 5%
3. **Soil air** occupies 25% of soil volume.

4. **Soil water** occupies 25% of soil volume.
5. **Soil living organisms** ranging from microorganisms to large animals that burrow into the soil.

Importance of soil

- It anchors plants.
- It provides nutrients to plants.
- It provides soil water to plants.
- It keeps warmth for seed germination, dissolution of nutrients and microbial activities.

Sunlight

This is light that from the sun.

Light intensity

It is the measure of the strength and brightness of light reaching the Earth's surface.

Factors that determine light intensity

- a. **Cloud cover:** during clear skies, light intensity is very as higher than during dense and extensive cloud cover.
- b. **Time of the day:** there very low higher intensity during midday than morning and evening.
- c. **Shading:** shade reduces light intensity

Influence of light intensity on the plant responses

- a. **Photosynthesis:** the rate of photosynthesis increases with increase in light intensity.
- b. **Seed dormancy:** some seeds require to be exposed to light in order to germinate, e.g. lettuce seeds.
- c. **Etiolation:** this is the aspect of a stem to grow long, thin and pale due to low light intensity. Plants have long internodes. The problems are caused when plants shade each other which causes lodging of plants and lower the rate of photosynthesis.
- d. **Tillering:** it is the growth of secondary stems at the base of the main stem. This is caused by good light intensity. This increases productivity in crops like tea, wheat, rice and barley. Due close plant spacing, there is reduced light penetration that in turn also reduces Tillering.
- e. **Flowering and grain filling:** shading affects flowering and fruiting.

Ways of improving light intensity in crops

- Pruning that ensures that crops do not shade each other.
- Thinning

- Weed control
- Use of ultra-heat sensitive greenhouse cover sheet that accumulate light intensity and filters short wavelength light to protect the crops.
- Staking the climbing crops such as beans.

Importance

- Plants use it for photosynthesis. This is a food making process whereby green plants combine water with carbon dioxide using light to produce glucose and release oxygen.
- It is sources of heat energy used for proper drying of crops.
- It provides heat necessary for controlling some pests e.g. eelworms.

Wildlife

This is a term used to describe undomesticated animals and plants

Importance

- Sources of income
- Sources of foreign exchange mostly through tourist
- Prevent effects of climate change
- Maintain the ecosystem
- A reserve for biodiversity

Minerals

A mineral is an element or chemical compound that is normally crystalline and has been formed as a result of geological processes.

Importance

- They are absorbed by plants for their normal growth and yielding.
- Dietary minerals are used by humans for their normal body functioning so that they are fit for agricultural operations.
- Some minerals like coal are used as a source of energy needed on a farm – example curing tobacco.
- They are a source of income through export so that a country

Light duration

It is the relative length of light and dark periods in a day. Along the Equator, dark and light hours are equal. Light intensity decreases with distance from Equator. On the other hand, dark hours increase with increase in distance from the Equator.

Plants are grouped into three groups according to their light requirements namely:

- Long-day plants:** they do well when they are exposed to long periods of light.
- Short-day plants:** they do well when they are exposed to short periods of light, such as soya beans, tobacco and rice.
- Day-neutral plants** do well irrespective of light periods.

Light wavelength

It is the quality of light which can be expressed as **short wavelength** and **long wavelength**.

Long wavelength is a visible light which is an important source of energy for plant growth. It facilitates photosynthesis. It is natural light from the sun and other artificial sources of light.

Short wavelength is the one outside visible light which include gamma rays, infrared waves, ultraviolet rays, microwaves and radio waves. These are harmful wave lengths and prevent photosynthesis.

Ways how natural resources are depleted

Water

- **Evaporation:** water from the soil and water bodies like rivers, lakes and oceans changes into gaseous water and goes into the air.
- **Transpiration:** this is the loss of water by plants in form of vapour. It should be noted that the water lost by plants is first absorbed from the soil.
- **Irrigation:** this occurs when water from reservoirs is used to grow crops.
- **Domestic use.**

Air

Human activity contributes to the availability of harmful and unnecessary gases in the atmosphere in several ways as outlined below:

- Dust which is often a bi-product of agricultural processes.
- Biomass burning produces a combination of organic droplets and soot particles
- Industrial processes (factories) produce wide variety of gases depending on what is being burned or produced in the manufacturing process
- Exhaust emissions from different transport systems like trucks, locomotive and cars.

These generate a great deal of gases which pollutes the air.

Vegetation

Vegetation has been reduced mainly due to human activities such as:

- Opening of new farms
- Clearing land for construction of buildings, roads and various infrastructures
- Fuel wood
- Timber and poles
- Bush fire

Soil

Erosion is the major way soil can be lost. Erosion is the washing away of top loose material either by wind or water. In Malawi, major agent of erosion is water.

Types of Erosion

a. Water erosion

This includes:

- Splash erosion
- Rill erosion
- Sheet erosion
- Gully erosion

b. Wind erosion

This may be caused whirl wind

Effects of soil erosion

- It leads to loss of plant nutrients which reduce crop yields.
- It exposes plant roots that cause weak anchorage and crop lodging.
- Eroded soil buries crops
- Land becomes degraded and results in low productivity.
- It raises the cost of production in an attempt to control soil erosion
- It leads to loss of beneficial soil organisms.
- Wind erosion causes poor visibility.

Wildlife

As already indicated, wildlife means undomesticated plants and animals. The environment you see today was not like these 20 to 50 years ago. There were very dense forests in various areas. Wild animals were not difficult to find.

Wild life has been depleted through:

1. Deforestation

As human population increases, so does the demand for lands for settlement and agriculture. As a result, people may have very little option but to clear the land by felling the trees. They also cut down trees for fuel wood and construction.

2. Poaching and hunting

Humans have been hunters for food since time immemorial. As the animals became fewer, the government set aside protected areas where animals can be preserved. However, some people go into these areas to hunt illegally. This is called poaching.

3. Wildfire

This kills vegetation and animals

4. Encroachment in protected areas

People either open garden or clear such land for settlement.

How minerals salts can be depleted from the soil

As crops grow in the garden, they make use of minerals salt.

1. Plant uptake

2. Soil erosion:

Agents of soil erosion such as water and wind do not only take away soil particles, they also take mineral salts they hold

3. Leaching

This is when dissolved mineral salt are take deep into soil where plants roots cannot reach

5. Formation of compound which are not usable by plants

6. Mining

The Meaning of Conservation for Nature Resources

Conservation of natural resources means wise use of the earth's resources by humanity. It involves proper utilisation of these resources to avoid depletion or destruction.

Ways of conserving natural resources

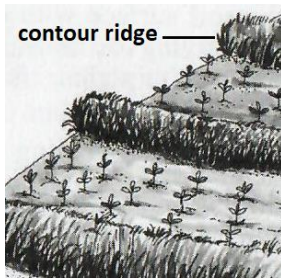
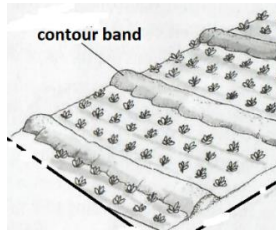
a. Cultural method such as:

- Practicing zero/no tillage
- Use of machine
- Mulching
- Correct plant population
- Early planting \and fertilizer application

b. Physical method like:

- Contour ridging: contour ridge is a large and raised band of soil constructed following contours and

planted with some vegetation, such as reeds or sisal.



- Making contour or graded bunds: it is the same as contour ridge, the only difference is that no vegetation is planted here.
- Establishing fish ponds
- Making ridges across the slope
- Constructing box ridges
- Making storm drains
- Making terraces on steep slopes in order to check the run-off.

c. Biological method such as:

- Planting trees and grass on bare land
- Making fire breaks

Ways of conserving natural resources

1. Soil

Soil conservation is a set of management strategies for prevention of soil being eroded from the earth's surface.

Method of the soil conservation

a. Cultural method

i. Crop rotation:

Crop rotation is the practice of growing a series of different types of crops in the same area in sequential seasons. In the next season, the plots are allocated with different crops.

- When the crops that cover the soil rotated with non-cover crops, there is a significant reduction in soil loss.
- Protection against soil loss is maximized with rotation methods that leave the greatest

mass of crop residues on top of the soil.

ii. Correct plant population:

A plot can have correct plant population if the following are correct:

- Space between rows or ridges
- Space between plants
- Number of plants per station

The correct plant population ensures complete soil coverage so that the soil well protected from raindrop impact and running water.

iii. Application of organic matter

Organic matter loosens the soil particles so that when it rains, the water sinks. The volume of the soil also increases so that it can hold a great volume of water before it overflows.

iv. Controlled grazing

This ensures that the pasture is not overgrazed and the land does not lose the grass coverage which protects the soil from erosion.

v. Zero or minimum tillage

Zero tillage, also called no-till farming or planting, is a way of growing crops from year to year without disturbing the soil through ploughing. No-till is an agricultural technique increases the amount of water and organic matter (nutrients) in the soil and decreases erosion.

vi. Correct land use

Every land is allocated with an agricultural activity which will protect the land. For example, hilly areas need not be opened to arable crops but trees or perennial crops like tea to avoid erosion.

There are two main methods of land conservation follows:

a. Biological methods

Such as planting vegetation like trees and grass on bare land. The aim is to ensure that soil is not exposed to agents of erosion.

b. Physical methods

This involves building physical structures such as terraces, contour or graded bands, ridges across the slope, box ridges, storm drains and dams. The purpose is to hold rain water and allow it to sink while at the same allowing excess water to drain away from the field of crops without being erosive.

Water conservation

Water is basically conserved in the soil and dams. Efforts used to conserve soil also conserve water.

Cultural methods of water conservation

The methods such as crop rotation, correct plant population. Controlled grazing, zero grazing and correct land use aim at ensuring that there is always adequate soil coverage to the soil so that when it rains, most of the water is trapped and forced to infiltrate into the soil.

a. Biological methods of water conservation

Biological methods basically depend on planting vegetation on bare land. People are also discouraged from setting bush fire and wanton cutting down of trees. The vegetation helps to open up the soil, trap running water thereby increasing rate of water infiltration into the soil.

b. Physical methods of water conservation

Recall that these methods make use of physical conservational structures such as box ridges, contour bunds, dams, storm drains and ridges across the slope. These

structures trap and hold increase infiltration.

Air conservation

- Restricting the use of chlorofluorocarbons (CFCs). These man-made compounds were produced for industrial use, mainly in refrigerants and air conditioners. They are now regulated under the Montreal protocol due to their adverse effect on the Ozone layer.
- Conservation of vegetation. Vegetation uses up carbon dioxide for photosynthesis. Of this gas in the atmosphere. The vegetation also covers up the soil and reduces dust.
- Avoid bush fire which emits smoke and their gases.
- Avoid smoke producing vehicles and locomotives.

Effects of rapid increase on natural resources

- Deforestation
People cut down trees as a source of wood energy to build house, or to create a place to grow food
- Pollution
Fires, cars, and factories make a lot of smoke come out from different places, especially in towns and cities and sometimes villages too.
- Cultivation of marginal land
- Desertification: it is because of excessive destruction of vegetation.
- Land degradation due to:
 - ✓ Overstocking and overgrazing
 - ✓ Continuous cultivation
- Setting bushfires

UNIT 2

THE MEANING OF AGRICULTURAL RESEARCH

Success Criteria**You must:**

1. Define the term 'agricultural research'
2. Explain the importance of agricultural research
3. Identify agricultural problems on which to conduct research
4. Explain the link between agricultural research and agricultural technology
5. Discuss the scientific approach to agricultural research

Agricultural research is a scientific and systematic procedure of finding solutions to agricultural problems.

Importance of Agricultural Research

The importance of agricultural research cannot be over-emphasized. You may recall that your parents never grew hybrid maize.

- Coming up with high yielding varieties of crops and breeds of livestock in order to increase food production, thereby reducing hunger.
- It helps to come up with better storage facilities in order to reduce post-harvest storage losses.
- Farmers can sell excess harvest for each.
- Due to increase productivities, the other land can be used for other agricultural activities e.g. livestock.
- It determines ecological conditions for various crops and livestock
- It helps to come up with new technologies that help to improve agricultural productivity.

Agricultural Problems on Which to Conduct Research

- a. Low quality of agricultural yields
- b. High susceptibility of agricultural pests, parasites and diseases.
- c. Spoilage of agricultural produce before consumption
- d. Effectiveness and ineffectiveness of agrochemicals.
- e. Land husbandry
- f. Crop husbandry practices
- g. Poor crop varieties
- h. Poor livestock breeds
- i. Livestock husbandry practices

Scientific approach to agricultural research

The scientific approach involves several stages. Do you have an idea of what these stages are?

The approaches are:

1. **Identify a problem or an area of study:** For example, a problem that could be faced by farmers could be "Of so many types of fertilizers available, what could be the best type of fertilizer for maize production?"
2. **Propose a hypothesis (guessed answer):** this is an answer which will be proved or disproved.
3. **Clearly state aims of the experiment:** this is what you want to achieve.
4. **Experimental design:** this means planning the layout of the experiment i.e. how the experiment will appear in the field.

Factors to consider when carrying out agricultural research experiment

- Treatment
- Replication
- Randomization

Treatment

This is a variable or feature or quality which may change or differ or vary. For example, in the experiment above what may vary would be the type of fertilizer under study. Propose types of fertilizer you know.

Plot 1	CAN
Plot 2	Urea
Plot 3	Sulphate of ammonium
Plot 4	No fertilizer

A simple experiment may appear as in table 2.1 above.

Replication

Plot	Block 1	Block 2	
1	CAN	CAN	CAN
2	urea	urea	urea
3	Sulphate of ammonia	Sulphate of ammonia	Sulphate of ammonia
4	No fertilizer	No fertilizer	No fertilizer

Replication means repeating the same experiment in different plots of the same field or at another place.

The importance of replication is to remove environmental differences which may exist e.g. soil fertility, structure, and texture. These differences affect results of the experiment.

Randomization

It means allocation of treatments to plots or blocks by chance. This is because it gives reliable results. For this reason, treatments must be randomized i.e. allocating treatments should be by chance and not using human idea.

Methods of randomization

- Tossing a coin. How many treatments would best use this method?
- Throwing a dice. How many sides have a dice? The sides would determine number of treatments.
- Use a piece of paper. The number of treatments would determine number of papers to be used i.e. if there are five treatments, there is need to use five papers. Each treatment is written on each paper and folded. Each piece is picked in turns and allocated to a block.

	Blk 1	Blk 2	Blk 3	Blk 4
Plot 1	CAN	Urea	Manure	DAP
Plot 2	Urea	DAP	CAN	Manure
Plot 3	DAP	Manure	Urea	CAN
Plot 4	Manure	CAN	DAP	Urea

Types of experimental design

a. Randomized block design

In this design (table 4 above)

1. There are two or more blocks i.e. replicates.
2. Each treatment appears once in block
3. Treatments are randomly allocated to the blocks

b. Latin square design

1. Numbers of blocks are equal to number of treatments
2. Each treatment appears once in a block
3. Each treatment appears once in a block and also once in a plot.

Carrying out experiment

The following are the stages which are taken when carrying out an experiments:

- i. Carry out field operations, e.g. land preparation, planting, applying fertilizer.
- ii. Data collection through observations and measurements. You observe leaf colour, disease incidences and presence of pests and diseases.
You measure height and weight using ruler/tape measure and scale respectively.
- iii. Data Recording: data is recorded in tables, pie-charts, histogram, bar graph and line graph.

Plot	BLOCK	Yield (Kg)
1	CAN	5,500
2	Urea	6,000
3	DAP	3,500
4	Manure	500

iv. Analyzing data

Data collected undergoes processes as follows:

- Calculation percentages e.g. germination percentage, survival percentage.
- Calculation of average or mean.
- Calculation of the range
- Data is analyzed to give a true reflection of the results.

v. Data evaluation

This is a summary of the finding in which the researcher discusses, concludes and recommends the finding to the farmer.

vi. Report Writing

Write a report of the experiment which was conducted.

UNIT 3

THE MEANING OF AGRICULTURAL TECHNOLOGY

Success Criteria

You must:

1. Define agriculture technology
2. Explain the importance of agriculture technology
3. Outline types of farm structures
4. Describe types of farm structures

Meaning of agricultural technology

It refers to the use of scientific tools and techniques for carrying out tasks in agriculture.

It also refers to tools, equipment, machinery and structure used in agricultural production.

Importance of agricultural technology

- It is fast and efficient. For example, it is faster to cultivate using a tractor than people.
- It is sometimes cheaper than using human labour.
- It helps to assess nutritional needs of the citizens
- It enhances the natural resource base and environment
- Improves environmental conservation by encouraging farming practices such as ploughing
- Improves adaptability to local ecological set-up
- They can only be done in certain tasks such as spraying chemicals, cutting down trees and mixing animal feed.

Link between agricultural research and agricultural technology

The research in agricultural technology forms the basis of improved agricultural productivity by:

- Improving crop yielding ability
- Improving crop resistance to pests, diseases and drought.
- Improving adaptability to various ecological conditions.
- Improving storage qualities of fruits

Farm structures

They refer to all physical constructions that are put up in a farm for the purpose of livestock and crop production.

They also refer to all physical constructions constructed or fixed to ground to aid agricultural production.

Categories of farm structures

a. Crop storage structures

They are used for preserved harvested crops for future use. They include:

- Granaries

They are used for storing unshelled grain crops and legumes like maize, millet and groundnuts.

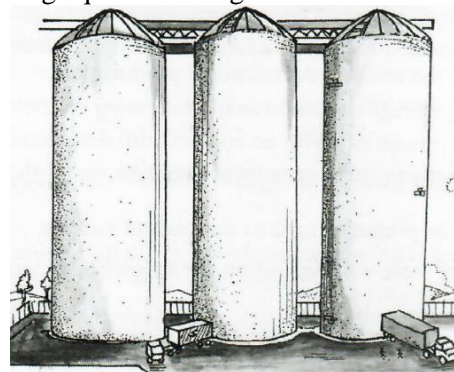


Maize granary

They are made of bamboos, grass and reeds.

- Silos

They are air-tight containers that hold large quantities of grains.



Grain silos

Some are locally made such as clay pots and drums.

- Grass baskets
- Grain drums/tanks
- Sacks
- Warehouse

They are used for storing animal feeds, farm tools and raw materials.

b. Crop processing structures

They are used for changing the farm produce to another form. They include:

- Maize driers
- Pulping machines for pulping coffee berries
- Maize millers
- Tobacco burn
- Silage making silos (pit silos, tower silos, clamp/bunker silos)
- Oil processing machines
- Forage harvester
- Cribs

They are used for drying crops like maize and groundnuts before they are shelled. They are made on a raised platform but they are more temporary than granaries.

c. Animal housing structures

- Battery cage house
- Coops (types of cages for rearing chickens)
- Fold or ark (it has both run and shelter sections for chickens. It made of mesh wire.
- Deep litter house
- Fish ponds
- Cattle crash
It is used for holding animals for easy handling during drenching, vaccinating, castrating and branding.
- Spray race
It is used for spraying animals in order to control external parasites.
- Milking parlour
It is used for handling animals when milking.
- Abattoirs
- It is used for slaughtering animals.
- Bee hives
- Fence
It is an encloser that limits or controls the movement of animals. It is also

constructed around the vegetable garden.

- Piggery: a pig house
- Irrigation channels
- Physical conservational structures like storm drains and bunds.

Importance of using farm equipment and tools

- They improve efficiency and speed up farm operations
- To minimize injuries to farmers and livestock
- To enhance milk production when using milking machine.

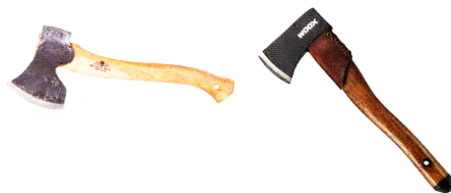
Categories of farm equipment and tools

a. Garden tools and equipment

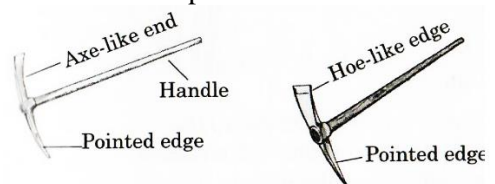
- Machetes



- Axe



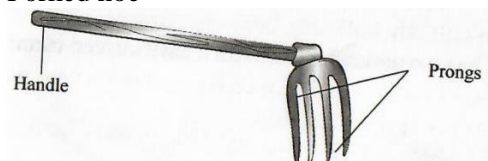
- Mattock or pick axe



- Hoe



- Forked hoe

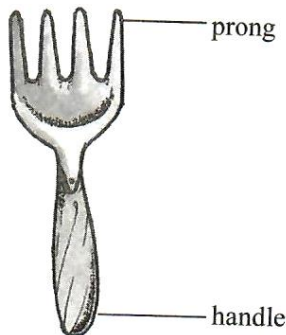


- Spade

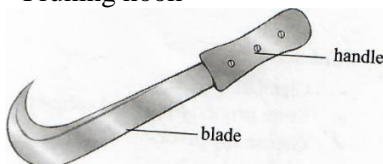


- Wheelbarrow
- Watering cane
- Rake

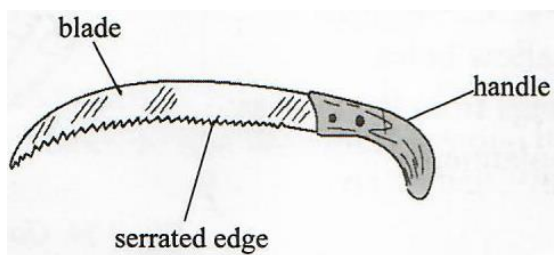
- Knapsack sprayer
- Garden fork



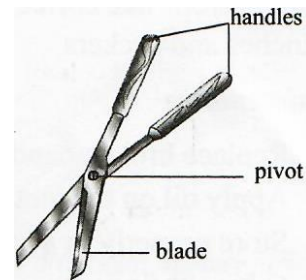
- Sprinkler
- Pruning hook



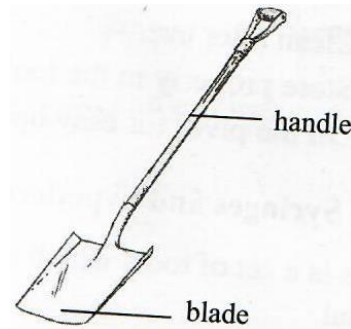
- Pruning saw



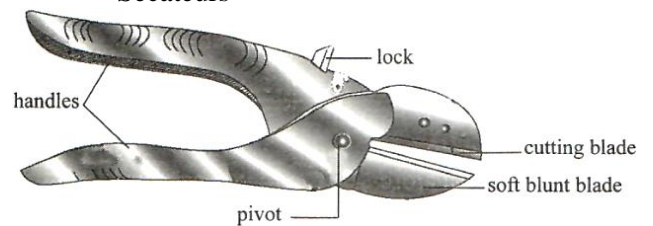
- Garden shear



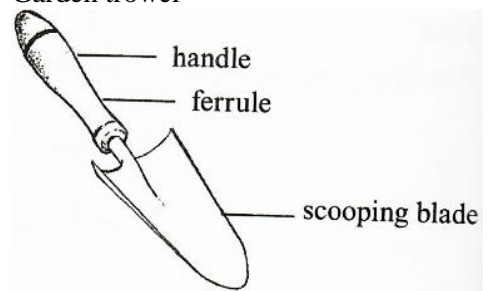
- Shovel



- Secateurs

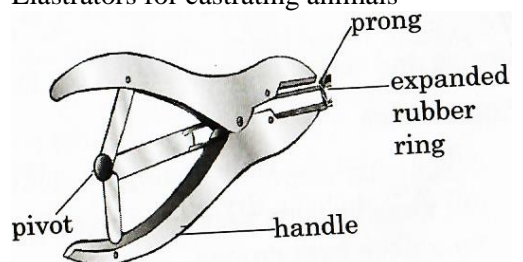


- Garden trowel

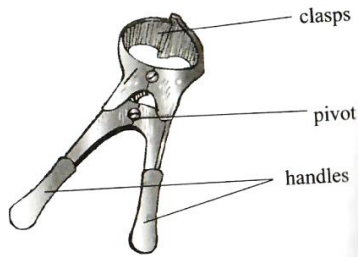


b. Livestock production tools and equipment

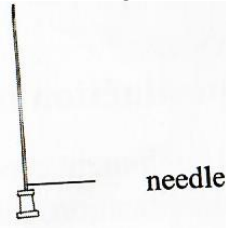
- Elastrators for castrating animals



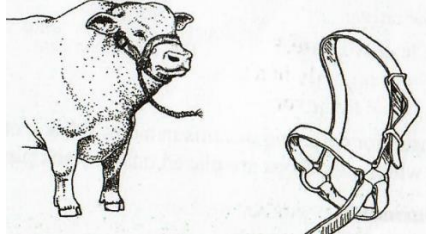
- Burdizzo for castrating animals



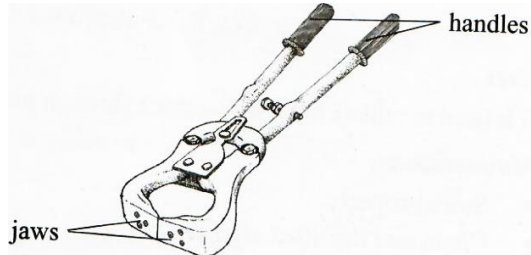
- Syringes and hypodermic needles for injections and taking blood samples



- Halter for restraining cattle



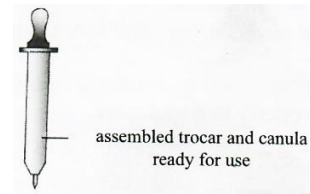
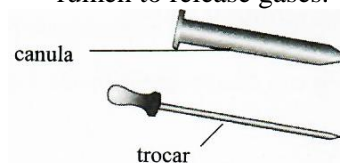
- Hoof trimmer



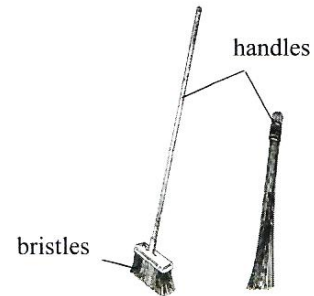
- Strip cup for detecting mastitis in cattle



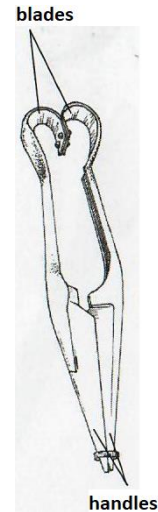
- Trocar and canula used for relieving bloat in livestock through piercing the rumen to release gases.



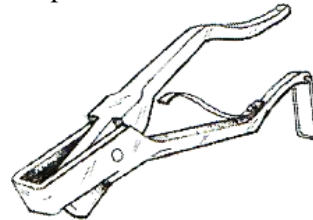
- Hard broom for washing concrete floors



- Wool shears for shaving wool in sheep



- Ear notcher for cutting identification shapes on ears of animals



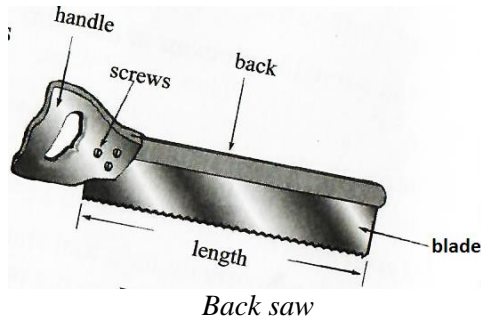
- Bull ring and lead stick for restraining bulls
- Stir-up pump (bucket pump) used for hand spraying animals against external parasites.
- Milk churn for storing and transporting milk

- Milk strainer or sieve used for removing impurities from milk
- Hot iron for destroying horn buds to prevent the growth of horns
- Teeth clipper for cutting off sharp teeth
- Drenching gun or dosing gun for the administration of oral liquid drugs
- Bolus gun for deworming animals
- Dehorning wire for dehorning cattle
- Chaff cutter for chopping straw, hay or grass into small pieces

c. Workshop tools and equipment

They are used for the construction and maintenance of farm structures. They include

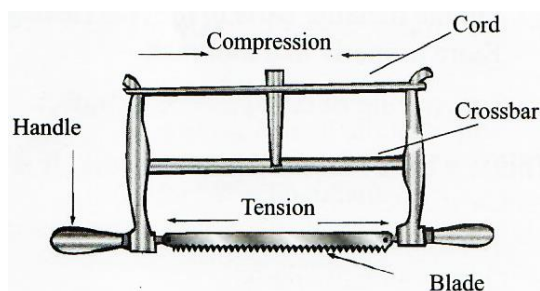
i. Woodwork tools



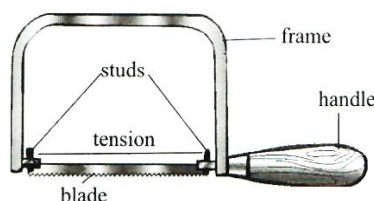
Back saw



Crosscut saw



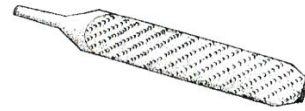
Bow saw



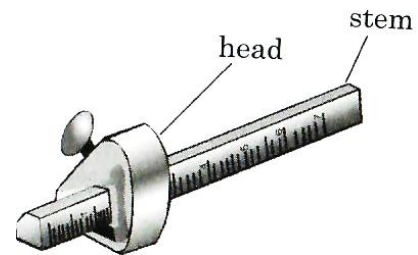
Coping saw



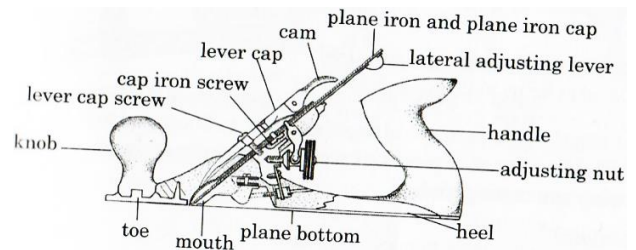
Rip saw



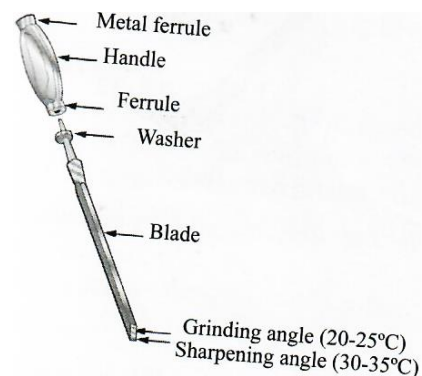
Wooden file



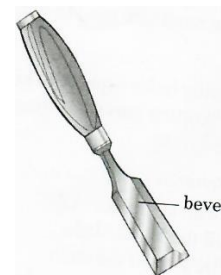
Marking gauge



Jack plane



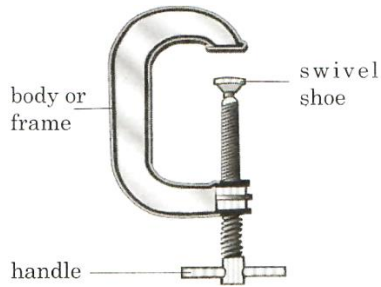
Sash mortise chisel



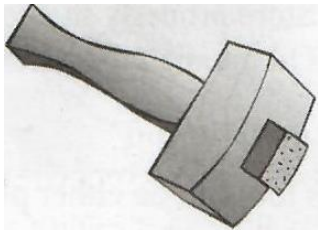
Firmer chisel level edge



Claw hammer



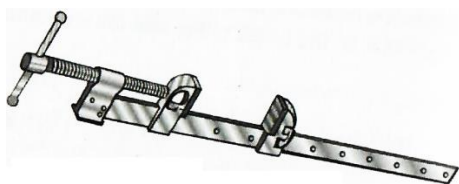
g-clamp: for holding pieces of wood



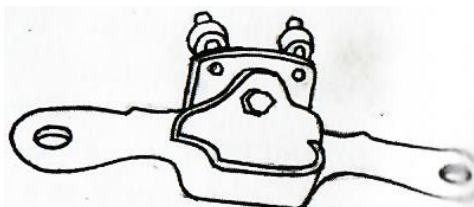
Wooden mallet: for driving in wood chisels



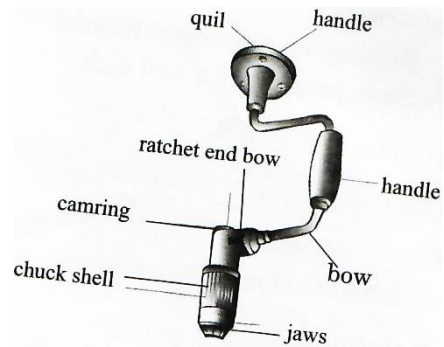
Striking hammer



Sash clamp



Spoke shave

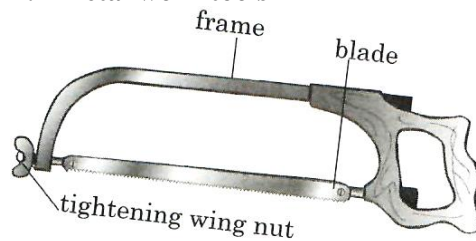


Brace and bit



Drilling bit

ii. Metal work tools



Hacksaw



Round-nosed chisel



Wire strainer: for tightening barbed wire during fence construction



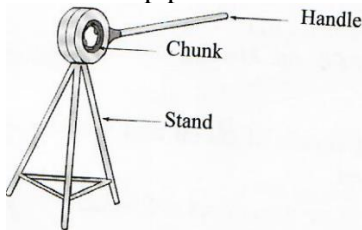
Plier: for holding and cutting wire pieces

iii. **Plumbing tools and equipment**

- Hack saw for cutting metals and wires
- Pipe wrench for opening and closing water pipes.

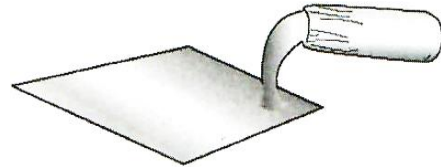


- Pipe cutter for cutting metal water pipes.



- Stock and die for cutting threads on pipes

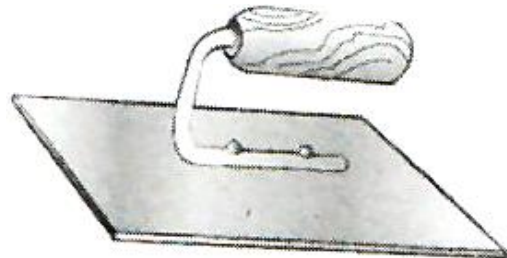
iv. **Masonry or construction tools and equipment**



Mason's trowel: for laying mortar during construction



Wood float: for smoothing concrete



Metal float: for smoothing concrete

Factors to consider when choosing tools and equipment

- Task to be performed
- The tool's efficiency
- The level of knowledge and skill of a user
- Availability of tools and equipment

UNIT 4

PROPER USE OF FARM STRUCTURES

Success Criteria

You must:

1. Discuss farm safety rules when using farm structures
2. Explain the importance of observing safety rules when using farm structures

Possible sources of danger on a farm

- Poorly stored agrochemicals
- Poor arrangement of tools and equipment in a workshop
- Careless exposure of highly flammable chemicals such as petrol
- Heavy rains washing structures, e.g. bridges
- Collapsing buildings
- Untrained personnel operating some machinery
- Failure to observe procedures before taking livestock to the dip tank
- Slippery floors in animal houses
- Broken pieces of glasses lying on the floor/ground

Farm safety rules when using farm structures

1. When spraying chemicals
 - Wear protective clothing such as face masks, gloves and gumboots.
 - Wash hands after spraying
2. Keep the farm structures in good condition all the time.
3. Equipment and all materials should be well arranged for easy inspection and access when needed.
4. Keep the farm structures away from the dwelling houses that cannot be accessed by children.
5. Exits in warehouses should be wide enough for free exits in times of fire.
6. Switch off all the engine during servicing.
7. Do wear loose clothing when servicing engines.
8. Store all fuels and chemicals away from children.
9. Check farm machineries before using them, e.g. breaks
10. Only trained and skilled should operate farm machinery

11. Using tools and equipment correctly
12. Do not smoke, eat or drink when spraying chemicals
13. Washing hands with soap after using chemicals
14. Repair all broken tools to avoid accidents.
15. Keep safe distance with others when using tools to avoid accidents.
16. Children should stay away from working machines

Importance of observing safety measures

- a. Substandard construction on a farm is avoided and the structures are durable.
- b. Well stored tools do not rust and cannot be stolen.
- c. Accidents are prevented on a farm when farm tools are stored properly
- d. Keeping highly inflammable chemicals helps to avoid dangerous fires
- e. Washing hands properly with soap after using chemicals keeps a farmer safe from swallowing toxic substances.
- f. Shunning smoking near the working machines and inflammable chemicals prevents fire accidents
- g. Proper lighting prevents accidents

Maintenance of roads and bridges to avoid accidents on a farm

- Tarmac roads should be recarpeted when worn out.
- Earth roads should be graded
- Clearing trees whose canopy block roads
- Raising bridges which allow water to overflow in rainy season
- Regular maintenance of damaged bridges
- Clearing vegetation on a sharp road bend/corner.
- All roads signs should clearly visible
- All drainage channels should be cleared of vegetation

UNIT 5

FARM BUSINESS MANAGEMENT

Success Criteria**You must:**

1. Explain basic farm business management concepts
2. Name factors of agricultural production
3. Describe the main factors of agricultural production
4. Explain how each of the factors influence agricultural production

Basic Concepts of Farm Business Management

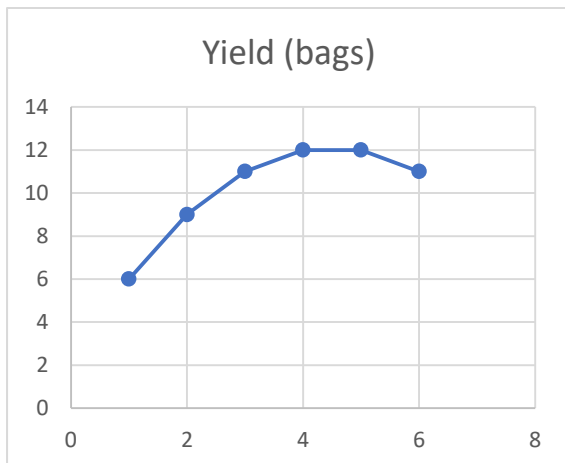
1. Production
2. Financing
3. Budgeting
4. Record keeping
5. Business decision making

Production

It means changing inputs into outputs which are needed by the consumers at a profit.

Inputs should be of the right quantity in order to make enough profit. This means that too little or too much of them is not important for a better profit as illustrated in the production curve below.

fertiliser (bags)	Yield (bags)
1	6
2	9
3	11
4	12
5	12
6	11



Product curve

The Product Curve above Shows that:

- Yields increase as the farmer increases the input (yield increase at an increasing rate).
- Yield increases as the farmer continues to increase inputs, such as above 4 bags (yield increase at a decreasing rate).
- Yield starts to decline if inputs continue to be increased.

Importance of production

- It provides employment
- It provides food to all people
- It provides market for industrial goods
- Production of raw materials for industrial use
- Source of government revenue
- It provides foreign exchange
- It improves standards of living to farmers

Financing

It means acquiring funds and making them available for the production. It is used for buying inputs and paying for the services on the farm.

Sources of Finances on the Farm

- a. Commercial banks
- b. Friends and relatives
- c. Self-savings
- d. Personal savings
- e. Village banks
- f. Grants or donations

Financial Management Principles that must be used on a Farm

- Obtaining credits from institutions which charge low interests.
- Buying cheap inputs from suppliers.

- Ensuring that liquid capital is readily available for the day to day operations.

Budgeting

Budget is a financial plan of income and expenditure over a period of a given time.

Importance of Budgeting

- It helps to stick to his/her plan.
- It helps to estimate the required production resources such as land.
- It is a useful documentation for negotiation of credit from financial institutions.
- It helps to improve practicability in the farming process
- It helps to identify progress of recess in the farming business based on the set alternatives.
- It encourages hard work and efficiency so as to meet the set objectives
- It helps a farmer to allocate resources to various enterprises which are profitable.
- It shows a farmer expected profit from each enterprise and is able to choose wisely.
- It tells a farmer expenses expected in advance and is able to finance activities adequately in advance.
- It helps in making sound and urgent decisions when comparing various alternative enterprises

Types of budgeting

- a. Partial budget
It shows the financial implications of proposed minor changes on the farm.
- b. Complete budget
It shows major changes on the farm when adopting new developments. It includes both fixed and variable costs.

Record Keeping

Farm records are the systematic entries of various farm activities and transactions in suitable books or on paper sheets.

The following are examples of different types of information kept as farm records:

- Planting dates
- Breeding dates
- Amount of livestock feeds
- Type and amount of fertilizer

Importance of Farm Records

- They tell a farmer whether the farm is making a profit or not.
- They help a farmer to make a progress or not.
- They help a farmer to know whether he/she is using the right quantities of inputs or not by making comparisons with the past records.
- They help to check the effectiveness of the production methods.
- They help a farmer to identify problems and weaknesses as they occur and is able to prevent them in future.
- They help a farmer to know whether the resources are available or not.
- They help a farmer to know whether he/she is credit worthy or not.

Business Decision Making

It refers to mental process resulting in the selection of course of action among several alternative scenarios.

Important decisions that farmers make

- a. **What to produce**
It is all about the type of enterprise.
Such animal and crop production
- b. **How much to produce**
It is about the size of production in relation to resources available.
- c. **When to produce**
It is a question about season such as dry or wet season.
- d. **How to produce**
It considers resources and techniques that may be used. E.g. whether to use hired labour or not, organic fertilizer or inorganic fertilizer
- e. **When to sell the produce**
Farmers make decision about when to sell their produce at a high price in order to make a large profit.

Factors of Agricultural Production

The main factors of production include:

1. Land
2. Labour
3. Capital
4. Management

Land

It is where all agricultural activities take place. It encompasses all the land resources like water, vegetation, rocks and soil.

Labour

It refers to the effort of people in the process of production. It also refers to amount of work done by people and measured in man days or man hours.

Capital

Capital refers to all materials which are used in the process of production. It includes living and non-living resources such as machinery, forest, inputs, livestock, granary and animal feeds.

Management

It means use of farmer's intelligence in organizing and using land, labour, capital and management to achieve the optimum levels of production.

How Factors of Production Influence Agricultural Production**LAND**

Land is an integration of naturally existing resources such as water, soil, rocks and vegetation.

Challenges associated with land**a. Size**

- It looks at hectareage to be allocated to each agricultural enterprise.
- Small land prevents the expansion of agricultural activities.
- Small land cannot accommodate all the crops that a farmer wants to grow.

b. Quality

- Quality of soil is in terms of fertility, slope, texture of soil, structure of soil that determines water holding capacity.
- Infertile soil affects production.
- Steep slopes facilitate soil erosion.

Methods through which farmers acquire land

- Inheritance from parents, relatives or well wishers
- Buying land from village sellers

- Leasing land from landlords where a tenant pays a specific amount
- Allocation by government

c. Location

Land that is close to the market or road is good for agricultural production so that the produce can easily reach the consumers at a low cost.

d. Labour

Labour is a challenge on a big piece of land.

Types of labour**1. Family labour****2. Hired labour**

This is either *permanent* or *seasonal* labour. Seasonal labour is also called casual labour it is hired depending on the prevailing amount of work to be done. When it is over, it is no longer wanted.

Permanent labour is there in all seasons.

Labour Factors that Affect Agricultural Production**a. Number of people**

The more the people are there on the farm, the quicker the operations will be done.

b. Capacity to work

This is in terms of skills in certain operations that come through training, exposure and experience help to increase agricultural production.

c. Willingness to work

Desire to work for more time increases production

d. Health of the people

Health people boost production.

e. Social activities

They are occasions like wedding, funeral and many other social events that take farmers' time away from their work. They delay farming operations or reduce amount of work.

Measuring efficiency of labour

Labour is expressed in terms of work done within man-hours, man-days, man-weeks, man-months and man-years.

For example, 10 man-hours indicate a piece of work which can be done by:

- One person within a period of ten hours
- Ten people within a period of one hour

Ways of improving labour efficiency

- Providing training to labour force to acquire necessary skills that boost production
- Giving incentives as a motivation to work hard
- Using farm mechanization to speed up work
- Assigning specific tasks which may be completed in time.

CAPITAL

It is any material used for production.

Types of Capital

a. Working capital

They are referred to inputs which are needed for the daily running of a farming enterprise such as feeds, seeds, fertilizer and chemicals.

b. Liquid or circulating capital

This is cash. It is called liquid capital because it can be changed to other forms of capital or buying other forms of capital.

c. Fixed or durable capital

It involves all assets which are used over a long period of more than one growing season. They include irrigation structures, granary, farm tools and implements, machinery and buildings.

How farmers acquire capital

- Personal savings
- Borrowing from banks and other financial institutions
- Village banks
- Friends and relatives

Management

In farm management, there are two aspects of management:

Technical aspect

This is an aspect of scientific principle and skills of crop and animal production. A farmer may acquire this through training or by hiring an expert in a particular field.

Business aspect

It involves decision making and organizational skills of the available resources. A farmer may decide on various alternatives.

Elements of Management

- Planning the operations** on what, how, where and when.
- Budgeting**
Allocating all financial and non-financial resources to the enterprise
- Implementing plans** (putting the plan into action).
- Supervision** (it is about guiding and controlling the implementation of plans by the junior staff).
- Record keeping** (of both production and sales).
- Risk taking**
A farmer should bear the risks and uncertainties in to survive the misfortunes such as bad weather, fire and low prices.
- Evaluation**
It involves assessing the effectiveness of implemented plan. It helps to make changes or improvements on the farm.

Roles of a farm manager

1. Acquisition of knowledge or information relevant to the farm business. He/she must translate decisions into actions.
2. Implementing farm business decisions
3. Risk bearing
4. Keeping up-to-date farm records
5. Comparing the farm performance with neighbouring farms or recommended standards.

Other factors

- a. Market
- b. Climate
- c. Quota
- d. Pests and diseases
- e. Risks and uncertainties

Market

Market is a place or a structure that allows buyers and sellers to exchange any type of goods, services and information.

It also refers to people or customers who are willing to buy goods and services.

How market influences agricultural production

- Conducting market research. It involves gathering information about markets, prices and customers.
- It helps farmers to obtain farm inputs.
- It enables farmers to sell their produce.

Supply and demand influence prices at the market.

How to solve the challenges associated with climate

- Joining agricultural cooperatives in order to buy inputs in bulk at low prices.
- Processing adding value to commodities in order to attract more customers.

Climate

Climate is an average weather condition experienced in an area over a long period of time. Weather is the daily condition of the day. Each farming enterprise is suited to a particular climate.

How weather and climate influence agricultural production

- It helps farmers to choose agricultural enterprise that suit the existing weather conditions.
- Farmers harvest more yields when there is adequate rain throughout the growing season.
- Drought reduces yields.
- Strong winds destroy crops.
- Humidity facilitates flowering and fruiting.
- Sunshine encourages ripening of fruits and drying of crops.

How to solve the challenges associated with climate

- Diversification of enterprise
- Practicing irrigation to withstand dry spells.
- Buying an insurance policy in case of weather-related natural disasters (cyclones).

Quota

Quota is the maximum amount of goods and services that are supposed to be produced or supplied at the market. Quota is imposed on cash crops like tobacco, tea, sugar and coffee.

Quota helps to control supply of goods and services on the market. It controls excess production and supply of products which may increase wastage of resources. Farmers should produce only amounts which consumers are willing to buy.

Effects of over – production

- Prices go down because there too much of the commodity at the market.
- Excess commodity may not be bought at the market.

How quota influences agricultural production

- It restricts the production levels to ensure that there is no oversupply of commodities on a market.
- It also prevents farmers who have a capacity to produce more.

How to solve the challenges associated with quota

This can be solved through value addition (processing the commodities into other products that can attract many customers).

Pests and diseases

Pests and diseases affect agricultural production because they:

- Reduce the amount of yields.
- Reduce quality of the produce. They make holes into the parts of a plant.
- Increase the cost of production. A farmer loses more money buying chemicals to control the pests and disease.

How to solve the challenges associated with pests and diseases

- Diversification of enterprise
- Growing disease resistant varieties
- Insurance against any loss by diseases and pests.

Risks and uncertainties

Risk is a situation which a person takes with full information while uncertainty is when there is less than full information.

About risk, one can predict or foretell its probability.

Examples of risks

- Fire
- Accident to employees or employer
- Diseases and pest outbreaks
- Health of a farmer and his/her household
- Variation in crop yield.

Uncertainty refers to the state of imperfect knowledge about future event or outcome. It is unpredictable; one cannot tell what will happen in future.

Examples of Uncertainty

- Price fluctuation
- Uncertainty of physical yield
- Uncertainty associated with new production technique
- Changes in government policies (change or devaluation of currency).
- Breach of contract
- Unavailability of labour
- Scarcity of agricultural inputs.

How to solve the challenges associated with risks and uncertainties

- Diversification of enterprise
- Selecting more reliable enterprises
- Contract production
- Input rationing
- Flexibility in production
- Adopting modern production techniques
- Taking insurance cover.
- Weather forecasting
- Research and extension services
- Subsidizing input prices
- Market regulation

How to solve the challenges associated with factors of production**a. Challenges with land**

- Land degradation
- Land tenure system
- Loss of soil fertility
- Land use changes from agricultural to real estate and industrial development
- Continued land subdivision

- Vast idle land denies the country the opportunity for production

Solutions

- ✓ Reviewing land reforms to benefit landless people
- ✓ Controlling soil erosion
- ✓ Enforcing land use policies, i.e. introducing tax on idle land

b. Challenges with capital

- Lack of affordable credit facilities
- High interest rates on loans
- Lack of collateral for loans to young people
- Lack of saving culture hence low investment

Solutions

- ✓ Subsidizing farm inputs by government
- ✓ Lowering interest rates on loans
- ✓ Supporting the special groups with grants
- ✓ Creating more financial facilities for farmers

c. Challenges with labour

- Shortage of labour during peak season
- Lack of skilled for some tasks
- Low efficiency especially in manual operations
- Strikes reduce labour productivity

Solutions

- ✓ invest in labour training
- ✓ Motivating workers by rewarding them.
- ✓ Mechanise operations

d. Challenges with management

- Old age and young age
- Little experience or lack of managerial skills

Solutions

- ✓ Mixing both young and old people to enhance managerial skills.
- ✓ Providing education and training

UNIT 6

AGRICULTURAL MARKETING AND FOOD SECURITY

Success Criteria

You must:

1. Define the term 'agricultural marketing'
2. State the importance of agricultural marketing
3. State the principles of demand and supply
4. Describe the relationship between demand and price
5. Describe the relationship between supply and price
6. Discuss how market forces determine price.
7. Categorize marketing functions
8. Discuss activities in each category of marketing functions
9. Practice marketing functions
10. Describe problems associated with agricultural marketing and possible solutions

Meaning of agricultural marketing and food security

Meaning of agricultural marketing refers to the process which involves the transferring goods from a point of production to a point of consumption.

Market is a place where exchange of goods and services takes place. Market includes a trading centre, shops and supermarkets.

Market is also defined as a situation where buyers and sellers of a particular product interact.

Importance of agricultural marketing

- It helps farmers to obtain income
- It enables farmers to sell their produce.
- It enables the distribution of goods and services to the public.
- Creation of employment opportunities in transport, advertisement and other fields.
- It determines the prices of goods
- It ensures value addition through processing.
- It encourages farmers to produce high quality products.
- It is source of government revenue through tax charge of agricultural produce offered at the market.
- It gives the country foreign exchange through the exports

Market forces

Market forces refer to the interaction of demand and supply that shapes a market

economy. The market forces of *supply* and *demand* determine the price of commodities at the market.

The principle of demand and supply

Demand

Demand means the quantity of goods and services that a consumer is ready to buy at a given price and time. It is only what consumers can afford to buy.

Factors which influence demand

1. Price of related goods or services

Related goods substitute each other at a market. For example, instead of buying beef you may go for pork.

2. Population

Demand is high when there is a high population.

3. Income levels of consumers

Increased levels of consumers' income results in increased demand for goods and services

4. Taste and preference of consumers

Preference of goods is affected by the levels of education, economy, religion and social status.

5. Price expectations

Demand is high when consumers find price according to their expectations.

6. Government policy

When the government charges large taxes, the prices go up which lowers demand for goods and services. On the other hand, when the government subsidizes goods, the prices go down and demand rises.

7. Advertisements

Well pronounced advertisement increases demand for goods and services.

The relationship between demand and price

Price (MK)	Demand (kg)
10	100
15	90
20	80
30	70
40	55
50	40
60	30



- Quantity demanded increases when price decreases.
- Quantity demanded decreases when price increases.

Supply

It means the quantity of goods and services that a seller is willing to sell at a given price and time. Not all people sell their produce soon after harvesting, they and sell when the prices at the market rise.

Factors that affect supply

1. **Number of sellers of similar products at the market**
When the number of sellers of the same product increases, supply also increases.
2. **Price of related goods**
Increase in supply of related goods results in decrease in certain products.
3. **Change in technique of production**

Some production techniques lower the cost of production and raise supply. For example, the use of hybridization increase availability of certain products throughout the year,

4. Seasonal in weather

There is high production of certain commodities in one season due to favourable weather conditions which increases supply. For example, supply of mangoes is high in rainy season.

5. Price expectations

When farmers suspect the price to rise in future, they keep their goods and sell them later. This means that supply is low when prices are low; and increases when prices go up.

6. Government policy

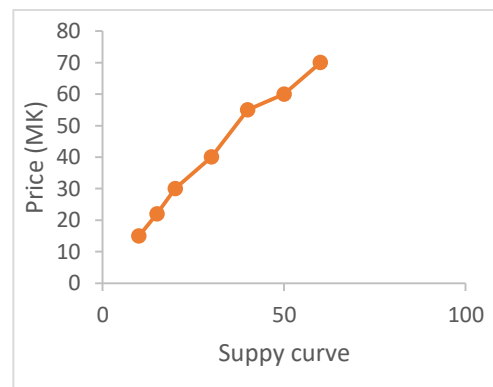
Quota and tax control supply of goods and services on a market.

The relationship between supply and price

Price (MK)	Supply (kg)
10	15
15	22
20	30
30	40
40	55
50	60
60	70

- Quantity supplied increases when price increases.
- Quantity demanded decreases when price decreases.

Demand and supply

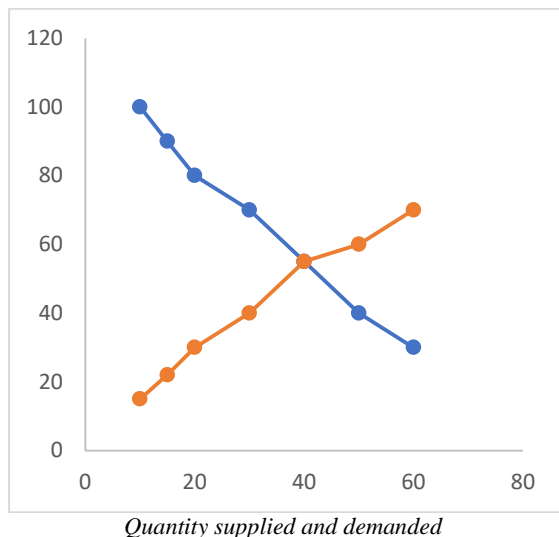


Supply and demand

- Demand is high when supply is low. It means there is scarcity of goods at the market and buyers are scrambling for the few resources.
- When supply is high, demand is low and the price drops.

Price (MK)	Demand (kg)	Supply (kg)
10	100	15
15	90	22
20	80	30
30	70	40
40	55	55
50	40	60
60	30	70

- The point when price and demand are equal is called an equilibrium point. The price charge at equilibrium point is called market price. This means that quantity supplied is equal to quantity supplied.
- If there is high supply of perishable goods like tomato, a farmer ends up reducing prices in order to avoid wastage.



Supply & demand curve

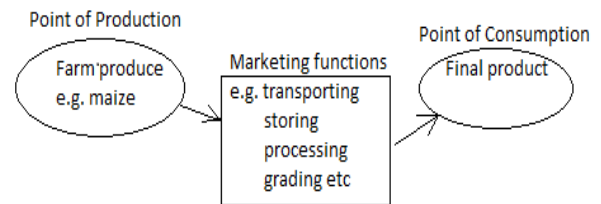
- In the figures above, K40.00 is a market price.

Marketing functions

Marketing functions are all activities which are carried out as the product moves from the point of production to a point of consumption.

Examples of marketing functions

- Processing
- Packaging
- Grading
- Sorting
- Transporting
- Storage
- Advertising
- Marketing bearing
- Risk bearing
- Buying and selling



Groups of Marketing functions

Exchange functions

They are activities done in the transferring of ownership of goods from producers to consumers.

They include:

- Buying
- Selling

Physical functions

They are about making goods available to consumers at a place, form and time most convenient to consumers. Examples are:

- Assembling
- Grading
- Packaging
- Transportation and distribution
- Storage
- Displaying

Facilitating functions

They make exchange and physical functions easy and smooth. They include the following:

- Financing
- Market intelligence
- Advertising

Buying

It involves paying money to acquire goods and services. Activities involved in buying are:

- Identifying suppliers.
- Selecting goods.
- Bargaining for better price.

- Paying for the goods and collecting them.

Selling

It means transferring the ownership of goods and services to a consumer. It involves the following:

- Assembling goods in large quantities.
- Packaging
- Displaying (arranging goods in attractive and suitable manner).
- Advertising through the media.
- Receiving payment for the product.

Transportation

It refers to a physical carriage of goods from one place to another.

Type of transport commonly used by farmers

- Bicycles
- Ox – carts
- Pick – ups
- Trucks
- Rail transport

Factors to consider when choosing the type of transport

- **Cost:** choose transport with reasonable charges to avoid making losses.
- **Quantity of goods:** choose transport according to size of the produce in order to enjoy high profit.
- **Distance:** choose efficient transport for a long distance.
- **Nature or perishability of the product:** the type of transport should suit the nature of goods. E.g. milk requires specially refrigerated road tankers.
- **Speed:** fast transport is good for highly perishable goods so that reach the market within a short time.

Processing

Processing is the changing of agricultural products into a form that consumers can use. Processing adds value to agricultural products that attract better prices.

For example, cotton is processed into a cloth.

Storage

Agricultural products are stored in various structures and containers to be sold at a higher price or used in future. Proper storage helps to solve the problem of seasonality of some

products. It ensures the availability of agricultural products throughout the year.

Grading

It is sorting the commodity according to uniform specifications, such as weight, length, colour, tenderness, texture, taste and presence of impurities.

Importance of grading

- It gives incentive to produce high quality products.
- It helps farmers to compare the prices of different commodities of the same grade at the market. It also enables to choose the best market where to sell the commodities.
- It enables consumers to buy according to their desired grade.
- It helps buyers and consumers to transact their businesses online without meeting physically.

Financing

It is about providing money to facilitate agricultural activities such as:

- Buying inputs
- Paying for the farm operations in case of hired labour.
- To facilitate the marketing functions.

Risk Bearing

A farmer should find ways of minimizing or handling risks and uncertainties.

Ways that farmers can minimize risks and uncertainties

1. Raising enough capital
2. Buying insurance policies
3. Diversification farming
4. Conducting market survey of market intelligence. It involves gathering information about the needs of customers before going to sell the commodities.

Information needed during a market intelligence

- Information about supplies
- Demand and supply
- Forecast on prices, supply and demand.
- Yield estimates in the coming season.

Common sources of market information

- Friends and relatives
- Newspapers
- Radios

- Television
- Ministry of Agriculture
- Internet
- ADMARC markets

Problems associated with agricultural marketing

- Seasonality of agricultural products. Some products are found only in one season.
- Bulkiness of agricultural products
- Farmers' lack of knowledge about marketing
- Perishability of the products
- Diverse nature of the products that may not attract customers
- Price fluctuations

Solutions to the problems of agricultural marketing

Problem	Solutions
Seasonality of products	<ul style="list-style-type: none"> • Irrigation farming • Proper storage

	<ul style="list-style-type: none"> • Preserving perishable products
Bulkiness of the produce	<ul style="list-style-type: none"> • Processing them • Using suitable transport
Diverse nature of products	<ul style="list-style-type: none"> • Grading • Processing them
Perishability of the products	<ul style="list-style-type: none"> • Preserving perishable products • Producing them near the market • Produce according to demand • Contract farming
Lack of market knowledge	<ul style="list-style-type: none"> • Teaching farmers about supply and demand
Price fluctuation	<ul style="list-style-type: none"> • Storing goods to sell in future when prices are high.

UNIT 7

AGRO-BASED INDUSTRIES

Success Criteria**You must:**

1. Explain the meaning of the term 'agro-based industry'
2. Identify agro-based industries in Malawi
3. Explain the role of agro-based industries in supporting the growing population

Agro-based industries are companies or agencies that deal with the supply, processing and distribution of farm products.

Types of agro-based industries

There are four types of industries namely

a. Primary Industry

It produces raw materials from the environment, such as agriculture, fishing, forestry and mining.

b. Secondary Industry

It turns raw materials into finished products. Industries that manufacture new products with employed labour is called factory. They include beer brewing, textile, cement making and soap making.

c. Tertiary Industry

It is concerned with distribution of goods and provision of services. E.g. transportation and extension services. Manufacturing does not take place here.

d. Quaternary industry

It collects and provides information as well as expert evaluation. It is also described as knowledge – based industry. Workers are highly qualified within their field of study. They include law, biotechnology and consultancy.

Groups of Agro-Based Industries**a. Agro-processing industries**

- Cotton ginning industries (Clark Cotton Malawi and Great Lakes Cotton Ltd).
- Milk processing industries (Dairy Board Malawi Ltd)
- Fruit processing industries (Dairy Board Malawi Ltd).
- Vegetable oil processing industries (Capital Oil Refining Industry Ltd).
- Meat processing industries Lilongwe Cold Storage Company Ltd.

- Tobacco processing industries (British American Tobacco Ltd)
- Tea processing industries (Malawi Factory Company Ltd)
- Coffee processing industries (Malawi Factory Company Ltd)
- Flour processing industries (Bakhressa and Milling Company)

b. Manufacturing industries

- Garment and textile industries (Mapeto Textile Ltd)
- Light engineering industries (Agrimal Ltd)
- Light chemical industries (Optichem Ltd)
- Animal feeds manufacturing industries (Charles Stewart Day-Old Chicks Ltd)
- Seed producing industries (Charles Stewart Day-Old Chicks Ltd)

The roles of the agro-based industries in supporting the growing population

- Feeding the country. E.g. Bakhressa and Milling Company sell bread and maize flour to the public.
- Providing employment to many people.
- They provide market for the agricultural products.
- They process the raw materials just to add value that fetch more money after sales.
- They supply inputs to farmers
- Providing farmers with inputs and other farming resources.
- Boosting foreign exchange through exports of agricultural products.
- Promoting international relations through multilateral and bilateral trade.

UNIT 8

FOOD DISTRIBUTION

Success Criteria

You must:

1. Differentiate 'food security' from 'self-sufficiency'.
2. Explain how proper food distribution ensures food security for the growing population
3. Explain how proper food storage ensures food security for the growing population
4. Explain how family size affects food security

Food security

It refers to the availability of food and one's access to it at all times.

Or, it refers to the accessibility of people to adequate, balanced, affordable, socially acceptable and safe food.

Components of food security

1. **Availability:** food should be supplied in adequate amounts to meet people's needs.
2. **Accessibility:** ability to have economic and physical means of obtaining food.
3. **Adequacy:** people should be able to have nutritious and safe food for a health-life style.
4. **Acceptability:** food should be accepted culturally.

Food self – sufficiency

This means the ability of a country to internally produce food that is adequate to meet dietary requirements for the population without importation.

At a family level, it also refers to the ability of people to produce enough food to feed them without relying on others.

People who are self – reliant do not beg from others. Begging gives a burden to others, when you do not get what you want you starve.

Factors that affect food security and food self – sufficiency

- Crop failure due to drought, pest and diseases and other environmental problems.
- Political instability, such as wars.
- Lack of capital and other economic means.

Food distribution

Food distribution refers to transporting food from one place to another.

Components of food distribution

1. Transport infrastructure (e.g. roads and bridges).
2. Food handling technology and regulation (e.g. warehouses, storage and refrigeration).
3. Adequate source and supply logistics based on supply and demand.

Factors that facilitate food distribution

- Some areas have surplus food while other have food deficit. Food is supplied to food deficit areas.
- Natural disasters that necessitate transportation of food to areas affected by disasters.
- Acute poverty to some vulnerable households.
- Need to cater for special groups, e.g. orphans.
- School feeding programs.
- Feeding refugees.

Agents of food distribution agencies

- a. Household: take food to the market.
- b. Marketing agencies: producers, middlemen, wholesalers, retailers and consumers.
- c. Government: through government agencies such as ADMARC and National Food Reserve Agency (NFRA), secondary schools, prisons, hospitals and other government institutions.
- d. Non – governmental organizations: i.e. UNICEF, WHO,

Proper food storage and food security

- It ensures that food is protected from spoilage and deterioration of quality.
- On–farm stores must be used sometimes for storage
- Proper food storage helps to stabilize prices.
- They also help to regulate food supply.
- They ensure availability of food for use.

- They ensure that the surplus food is stored for future use.

Family size and food security

- Large families endanger food security by excreting pressure on scarce production resources.
- Most households are both producers and consumers.
- Large families provide labour for agricultural production, hence leading to surplus production.
- There is high expenditure for food consumption more than investing in farming.
- Malnourished children due to insufficient food.

How proper food distribution ensures food security for the growing population

- It ensures that people get food which they cannot produce on their own. For example, not all people grow rice in Malawi but still they get it from shops.
- Food is sent to where it is needed

UNIT 9

ESSENTIAL PLANT NUTRIENTS

Success Criteria**You must:**

1. List essential plant nutrients
2. Classify essential plant nutrients into macro nutrients and micro nutrients
3. Explain the role of essential plant nutrients in plant growth and crop production
4. Explain how the essential plant nutrients are depleted from the soil
5. List sources of essential plant nutrients
6. Describe the deficiency signs of essential plant nutrients
7. Apply appropriate chemical fertilizers and organic manure.

Essential plant nutrients

Essential plant nutrients are the chemical elements required by plants for optimal growth and development.

Sources of essential plant nutrients

- Decayed organic matter
- Organic manure (i.e. farmyard manure and compost manure).
- Inorganic fertilizer
- Soil amendment: lime application adds calcium and magnesium
- Rain water dissolved with some elements
- Biochemical fixation of nitrogen by Rhizobia bacteria in root nodules of leguminous plants.

Roles of essential plant nutrients

- They take part in enzymatic reactions
- They are structural components of the plant cell

- They are constituents of cell metabolic compounds
- They are important in energy transformation reactions in the cell

Classification of essential plant nutrients

Essential plant nutrients are classified into two main groups such as:

1. Macro Nutrients

Macro-nutrients are those needed by plants in large quantities. They include: Nitrogen, Phosphorous, Potassium, Calcium, Magnesium and Sulphur. Include on the list are Oxygen, Carbon and Hydrogen.

2. Micro Nutrients

Micro-nutrients are those which are needed by plants in small quantities. They are Chlorine, Iron, Boron, Manganese, Molybdenum, Zinc and Copper.

Functions of essential plant nutrients

Nutrient	Function	Sources	Depletion	Deficiency signs
NITROGEN Is absorbed by plants as nitrate ions (NO ₃ ⁻) or ammonium ions (NH ₄ ⁺)	<ul style="list-style-type: none"> • It gives the dark green colour to plants to leaves because it is part of the chlorophyll molecule • It is important in formation of protein molecules. • It encourages vegetative growth in plants making the plant to increase in height or length and sizes of leaves. • Makes plants and their fruits succulent. This is an important quality for herbs, cabbages, lettuce, carrots, melons and cucumbers. • It increases yield of cereals and legumes by increasing the size of grain. • It controls the use of phosphorus and potassium in plants. 	<ul style="list-style-type: none"> • Inorganic fertilizers such as Calcium Ammonium Nitrate (CAN-21%N) and Urea (46%N) • Organic manures such as compost and farmyard manure (FYM) • Fixation by symbiotic Rhizobium bacteria and free-living bacteria (Azotobacter) through the nitrification process. • Nitrification of atmospheric nitrogen through lightning 	<ul style="list-style-type: none"> • Volatilisation: Nitrogen is released into the atmosphere as a gas through activities of the denitrifying bacteria. • Immobilization used by micro-organisms to build up their bodies. • Absorption by plants and the consequent removal of crop plants (products) from the land through harvesting. • Soil erosion carries away nitrates, together with the top soil, down the slope. • Leaching. The nutrients (nitrates) are washed vertically down the soil profile to 	<ul style="list-style-type: none"> • Chlorosis: (loss of colour) of leaves from the tips of lower leaves in the stem. • Crops ripen prematurely and fruits fall off. • Stunted growth of plants. • Leaves falling down before the plant matures.
PHOSPHOROUS Is absorbed by plants as H ₂ PO ₄ especially at lower pH values and HPO ₄ ³⁻ at higher pH values.	<ul style="list-style-type: none"> • It encourages formation of strong roots and stems. • It encourages seed germination, flowering, fruit formation and maturity of crops. • It speeds up ripening of fruits. • It improves the quality of pastures and vegetables. • It increases the resistance of crops to diseases. • It encourages plant growth because it helps in the production of new cells. • It is important in the process of respiration and manufacturing of fats and carbohydrates. • It is used in enzyme and protein formation. 	<ul style="list-style-type: none"> • Artificial fertilizers such as single superphosphate, double superphosphate and triple superphosphate. • Organic manure such as farmyard manure compost and green manure. • Weathering of phosphate containing rocks which release phosphate salts like calcium phosphates. 	<ul style="list-style-type: none"> • Plant absorption and crop removal. • Fixation through adsorption into silicate clays. • Leaching • Soil erosion. 	<ul style="list-style-type: none"> • Reduced root development, especially secondary roots. • Leaves have a purplish colour. • Low and stunted growth. • Poor branching, since lateral buds remain dormant. • Dead spots on leaves and fruits. • Fewer and smaller tubers. • Delayed maturity

POTASSIUM Is absorbed by plants in the form of potassium ions (K+)	<ul style="list-style-type: none"> • Makes the stem strong reducing lodging and increasing the plant's resistance to bacterial disease. • It is important in the formation of carbohydrates. • Makes the transportation of fluids in plants possible leading into well-filled seeds and tubers. • Helps in absorption of nitrates from the soil. • Controls the opening and closing of the stomata. • Improves the quality of fruits and vegetables. 	<ul style="list-style-type: none"> • Inorganic fertilizers such as Muriate of Potash (KCl), Potassium Sulphate and Potassium Nitrate. • Organic manures and crop residues. • Potash rocks like mica and feldspar (dolomite, calcium carbonate and quicklime (CaO)) 	<ul style="list-style-type: none"> • Absorption by plants • Soil erosion. • Leaching • Adsorption (fixation in soil particle of some clay). 	<ul style="list-style-type: none"> • Scorched (burnt) leaf margins from the tips spreading backwards, beginning with lower leaves. • Weak stalks resulting in high plant lodging. • Small fruits, seeds and tubers (shriveled seeds) • Small dots appearing on leaves
CALCIUM Is absorbed in form of calcium ions (Ca ²⁺).	<ul style="list-style-type: none"> • It helps the cell walls to be strong. • It helps in transportation and storage of carbohydrates and proteins into seeds and tubers. • It neutralizes soil pH which makes phosphorous and potassium to be available. • It also increases the activities of nitrogen fixing. 	<ul style="list-style-type: none"> • Commercial fertilizers such as CAN. • Crop residues and manure. • Weathering of soil minerals such as limestone. • Agricultural lime such as 	<ul style="list-style-type: none"> • Absorption by plants • Erosion x Leaching 	<ul style="list-style-type: none"> • Terminal buds stop growing. • The young leaves of maize fail to open up. • The plant shed off flowers and buds. • The stems are weak and this results in lodging of plants.
MAGNESIUM Is absorbed as Mg ²⁺ ions.	<ul style="list-style-type: none"> • It is a component of the chlorophyll responsible for photosynthesis. • Increases the amount of oil stores in groundnuts and Soya beans. • Activates enzymes in the metabolism of carbohydrates and nitrogen. 	<ul style="list-style-type: none"> • It is a component of the chlorophyll responsible for photosynthesis. • Increases the amount of oil stores in groundnuts and Soya beans. x Activates enzymes in the metabolism of carbohydrates and nitrogen. 	<ul style="list-style-type: none"> • Inorganic fertilizers • Organic manures • Dolomitic lime • Weathering of magnesium containing rocks 	<ul style="list-style-type: none"> • Inorganic fertilizers x Organic manures • Dolomitic lime • Weathering of magnesium containing rocks
SULPHUR Is absorbed by plant roots as sulphate (SO ₄ ²⁻) ions.	<ul style="list-style-type: none"> • It increases the amount of stored oil in sunflower, groundnuts and Soya beans. • It is a constituent of three amino acids: cystine, cysteine and thiamine. • Useful in nodule formation on nodule roots for nitrogen 	<ul style="list-style-type: none"> • In organic fertilizers such as ammonium sulphate and 23:21:0+4S. • Oxidation of sulphides such as copper sulphide (CuSO₂), Iron sulphide (FeSO₂) forms sulphates. • Rain water. • Atmospheric Sulphur from industries where coal is burnt to release Sulphur dioxide (SO₂). 	<ul style="list-style-type: none"> • Plant absorption and crop removal • Volatilisation in form of hydrogen sulphide gas (H₂S) 	<ul style="list-style-type: none"> • Leaves turn light green /yellow starting with young leaves. • Small and short plants with thin (spindly) stems. • Reduced nodulation in legumes.

	fixation. • It is needed in protein synthesis and improves the biological value of proteins			
IRON Is absorbed by plant root as ferrous ions (Fe ²⁺) or ferric ions (Fe ³⁺)	• Necessary for the formation of chlorophyll. • Activates various respiratory enzymes.	• Inorganic enriched fertilizers and chelates. • Organic manure.	• Soil erosion • Leaching • Fixation into insoluble forms	• Interveinal chlorosis of young leaves. • Young leaves can turn completely white in severe cases. • Twigs stop growing and die.
MANGANESE Is absorbed by plants in the form of Mn ²⁺ ions.	• Activates enzymes and acts as a catalyst in the formation of chlorophyll.	• Fertilizers like manganese sulphate are used to correct deficiency. • Organic matter.	• Soil erosion x Leaching in acidic soil conditions. • Fixation in alkaline soils.	• Mottled interveinal chlorosis of young leaves. • Interveinal white/brown specks in some cereals.
BORON Is mostly absorbed as borate (BO ₃ ⁻) ions.	• Essential for cell division in meristematic tissue. • Regulates carbohydrate mechanism. • Important in the transfer of sugars (starch) within	• Fertilizers and borax.	• Soil erosion • Leaching	• Poor growth and sometimes terminal buds die. • Shortening of internodes. • Poor grain filling on maize cobs. • Soft or necrotic sports on fruits or tubers.
MOLYBDENUM Is absorbed as molybdate ((MoO ₄ ²⁻) ions.	• Promotes symbiotic nitrogen fixation in legumes. • Increases nitrogen utilization	• Inorganic enriched NPK fertilizers. • Organic matter.	• Soil erosion. • Leaching in alkaline soils. • Fixation into insoluble forms by ferrous oxides in acidic forms.	• Curling of leaves • Scorching of leaves.

Preparing compost manure

Compost manure is the one that is prepared from the decomposed organic wastes, such as kitchen wastes, organic animal dungs and other crop residues.

Factors to consider when selecting site for preparing compost manure

- Drainage: avoid water logged area that where leaching may take place. It should be on a well-drained land.
- Nearness to plot of use on a farm
- Direction of prevailing wind: it should be on a leeward side of wind to avoid bad smell reaching the houses.

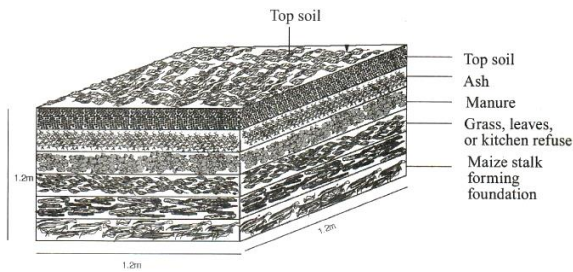
Methods of preparing compost manure

There are:

- a. Indore or pit method
- b. Stack or heap method

Procedure for preparing compost manure Indore method

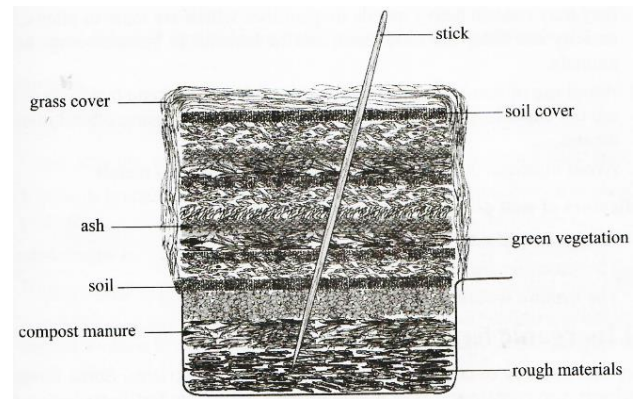
1. Dig a pit in a shade to prevent water with the dimensions of 1.2m long, 1.2m wide and 1.2m deep.
2. Place materials in the following sequence:
 - Select a sheltered place, e.g. shade.
 - Gather plant residues and well rotten manure or chicken droppings
 - Add wood ash and phosphatic fertilisers to improve the phosphorous content.
 - Add water to facilitate decomposition and regulate temperature.
 - Add layer of topsoil as it contains microorganisms.



The process should be repeated until the pit is full.

Procedure for preparing compost manure heap or stack method

1. Clear the site
2. Level the site
3. Fix four poles 2m high each pole at a distance of 2m apart to form four corners of heap.
4. Fix wood planks on the sides.
5. Gather plant residues
6. Pile them on a heap in layers as follows
 - 1st layer: organic matter
 - 2nd layer: small layer of soil and ash
 Repeat the process as much as you can.
7. Add small amounts of inorganic fertilizer in order to increase nitrogen content.
8. Add some animal dung in order to supply bacteria that may facilitate decomposition.
9. Add water to dry plant residues in order to speed up decomposition.
10. Turn the material regularly in order to allow free penetration of air. This also facilitates decomposition.
11. Use pits if it is in dry season, in rainy season it may lead to water logging. If compost is made in rainy season, find a place where the soil is free draining.
12. Cover a pit with a layer of soil if it is filled.



How to apply compost manure

It must be applied and buried on planting stations before planting. This must be in dry season, just soon before the onset of the main rainy season.

How to apply inorganic fertilizer

Inorganic fertilizer is applied in two ways based on:

- a. Time of application
- b. Fertilizer placement

Application based on time of application

i. Basal dressing

Fertilizers are applied on each planting station during planting or soon after the seedlings emerge. Fertilizer is then covered with soil. The seeds are placed above the fertilizer.

ii. Top dressing

This is the subsequent application of fertilizer after the first application. Nitrogen rich fertilizer is important as it helps to boost the yielding potential of a plant.

Things to avoid when making compost manure

- Do not use industrial wastes, such as chemicals and oils.
- Do not use non – biodegradable wastes such as polythene objects and rubber.

- Do not include sharp objects that may cause injuries.

Indicators of well decomposed compost manure

- Absence of odour
- Materials become lighter in weight
- Manure turns dark in colour

Application based fertilizer placement

i. Dollop Method

Sticks are used to make two holes 7cm-10cm away from the plants on either side. Fertilizer is applied into the holes using a fertilizer cup of a recommended size according to the type of fertilizer.

ii. Side dressing

Fertilizer is applied on the side of the planting station by using dollop or making a trench around a planting station, more especially applicable in fruit trees as shown below.



iii. Broadcasting method

Fertilizer is spread throughout the garden. In case of manure, it is incorporated into the soil during Ploughing. This works well in rice farming.



iv. Injection into the soil: fertilizer in liquid form is injected into the soil.

v. Irrigation method: fertilizer is mixed with water in a tank. During normal irrigation, water is applied together with fertilizer.

vi. Foliar method: fertilizer is applied to leaves in liquid form. This is practiced in tea plantation.

UNIT 10

VEGETABLE GROWING

Success Criteria**You must:**

1. State the importance of vegetables
2. Classify vegetables into indigenous and exotic
3. Explain the advantages of indigenous vegetables
4. Select a suitable site for vegetable growing
5. Construct a vegetable garden fence
6. Describe how to prepare seed beds for vegetable growing
7. Describe how to sow indigenous and exotic vegetables
8. Discuss how to care for vegetable seedlings
9. Discuss how to transplant indigenous and exotic vegetables
10. State how to care for the transplants
11. Discuss how to control pests and diseases in vegetables
12. Describe how to harvest vegetables

Importance of vegetables

- They are source of nutrients like vitamins and minerals such as vitamins A, B, C, K and E; and minerals as iron, calcium, phosphorous, iodine, sodium, potassium.
- They are source of income after sales.
- Vegetables provide employment to farmers and other agro-traders in vegetables selling.

Classification of vegetables

Vegetables are classified into:

- a. Indigenous vegetables
- b. Exotic vegetables

Classifying vegetables into indigenous and exotic vegetables

Indigenous vegetables	Exotic vegetables
Bonogwe – amaranthus thunbergii	Cabbage
Luni (cat's whiskers) – gynandropsis	Rape

gynadra	
Denje – corcohorus trilocularin	Pumpkins
Mpiru (local mustard) – brascajuncea	Lettuce
Mnthwani – cucurbita maxima	Carrot
Chitambe – vigma unguiculata	Cucumber
Khwanya – phaseolus vulgaris	Egg plant
Limanda – Mhibiscus acetosella	Tomatoes
Chisoso/kazota (black jack) – biden spolosa	Beans and peas
Mwamunaaligone-galinsogaparviflora	Onions
Zumba – crotalaria ochroleuca	Cauliflower
Kamganja – brusca juncea	Pepper
Chikaka/chipwete (pricky cucumber) – Momordica foeda	Beetroot

Advantages of indigenous vegetables

- They are higher nutritional value than exotic vegetables.
- They are more suitable to local environmental conditions than the exotic vegetables.
- The indigenous vegetables grow naturally without proper care as opposed to exotic vegetables.

Suitable site for vegetable growing:

- Adequate and permanent water supply**
- Well drained and fertile soils.** Sandy loam is suitable for vegetable growing.
- Closeness to the market** in order to reach the customers in time. This saves money for transporting vegetables.
- Size of land**
Land should be available for all the vegetables.

Task in the constructing of a vegetable garden fence

- Marking boundary of the field.
- Digging holes in which to fix poles.
- Fixing the poles around the field.
- Typing cross members to the poles.
- Thatching with grass/reeds tying them to crossmembers with strings.
- Trimming the grass.



Importance of a vegetable garden fence

- The vegetables are protected from animals.
- To protect vegetables from strong wind.

How to prepare seed beds for vegetable growing

Preparing a seed bed for vegetables involves operations such as the following

a. Ploughing the field

Plough to a depth of between 25 cm and 30 cm to ensure proper aeration and drainage of water.

b. Harrowing

This is the breaking down of large soil lumps called clods into small particles in order to ensure that the soil will have a fine tilth.

Importance of seed bed with fine tilth

- Seeds can be placed to a correct planting depth.
- It removes big soil lumps which can prevent germination.

c. Applying manure

Manure improves soil fertility, structure and colour of soil. It supplies soil with important plant nutrients.

- Levelling the ground so as to help reducing the run-off.

Construct the seedbeds across the slope.

Raised seed beds should have right angles or be parallelograms. In order to ensure right angles, use 3, 4, 5 or triangulation method.

Types of seedbeds

- Raised seedbeds
- Sunken seedbeds
- Nursery beds

Raised beds



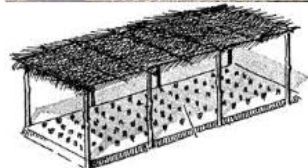
The ground is raised up by piling already prepared during the rainy season to drain away excess water.

Sunken beds



These seed beds are constructed in this way in order to hold more water during the dry season.

Nursery beds



Nurseries are where seedlings are raised before they are transplanted into the main field.

Sowing indigenous and exotic vegetables

Seeds are sown in two ways namely:

a. Direct sowing

Seeds are sown directly into the main field where they grow and mature. No need for a nursery bed. They include carrot, beet root, spinach, turnips, okra, cucumbers, pumpkins, beans (khwanya), peas and chitambe. These vegetables do not tolerate root disturbance.

b. Indirect sowing

Seeds are sown on a nursery bed and then transplanted into the open field. This is good for vegetables that tolerate root disturbance during transplanting such as cabbage, egg plants, rape, lettuce, luni, denje and Chisoso.

Importance of nurseries or indirect sowing

- Seedlings are easier to start on the nursery bed better than directly in the field.
- You get a jump on the growing season when you sow seeds indoors.

Steps taken when indirectly sowing vegetable seeds on a nursery

- Irrigating the nursery bed till all the soil gets wet.
- Make drills where the seeds will be sown.
- Mix the seeds with sand soil or saw dust and sow them in the drills.
- Cover the drills with soil.
- Cover the seed beds with vegetative materials. The process of covering the soil with vegetative materials is called *mulching*. It protects seedlings from intense sun's heat.
- Apply water to the seed bed.

Caring for seedlings

Soon after germination, reduce the amount of grass used for mulching until eventually all grasses are removed.

Caring for vegetables involves water application, fertilizer application, weeding, tilling, applying organic manure and pest and disease control.

Water application

Apply water once or twice a day depending on the water loss from the soil. Water can be

lost through evaporation or infiltration. Too much water prevents root growth and reduces soil air.

Fertilizer application

A lot of nitrogen fixing fertilizers such as CAN and manure are good for vegetables. Nitrogen is needed for rapid growth of vegetables.

Weeding

It refers to the removal of weeds from the field. It helps to avoid competition between vegetables and weeds for nutrients, air, sunlight and water.

Tilling

Tilling keeps the soil particles loose for free circulation of water and air. A hand fork is used for tilling.

Applying organic and inorganic fertilizer

Organic manure is better than inorganic one it helps to improve physical properties of soil like structure.

Pest and disease of vegetables

Diseases of vegetables

- Leaf spot, powdery mildew, root rot and damping off are the common diseases of vegetables.
- Leaf spot can be controlled by:
 - ✓ spraying Daconil
 - ✓ practicing proper crop husbandry practices such as crop rotation, planting clean seeds and rouging (destroying) infected plants.
- Damping-off is caused by heavy application and congested plant population. It can be controlled by:
 - ✓ Controlling the amount of water applied to a seed bed.
 - ✓ Ensuring correct plant population.

Groups of vegetable pests

a. Piercing and sucking pests

They attack leaves, stems and flowers by piercing and sucking sap from the plant.

They include aphids, thrips and mites. They also cause distortion of leaves and shoots.

They can be controlled by applying Dimethoate or rogor.

b. Biting and chewing pests

They cause physical damage of leaves, stems, roots, flowers, fruits and seeds.

They include nematodes, mammals, insects and birds. Nematodes can be controlled by practising crop rotation and fumigating soil.

- Caterpillars and cutworms are controlled by spraying carbaryl or malathion.
- Locusts eat leaves and other plant parts.

Thinning

This is the uprooting of excess seedlings from the seed beds. This is to control competition for food, light, water and air. Apply water to a seed bed before thinning in order not to disturb root system.

When you delay thinning, the seedlings become tall, thin and yellow due to competition amongst them.

Hardening off the seedlings

Hardening off means preparing seedlings to new growing conditions by reducing the amount of water applied to a nursery two weeks before transplanting. Hardening off helps the seedlings to develop tough stems and leaves which will withstand inadequate moisture and root disturbance during transplanting

Transplanting vegetable

Here are the stages that a vegetable farmer must take when transplanting vegetables:

- Apply water thoroughly to both a nursery and the field for easy uprooting.

- Mark the planting stations following the recommended spaces.
- Lift the seedlings from the nursery with a minimal root disturbance using a spade as shown below.



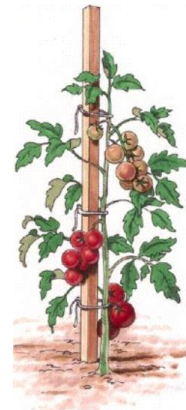
- Insert the transplants into the holes and firm the soil around the seedlings.
- Cover the transplants with grass or banana leaves. This is called mulching.

Importance of mulching

- ✓ It protects seedlings from the impact of sun's heat.
- ✓ It helps to conserve moisture by reducing the rate of evaporation.
- ✓ It suppresses weeds.
- ✓ It controls soil erosion and soil compaction.
- Water the transplants.
- Remove the mulches once the transplants are well established.

Caring for transplants

- Applying organic and inorganic fertilizer.
- Staking and desuckering. Staking means supporting the vegetable stem with a wooden stick.



Staking tomato plant

It prevents vegetable parts (i.e. fruits) from touching the ground). Desuckering is the removal of suckers for the development of high quality vegetables.

Ways of controlling pests and diseases

Methods of controlling pests and diseases are classified into the following groups:

- Cultural methods
- Physical methods
- Biological methods
- Chemical methods
- Legislative methods

Methods of controlling diseases

a. Cultural methods of disease control

The methods include:

- Practicing crop rotation in order to break the life cycle of disease causing organisms.
- Destroying crop residues either by burning or burying them deeply in the soil.
- Planting resistant varieties.
- Rogueing
Uprooting and destroying diseased plants from the field. rest of the crops:
- Ploughing the field
- Early planting. A crop that has been planted early is given an opportunity to begin its life early enough to develop natural resistance against disease attack before onset of an attack.
- Use of clean planting materials.
- Correct spacing.

b. Physical or mechanical methods

They include:

- Flooding to suffocate soil pests
- Heat treatment to kill pathogens
- Hand picking and killing

c. Biological methods

It involves the use of one living organism to inhibit the activity of a living plant pathogen.

d. Chemical control

It uses chemicals to prevent pathogens from attacking crops. The chemicals include:

- Fungicides control fungi.
- Bactericides control bacteria
- Nematicides control nematodes
- Acaricides control mites that are vectors of viral diseases.

e. Legislative procedures

It is the use of laws to prevent introduction of new pests into an area or spread of the existing pests to areas in the country which have been free from the pests since.

- Routine inspection of all exported agricultural products at the immigration point
- Quarantine of imported goods suspected of infection and infestation.

Harvesting Vegetables

Factors that determine the time of harvesting vegetables are as follows:

a. Intended use of vegetables

If you want green beans for relish, you harvest earlier but if you want seeds from the next growing season, then you wait till they mature.

b. Taste and preferences of consumers

Some people like immature and tender products. Other prefer mature and hard products.

c. Market demand

You harvest earlier when market demand is very high.

d. Pest and disease outbreak

Crops can be harvested earlier to control some diseases and pests.

e. Prevailing weather conditions

Some crops need wet weather while others need dry weather.

Methods of Harvesting Vegetables**1. Leaves vegetables**

- Cutting with a knife slanting downwards in the morning or late afternoon.
- Harvested vegetables should be loosely packed in baskets.

2. Fruit vegetables

Plucking them gently without squeezing. Do not remove the stalks if they are not fully ripe.

3. Root vegetables and bulbs

Uprooting gently (carrot and onion)

4. Legumes

Picking the pods from the stem, such as peas and beans

5. Digging in ground beans.

UNIT 11

CLASSES OF LIVESTOCK

Success Criteria**You must:**

1. Classify livestock into ruminants and non-ruminants
2. Distinguish the digestive systems of ruminants from non-ruminants
3. Explain the functions of different parts of digestive systems of ruminants and non-ruminants
4. Explain the differences of the digestive systems among non-ruminants

Classes of livestock

There are:

- a. Ruminant (polygastric) animals
- b. Non ruminant (monogastric) animals

Ruminant Animals

They are animals that partially digest food and regurgitate it semi-digested food, called cud, back to mouth for rechewing and swallowing.

The process of rechewing cud for further break down of matter and stimulate digestion is called 'ruminating.'

Examples of ruminant animals

- Cattle
- Goats
- Sheep
- Donkey

It is important to know the digestive system of farm animals because it helps to choose the right food for the livestock.

Differences between ruminant and non-ruminant animals

Ruminant animals	Non-ruminant animals
<ul style="list-style-type: none"> • Have stomach chambers (polygastric) 	Have one stomach (monogastric)
<ul style="list-style-type: none"> • Chew cud 	Do not chew cud

<ul style="list-style-type: none"> • No chemical digestion in the mouth 	There is chemical digestion in the mouth
<ul style="list-style-type: none"> • Digest cellulose 	Do not digest cellulose
<ul style="list-style-type: none"> • Have four stomachs 	Have one stomach
<ul style="list-style-type: none"> • Ruminant 	Do not ruminate

Similarities between ruminant and non-ruminant animals

- Water absorption occurs in colon in both ruminant and non-ruminant animals.
- The last stage of digestion of proteins occurs in the small intestines in both groups.

Functions of different parts of digestive system of ruminant animals**Digestion in mouth**

Chewing and swallowing of food. No chemical digestion in mouth. Saliva only softens and lubricates food.

Oesophagus

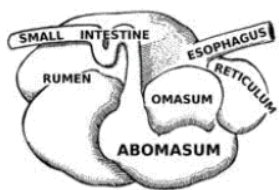
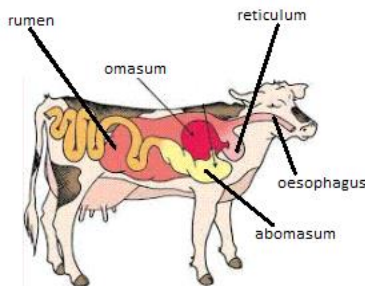
It allows the movement of food through muscular contractions called *peristalsis* and *antiperistalsis*.

Peristalsis is the movement of food from mouth to stomach, while **antiperistalsis** is the movement of partially digested food from stomach (rumen) back to mouth for further chewing.

Stomach chambers of ruminant animals

Ruminant animals have four stomach chambers namely:

- 1st stomach or rumen
- 2nd stomach or reticulum
- 3rd stomach or omasum
- 4th stomach or abomasum



Digestive system of

Rumen

- It is the first and largest compartment where food is temporarily stored during grazing. It looks like a sack or paunch.
- The muscular contraction in rumen churn and mix feed with digestive juices and microorganisms such as bacteria and protozoa.
- The digested or fine particles are sent to the next chamber called reticulum.
- Partially digested feed or coarse feed is sent back to mouth for rechewing. When the animal is resting, it

regurgitates the feed and chew it for further physical breakdown.

- Feed can be regurgitated several times till it is finally broken down.

Benefits of microorganisms in rumen

- Microorganisms breakdown cellulose in plant matter.
- They synthesise proteins from the broken down cellulose. That is why ruminant animals do not need protein rich feeds. Microorganisms in rumen manufacture proteins.
- They digest fats found in feeds
- They synthesis vitamins K and B which are used by the animal.

Benefits of microorganisms from rumen

- They get a suitable living environment.
- They obtain food from the host (animal).

Reticulum

- It is the second compartment which is also called honey comb because of its appearance.
- It receives only fine or digested particles from rumen.

Omasum

- It is also called the Bible as it has so many compartments. The compartments provide large surface area for the absorption of water. This means that the main function of omasum is to squeeze water from food and absorb it into the blood streams.

Abomasum

- This is now a **true stomach**.
- Muscular walls churn feed and mix it with gastric juice which reduce the feed to a uniform creamy soup called chyme.
- It allows chemical digestion of protein by the enzymes known as *pepsin* and *renin*.
- It contains hydrochloric acid secreted by the cells of the gastric glands.

Hydrochloric acid has the following functions:

- ✓ Kills harmful microorganisms within the food substances
- ✓ Provides a suitable acidic medium for pepsin enzyme to function.

Small intestines

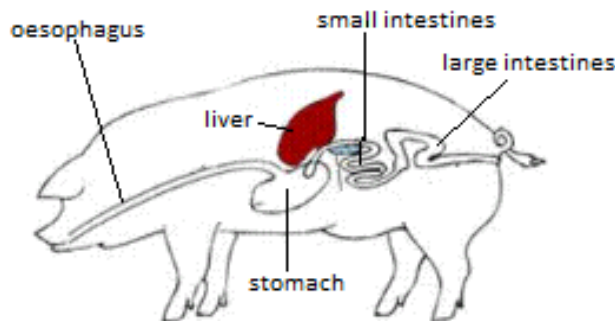
- Digestion of proteins occurs in a duodenum by means of pancreatic juice.
- Proteins are further broken down into amino acids.
- Ileum allows absorption of fully digested products into the blood stream.

Large intestines

No digestion takes place here. It is only absorption of water into the blood stream.

Non ruminant animals

Non ruminant animals do not have four chambered stomach. They have only one stomach as illustrated in the figure below.



Digestive system of pig

Examples of non-ruminant animals

- Pig
- Birds
- Rabbit
- Horse

Horse and rabbit are not ruminant animals but they digest cellulose because they have large and functional caecum which contains microorganisms that digest cellulose. This is a reason why you see these animals grazing.

Digestion in pigs

a. Mouth

Feed is mixed with saliva.

b. Stomach

- Food is digested by *ptyalin*.
- The walls of a stomach produce gastric juice which contains hydrochloric acid and enzymes, *pepsin and renin*.
- Pepsin breaks down proteins into smaller molecules called peptides.
- Renin digests milk protein in piglets.
- Hydrochloric acid has the following functions:
 - ✓ Kills harmful microorganisms within the food substances
 - ✓ Provides a suitable acidic medium for pepsin enzyme to function.
 - ✓ Dissolves hard substances swallowed by the animal such as bones.

c. Small intestines

Duodenum

- Pancreatic juice secreted by pancreas contains three enzymes: *trypsin, lipase and amylase*.
- Trypsin digests proteins, lipase digests fats while amylase digests carbohydrates into maltose.
- Gall bladder secretes bile that emulsifies fats (break down of fats into smaller globules for trypsin to act).

Ileum

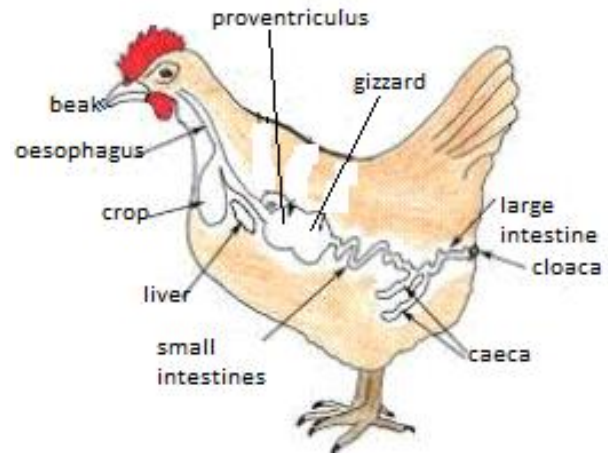
- Intestinal walls secrete intestinal juice that contains enzymes, *peptidase, lipase, maltase and sucrose*.
- Peptidase completes the digestion of peptides into amino acids.
- Lipase completes the digestion of lipids into fatty acids and glycerol.

- Maltase completes the digestion of maltose into glucose.
- End products of digestion are glucose, amino acids and fatty acids or glycerol which are absorbed into blood streams through villi which are found in the walls of ilium.
- This means that ilium has two main functions: digestion and absorption of food.

d. Large intestines or colon

- Caecum contains microorganisms which digest cellulose.
- Large intestines absorb water from food.

- Rectum temporarily stores stools before they are passed out.



Digestive system of a chicken

Digestive system of a chicken

Part	Description	Functions
Beak	This is a bone-like structure capable of growing if it is cut.	<ul style="list-style-type: none"> • It picks up food from the ground • It breaks up food into small sizes.
Mouth	There are no teeth; but a pointed tongue which has taste buds. Its saliva does not have salivary amylase	<ul style="list-style-type: none"> • The taste buds on the tongue help the chicken in selecting feeds. • The tongue helps in swallowing feeds
Upper Oesophagus	It is tube	It is a passage of feed from the mouth to the crop
Crop	It is enlargement of the Oesophagus	It stores and moisten feed in readiness for physical digestion.
Lower Oesophagus	It connects the crop and the proventriculus. It is more swollen than the upper Oesophagus	It is a passage of feed from the crop to the proventriculus.
Proventriculus	It is true stomach	It produces gastric juice (water, hydrochloric acid and enzymes) which digest protein.
Ventriculus	It is thick and muscular wall with rough lining. It contains sand called <i>grit</i> .	With the help of the grit and rough lining, the gizzard grind feed into small particles.
Small intestines	It is made of duodenum and ileum	It is only chemical digestion and absorption of feed.
Caecum	Made up of two branched blind sacs	They contain microorganisms which digest cellulose.
Colon	Large intestine	Absorption of water from the indigestible feed.
Cloaca	It is common opening for urinary, digestive and reproductive systems	It is passage through which faeces and urine are passed out

UNIT 12

CHICKEN PRODUCTION

Success Criteria

You must:

1. List main practices in chicken production
2. Describe breeds of chickens
3. Explain the housing requirements of chickens
4. Describe how to construct a chicken house
5. Discuss how to feed broilers
6. Discuss how to feed layers
7. Identify diseases of chickens
8. Describe causes of chicken diseases
9. Discuss signs and symptoms of chicken diseases
10. Discuss how chicken diseases can be transmitted
11. Discuss how to control chicken diseases
12. Identifying parasites of chickens
13. Describe the effects of chicken parasite
14. Describe the control measures of chicken parasites
15. Identify predators of chickens
16. Describe control measures of predators in chickens

Breeds of chicken

Two main breeds of chickens are available in Malawi. These are local and exotic breeds.

The breeds differ in

- Growth rate (feed conversion ratio)
- Disease resistance
- Mature size weight
- Wide variation in plumage, colour, and size

Local Breeds

These are kept for both meat and eggs. They include: Chapazga (north), Chalinda (centre) Yakuda, Yoyera and Yankhanga.

Characteristics of local breeds of chickens

- They are low yielding
- They often go broody
- They are hardy
- They are reared under village system for subsistence

- They have small bodies
- They grow very slowly
- They are not adapted to local conditions

Exotic breeds of chickens

These breeds that originated from temperate regions such Canada

They include the following: White Leghorn, Black Leghorn, Anacona, Minocras, Exchequer, Light Sussex, Cornish White, Cornish Dark, Jersey Black Giant, Rhode Island Red, Black Australops and New Hampshire Red.

Characteristics of exotic breeds of chickens

- They grow faster
- They are good broilers
- They are heavier
- They are good layers

- They mature early

Hybrids

These are birds bred to suit the particular management conditions. They are produced by cross breeding two different pure bird breeds.

They include: Thorn Ber 404 and 704, Hayline Stock, Shavers, Sterling, Ross, Super White, Brown Eggers, Kigwaru Queen and Issa Brown.

Differences between local and exotic chicken

Breed	Characteristics
Local	<ul style="list-style-type: none"> • Slow growth rate • More disease resistance • Small mature weight size • Wide variation in plumage (rough and smooth), colour • Some have naked necks • Some have <i>tsumba</i> • Size, colour, shape of wattle • Height (<i>zimbwatha</i>)
Exotic	<ul style="list-style-type: none"> • Fast growth rate • Less disease resistance • Large mature weight size • Distinct and uniform feature like feather colour, size, wattle shape, hand height • High productivity

Husbandry practices for chicken rearing

- Proper housing
- Proper feeding
- Parasite and disease control
- Breeding

Housing

Importance for a chicken house

- It protects chickens from adverse weather conditions and predators.
- It protects chickens from theft.

Qualities of a good chicken house

- It should be roomy to accommodate all chickens.
- It should be well ventilated
- It should be well drained
- It should be easy to clean
- It should have well thatched
- It should be clean and dry
- It should be well lighted
- It should be strong and secure
- It should be warm in cold months and cool in hot months.

Housing systems of chickens

a. Intensive system

A large of chickens are kept in their house throughout their life. Feed and water are provided to them. Example include deep litter and battery cage.

b. Semi – intensive system

Chicken house is surrounded by a fence where they are allowed to move freely within the fence.

c. Extensive or free range system

Birds are reared on open field where they move freely to find water and feed on their own. A farmer also provides feed and water just as supplements.

Constructing a chicken house

Materials for the construction of a chicken house are:

- Bricks
- Timber
- Bamboo
- Thatching grass

- Nails, ropes
- Cement, sand, gravel and soil
- Wire mesh
- Iron sheets

Types of chicken houses

1. Deep litter house

The birds are confined within a big house. The house usually has no partition and the floor is covered with absorbent litter. It also has feeders, wearers, laying nets and other.



Deep litter house

Advantages of a deep litter house

- There is high stocking rate
- Low labour requirements
- Fast accumulation of manure
- Egg collection is easier

Disadvantages of a deep litter house

- Attending to individual birds is difficult.
- Cannibalism and egg eating are common
- Diseases and parasites spread easily among the chickens

2. Battery cage

Birds are confined in cages or compartments. Each bird has its own cage and this is good for layers.



Battery cage house

Advantages of battery cage

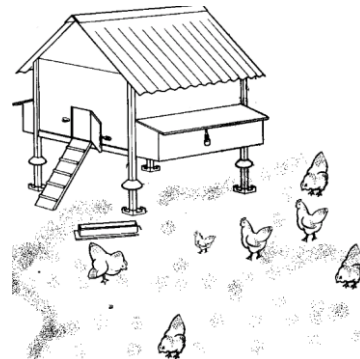
- There is very high stocking ratio
- It is easy to keep records for each bird
- There is very high performance for each bird due to limitations in movements
- Cannibalism and egg eating are controlled
- Clean eggs are produced
- It minimizes broodiness among the birds as they do not reach their eggs

Disadvantages of battery cage

- It requires very high initial capital
- It requires very high levels of management
- The system is not suitable for breeders and broilers
- The cages are not comfortable that may bruise birds.

3. Traditional house

Chickens are raised in a room at night and released during the day to look for their own food and water on.



A traditional chicken house

Advantages of Traditional house

- It is cheap
- Feeds and water are locally available
- It is not labour intensive

Disadvantages of Traditional house

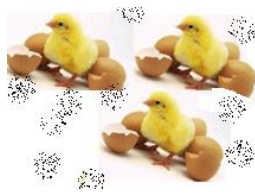
- Diseases and parasites attack chickens
- Chickens can easily be attacked by predators
- Difficult to keep records

Feeding broilers

Broilers are chicks which are raised for meat production. They are raised for not more than 8 weeks.

There are three types of feed for broilers as listed in a table below.

Stage of growth	Type of feed
Day old to 4 weeks	Broiler starter
4 – 6 weeks	Grower's mash
6 – 8 weeks	Broiler finisher



Day old chicks



Eight-week old broilers

These feeds are bought from shops or can be made by the farmer if he/she has knowledge and skills to make it.

When feeding chickens, make sure that:

- Feed and water should be cleaned regularly to prevent disease
- Add oxy-vit (antibiotics and vitamins) to water to prevent diseases
- Do not overfill the feeding troughs to prevent wastage of feeds
- Feeds should not be on plastic papers so that the feeds which are likely to spill out of the troughs do not get contaminated
- Between three and eight weeks, the feed troughs are raised so that the chickens can eat from the troughs while standing on the floor.

At 8 weeks, old broilers are sold and more than that, a farmer may lose more money buying extra feeds.

How to feed layers

A layer is a chicken solely for laying eggs and they do not brood. The egg are not fertilized.

Layers' chicken feed

Age	Type of feed
Day old to 5 weeks	Chick starter
6-20 weeks	Growers mash/pullet grower
Over 20 weeks	layers mash

How to feed a 0 -8 w33k old chicks

- Day old chicks should be given chick mash.

How to feed growers (9 weeks to 20 weeks old)

- At 9 weeks, they are called growers or pullets
- Give each chicken 115 grams of growers' mash per day that contains 16 -17% crude protein.
- Supplement the feed with grains and green vegetables.
- At 20 weeks, introduce soluble grit (oyster shell).
- Give them clean water

How to feed chickens over 20 weeks old

- Give them layers mash with 14 – 16% crude protein
- Provide clean water
- Provide grains and green vegetables
- Provide sand particles that aid digestion

Diseases of chickens

Disease refers to any alteration in the state of the body of an animal. Or, it refers to the

abnormal functioning of the body of an organism.

Classification of chicken diseases

Chicken diseases are classified based on causes such as:

- a. Bacterial diseases
e.g. fowl typhoid and fowl cholera.
- b. Viral diseases
e.g. fowl pox, Newcastle and gumboro.
- c. Protozoan diseases
e.g. coccidiosis

Diseases of chickens, their causes, symptoms, methods of transmission and control methods

Disease	Cause	Transmission	Signs and symptoms	Control
New castle	Virus	Contact	<ul style="list-style-type: none"> Paralysis of one side. Loss of balance. Twisting of the neck. Difficulty in breathing. Green diarrhea. Shaking. 	<ul style="list-style-type: none"> Vaccinating the chicken at 3 weeks old. Kill and burn or bury all infected chickens. Sanitation and hygiene of the chicken house and utensils Never mix old with newly bought chickens. Adequate ventilation
Fowl pox	Virus	Contact with infected chickens.	<ul style="list-style-type: none"> sores on the comb, wattles and around the beak. 	<ul style="list-style-type: none"> Vaccinating them at 3 weeks old. Threat the sores by use of iodine solution. Isolation of the sick from health.
Gumboro	Virus	Contact	<ul style="list-style-type: none"> Dullness. Sleepy. Swollen cloaca. Restlessness. Death of 4 week old chicks. 	<ul style="list-style-type: none"> Vaccination Prophylactic treatment by using antibiotics
Coccidiosis	Protozoa called coccidian	Picking from ground.	<ul style="list-style-type: none"> Blood tinged faeces. Rough plumage. Deaths of chicks. 	<ul style="list-style-type: none"> Vaccination Keeping the chicken house dry to reduce multiplication of coccidian. Giving chickens amprolium in water or feed.
Fowl typhoid	Bacteria	Trans-ovary. It is dangerous to human if eggs are eaten raw.	<ul style="list-style-type: none"> Whit yellowish or green yellowish diarrhea. Difficulties in breathing. Dullness. Drooping wings. Sleepy eyes. Anaemia-comb and wattle get shrunken and pale yellow. Sudden death is usual. 	<ul style="list-style-type: none"> Amprolium in water or feed. There is poor response to treatment. Testing and killing infected birds. Regular vaccination. Keep poultry houses clean, dry and well ventilated.
Fowl cholera	Bacteria	<ul style="list-style-type: none"> Contact with carriers. Contaminated feeds and water. Contaminated soil or litter. 	<ul style="list-style-type: none"> Inappetence. Loss of body weight Gasping, cough and sneezing. Difficulties in breathing. Diarrhea with grey 	<ul style="list-style-type: none"> Keep new birds in isolation for one month before mix them with the rest. Never mix the old with the young ones. Slaughter all sick birds.

		<ul style="list-style-type: none"> • Infected carcasses when not properly disposed off. 	<p>yellow/green colour.</p> <ul style="list-style-type: none"> • Lameness and swelling of joints (wings and legs). • Head, comb and wattles turn purple. • Oedema around the eye region. 	<ul style="list-style-type: none"> • Disinfect the house before new ones are introduced. • Vaccinate the chickens when they are 8-12 weeks old. • Use of drugs like sulphadimidine can be effective although there is no economic treatment
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Parasites

Parasites are organisms which live and feed on other living organisms referred to as *hosts*. Parasites are harmful on the life of a host.

Classification of chicken parasites

There are:


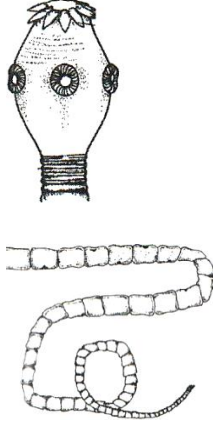
a. External parasites






They feed on the external parts of a host. They include: lice, mites, ticks and fleas.

b. Internal parasites

They live inside the host animal. E.g. roundworms, hookworms and tapeworms.

Effects and control of chicken parasites

Parasite	Effect	Control
<p>Mites</p> 	<ul style="list-style-type: none"> • Suck blood causing anaemia leading to general body weakness. • Cause irritation and discomfort. 	<ul style="list-style-type: none"> • Burning litter and nesting boxes in order to control the infection. • Filling cracks which are the hiding places. • Cleaning the house, feed and water troughs. • Disinfect the house and equipment.
<p>Tape worm</p> 	<ul style="list-style-type: none"> • Suck food nutrients from small intestines causing retarded growth in chicks and loss of production in layers. • Increased susceptibility to other diseases. • Diarrhea increased thirst. 	<ul style="list-style-type: none"> • Ensuring high standards of sanitation and hygiene. • Providing chicks with clean water. • Confine the chicks so that they should not ingest intermediate hosts like ants and grasshoppers. • Pasture dressing with benzene and hexachloride. • Treatment is not economical, however use di-n-butyl tin dilaurate or di-n-butyl tin oxide is effective.
<p>Round worm</p>	<ul style="list-style-type: none"> • Suck food nutrients from small intestines. • Retarded growth. • Reduced egg production. • Diarrhea • Hemorrhages and anemia. 	<ul style="list-style-type: none"> • Keeping the house clean. • Always keep the water and food troughs clean. • Do not put old and young chicks together.

		<ul style="list-style-type: none"> Give the chicks drugs called piperazine, phenothiazine or hygromycin.
<p>Fleas</p>  <p>Tampan</p>  <p>Lice</p> 	<ul style="list-style-type: none"> Body irritation. Sucking blood and causing irritation and anemia. Heavy infection of the head causes swelling and ulcers. 	<ul style="list-style-type: none"> Apply lard with paraffin on infected areas the flea which suffocates the fleas. Remove and burn infected litter. Apply malathion or creosote to the infected house.
<p>Hookworm</p> 	<ul style="list-style-type: none"> Attach themselves to the intestinal lining and suck blood. Causes anaemia leading weight loss and weakness. 	<ul style="list-style-type: none"> Disinfect chicken house. Foot bath at entrance to chicken house with disinfectants. Proper disposal of chicken droppings

General effects of predators on chickens

- Damage the skin of animals
- Suck blood and cause anaemia
- They act as vectors of some diseases
- They cause irritation on the animal
- They feed on the body tissues, causing anaemia and retarded growth.
- They block the digestive system of animals.

Chicken predators

Predators are animals which catch and feed on farm animals, such as chickens. Some of the predators for chickens are:

- Wild cats
- Hawks
- Eagles
- Ravens
- Alligators
- Nyenga

- Snakes

Ways of controlling predators

- Raising chickens under the intensive system, e.g. battery cage.
- Keep the house well lighted so that the farmer can be able to see any predator.
- Vents should fitted with wire mesh in order to prevent snakes and cats from entering a chicken house.
- Construct a chicken house with strong materials.
- Keeping dogs that guard against predators.
- Making a strong fence around a chicken house.
- Using baited traps to catch predators.
- Use bright security bulbs at night to check the predators.

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