FORM 1: AGRICULTURE

TOPIC 1: NATURAL RESOURCES

Natural resources are things obtained from the physical environment to meet needs of living organisms. These include:

- Water
- Air/wind
- Vegetation
- Soil
- Sunlight
- Wildlife
- Minerals

Importance of natural resources

a) Water

- ✓ Germination of seeds
- ✓ Dissolving and uptake of plant nutrients or elements
- ✓ Cooling plants and animals through transpiration and evaporation respectively An agent of soil formation through physical and chemical weathering
- ✓ Fish farming
- ✓ Generating hydro-electric power
- ✓ Providing water transport
- ✓ Soil erosion
- ✓ Transmission of diseases to both crops and animals, also humans
- ✓ Floods which destroy crops, animals, land and people's houses
- ✓ Crop lodging
- ✓ Hailstorm destroys crops, like tobacco, fruits and flowers
- ✓ Excess water leaches nutrients deep into the soil where plant roots cannot reac
- ✓ Dilution of chemicals
- ✓ Medium of biochemical reactions in the cells of living organisms

Main sources of water

- Rain
- Surface water; rivers, streams, dams, lakes, ponds and oceans
- Underground water; springs, wells and boreholes

b) Air/wind

- ➢ Air refers to a mixture of gases found in the atmosphere and in the soil. Major gases found in the atmospheric air include:
  i. Nitrogen

ii. Oxygen
iii. Hydrogen iv. Carbon dioxide

Importance of air/wind

- ✓ Air provides oxygen for respiration in seed during germination; in plants, micro-organisms and animals Air is necessary for drying of crops such as air cured tobacco (burley)
- ✓ Wind brings about rainfall
- ✓ Wind helps in pollination of some plants
- ✓ Wind helps in seed dispersal
- ✓ Wind is used for driving windmills
- ✓ Wind causes plant lodging
- ✓ Wind transmits diseases and pests
- ✓ Wind causes soil erosion
- ✓ Wind increases rate of evapotranspiration
- ✓ Wind disturbs grazing animals
- ✓ Wind damages buildings

c) Vegetation

- ➢ Vegetation refers to plants such as trees, shrubs, herbs and grass

Importance of vegetation

- ✓ Protects the soil from forces of raindrop impact which causes soil erosion
- ✓ Traps run-off 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 gases in the atmosphere (air)
- ✓ It provides fuel wood for cooking and tobacco curing
- ✓ Medical purposes
- ✓ Provide shelter in times of intense heat
- ✓ Source of food for both animals and humans
- ✓ Aesthetic values; plants provide beauty in their natural growth and around buildings
- ✓ Source of construction materials
- ✓ Improves soil fertility
- ✓ It provides habitat for wild animals

d) Soil

- ➢ Soil is the loose natural material covering the earth's surface onto which plants grow

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
- ✓ It provides air to plant roots and soil organisms for their respiration
- ✓ It is a habitat for soil organisms responsible for decomposition of organic matter
- It provides raw materials for construction of agricultural infrastructure

Constituents of the soil

Mineral matter (45% of total soil volume)

- Organic matter (5% of total soil volume)
- Soil air (25% of total soil volume)
- Soil air (25% of total soil volume)

e) Sunlight

Importance of sunlight

- ✓ For plant photosynthesis
- ✓ Source of heat energy used for proper drying of crops
- ✓ Provides heat necessary for controlling some pests, eg., eelworms

Equations for photosynthesis

Word equation:

In the presence of sunlight

Water + Carbon dioxide ⟶ Carbohydrate

+ Oxygen Chlorophyll

Chemical equation:

In the presence of sunlight

$6H_2O + 6CO_2 \longrightarrow C_6H_{12}O_6 + 6O_2$

Chlorophyll

Aspects of light that affect agricultural production

1. Light intensity
2. Light duration
3. Light wavelength

Light intensity

- This is the strength of light ranging from dull to bright

Factors that affect light intensity

- Cloud cover
- Time of the day
- Shading

Effects of light intensity in plants

- It influences seed dormancy:- time taken for a seed to germinate
- It influences etiolating:- plant stem growing long, thin and pale in colour due to low light intensity It influences tillering:- growth of secondary stems at the base of the main stem It influences flowering and grain filling.

Categories of plants based on light intensity

(i) Long day plants:- they require more day light period (greater than 12 hours) to flower Examples of such plants are

- Wheat
- Barley
- Lucerne
- Oats
- Sugar beets

(ii) Short day plants:- they require shorter day light length (less than 12 hours) to flower.

Examples of such plants are:

- Soya beans
- Rice
- Maize
- Peanut
- sugarcane

(iii) Day neutral plants:- they are insensitive to day light length.

Examples of such plants are:

- Tomatoes
- Cucumbers

Note: light duration is recorded using ***cambell shine recorder***.

Categories of light wavelength (qualities of light)

(i) Short wavelength
(ii) Long wavelength

f) Wildlife

- Wildlife refers to undomesticated animals and plants.

Importance of wildlife

- ✓ Source of income
- ✓ Source of foreign exchange mostly through tourism
- ✓ Prevent effects of climate change
- ✓ Maintain the ecosystem
- ✓ A reserve for biodiversity

g) Minerals

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

Importance of minerals

- ✓ 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 are used as a source of energy needed on the farm
- ✓ They are a source of income through export or foreign exchange **Ways in which**

natural resources can be depleted

a) Water o
Evaporation o
Transpiration o
Irrigation o
Domestic use

b) Air o 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 a wide variety of gases depending on what is being burned or produced in the manufacturing process
- Exhaust emissions from different transport systems, e.g., trucks, locomotives and cars.

c) **Vegetation** o
Opening new farms

- Clearing land for construction of buildings, roads and various infrastructures o Fuel wood o Timber and poles o Bush fires
-

d) **Soil** o Erosion is the major way soil can be lost.

Two main types of soil erosion are:

(i) Water erosion
- Splash erosion
- Sheet erosion
- Rill erosion
- Gully erosion

(ii) Wind erosion
- May be caused by whirl wind

e) **Wildlife** o
Deforestation o Poaching and hunting o Wild fires

- Encroachment in protected areas

f) **Mineral salts** o
Plant uptake o Soil erosion o Leaching

- Formation of compounds which are not usable by plants o Mining

General ways of depletion of natural resources

- Deforestation o Poor farming methods
- Improper use of agricultural inputs and industrial chemicals o Soil erosion o Rapid population growth

Conservation of natural resources

- Conservation is the deliberate act of protecting and taking care of the natural resources in the environment to avoid their exhaustion and degradation.

Importance of conserving natural resources

- To ensure economic benefits for current and future generations
- Wildlife has continuous benefits on people through agriculture, eg., insects as pollinators of crops while others as predators of crop pests
- Soil and water enhances agricultural production
- Forest protects water catchment areas which ensures continued provision of water for people, livestock, crops and wildlife
- Forest also maintains and modifies rainfall and climate patterns
- Forest helps to maintain a balanced environment between continued exploitation of resources by people as well as replacement and maintaining its beauty
- Conserving soil, water and forests in agriculture helps to maintain land productivity and ensure food security

Measures of water, soil and air conservation

1. Soil conservation methods
   a) Cultural methods
      - Crop rotation
      - Correct plant population
        - This is affected by
          (i) Space between rows or ridges
          (ii) Space between plants
          (iii) Number of plants per station
      - Application of organic matter (green, farmyard or compost)
      - Controlled grazing
      - Zero or minimum tillage
      - Correct land use
   b) Biological methods
      - Planting vegetation, e.g. trees and grass on bare land
   c) Physical methods (building physical structures)
      - Terracing
      - Contour or graded bunds

- Makings ridges across the slope
- Making box ridges
- Construct storm drains
- Making dams

2. Water conservation methods
   a) Cultural methods
      - Crop rotation
      - Correct plant population
      - Controlled grazing
      - Zero grazing
      - Correct land use
   b) Biological methods
      - Afforestation
      - Avoid setting bush fires
      - Avoid wanton cutting down of trees
   c) Physical methods
      - Making box ridges
      - Making contour bunds
      - Making dams
      - Making storm drains
      - Ridging across the slope
3. Air conservation methods
   - Restricting the use of chlorofluorocarbons (CFCs)
     - These are man-made compounds that were produced for industrial use, mainly in refrigerants and air conditioners
     - They have adverse effect on the Ozone Layer
   - Conservation of vegetation
   - Avoid bush fires which emit smoke and other gases Avoid smoke producing vehicles and locomotives

Effects of rapid population increase on natural resources

- Increased demand for fuel wood
- Increased demand for land to farm
- Increased demand for land to settle
- Increased production of gases from factories
- Increased fight between people who like to leave nature unharmed and those who feel they need to use more of nature about what they should do.

TOPIC 2: AGRICULTURAL RESEARCH

 Agricultural research is a formal framework undertaken systematically to increase knowledge of agriculture, solve new or existing problems, develop new theories and test the validity of instruments or procedures.

Aim of agricultural research

 To provide answers to various agricultural problems

 One major problem in Malawi is food insecurity (not having enough food for everyone)

Importance of agricultural research

- ✓ Coming up with high yielding varieties of crops and breeds of livestock in order to increase food production, thereby reducing hunger
- ✓ Coming up with better storage facilities in order to reduce post-harvest storage losses
- ✓ Farmers can sell excess harvests for cash
- ✓ Due to increased productivity, the other land can be used for other agricultural activities, e.g. livestock production

Areas of agricultural research

1. Land husbandry
   - ➢ So that land continues to be fertile without losing its fertility
2. Crop husbandry practices, e.g. weeding, fertilizer application, pest and disease control, storage and processing **3.** Crop varieties
   - ➢ So that new varieties which can produce high yield from small hectare are produced
4. Livestock breeds
   - So that new breeds which grow quickly while being fed on small quantities of feeds, resist various parasites and diseases, etc. are produced
5. Livestock husbandry practices, e.g. new feeding methods, advanced housing, new disease and parasite control techniques

Scientific approach to agricultural

research It flows as follows:

a) Identify a problem or an area of study

- ➢ This is the one that researchable, e.g. ‘‘Of the so many types of fertilizers available, what could be the best

  type of fertilizer for maize production?’’

b) Propose an hypothesis (guessed answer)

- This is an answer which will be proved or disproved

c) Clearly state aims of the experiment

- This is what the researcher wants to achieve

d) Experimental design

- This includes planning the layout of the research or experiment, i.e. how the experiment will appear in the field

Considerations in carrying out agricultural research experiment

- Treatment
- Replication
- Randomization

(i) Treatment

- This is a variable or feature or quality which may change or differ or vary, e.g. If the researcher wants to find out the type of fertilizer best for maize production, the treatment will be the *types of fertilizer under the study.* For example

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

(ii) Replication

- Replication means repeating the treatments in different plots of the same field or at another place. For example

Plot	**Block 1**	**Block 2**	**Block 3**
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

Importance of replication

- To remove environmental differences which may exist, e.g. soil fertility, structure and texture - They affect results of the experiment

(iii) Randomization

- Randomization means allocating treatments in plots by chance.

Importance of randomization

- It avoid bias or favour

Methods of randomization

1) Tossing a coin
- Best for experiments with two treatments because a coin has two faces
- Each treatment is assigned to a side of the coin

2) Throwing a dice
- A dice has six faces
- Best for experiments with six treatments

3) Use of pieces of paper
- The number of treatments determine the number of pieces of paper to be used
- Each treatment is written on each piece of paper, folded and put in a shuffle box
- Each piece of paper is picked in turns and allocated to a block
- This is repeated to the blocks available

For example the results may be as in the table bellow

Plot	**Block 1**	**Block 2**	**Block 3**	**Block 4**
1	No fertilizer	CAN	No fertilizer	No fertilizer
2	Sulphate of Ammonia	Urea	Urea	Urea
3	CAN	Sulphate of Ammonia	Sulphate of Ammonia	CAN
4	Urea	No fertilizer	CAN	Sulphate of Ammonia

Types of experimental designs

(i) Randomized block design

Characteristics o There are two or blocks, i.e. replicates o Each treatment appears once in each block o Treatments are randomly allocated

(ii) Latin square design

Characteristics o Number of blocks is equal to number of treatments

- Number of treatments determines number of blocks o Each treatment appears once in each block o Each treatment appears once in a plot

o Treatments are randomly allocated

e) Carrying out the experiment

- This is the implementation of the designed plan in the field

Note: All husbandry practices are the same except the treatments under study

Reason: To ensure that the results obtained from the plots are as a result of the treatments.

- Observing and collecting data from the different treatments

  - In case of testing fertilizer required for maize production data (information from an experiment) can be in terms of:

(i) Leaf colour
(ii) Plant height
(iii) Number of flowers
(iv) Branching
(v) Leaf length and breadth
(vi) Stem circumference
(vii) Plant lodging
(viii) Pest and disease incidence

f) Data recording

Data is recorded in form of:

(i) Pie chart
(ii) Histogram
(iii) Bar graph
(iv) Line graph (v) Table

For example:

Plot	Block 1	Yield (Kg)
1	CAN	5500
2	Urea	6000
3	Sulphate of Ammonia	3500
4	No fertilizer	500

Figure f (ii). A line grap

Figure f (i). A table

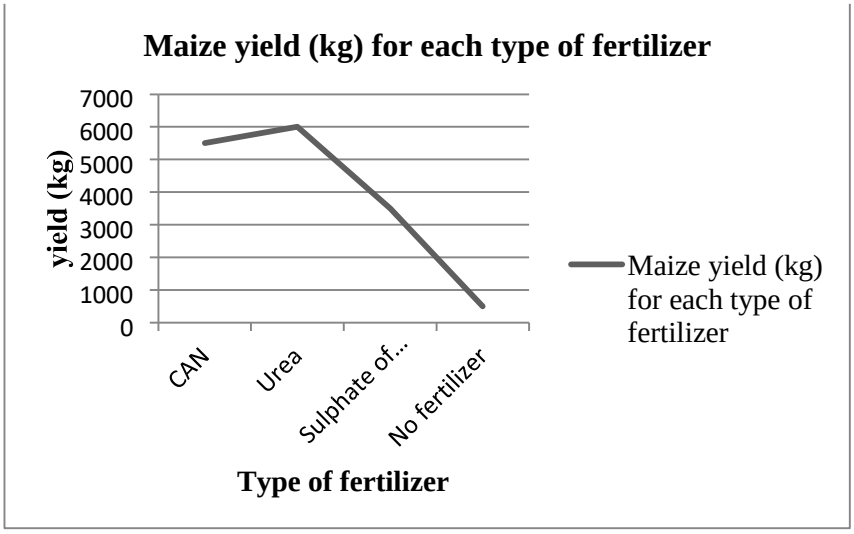

Figure f (ii). A line grap

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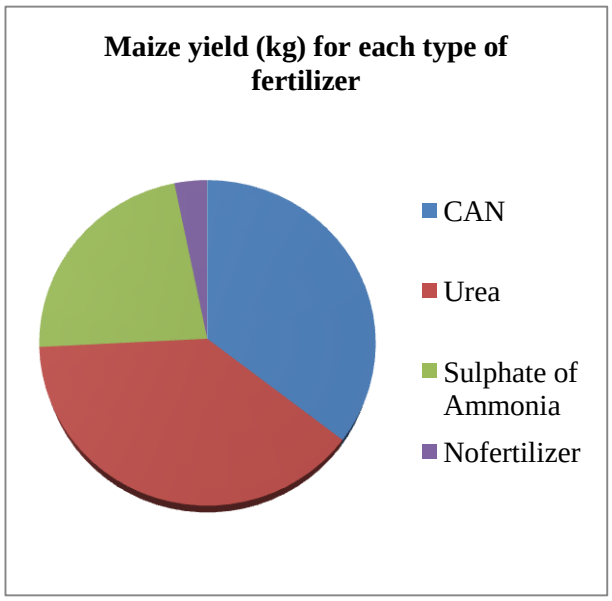

Figure f (ii i). A Pie chart

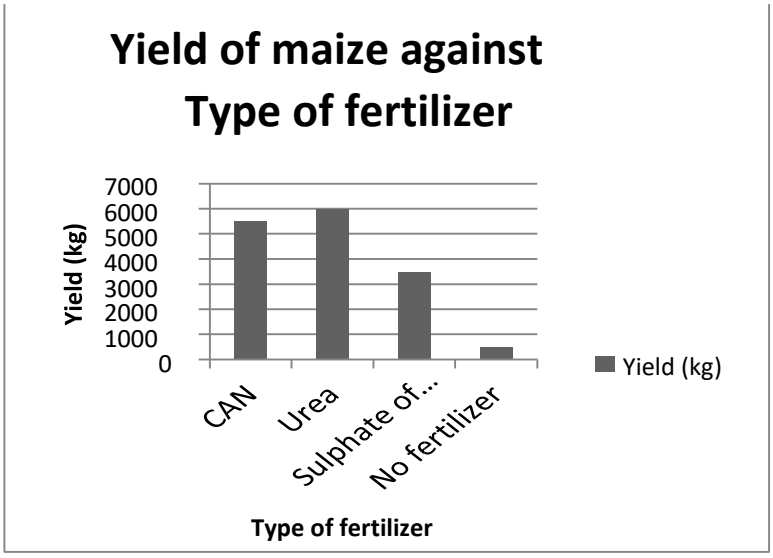

Figure f (iv). A bar graph

g) Analysing data

- Calculation of percentages, e.g. germination percentage, survival percentage
- Calculation of average or mean
- Calculation of range

Note: The aim of data analysis is to give a true reflection of the results

h) Data evaluation

- This is the summary of the findings in which the researcher discusses, concludes and recommends the findings to the farmer

i) **Report writing**

- This is a formal document of the experiment which was conducted

Importance of research report writing

 It informs the user, i.e. the farmer of the new technology that has been identified through the research It helps other researchers not to repeat the experiment but continue from where it was stopped.

TOPIC 3: AGRICULTURAL TECHNOLOGY

- Agricultural technology is the use of scientific tools and techniques for carrying out tasks in agriculture.
- Agricultural technology also means new ideas and inventions which increase agricultural production.

Roles of agricultural technology

- It is fast and efficient
  - Use of farm machinery speeds up work than use of simple tools, e.g. feeling trees using a machine than axes
- It may be cheaper than the use of human labour, e.g. use of hand maize Sheller than use of hand
- Other tasks can only be done by use of technology, e.g. spraying of pesticides, cutting down of trees, feed mixing

Relationship between research and technology

- Research means finding out answers to the problems which brings about new ideas which are in themselves technology
  - Among the technology are farm structures
  - Agricultural production and productivity is basically supported by farm structures.

Farm structures

- Farm structures refer to all buildings and facilities that aid agricultural production and productivity

Types of farm structures

Farm structures are basically categorised according to their main purpose which include:

1. **Production structures**
   - These are farm structures used for crop and livestock production, e.g. spray race, cattle crush, milking parlour.

2. **Storage structures**
   - These are farm structures used for proper storage of farm produce, inputs and implements, e.g. warehouses, silos, granaries, crib
3. **Transportation structures**
   - These are farm structures that are used for or aid in transportation of farm produce, inputs and implements, e.g.

     roads and bridges, trailers, oxcarts, vehicles bicycles
4. **Miscellaneous structures**
   - These are farm structures used for other functions, e.g. fence, farmer's houses, farmer's

     offices **Some farm structures**

a) **Granaries**
   - They are used for storing unshelled grain crops like maize, groundnuts and millet.
   - They are made up of
     (i) A roof
     (ii) A basket
     (iii) Rafter raised up from the ground

(Figure 3.1 Arise page 26)

b) **Crib**
   - It is used for drying crops like maize and groundnuts before shelling
   - It is built on a well raised rectangular rafter
   - Materials used for the body not tightly packed together as in granary

     - They are spaced at about 10 to 20 cm apart to allow free blowing of air to

     promote drying process **(Figure 3.2. Arise page 26)**

c) **Silos**
   - These are air-tight containers
   - They are used for storing grains or seeds
   - Locally made silos are
     (i) Clay pots
     (ii) Tins
     (iii) Drums

     - These become silos if they are provided with a lid which prevent free air circulation
   - There are more highly mechanised silos which can hold large quantities of grains.

(Figure for mechanised silos)

d) Spray race

- It is used for spraying animals against exo-parasites like ticks
- Animals pass through the structure while the pesticide is being sprayed
  - by the time the animal leaves the structure, the whole animal will have been sprayed

(Figure. Arise page 27)

e) Cattle crush

- It is used for handling cattle when drenching, vaccinating and branding
- The animal's neck is held up so that the animal fails to pass through or the head cannot be withdrawn - This makes it easy to handle

(Figure. Arise page 27)

f) Milking parlour

- It is used to handle cows during milking
- The animals are driven into the structure in which they cannot move forward or backward while being milked **g) Abattoir**
- It is a structure in which animals are commercially slaughtered without being tortured, graded or condemned before being taken for storage and/or consumption

Proper use of farm structures

Safety rules when using farm structures

- Wear protective clothes, e.g. gumboots, overalls, gloves and headgear
  - This is critical when spraying chemicals to crops in the field and before storage
- Farm structures need to be in good condition all the time
- Farm structures should be stored away from the dwelling houses so that they cannot easily be accessed by children
- Provide animals with appropriate handling structures, e.g. cattle crush
- Structures such as warehouses need to have exits which are wide enough to allow free exit in times of fire
- Equipment and materials should be properly stacked or arranged for easy inspection and access in times of need
- Switch off the engine of farm machinery when servicing it
- Do not put on loose clothing when servicing farm machinery
- Store fuel and any chemicals in safe places where children cannot reach

Importance of observing safety rules when using farm structures

- To ensure that farm structures are well maintained and stored so that they can last long

- To make sure that people are not harmed while in the course of using the farm structure
  - To ensure that livestock are not hut, in case of livestock

TOPIC 4: FARM BUSINESS MANAGEMENT

 Farm business management is the process by which resources and situations are manipulated by the farm family in trying to achieve its goals.

Farm business management concepts

- ✓ Production
- ✓ Financing
- ✓ Budgeting
- ✓ Record keeping
- ✓ Business decision making

a. Production

 Production means changing inputs to outputs which are needed by consumers at a profit Farmers must use the right amounts of inputs in order to make high profits

Production curve

 This is a curve that shows the relationship between the inputs and production levels

 Usually production increases as level of inputs rises to a point when output starts to decline

(Figure 5.1. Arise page32)

Sections of the production (product) curve

(i) Yield increases as the farmer increases inputs
- Yield increasing at increasing rate

(ii) Yield increases as the farmer continues to increase input - Yield increasing at a decreasing rate

(iii) Yield starts to decline if inputs continues to be increased

Note:

i. This works where there is a direct relationship between input and output, e.g. yield and fertilizer ii. The farmer should operate within the second segment of the product curve

As the saying goes, ***''Too little or too much is dangerous''***

b. Financing

- Financing means acquiring funds and making them available for production
- Availability of funds gives the farmers control over all the production operations

Ways through which farmers acquire funds for agriculture

- ✓ From commercial banks
- ✓ From friends and relatives
- ✓ Personal savings
- ✓ Village banks

Financing principle to be applied by farmers

- Obtaining credits from institutions which charge low interest rates
- Buying cheap inputs from suppliers
  - This may be done by buying them in groups or at a wholesale than retail supplier Ensuring that liquid capital is readily available for day to day operations
- Ensuring that they build their capital base by investing part of their profits **c.**

Farm budgeting

- A budget is a financial plan of income and expenditure over a given period of time
- The farmer must estimate the expected income and expenditure from a crop and livestock enterprise.

Importance of budgeting

- It helps the farmer to stick to his or her plan
  - Thus, buying or spending money on planned activities only
- The farmer allocates resources to various enterprises which are most profitable
- It shows the farmers expected profit from each enterprise and is able to choose wisely
- Tells the farmer expenses in advance and is able to finance the farm activities adequately in advance

d. Record keeping

- Farm records refer to systematic entries o various farm business activities and transactions in suitable books or sheets of paper

Importance of farm records

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

e. Business decision making

- Decision making is the mental process resulting into selection of a course of action among several alternative scenarios

Situations that require decision making

(i) What to produce

- This refers to the choice of the enterprise to be involved in production Some may choose maize for food, cotton for sale, etc. **(ii)** How much to produce
- This is the quantity of production due to economic or social factors
  - A farmer cannot produce more than what his/her resources can allow **(iii)** How to produce
- This refers to time of production, e.g.
  - Some farmers choose to produce tomatoes during the dry season because diseases are less troublesome **(iv)** When to produce
- This refers to the methods of production and resources to be used, e.g.
  - The farmer may decide to use manure or inorganic fertilizer **(v)** When to sell the produce
- This is the time for selling the farm produce, e.g.
  - Some farmers sell their produce soon after production, while others will keep them until prices go up in order to make more profit

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Factors of production

- Factors of production are the inputs needed to the production process Input level determines the quantity and quality of output.

Major factors of production

a) Land

- Land is a factor of production which comprises all natural occurring resources like water, soil, rocks and vegetation.
  - It is where agricultural production takes place.

Figure 5.2. Arise page 38

Challenges associated with land

- Productivity of land depends on its
  - ✓ Size
  - ✓ Quality
  - ✓ Location

2. Size o This is the amount of land in hectares or acres o Land size determines:
   (i) Scale of production
   - The number of hectares that can be allocated to an enterprise

   (ii) The number of enterprises a farmer can have
   - Small pieces of land prevent farmers from combining many different enterprises

   (iii) Cropping system (how crops are arranged in the field every growing season)
   - Where a farmer has a big land holding, each crop can be grown on its own field
   - Due to small land holding, many smallholder farmers adopt mixed cropping system - Land holding can be increased through buying more land

3. Quality o Quality of land is determined by
   (i) Soil fertility
   (ii) Slope of the land
   (iii) Texture/structure of soil (water holding capacity) o A flat land with fertile loam soil would be good for agricultural purposes
   o Sloppy land can be modified by physical soil conservation structures to maintain fertility of the soil, e.g. terraces
4. Location o Land close to a market or road is more suitable for agricultural purposes than land which is very far away because consumers can easily be reached at a low cost

o It is therefore imperative to improve road and transport network for agricultural commodities to reach the markets quickly enough without incurring damage

b. Labour

- Labour is the amount of work done by humans
- It is measured in Man-days or hours

Labour factors that affect agricultural production

1. Number of people
   - The more the people there are on a farm, the quicker the operations will be done
2. Capacity to work
   - Capacity or skill can be as a result of
   (i) Training
   (ii) Exposure
   (iii) Experience
   - A workforce which has capacity or skill will increase production as it effectively do the work
3. Willingness to work
   - People's desire to work for long hours increases production
4. Health of people
   - Healthy people are more able to work and produce than those who are sick
5. Social activities
   - These could be
   (i) Funerals
   (ii) Initiation ceremonies
   (iii) Weddings
   (iv) Religious ceremonies
   - Social activities reduce the amount of time which could be devoted to work **c. Capital**

Capital refers to resources used to start any production process or

- Capital is a list of items or materials which can be living or non-living but are used for production
- It is as a result of human effort
- Different agricultural enterprises need different capital items.

Types of capital

(i) Working capital o This refers to the inputs o Inputs are needed for daily running of the business, e.g.

- ✓ Animal feeds
- ✓ Fertilizer
- ✓ Pesticides
- ✓ Seeds/seedlings

(ii) Liquid capital o This is cash

o It can easily be changed into other forms of capital

(iii) Fixed capital o This capital is made up of all those materials which are used over a period of more than one production season

o Examples are:

- ✓ Buildings
- ✓ Machinery
- ✓ Tools and implements
- ✓ Irrigation system
- ✓ Fences

Figures 5.3 and 5.4 Arise page 40

Ways through which farmers acquire capital

1. Personal saving
   - Farmers save from what they get so that they buy more capital
2. Borrowing
   - Farmers can get credit from financial institutions, e.g.
     (i) Banks
     (ii) FINCA
     (iii) Microloan
     (iv) Pride-Malawi
     (v) FINCORP
     (vi) SACCO
   - They can also get credits from friends and relatives
3. Village banks
   - People form groups and bring together cash which the needy can borrow

d. Management

- This is the way how the three basic factors of production (land, labour and capital) re used in the production process

Aspects of farm management

(i) Technical aspect

- This refers to scientific principles and practical skills of crop and livestock production
- In case where the farmer lacks these skills, he/she can hire personnel with the required skills

(ii) Business aspect

- This refers to decision making and organizational skill of the available resources
- The farmer chooses from a wide range of alternatives

Duties of the Farm Manager

1. Planning operations
   - What, when, where, how should an operation be done
2. Budgeting resources
   - The Farm Manager allocates various resources to the enterprise in terms of finances
3. Implementing the plan
   - Putting the plan into practice
4. Supervising operations in order to guide and control the plan
5. Keeping records of production and sales
6. Taking measures to bare risks so that when misfortunes such as bad weather, diseases and pest occur, the farmer should still survive
7. Evaluating the effectiveness of the implemented plan
   - Make changes and improvements, where necessary

Other factors that affect agricultural production

- Market
- Climate
- Quota
- Pests and diseases
- Risks and uncertainties

a) Market

- A market refers to people or customers who are willing to buy goods and services
- Ordinarily, a market refers to any structure that allows buyers and sellers to exchange any type of gods, services and information.

Importance of a market

- ✓ It enables farmers to obtain farm inputs without which production would be impossible
- ✓ It enables farmers to sell their produce
  - ➢ Farmers would produce a lot of produce if there was a market to sell them
  - ➢ Good prices of the farm produce also encourages farmers to produce even more

Types of markets

(ii) Factor market

 A factor market is a market which sells inputs, e.g. Farmers World, Kulima Gold, ADMARC

(iii) Product market

 A product market is a market where goods and services are sold, e.g. Auction Floors

Challenges associated with market

1. Increase in prices of inputs

- When prices of inputs increase, farmers fail to buy adequate inputs which in turn reduces production

2. Decrease in prices of outputs

- When prices of outputs go down, farmers do not make high profits

Solutions to challenges associated with market

1. Farmers forming groups and buying the inputs in bulk and at a discount to solve the problem of high cost of inputs
2. Farmers forming associations so that they can become price makers and not price takers to solve the problem of low prices of outputs

 This is much evident in tobacco farmers, buyers at the auction floors who set prices for the farmers commodities

b) Climate

- Climate refers to the average weather condition of a particular area experienced over many years

Weather is the atmospheric condition of the day

 Farmers choose agricultural enterprises which suit the existing weather conditions, e.g.

- High temperatures are good for cotton
- Bumper harvests are produced when rainfall comes adequately throughout the crop growing season - Humidity is important during flowering and pollination

Challenges associated with climate

1. Multiplication of diseases due to high relative humidity
2. Prolonged dry spells leading to wilting of crops
3. Strong wind which destroys crops
4. Extreme temperatures which may lead to high evapotranspiration and solidification of water which makes it unavailable to crops

Solutions to challenges associated with climate

1. Diversification of enterprises
   - This is when a farmer takes up different enterprises so that should one fail, ther other could still provide a cushion
2. Setting up irrigation systems so that in times of dry spells the farmer can use irrigation to supply the crops with water
3. Buying an insurance policy
   - In the event of a climate change, e.g. hailstorm, the insurance company can compensate the farmer

c) Quota

- A quota is a maximum amount of commodity to be produced and sold
- Usually, it is imposed on commodities which are produced purely for sale, e.g.
  - (i) Tobacco
  - (ii) Tea
  - (iii) Coffee
  - (iv) Sugar
  - (v) Minerals (vi) Oil
- Quota is imposed on cash crops to control supply of these commodities on the market so that farmers should only produce the amount which customers are willing to buy.

Effects of overproduction

1. Prices go down because there is too much of the commodity on the market
2. The excess commodity may not find a market

Challenges associated with quota

1. It limits capacity to produce higher than the farmer's capacity
2. It leads to low supply in case of crop failure in other areas due to climatic/seasonal changes

Solution to challenges associated with quota

- Adding value to the product rather than selling it raw
  - Through processing, the farmer can transform the product into something different and be able to defeat the restriction

d) Risks and uncertainties

A risk is a situation which a farmer takes with full information

Uncertainty is when there is less than full information

- In a risk, one can foretell the probability of the situation
- In uncertainty, one does not know what is going to happen next and what the possible distribution looks like

Examples of risks and uncertainties in agricultural production

(i) Drought
(ii) Cyclones
(iii) Pests and diseases
(iv) Theft
(v) Price fluctuation of inputs and agricultural products (vi) Fire

Challenges associated with risks and uncertainties

1. Some farmers may choose enterprises of low risks although there returns are generally lower

- This is because they fear that if the disaster strikes , loss will be very unbearable if they choose those other enterprises

2. Farmers are not willing to expand high risk enterprises

Ways of dealing with risks and uncertainties

1. Input rationing

''Farmers buy and apply inputs according to their recommended rates''

- Input rationing is when farmers use fewer inputs than recommended so that when fate strikes, the farmer incurs lower losses than when recommended inputs were used

2. Selecting enterprises which are more certain of producing a yield or more likely to sell the produce

- The farmer needs not to go for the risky enterprise for the sake of high returns but rather go for the less risky one although their income is low

3. Diversification of enterprises so that the farmer still survives on those that have not been affected
4. Buying an insurance policy so that the farmer can be compensated in case of crop or harvest failure

Challenges that arise due to pests, parasites and diseases

1. Outbreaks of pests, parasites and diseases can destroy crops and livestock causing a complete enterprise failure if not properly checked
2. Farmers are forced to spend large sums of money to control and treat pests, parasites and diseases

Ways of dealing with challenges associated with pests, parasites and diseases

1. Raising resistant varieties of crops or breeds of livestock
2. Diversification
3. Insurance policy

TOPI 5: AGRICULTURAL MARKETING AND FOOD SECURITY

 Agricultural marketing is the process which involves transferring of agricultural inputs and outputs from producers to consumers.

Importance of agricultural marketing

- ✓ It provides inputs to the farmer
- ✓ It is at the market where farmers sell their produce
- ✓ It distributes goods and services
- ✓ It determines prices of goods
- ✓ Through processing there is and additional of values of these agricultural produce
- ✓ It encourages farmers to produce products of high quality due to competition on the market

The principle of demand and supply

- ❖ Demand means the quantity of goods and services a customer is ready to buy at a given price and time.
  - ➢ It is not a want because people want so many things, most of which they cannot afford to buy
  - ➢ This implies that demand is only what a customer can manage to buy
- ❖ Supply means the quantity of goods and services a seller is willing to sell at a given price and time These are goods and services seen or found on a market

Relationship between demand and price of a commodity or service

- ❖ As the price increases, demand decreases and when the price decreases, there is increase in demand.

Relationship between supply and price of a commodity or service

- As price increases, amount of goods or services supplied at the market also increases and when price decreases, supply also decreases.

  A seller always wants to maximise profits, therefore he/she makes sure that the commodity is released only when the price is reasonable.

  Figure 6.2. Arise page 53

How marketing forces determine prices

- When demand is high on the market and yet there is low amount of commodities supplied, the price increases.
- When the amount of supply is high and yet there is low demand, the price drops. **Table 5.1.** *Demand and Supply*

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

Figure 6.3. Arise p54

Marketing functions

- Marketing functions are all those activities which occur as a product moves from point of production to point of consumption These are:
  - ✓ processing
  - ✓ grading
  - ✓ packaging
  - ✓ sorting
  - ✓ transporting
  - ✓ storage
  - ✓ advertising
  - ✓ market bearing
  - ✓ risk bearing
  - ✓ buying and selling

Importance of marketing functions

Marketing functions help to ensure that consumers get the product at their point of convenience.

Table 5.2. *Categories of marketing functions*

Category	Marketing function
Exchange	buying selling
Physical functions	• assembling • grading • processing • packaging • transporting and distribution • storage • displaying
Facilitating functions	• financing • market intelligence • advertising

Activities involved in the categories of the marketing functions

I. Exchange functions

These are activities involved in transferring of ownership of a product The main activities here are buying and selling

a) Buying

- Buying is a process of acquiring goods and services
  It involves

1. Identifying suppliers of goods and services
   - Where goods and services can be found
2. Selecting the goods
   - Selection is based on
   (i) quality
   (ii) price
   (iii) quantity
3. Bargaining for a lesser price so that the buyer can more goods with same money
4. Paying for the goods and collecting them

b) Selling

- This is transferring of goods and services to a buyer

It involves

1. Assembling the goods in large quantities
2. Packaging, i.e. putting the commodities in suitable containers
3. Selecting the right marketing channel, i.e. how and where to sell the product
4. Displaying in attractive and suitable manner
5. Advertising through radio, television, billboards, etc.
6. Receiving payment for the product

II. Physical functions

- This involves activities that make the goods available to the customers at a place, form and time most convenient to the consumer

a) Transportation

- Transportation means carrying goods or commodity from one point to another
- It ensures that the commodity is found at a place the consumer and supplier find convenient

Modes of transport used by farmers

(i) Bicycles
(ii) Ox-carts
(iii) Pick-ups
(iv) Trains
(v) Ships
(vi) Boats
(vii) Aircrafts

Factors to consider when choosing method of transporting goods

1. Cost
   - The cost needs to be reasonable to avoid losses 2. Quantity of goods
   - The transport used needs to be in accordance with the quantity in order to reduce costs and maximise profit
4. Distance to the market
   - The longer the distance to the market, the more the need for an efficient transport system
5. Nature of the product
   - Transport system depends on whether or not the produce can easily be bruised like vegetables and fruits
6. Perishability of the commodity

- Perishable goods need fast transport system

7. Speed
   - Fast transport system is necessary for perishable goods so that they reach the market in good condition

b) Processing

- This refers to changing the agricultural product to a form best usable by consumers.

c) Storage

- This means keeping excess products so that they are used some time
- It achieves time space
- It solves the problem of seasonality of the products
- It ensures that the products are sold at higher prices taking advantage of limited supply of the commodities

d) Grading

It involves sorting a commodity according to uniform specifications Attributes used for grading are:

(i) Weight
(ii) Length
(iii) Colour
(iv) Tenderness
(v) Diameter
(vi) Texture
(vii) Taste
(viii) Presence of impurities

Importance of grading

- ✓ It gives a buyer an incentive to produce commodities of high quality in order to maximise profits
- ✓ It enables farmers to compare prices of commodities of the same grade at different markets and be able to choose the best market where they can sell at a maximum profit
- ✓ It enables every consumer to buy according to their desired grade
- ✓ Buyers and sellers can transact business electronically (through phone, e-mail) without meeting simply by using conventional grades.

III. Facilitating functions

- These make the exchange and physical functions easy and smooth

a) Financing

- It involves providing money to facilitate activities, e.g.

i. Farmers need resources in form of money to buy inputs like seeds, feeds and fertilizer

ii. Operations like planting, weeding, harvesting require money with which to pay for labour

iii. Farmers need cash to facilitate storage, grading, processing, transportation and advertisement

b) Risk bearing

- Farmers can minimise risk through:
  1. Buying an insurance cover
  2. Building enough capital so that should a risk strike, the business can still continue
  3. Diversification so that should one enterprise fail, the other (s) can still provide income

c) Market intelligence

- This is the advance knowledge about customer needs before embarking on selling of any commodity. Information required can be :
  - i. Most recent information on supplies
  - ii. Demand and supply
  - iii. Forecast on prices, supply and demand
  - iv. Yield estimates in the coming season

Sources of useful information for farmers

- ✓ Friends and relatives
- ✓ Newspapers
- ✓ Radio
- ✓ Ministry of Agriculture
- ✓ Internet
- ✓ ADMARC Markets

Problems associated with Agricultural Marketing

1. Seasonality of agricultural produce
   - ➢ There is very high supply of the produce during harvest time and become scarce later
     - As supply increases at harvest time, prices drop
2. Bulkiness of the produce
   - ➢ Most of the agricultural produce occupy large volume and yet have low value
   - ➢ This attracts high storage and transportation costs
3. Diversity in their nature
   - ➢ Agricultural produce are not the same in size, volume, shape and colour which makes it difficult for farmers to set realistic prices
4. Perishability of the produce
   - ➢ Farmers find it difficult to deal with perishable goods such as vegetables, fruits and milk when produced in large quantities

- If the market is very far away
- When there is poor transport system

5. Farmers' lack of knowledge about marketing
   - Farmers produce with prior knowledge of demand which makes the produce not bought or bought in less quantity
6. Price fluctuation
   - It is difficult to maintain market prices because production is seasonal

Solutions to problems of agricultural marketing

Table 5.1. solutions to the problems of agricultural marketing

Problem	**Possible solution**
Seasonality of agricultural produce	▪ Irrigation farming can maintain supply of the commodities ▪ Where farmers depend on rain-fed farming, high production can be stored for future use
Bulkiness	Processing into forms which are less bulky, e.g. fruits can be processed into fruit juices
Diverse nature of the products	Grading
Perishability of products	▪ Producing them near a market ▪ Produce in line with demand so that there is no much excess produce ▪ Efficient transport system so that the produce can easily be moved to places where the commodity is not produced, e.g. tangerines from Mwanza
	to the rest of the country
Lack of knowledge	Teaching farmers about how supply and demand affect prices
Price fluctuation	Offering farmers guarantee minimum prices

TOPIC 6: AGRO-BASED INDUSTRIES

- ❖ ''Agro'' comes from the word ''Agriculture''
- ❖ Agro-based industries are industries dealing with the supply, processing and distribution of farm products.

Examples of Agro-based industries in Malawi

Table 6.1. Agro-industries which process agricultural commodities in Malawi

Name of industry	**Raw materials**	**Products**

Bakhresa Grain and Milling (Malawi) Limited	Maize, Wheat	Maize and Wheat flour
Malawi Dairy Industries	Milk	Processed milk, Chambiko and Cheese
Chibuku Products Ltd	Maize, Sorghum, Millet	Chibuku beer
Capital Oil Industries Ltd	Groundnuts, Cotton seeds, Sunflower	Cooking oil
Mapeto (DWSM) Ltd	Cotton	Cloth
clothIllovo Sugar Company	Sugarcane	Sugar
Chombe Tea Compny	Tea	Tea

Table 6.2. *Agro-industries which produce agricultural inputs*

Name of industry	**Input manufactured**
Optichem (2000) Ltd	Fertilizers like NPK compounds such as Urea, Calcium Ammonium Nitrate
Pannar Seed (Mw) Ltd	Hybrid maize varieties like *Kanyani*, *Mkango*, *Njobvu*
Agricultural Trading Company Ltd	Suppliers of protective clothing, e.g. overalls, raincoats; knapsack sprayers, pesticides, herbicides
Charles Stewart Day-Old Chicks Ltd	Raise breeding stock
Agrimal (Malawi) Ltd	Hoes, axes, ox-drawn implements like ploughs, ridgers, tobacco pressers, *pangas*, slashers

Roles of Agro-based industries in supporting the growing population

1. Feeding the nation
   - Some industries provide food
2. Providing employment
   - Large numbers of people are employed in these industries and thereby earning a living
3. Providing a market for agricultural products
   - This motivates farmers to increase quantity and quality of their production
4. Processing agricultural raw materials
   - Agricultural products are added with more value so that they can fetch more money

5. Providing farmers with farming resources
   - Some of the industries manufacture inputs, e.g. fertilizers, farm tools, pesticides and supply them to farmers **Food distribution**

- This is the method of transporting or moving out food from one place to another **Food security**

- This refers to the availability of food and one's access to it
  - A household is considered food-secured when its occupants do not live in hunger or fear of starvation

Food self-sufficiency

- This refers to sustainable living in which people eat only what they produce without relying on any assistance.
  - Here, people must produce all kinds of foodstuffs which the body needs for a healthy living **How proper food distribution ensures food security for the growing population**

- It ensures that areas which cannot produce or adequately produce food should still access the food

Components of food distribution

1. Transport infrastructure These include:
   (i) Roads
   (ii) Vehicles
   (iii) Rail transport
   (iv) Air transport
   (v) Ports
2. Food handling technology and regulation These include:
   (i) Refrigeration
   (ii) Storage
   (iii) Warehousing
3. Adequate source, supply and logistics
   This is based on demand and need

- Logistic are practical arrangements that are necessary in order to organise something successfully, especially something involving many people

How proper food storage ensures food security for the growing population

Storing of food has the following main purposes

1. Storage of harvested and processed plant and animal food products for distribution to co summers in areas of scarcity
2. Enabling a better balanced diet throughout the year
3. Reducing kitchen waste by preserving unused or uneaten food for later use
4. Preparedness for catastrophes, e.g.
   (i) Emergencies
   (ii) Droughts or floods
   (iii) Periods of scarcity
5. Protection from destruction by animals or loss through theft

Family size and food security

- As the family size increases, there is also increase in the amount of food needed, hence food insecurity
- A farming household, small sized is more likely to provide its children with good opportunities including good feeding, hence food-secured family

TOPIC 7: ESSENTIAL PLANT NUTRIENTS

- These are the elements needed for plant growth and development **Table 7.1.** *Classification of plant nutrients*

Macro (Major) nutrients	Micro (minor) nutrients
Nitrogen Phosphorus Potassium Calcium Magnesium Sulphur Oxygen Carbon Hydrogen	Chlorine Iron Boron Manganese Molybdenum Zinc Copper

- Macro nutrients are required in large quantities by plants
- Micro nutrients are needed in small quantities by plants

Roles of essential plant nutrients in plant growth and crop production

Table 7.2. *The roles of Essential Plant Nutrients in Plant and Crop Production*

Type of Nutrient	Function/Role	Depletion	Sources	Deficiency sign
Nitrogen	• Responsible for chlorophyll which is deep green colour necessary for photosynthesis in plants • A major component of protein molecule in plants • Makes plants and their fruits succulent (having full of water) • Increases grain yield by producing excess glucose and protein which is stored in the grains cereals and legumes	• Crop removal: crops absorb nitrogen as they grow • Soil erosion: erosion carries away soil together with nitrogen • Leaching: soluble nitrogen especially nitrates (NO^{+3}) goes deep into the soil where plant roots cannot reach • Volatilization: nitrogen is released into the atmosphere in form of nitrogen gas • Immobilization: bacteria uses nitrogen to build up their bodies • Fixation: nitrogen becomes	• Inorganic fertilizers such as straight fertilizers, e.g. Calcium Ammonium Nitrate (CAN) 27% Nitrogen, Urea 46% N; compounds like 23:21:0+4s • Organic manure • Ammonification of atmospheric nitrogen through lightening • Fixation by symbiotic Rhizobium bacteria and free living bacteria like Azotobacter through nitrification process	• Chlorosis (loss of green colour and becoming yellow) from the tip of the leaf • Stunted growth • Premature falling of leaves
		unavailable to plants when it gets attracted to clay particles or forms organic matter which is difficult to decompose		

Phosphorus	• Increases development of secondary roots • Speeds up maturity of crops by stimulating flowering and seed formation • Increases disease • resistance in crops Improves the quality of • fruits, vegetables and cereal crops • Strengthens straw of cereal crops thereby reducing crop lodging It is an energy carrier needed for metabolic processes in plants	• Plant absorption and harvesting away of crops • Fixation through • absorption into • clay minerals Leaching erosion	•inorganic fertilizers such as Single Superphosphate, double and triple Superphosphate •Organic fertilizers such as Farmyard, compost and •green manure Mineralization of phosphate rocks	• Leaves become purple in colour • Reduced root development especially secondary roots • Poor branching because lateral buds become dormant • Fewer and smaller tubers • Delayed maturity • Dead spots on leaves and fruits • Poor development of seeds, grains and fruits
Potassium	• Promotes growth of meristematic tissues • Helps to resist diseases, e.g. root rot • Necessary in the formation of • starch and proteins Strengthens cellulose in cell wall to make • stems strong and reduce lodging Facilitates in translocation of sugars from leaves to other plant parts especially tubers and seeds so that they are well filled	• Inorganic fertilizers such as muriate of potash, potassium sulphate, • potassium nitrate Potash rocks like • mica and feldspar Organic manure	•Plant absorption •Soil erosion •Leaching •Adsorption (fixation in soil particles of some clays)	• Small dots appear on plant leaves • Weak stalks resulting in lodging • Scorched or burnt leaf margins from tips spreading backwards • beginning with lower leaves Small frits, seeds and tubers

Calcium	• Necessary for cell division (mitosis) which promotes elongation of apical tips of the roots and shoots • It is a component of cell wall • structure It is useful in protein synthesis Raises soil pH thereby increasing	• Inorganic fertilizers such as Calcium Ammonium Nitrate • Weathering of calcium rocks • Organic matter • Agricultural lime such as dolomite, calcium carbonate and quick lime (CaO)	•Absorption by plants •Leaching •Erosion	• Weak stems • Premature shedding of flowers and buds • Death of terminal buds • In maize, the funnel fail to unfold, and • emerge Terminal buds and root tips fail to grow; as a result the plant fails to
	availability of phosphorus and potassium and multiplication of nitrifying bacteria			grow
Magnesium	• It is a component of the chlorophyll • molecule Activates enzymes in metabolism of carbohydrates • and nitrogen compounds Increases oil contents in oil crops like groundnuts, soya beans, sunflower	• Inorganic fertilisers, e.g. dolomitic lime, i.e. {$CaMg(CO_3)_2$} • Organic manure • Weathering of magnesium containing rocks	•Absorption by plants •Leaching •Soil erosion	• Interveinalchloros is on leaves where veins remain green while the rest of the leaf is yellow • In some crops like cotton, lower leaves develop a reddish-purple colour
Sulphur	• It is needed in protein synthesis • and improves value of protein • Activates some proteolylic • enzymes such as papain Used for nodule	• Inorganic fertilisers like Ammonium sulphate, 23:21:0+4s • Oxidation of sulphides in soil minerals such as $CuSO_2$ • and $FeSO_2$ to sulphates Rain water • Atmospheric sulphur from	•Plant absorption • and crop removal Volatilization in the form of hydrogen sulphide gas (H_2S)	• Leaves turn light green (sometimes • yellowing , starting with young leaves) • Small and short plants with thin (spindly) stems Reduced nodulation in groundnuts

	formulation on legume roots for nitrogen formation Increases oil content of oil crops like groundnuts, soya beans, sunflower	industries where coal is burnt to release sulphur dioxide (SO_2)		
Iron	• Necessary for the • formation of chlorophyll Activates various respiratory enzymes	• Inorganic enriched NPK • fertilisers and chelates Organic matter	•Soil erosion •Leaching, especially of acidic soils, in which iron is soluble	• Interveinal-clorosis of • young leaves Young leaves • turn completely white in severe cases Twigs stop growing and die (the whole branch may die in severe cases)
Boron	• Essential for cell division • of meristematic tissue • Regulates carbohydrate metabolism Important in the transfer (translocation) of sugars (starch) within the plant	• Inorganic enriched NPK • fertilisers and borax Organic manure	•Soil erosion •Leaching	• Poor growth and sometimes • terminal buds die Shortening • of internodes Poor or necrotic spots on fruits or tubers
Manganese	Activates enzymes and acts as a catalyst in the formation	• Fertilisers like Manganese Sulphate are used • to correct deficiencies	• Soil erosion • Leaching in acidic soil condition	• Mottled interveinal chlorosis of young leaves • Interveinal white/ brown

	of chlorophyll	Organic matter		specks in some cereals
Molybdenum	• Promotes synthetic nitrogen • fixation in legumes • Increases nitrogen utilization	• Inorganic NPK • enriched fertilisers Organic matter	• Soil erosion. • Leaching in alkaline soil, in which it is very soluble Fixation into insoluble forms by ferrous oxides in acidic conditions	• 'Whip tail' in brassica crops such as cauliflower and broccoli (leaves • curl into a whip-like tail) Failure of legumes (in severe cases)

Applying appropriate chemical fertilizers and organic manure

Compost manure preparation

❖ Compost manure is the decayed organic waste

Preparation procedure

1. Gather plant residues
2. Pile them on a heap or in a pit in layers
3. Add a source of nitrogen to the material in form of nitrogen fertilizer or already decayed farmyard MANURE
4. Vary drying materials such as maize stalks need to be added with water to facilitate decomposition
5. Turn the material occasionally in order to promote decomposition by allowing air to penetrate into the pit or heap
6. If compost is done in the wet season, find a place where soil is free draining
7. Cover up pit/heap with a layer of soil once full

Applying compost manure

- Compost manure is applied to each planting station before planting
- The manure is then buried so that when planting time comes, the seed is planted on top of the manure

How to apply inorganic fertilizer

1. **Based on time of application**
   (a) Basal dressing
   - Fertilizer is applied during planting or soon after seedling emergence

- The fertilizer is applied on each planting station (at the base of the crop) and then covered with soil in case three seeds per station using dollop method
- Where *Sasakawa* method is used, fertilizer is applied between the consecutive planting stations using dollop method
- In case where the crop is closely planted, e.g. in beans, the ridge is first cut into a trench in which fertilizer is sprinkled, covered with soil before the seed is planted at the appropriate spacing - this is banding method (b) Top dressing
- This is any subsequent application of fertilizer made after first application
- Usually, nitrogen containing fertilizers are applied in order to boost the crop's yielding potential

2. **Based on fertilizer placement**

(a) Dollop method/Side dressing

- Two holes are made on each side of the planting station using a stick
- The holes should be 7 to 10 cm away from the plants to avoid cutting the roots of the plant and 10cm deep.
- Fertilizer is applied in these holes using recommended measurements
- The holes are then covered with soil to prevent fertilizer from splashing out by rain drops or being washed away by run-off

(b) Banding method

- A trench or groove is made around the planting station
- The fertilizer is sprinkled in the trench
- Then the trench is covered with soil
- It is commonly used in fruit trees

(c) Broadcasting method

- Fertilizer is broadcast onto the crop using a hand or machine (a broadcaster) It is usually used in rice, millet, wheat

TOPIC 8: VEGETABLE PRODUCTION

Importance of vegetables

1. They are source of nutrients like vitamins and minerals

 Vegetables provide

(i) Vitamin A, B, C, K and E

(ii) Minerals, e.g.

- ✓ Iron
- ✓ Phosphorus
- ✓ Calcium
- ✓ Iodine
- ✓ Sodium
- ✓ Potassium

2. They are a source of income
3. They provide employment to farmers and other agro-traders in vegetable selling

Classification of vegetables

Table 8.1. *Classification of vegetables*

Indigenous vegetables		**Exotic vegetables**
Local/English name	***Scientific name***	
Luni (Cat's whiskers)	Gynandropsis *gynandra*	Cabbage
Bonongwe	Amaranthus *thunbergii*	Rape
Denje	Corcohorus *trilocularis*	Pumpkins
Mpiru (Local mustard)	Brasca *juncea*	Lettuce
Mnkhwani	Cucurbita *maxima*	Carrot
Chitambe	Vigna *unguiculata*	Cucumber
Khwanya	Phaseolus *vulgaris*	Egg plants
Limanda	Hibiscus *acetoslla*	Tomatoes
Chisoso/Kazota (Black jack)	Biden *spilosa*	Beans and peas
Mwamunaaligone	Galinsoga *parviflora*	Onions
Zumba	Crotalaria *ochroleuca*	Cauliflower
Kamganje	Brusca *juncea*	Pepper
Chikaka/Chipwete (Pricky cucumber)	Monordica *foetida*	Beetroot

Advantages of indigenous vegetables over exotic vegetables

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

Factors to consider when choosing a site for vegetable growing

(a) Water supply
- Water supply must be adequately available throughout their growing period so that they do not dry up before maturity
- Water sources for vegetable growing can be
  (i) A dam
  (ii) A river or stream
  (iii) Lake

(b) Suitability of soil
- Freely drained soils are best for vegetable growing
- Waterlogged soils cause suffocation of roots resulting into crop failure
- Sandy loam soil with high nutrient levels is suitable (c) Closeness to the market and home
- This ensures that the vegetables reach the market before they get damaged, as they are perishable goods

(d) Size of land
- This determines how much and how many types of vegetables the farmer wants to grow

Construction of a simple vegetable fence

Materials used

- Grass/reeds
- Bamboos
- Strings/ropes
- Poles

Procedure

1. Marking the boundary of the field
2. Digging holes in which poles are fixed
3. Fixing the poles around the field
4. Tying cross members to the poles
5. Thatching with grass/reeds with strings/ropes
6. Trimming the grass **Figure 10.1. Arise p86**

Note: - Some farmers make a wire fenced vegetable garden

- This is more expensive but durable

Importance of constructing a fence around a vegetable garden

- The fence protects the vegetables from animals such as goats, cattle and chickens
- The fence protects the vegetables from strong wind which may spread pests and diseases.

Preparing seed beds for vegetable growing

 A seed bed is a place that has been prepared for planting seeds and raising plants

Operations for preparing a vegetable seed bed

1. Ploughing the flied
   - The field should be ploughed to a depth of between 25cm and 30cm
     - This ensures that water will properly infiltrate and drain
     - It also ensures proper root penetration and development
2. Harrowing
   - Harrowing is a practice of breaking large soil lumps (clods) which are realised during ploughing - It ensures that the soil will have a fine tilth

Tilth is a physical property of soil which describes the size of soil lumps on the seed bed.

Importance of fine tilth in a seed bed

- Seeds can be placed to a correct planting depth
- It promotes emergence of seedlings
  - since big soil lumps prevent seedlings from getting out of the soil

3. Applying manure
   - Vegetables do well where large quantities of manure are applied

Importance of manure application

- Manure applies nutrients to plants
- Manure keep moisture in the soil necessary for plant growth
- Manure improves soil structure, thereby preventing soil erosion

Note: Manure should be thoroughly mixed up with the soil

4. Levelling the ground
   - It prevents water flow
5. Constructing seed beds across the slope, where a raised seed bed is preferred Preferably, a bed should be one metre wide and of any length Length depends on:
   (i) Farmer's desire
   (ii) Number of seedlings to be raised
   - Preferably, the distance between the beds should be 30cm to 50cm
     - to allow the farmer to move freely between them Raised seed beds should:
   (i) have right angles or
   (ii) be parallelograms

Method used to ensure that seed beds have

right angles o 3, 4, 5 or triangulation

method

How to construct a seed bed using triangulation method

Materials

- Tape measure
- Pegs
- Hummer

Procedure

1. Peg points a, b, c with a right angle at a.
2. Peg another point from c to d so that it is 4m long
3. Connect points b and d
4. Construct a seed bed whose dimensions are 4m x 1m
5. Repeat steps 1 to 4 several times depending on number of seed beds required

Figure 10.2. Arise: Triangulation method

Types of seed beds

There are three types of seed beds

1. **Raised beds**
   - These are seed beds where the ground is raised by piling up the already prepared soil to a height depending on type of soil

   They are constructed during the rainy season

   - to drain away excess water
2. **Sunken beds**
   - These are seed beds where the ground is first dug in order to make a basin
   - Then the ridge is created around the bed
   - A lot of manure is then put in the bed

   They are made for dry season gardening

   - to keep water
3. **Nursery beds**
   - These are beds where seedlings are raised before they are transplanted in the field
   - They are constructed like raised beds

- Their size is based on quantity of seedlings needed for the field The soil should be of fine tilth

Sowing vegetables

 Sowing means planting seeds into seed beds.

Ways of sowing vegetable seeds

- Direct sowing
- Indirect sowing

a) Direct sowing

- Seeds are sown on the main field where they will grow and mature ready for harvest
- It does not require a nursery bed
- It is suitable for carrot, beet root, spinach, turnips, okra, cucumbers, pumpkins, beans (khwanya), chitambe, peas

b) Indirect sowing

 This is when seeds are first sown on the nursery bed and later the seedlings are transferred to the main field Most vegetables can be sown indirectly.

Importance of indirect sowing

 Seedlings are easier to start on the nursery bed than directly on the field

- Perfect conditions to hard-to-germinate or very small seeds are easily provided

 A farmer gets a jump on the growing season when he/she sow seeds indoors

- Where the weather is too cold to sow seeds in the field, the seedlings can be sown indoors while waiting for the weather to become ideal (Seed starting or starting, in short)

 Vegetables suitable for indirect sowing are those that tolerate root disturbance during transplanting

Steps followed when sowing seeds on a seed bed

1. The nursery bed be watered thoroughly up until all the soil is wet
2. Make drills where the seeds shall be sown
   - Seeds must be placed four times their diameter into the soil so that seedlings can emerge
3. Mix the seeds with sand or saw dust and sow them in drills
   - The sand or saw dust helps the seeds to be evenly spread on the drills during sowing
4. Cover the drills with sand
5. Cover the seed bed with grass
   - To protect the seedlings from sun's heat

- To conserve water

6. Apply water to the seed bed

Caring for seedlings

1. Water application
   - Seedlings need adequate water
   - Frequency of water application depends on the rate of water loss from the seed bed
   - Seedlings can be watered once or twice a day to ensure that the seed bed is kept moist all the time

   Too much water makes the soil saturated
   - This reduces amount of air in the soil, hence poor root respiration
2. Fertilizer application
   - In addition to adequate manure, high quantities of nitrogen are essential to ensure rapid seedling growth
     - Apply nitrogen fertilizers, e.g. Calcium Ammonium Nitrate (CAN)
   - Fertilizer can be applied by broadcasting it on the surface of the bed
   - However, vegetables do better with manure than more pure inorganic fertilizers
3. Weeding

   Weeding is the removal of unwanted plants in the crop field
   - It should be done as quickly as possible to avoid competition for sunlight, space, nutrients and water with the seedlings
   - It must be done anytime the weeds are seen growing on the seed bed
4. Tilling
   - The soil should be tilled
     - Tilling loosens the soil so that water and air can enter and circulate in the soil
       The farmer uses a garden fork for tilling
5. Pest and disease control
   - Vegetable pests attack both leaves and roots

Table 8.2. *Common vegetable pests*

Pest	**Part attacked**	**Vegetable**	**Control**
Nematodes	Roots causing plant wilting	▪ Cabbage ▪ Rape ▪ *Denje*	▪ Crop rotation ▪ Soil fumigation
Aphids	Roots	▪ Rape ▪ Cabbage ▪ *Denje*	Applying *Dimethoate* or *Rogor*
Caterpillars and cutworms	Leaves Roots	Almost all vegetables	Spraying *Carbaryl* or *Malathion*

- Most common diseases of vegetables are
  (i) Leaf spot
  (ii) Powderly mildew
  (iii) Root rot
  (iv) Dumping off

Table 8.3. *Ways of controlling most serious diseases of vegetables*

Disease	**Control**
Leaf spot	▪ Spraying with *Daconil* ▪ Crop husbandry practices, e.g. crop rotation, use of clean planting seeds ▪ Rouging the affected plants
Dumping off	▪ Correct plant population ▪ Controlling amount of water application to the seed bed

6. Tilling the seedlings
   - Thinning means uprooting excess seedlings
   - It should be done about ten days after germination
     - A delay can reduce the quality of seedlings because they will compete for water, nutrients and sunlight It causes seedlings to grow thin, tall and yellow
   - The bed should be watered before thinning
     - So that only the seedlings intended are removed
7. Hardening off the seedlings
   - Hardening off means to prepare the seedlings to new growing conditions by reducing amount of water applied to the nursery two weeks before transplanting
     It helps seedlings to develop tough stems and leaves to withstand inadequate water and root disturbance when uprooted at the time of transplanting

Transplanting vegetables

Steps to follow when transplanting vegetables

1. Apply water thoroughly to both the nursery and the field
2. Marking planting stations following recommended spaces

Table 8.4. *Measurements of planting stations for vegetables*

Name of vegetable	Distance between planting stations
Tomato	90cm x 60cm x 1 seedling
Cabbage (large)	60cm x 60cm x 1 seedling
Cabbage (small)	50cm x 45cm x 1 seedling
Bonongwe	45cm x 45cm x 1 seedling
Rape	45cm x 45cm x 1 seedling
Onion	30cm x 10cm x 1 seedling
Egg Plant	90cm x 60cm x 1 seedling
Chinese Cabbage	45cm x 45cm x 1 seedling
Lettuce	45cm x 45cm x 1 seedling
Green Pepper	2m x 2m x 1 seedling
Mpiru	45cm x 45cm x 1 seedling
Carrot	30cm x 10-15cm x 1 seedling
Okra (exotic)	60cm x 30cm x 2-3 seeds
Okra (indigenous)	60cm x 60cm x 2-3 seeds
Paprika	15cm x 15cm x 1 seedling

3. Lift seedlings from the nursery with as minimal root disturbance as possible **Figure 10.3. Arise: Carrying seedlings**
4. Insert the transplants into the holes and firm the soil around the seedling
5. Cover the transplant with grass or plant leaves which are big enough to cover them This is mulching

Importance of mulching

- It protects the seedlings from hot sun
- It conserves water by reducing evaporation
- It checks weeds
- It controls erosion and soil compaction

6. Water the transplants
7. Once the transplants are established, the cover should be removed

Caring for transplants

- Caring for transplants is the same as in seedlings while on the nursery beds

- In tomato, production, staking and de-suckering are very important (a) Staking means supporting the tomato plant with a stick.
  - To avoid the plant to fall to the ground
  - To protect the fruits from getting in contact with the soil from which they can develop fruit to rot disease

(b) De-suckering means removing suckers from the plant

 This ensures that mineral salts and plant food needed for development of high quality tomatoes are used by few branches

Ways of controlling pests and diseases in vegetables

 Pest control refers to the regulation or management of pest, usually because it is perceived to be detrimental to a crop.

General methods of pest and disease control

a) Cultural methods

- The use of cultural or husbandry practices to reduce pests and disease incidents in vegetables, e.g.
  - Early planting
  - Use of clean seeds
  - Crop rotation
  - Correct spacing in plants
  - Mulching
  - Early weeding
  - Intercropping or mixed cropping
  - Removing volunteer vegetables
  - Destroying crop residues soon after harvest to avoid carry over from one season to another **b) Chemical methods**
- This is the use of toxic substances, e.g. dust, liquid or fumes sprayed using hand units equipment like hand sprayers to control pests and diseases

 Great care must be taken when using the chemicals as some may be dangerous to humans and wildlife **c) Physical methods**

- This is mechanical pest control by the use of hands-on techniques as well as simple equipment, devices and natural ingredients that provide a protective barrier between plants and pests, e.g.
  - Physically removing pests from the ground (tillage)
    - For weed control
  - Hand picking (removing by hand)
    - For army worms, grasshoppers, beetles, caterpillars

- Scaring away
  - For birds, rats
- Use of traps
  - For rats or mice

d) Biological methods

- Biological pest control is done through the control and management of natural predators and parasites
  - It aims at eliminating a pest with minimal harm to the ecological balance of the environment in its present form

Harvesting vegetables

(a) Leaf vegetables

- ✓ Leaf vegetables should not be harvested when they are too tender (succulent) or too tough
  - They tend to be too watery or to have too much fibre
- ✓ A well matured vegetable leaf looks shiny and pale
- ✓ When leaf vegetables start flowering, they become less nutritious because nutrients translocate from the leaves to the developing seeds

(b) Fruit vegetables

- ✓ They need to be harvested when they are ripe
  - Ripeness differs with the type of fruit vegetable
- ✓ Okra, egg plants should be harvested before they start developing fibre

Methods of harvesting vegetables

1. Leaf vegetables are harvested by use of a knife
   - ➢ Cutting must be slanting downward

   Reason: To avoid water accumulating on the wound that can cause rotting

   - ➢ Best time for harvesting leaf vegetables is:
   - ➢ Leaf vegetables should be packed tightly in baskets where fresh air can circulate

   Reason: To avoid dumping off

2. Fruit vegetables are harvested by plucking gently without squeezing
   - If there is no ready market, the stalk should remain on the fruit, especially

   tomatoes **Reason**: So that they ripen slowly

TOPIC 9: CLASSES OF LIVESTOCK

Classes of livestock based on their digestive system

(i) Ruminants
(ii) Non-ruminants

Ruminants

- A ruminant is a mammal that digests plant-based food by initially softening it within the animal's first compartment of the stomach, then regurgitating the cud and chewing it again
- Cud is the semi-digested mass
- The word 'ruminant' comes from the Latin word '*ruminare'*, which means 'to chew over again' Examples of ruminants are:
  (i) Cattle
  (ii) Goats
  (iii) Sheep
  (iv) Horses
  (v) Birds

Non-ruminants

- A non-ruminant is an animal that does not regurgitate the cud Examples of non-ruminants include:
  (i) Donkey
  (ii) Pig
  (iii) Rabbit

Importance of classification of livestock based on their digestive system

- It helps to decide on the type of feeds they should be given
  - This makes the feed given to the livestock to be useful

The difference between the digestive system of ruminants and non-ruminants

- Ruminants have four chambered stomachs while the stomachs of non-ruminants has only one chamber
- Ruminants digest cellulose while non-ruminants do not digest cellulose

Figures 11.1 and 11.2. Arise p103

Functions of different parts of the digestive system of livestock

Ruminant digestive system

(a) Rumen/paunch

- Temporary stores the feed for regurgitation
- It is where muscular contractions churn and mix feed with digestive juices together with microorganisms (bacteria and protozoa) present in the compartment
  - There is a symbiotic relationship between the rumen and microorganisms o Symbiotic relationship is a relationship whereby each benefits from the other

Ways in which the rumen and microorganisms benefit from each other

Benefits to the animal

(i) Microorganisms break down cellulose found in the cell walls of vegetative feed, hence the animal obtains nutrients from the feed

(ii) The microorganisms synthesise protein from the nutrients released from the broken down cellulose which the host animal uses for body building

(iii) The microorganisms also synthesise vitamins B and K which are used by the animal

Benefits to microorganisms

(i) Rumen provides suitable living environment for microorganisms

- The pH of the rumen is 7 (neutral as water) making it suitable for living

(ii) The animal provides food to microorganisms

(b) Reticulum/honey comb

- It screens the feed
  - Only fine particles proceed to the next compartment
  - Coarse feed is sent back to the rumen for further break down

(c) Omasum/bible/many plies

- It is called the bible or many plies because it contains a lot of leaf-like structures
- It is where large quantities of water found in the feed is absorbed

  Reason: so that when the feed gets into the next compartment, enzymes can be effective enough to digest the feed

(d) Abomasum

- This s the true stomach
- It is where feed is mixed with gastric juice thoroughly
- Feed is reduced to a uniform creamy soup (chime)
- Enzymes and hydrochloric acid secreted by the cells of the gastric glands digest proteins chemically
- This is where both, physical and chemical digestion take place

(e) Small intestine (duodenum and ileum)

- This is where the feed is mixed with pancreatic juice to break down protein further into amino acid
- It is where amino acid s are absorbed

(f) Large intestine/colon

- Here, no any digestion takes place
- Only water absorption takes place **Non-ruminants digestive system**

Figures 11.3, 11.4 and 11.5. Arise p105-106

Differences in digestive systems among non-ruminants

Non-ruminants like horses, rabbits and donkeys digest cellulose just like ruminants

Reason: They have a functional caecum which works like the rumen of ruminants

- The caecum contains millions of bacteria and protozoa which ferment the cellulose and synthesise proteins and some vitamins

Digestion in chicken

Table 9.1. *Digestion in a chicken*

Part	Description	Functions
Beak	This is a bone-like structure capable of regrowing if it is cut	• It picks up food from the ground • It breaks up food into small sizes - In case of groundnuts, the beak can break the pod to release the nuts
Mouth	• There are no teeth; but a pointed tongue which has taste buds. • Unlike other animals, the saliva does not have salivary amylase	• The taste buds on the tongoue help the chicken in selecting feeds • The tongue helps in swallowing feeds
Upper oesophagus	It is a tube	It is a passage of feed from the mouth to the crop
Crop	It is an enlargement of the oesophagus	It stores feeds during which it gets moistened in readiness for physical digestion
Lower oesophagus	• It is a connecting tube between the crop and the proventriculus.	It is a passage of feed from theo crop to the proventriculus

	• It is more swollen than the upper oesophagus	
Proventriculus	It is the true stomach	It produces gastric juice (water, hydrochloric acid and enzymes) which digest protein
Ventriculus (Gizard)	• It has thick and muscular walls. • Its lining is rough. • It contains sand called grit	With the help of the grit and rough lining, the gizzard grind feed into small particles
Small intestines	It is made up of duodenum and ileum	It is only where chemical digestion takes place, releasing feed nutrients which are also absorbed here
Caecum	It is made up of two branched blind sacs	They contain microorganisms which digest cellulose
Colon	Large intestine	Absorption of water from the indigestible feed
Cloaca (vent)	It is a common opening for urinary, digestive and reproductive system	It is a passage through which feaces and urine are passed out

TOPIC 10: CHICKEN PRODUCTION

Breeds of chicken

- Local breeds
- Exotic breeds

How breeds of chicken differ

They differ in

(i) Growth rate (feed conversion ratio)
(ii) Disease resistance
(iii) Mature size weight
(iv) Wide variation in plumage, colour and size

Table 10.1. *Characteristics of local and exotic chicken*

Breed	Characteristics
Local	▪ Slow growth rate ▪ More disease resistant ▪ Small mature weight size ▪ Wide variation in plumage (rough and smooth), colour ▪ Some have naked necks (Kadzimete)
	Some have curled feathers (Kasilanga) Size, colour, shape of wattle differ Height –some are dwarf *(kabwata)*
Exotic	Fast growth rate Less disease resistant Large mature weight size Distinct and uniform features, e.g. feather colour, size, wattle shape and height High productivity

Figure 12.1. Arise p 110

Main practices in chicken production

- Housing
- Feeding
- Breeding
- Parasite and disease control

Housing requirements for chickens

A chicken house (shelter) serves to protect chickens from

(i) Predator
(ii) Adverse conditions of cold and heat
(iii) Theft

Qualities of a good chicken house

It must

- be big enough to accommodate all the chickens
- be well ventilated
- be easy to clean
- be warm, especially during cold season and cool in the dry season
- be clean and dry

- have well thatched roof
- be well lighted
- be strong and secure

Constructing a chicken house

Some materials used are

- ✓ bricks or soil blocks
- ✓ timber or wooden poles and bamboos
- ✓ nails, *linya*, ropes, strings
- ✓ cement, sand, gravel and/or soil
- ✓ wire mesh
- ✓ iron sheets or thatching grass

Types of chicken houses

1. **Deep litter house**
   - It houses chickens of all sizes and production stages
   - It should have hanging pegs
   - They allow chickens roost on at night
   - It should have nesting boxes at different strategic places
   - These allow laying hens find security for their eggs and hatching chicks
   - Chickens are allowed free-range to pick whatever they can find outside

   Figure 12.2. Arise p112

2. **Battery cage house**
   - It is ideal for laying hens
   - Each hen has its own cage
   - It only allows the chicken very limited movement to ensure that there is very little energy wasted; instead it should be directed toward egg production
   - Feed and water troughs are placed strategically close to the chickens
   - The farmer brings feed and water to the chickens

   A battery cage is an improved deep litter system
   - It can accommodate more hens on a small space as the house expand upward

   Figure 12.3. Arise p113

3. **Traditional house**
   - It is to be constructed using locally available materials
   - Size of the house should match with the number of chickens being housed
   - It has no special design
   - It is basically meant to protect chickens during the night and be released at day break

Feeding chickens

Feeding broilers

- Broilers are chickens raised primarily for meat
  - Should be raised not more than eight weeks to get more profit
- Sources of broiler feeds are:
  - (i) Commercially produced or bought from the market
  - (ii) Formulated from selected feeds
- The three types of feed for broilers based on age of growth are as follows

Table 10.2. *Type of feed given to broilers*

Stage of growth	**Type of feed**
Day old to 4 weeks	Broiler Starter Marsh
4-6 weeks old	Broiler Growers Marsh (Broiler Marsh)
6-8 weeks old	Broiler Finisher Marsh

- Avoid over-filling the feeding troughs
  - This prevents wastage of feeds
- Cleaning feed and water troughs regularly
  - To prevent diseases
- During the first two weeks, add Oxy-Vit (antibiotic and vitamins) to water
  - To prevent diseases
    - The feed troughs are put on plastic paper

Reason: 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

Reason : So that the chickens can eat from the troughs while standing on the floor

Feeding layers

- A layer is a chicken solely for laying eggs and does not brood
  - Their eggs are not fertilized
- The three types of feed for layers based on age of growth are as follows

Table 10.3. *Type of feed given to layers*

Stage of growth	**Type of feed**
Day old to 5 weeks	Chick Starter Marsh
6-20 weeks old (pullets)	Growers Marsh/Pullet Marsh
Over 20 weeks (layers)	Layers Marsh

How to feed day old chicks

- The feed is put on flat surface, usually on sheet of paper

  Figure 12.4 Arise p115

How to feed pullets

- The feed trough is put on the ground

  Figure 12.5. Arise p115

How to feed chickens over 20 weeks old

- The feed trough is hang up

Reason: so that the chickens do not spill out the feed to the floor while feeding

Diseases of chickens, their causes, signs/symptoms, transmission and control

Table 10.4. *Diseases of chickens, their causes, sign/symptoms, methods of transmission and control methods*

Disease	Cause	Transmission	Signs and symptoms	Control
New Castle	Virus	Contact with infected chicken	• Paralysis of one side • Loss of balance • Twisting of the neck • Difficulties in breathing • Green diarrhea • Shaking	• Vaccinate the chicken at 3 weeks old • Kill and burn or burry 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 chicken	Sores on the comb, wattles and around the beak	• Vaccinate them at 3 weeks old • Treat the sores by use of iodine solution • Isolate the sick from the health
Gumboro	Virus	Contact with infected chicken	• Dullness • Sleepy • Swollen cloaca • Restlessness	• Vaccination • Prophylactic treatment by using antibiotics

			• Death of 4 week old chicks	
Cocidiosis	Protozoa called coccidian	Picking from the ground	• Blood tinged feaces • Rough plumage • Deaths of chicks	• Vaccination • Keeping the chicken house dry to reduce multiplication of coccidian • Giving the chickens amprolium
				in water or feed
Fowl Typhoid	Bacteria	-Trans-ovariary. -It is dangerous to humans if eggs are eaten raw	• White 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	• Amprolium in • water or feed • Testing and killing • infected birds • Regular • vaccination Keep poultry house clean, dry and well ventilated There is poor response to treatment
Fowl Cholera	Virus	• Contact with carriers • Contaminated feeds, water, soil or litter • Infected carcasses when not properly disposed of	•Loss of appetite •Loss of body •weight Gasping, coughing •and sneezing •Difficulties in breathing •Diarrhea with grey •yellow/green colour Lameness •and swelling of joints (wings and legs) Head, comb and wattles turn purple	• Keep new chickens in isolation for one • month before mixing them with the rest • Never mix the old with young ones • Slaughter all sick • birds Disinfect the house before new ones are introduced Vaccinate the chickens when they are 8-12 weeks old

			Oedema around the eye region	Use of drugs like Sulphadimidine can be effective although there is no economic treatment

Figures on some diseased chickens

Parasites of chickens

- ✓ Flea
- ✓ Tampans
- ✓ Leg mites
- ✓ Round worms
- ✓ Hook worms
- ✓ Tape worms
- ✓ Lice

Types of parasites of chickens based on the site of infection

1. Internal parasites/Endo-parasites
   - ✓ Round worms
   - ✓ Hook worms
   - ✓ Tape worms
2. Exo-parasites (External)
   - ✓ Fleas
   - ✓ Tampans
   - ✓ Leg mites
   - ✓ Lice

Effects and control of chicken parasites

Table 10.5. *The effects and control of chicken parasites*

Parasite	Effect	Control
Mites	• Suck blood causing anaemia leading to general body weakness • Cause irritation and discomfort	• Litter should be burnt in case of infection and nesting boxes should be cleaned

		• Cracks should be filled because that is where they
		hide during the day - Clean the house, feed and water troughs - Disinfect the house and all the equipment by use of nicotine or malathion
Tape worms	• Suck food nutrients from the small intestines causing retarded growth in chickens and loss of production in layers • Increased susceptibility to other diseases Diarrhoea Increased thirst birds become unthritfty	• Sanitation and hygiene • Give chickens clean water • Confine the birds so that they do not ingest intermediate hosts like grasshoppers or ants Pasture • dressing with benzene hexachloride Treatment is not economical. However use of di-nbutyl tin dilaurate or di-n-butyl tin oxide is effective
Round worms	• Suck food nutrients from the intestines • Retarded growth • Reduced egg production • Diarrhoea Hemorrhages and anaemia	• Keeping the house clean • Always keep the feed and water trough clean Avoid keeping old and young chickens together - Usually the older ones are more resistant than the young ones - Give the chickens drugs such as piperazine, phenothiazine or hygromycine B
Fleas, tampans and lice	• Body irritation • Suck blood and cause anaemia and loss of production • Heavy infection of the head causes swelling and ulcers	• Apply lard and paraffin on infected areas. - The lard causes the fleas to suffocate; as a result they fall off Infected litter should be removed and be burnt Apply malathion or creosote to the infected house
Hook worms	• Attach themselves to the intestinal lining and suck blood •	• Disinfect the chicken house • Foot bath at entrance to chicken house with disinfectant •

	Cause anaemia leading to weight loss and weakness	Proper disposal of sweepings from the chicken house

Chicken predators

 A predator is an animal which catches and feeds on another animal Some of the predators of chickens are:

- ✓ Wild cats
- ✓ Hawks
- ✓ Eagles
- ✓ Ravens
- ✓ Alligators
- ✓ *Nyenga*
- ✓ Snakes

Ways of controlling predators of chickens

- Keep the chickens in complete confinement
  - ➢ so that they are not exposed to any of these predators
- Where chickens are raised in a house with a run (open space), wire mesh should be put above the open space So that no predator enters the open space through the top
- Keep the house well illuminated
  - ➢ So that the farmer can see the inside clearly
- Vents should be filled with wire mesh
  - ➢ To avoid snakes, wild cats from using them to enter the house

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