AGRICULTURE

FOR

STANDARD 8

BY CIDRECK MACHESO **0995 734 221**

STANDARD 8 AGRICULTURE

Written by CIDRECK MACHESO

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CIDRECK MACHESO

UNIT 1 THE PROBLEMS OF A FARM BUSINESS AND THEIR SOLUTIONS By CIDRECK MACHESO

THE PROBLEMS OF FARM BUSINESS

- what to produce
- how to produce
- when to sell
- where to sell
- how much to produce
- when to produce

SOME OF THE SOLUTIONS TO FARM BUSINESS PROBLEMS

a. What to produce
   - The farmer should produce where the market is readily available
   - The farmer should produce where the roads are near and passable
   - The farmer should produce where the climatic conditions are favourable

b. How to produce
   - the farmer should aim at using methods or technologies that are cheaper and yet profitable

c. When to sell
   - farmers should sell their commodities when the price is high

d. When to produce
   - farmers should produce throughout the year by using irrigation during the dry season
   - farmers should produce when the commodities are scarce for a higher price

UNIT 2 THE PRINCIPLES OF A FARM BUSINESS

In order to solve the problems of farm business such as what to produce, how to produce, when to produce, when to sell and where to sell, some principles of agricultural production can be applied.

These principles are:

- comparative advantage
- substitution of inputs
- demand and supply

a. Comparative advantage

Farmers should engage in the enterprises which are best suited in their areas in order to produce more.

The production will be increased if farmers engage in those activities for which they have the greatest advantage over others.

The principle encourages farmers to specialize in enterprises that are suited in their areas.

This principle is applied to solve the problems of what to produce and where to produce.

b. Substitution of inputs

The principle of substitution of inputs guides the farmer in choosing the better inputs, resources, technology or method of production.

Farmers should substitute an input, resource, technology or method for another if it:

- reduces costs but produces the same level of production
- has the same cost but increases production

A farmer can decide to weed a maize garden by either spraying herbicides or hoeing out the weeds.

A farmer can also decide to improve soil fertility by either applying inorganic fertilizers or organic fertilizers.

This principle is applied to solve the problems of how to produce and how much to produce.

c. Demand and supply

Demand is the quantity of a commodity required by buyers.

Supply is the quality of a commodity available for sale.

The price of a commodity is determined by both demand and supply for it.

If the demand for a commodity is greater than the supply, the price will be high.

If the supply of a commodity is greater than the demand, the price will be low.

The actual price of a commodity is determined when demand and supply are equal.

This principle is applied to solve the problems of what to produce, how much to produce, where to sell and when to sell.

UNIT 3 RISKS IN FARM BUSINESS

THE MEANING OF THE TERM 'RISKS' IN A FARM BUSINESS

Risks are unpredictable or unforeseeable occurrences that negatively affect agricultural production or profits.

RISKS ASSOCIATED WITH A FARM BUSINESS

- weather changes
- fire
- pests and diseases
- price changes
- floods
- policy changes

RISK MANAGEMENT

There are various ways of coping with risks in a farm business.

Some of them are as follows:

- ★ insurance
- ★ enterprise diversification
- ★ market research
- ★ contract production
- ★ use of appropriate agricultural practices

UNIT 4 THE PROBLEMS OF AGRICULTURAL MARKETING AND THEIR SOLUTIONS

PROBLEMS OF AGRICULTURAL MARKETING

Some of the problems of marketing agricultural products are as follows:

- bulkiness of farm produce
- seasonality of produce
- perishability of products

Solutions to the problems of agricultural marketing

Problem	**Possible solutions**
Bulkiness of farm produce	• Packaging produce in suitable containers such as tobacco in bales, eggs in trays

	• Using special transport facilities for certain produce such as special trucks for cattle
Seasonality of production	• Storing produce in time of plenty to sell at a time of scarcity at a better price
Perishability of produce	• Producing the perishable products near a market • Storing produce in cold rooms or freezers • Processing produce such as drying, salting or smoking fish and meat; canning fruits

UNIT 5 SOIL FERTILITY

Meaning of the term 'soil fertility'
Soil fertility is the ability of a soil to supply adequate water, air and nutrients in proper balance for plant growth and development.

Characteristics of fertile and infertile soils

Characteristics	**Fertile soil**	**Infertile soil**
Nutrient availability	High	Low
Organic matter content	High	Low
Soil texture	Medium	Too course or too fine
Soil structure	Crumb or granular	Compact or course
Soil depth	Deep soils (especially top soil layer)	Shallow soils
Drainage	Adequately well-drained	Poorly drained
Presence of micro-organism	High	Low
Plant growth	Rapid or vigorous	Slow and stunted

UNIT 6 SOIL NUTRIENTS

SOIL NUTRIENTS
Plants require different elements for normal growth and production.

Some of these are non-mineral elements supplied by air and water.

The other mineral elements are obtained from the soil.

CLASSIFICATION OF NUTRIENTS

Nutrients can be classified into major and minor types.

MAJOR NUTRIENTS

These are nutrients required by the plants in large quantities.

These include: nitrogen, phosphorus, potassium, calcium, magnesium and sulphur.

MINOR NUTRIENTS

These are nutrients required by the plants in small quantities.

These are iron, boron, copper, manganese, chlorine, molybdenum and zinc.

These are also called trace elements.

Functions of some of the major nutrients

Nutrients	**Functions**
phosphorus	• vegetative growth of plants • formation of dark green leaves
potassium	• development of strong roots
potassium	• development of strong stem • formation of high quality fruits

DEFICIENCY SIGNS OF MAJOR NUTRIENTS IN CROPS

This are signs that appear in plants when a nutrient is lacking. Such signs can be corrected by applying a fertilizer that contains the lacking nutrients.

Deficiency signs of some major nutrients

Nutrient	Deficiency signs
nitrogen	• stunted growth (thin and shot plants) • yellowing of leaves starting with the tip following the mid forming V-shape
phosphorus	• poor root development

	• purple leaves
potassium	• weak stem • yellowing of leaves starting with the leaf margin and later turns brown • poor quality fruits • immature fruit fall

UNIT 7 IMPROVING SOIL FERTILITY

WAYS OF IMPROVING SOIL FERTILITY

a. Practising mixed cropping

Mixed cropping involves growing different crop in in the same field during the growing season.

For instance in the same garden the following crops may be planted together: maize, sorghum, beans, cassava and pigeon peas.

Soil fertility will be improved because a lot of organic matter is produced. This organic matter holds and binds fine soil particles which improves soil structure.

Some crops may fix nitrogen with increases nutrient content in the soil.

b. Agroforestry

Trees are grown together with arable crops on the same piece of land.

This improves soil fertility in the following ways:

- leguminous trees fix nitrogen which is one of the of the major nutrients in the soil
- there is effective ground cover which reduces evaporation and soil erosion
- nutrients are recovered by deep rooted crops from subsoil to topsoil layer

c. Application of mature

Different types of manure such as farm yard, compost and green mature can be applied to the soil.

These improve nutrient content, drainage and soil structure.

d. Practising crop rotation

This involves growing different types of crops on the same piece of land one after the other following a defined pattern.

If legumes are included, they fix nitrogen, soil erosion is reduced when cover crops such as pumpkins and dwarf beans are planted.

e. Fallowing

This means leaving the land uncultivated for some time so that bush grows.

This increases organic matter.

COMPOST MANURE

Compost refers to plant and organic wastes which has decomposed.

HOW TO MAKE COMPOST

1. measure 1.5 to 2 m diameter on a clear ground
2. fix a 2m stick in the centre of the circle
3. heap a 30 cm thick layer of chopped organic matter
4. add a 3-5 cm layer of chicken manure to encourage decomposition by bacteria
5. add a layer of soil to a depth of 5-8 cm
6. water adequately until it oozes out when the organic matter is squeezed.
7. add wood ash to reduce acid
8. repeat the layers 1.5 height is reached
9. reduce the diameter of the heap as more layers are added. This will result in forming in a conical shape.
10. turn the heap every 7 days or place several sticks close to the base of the stack and several others heights. These will serve as entry points for air. Air is required for effective bacterial work.

IMPOTANCE OF IMPROVING SOIL FERTILITY

- nutrients content of the soil is increased
- when more organic matter is added to the soil and when leguminous plants are included
- it improves aeration of soil
- the organic matter turns into humus upon decomposition. The spongy structure of the humus promotes circulation of air in the soil.
- it improves water holding capacity of soil
- organic matter is spongy hence holds water for a long time
- it supports plants growth.
- when soil fertility is improved crops can grow well

UNIT 8 INDIGENOUS FARM MACHINERY AND TECHNOLOGIES

TYPES OF INDIGENOUS FARM MACHINERY AND TECHNOLOGIES

Indigenous farm machinery and technologies are those that are local in origin.

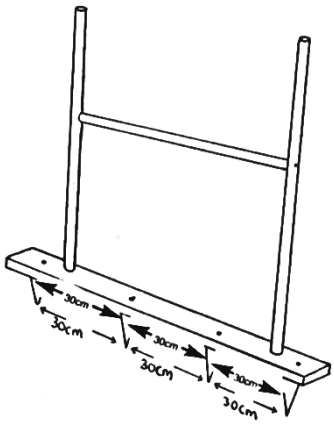
There are different indigenous farm machinery and technologies.

These include the following:

- planting frames
- querns
- leaf bag
- ash
- soot
- winnower

PLANTING FRAMES

This is a plank or wood which has fixed sharp pegs positioned according to recommended spacing of a given crop.



QUERNS (MPHERO)

This is a pair of stones. One is large and the other is small.

They have flat rough surfaces.

They are used for grinding grains.

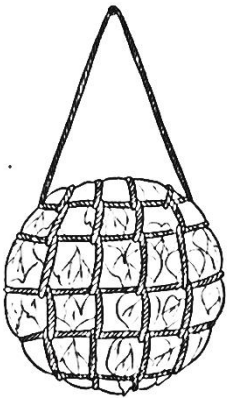
The large stone could be about 60cm long and about 50cm wide.

The large stone is known as 'mother stone ' and the smaller one is known as 'daughter stone'

The grinding is achieved by placing the grains on the mother stone and sliding the daughter stone over the mother stone by forward and backward movements.

LEAF BAG (CHIKWATU)

This is known as chikwatu.

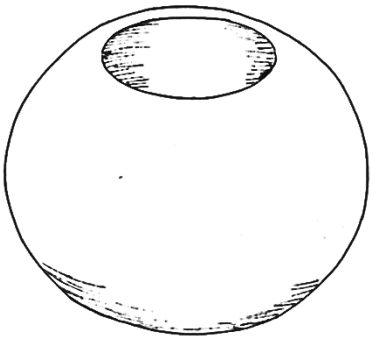


It is an oval or around bag made by tying leaves together with strings.

ASH

Ash that collect after burning specific plants and trees such as amaranthus and baobab are also useful to the farmer.

GOURD (CHIPANDA)

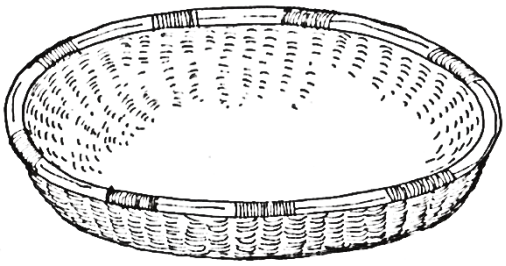


Large fruits of squash plants that are dried and used as containers

SOOT (MWAYE)

This refers to black powder left by smoke which accumulates above a fire place in a tradition kitchens.

WINNOWER (LICHERO)



A flat basket made of bamboo

USES OF INDIGENOUS FARM MACHINERY AND TECHNOLOGIES

MACHINERY /TECHNOLOGY	USES
planting frames	• for accurate measuring and marking planting stations
querns	• for size reduction of legumes. • ending small grains into flour
leaf bag	• for storing seeds and dried vegetables
gourds	• for storing seeds and dried vegetables • for fermenting some agricultural products
pesticides	**Ash** • used as a pesticide such as storing sweet potatoes in potato pits
	• controlling the beetles in pumpkin leaves
	• controlling red ants (linthumbwi)
	Soot • to control weevils in stored grains and cereals
	Tephrosia • used as a pesticide in stored grains • used for controlling mites in pigs • controlling particles in vegetables

UNIT 9 MODERN AGRICULTURAL TECHNOLOGIES

TYPES OF MODERN TECHNOLOGIES

There are many modern technologies that are used to increase agricultural production.

These includes:

- irrigation
- use of herbicides
- permaculture
- composting toilet(eco-san toilets)

IRRIGATION

This is the artificial application of water to crops when the rainfall is not adequate for the crop production.

This system helps to improve agricultural production in the following ways:

- crops can be grown throughout the year. This means farmers can harvest crops throughout the year, hence increased production.
- crops can be grown even when rain fails.
- it enables certain crops to grow in an area where they could not due to shortage of rainfall

USE OF HERBICIDES

These are chemicals that are applied in a garden to control weeds.

They help to improve agricultural production in the following ways:

- killing growing weeds
- preventing weed seeds from germinating

PERMACULTURE

Permaculture is a combination of two words, 'permanent' and 'culture'.

Permaculture aims to design sustainable systems such as building, transportation, agriculture, energy and water.

In agriculture, permaculture imitates nature where different plants and animals grow together and support each other.

Nature does not apply chemicals to improve soil fertility or kill insert pests, but allows everything to grow and produce in balance.

It also makes food available for every living thing throughout the year.

Permaculture encourages:

- growing of a variety of different species of plants and animals that are appropriate to a particular area and that support each other on the same piece of land
- improvement of soil fertility and structure through the use of organic matter and growing of plants that add nutrients to the soil as opposed to artificial chemical fertilizers that pollute the soil, water and air.
- use of natural predators to balance insect as opposed to artificial chemical pesticides or insecticides that harm people and surroundings
- mulching to suppress the growth of unwanted plants as opposed to use herbicides. Mulching also has a benefit of conserving soil and water and improving soil fertility and structure during decomposition

Permaculture involves designing the land in such a way that each plant or animal on the plot plays a role.

A combination of different species on a plot that support each other is called guild.

For example, a plot may have maize, climbing beans, onions, sweet potatoes and chickens.

The beans fix nitrogen that is used by the maize, sweet potatoes and the onions; the maize provides support to the climbing beans; the sweet potatoes cover the ground, protecting it from soil erosion and conserving moisture.

The potato tubers open up the soil for water and air that is used by the other crops including microorganisms; the onions repel harmful insects that attack plants on the plot (instead of onions, the farmer may decide to grow mpungabwi – also known as local basil – to repel insect pests).

The chickens eat insect pests, while droppings add fertility to the soil.

As the chickens scratch the soil, they mix the topsoil with manure.

Permaculture as a technology improves agricultural productivity in the following ways.

- increases production since, from the same piece of land, there will be a variety of products that will be harvested at different times of the year.
- Reduces cost of buying inputs. The money saved can be used to buy other things.
- The farmer can continue producing since the production is not affected by the price of farm inputs such as fertilisers, herbicides or insecticides.
- Land will be used for production forever since there is no danger of soil exhaustion or pollution.

COMPOSTING OR TOILET

This toilet stores human faeces in a tank – unlike the ordinary toilet that leaves them to pollute underground water.

While being stored, the human faeces are decomposed into manure.

There are several types of composting toilets.

Some of which are the Skyloo and the Arborloo.

SKYLOO TOILET

The toilet has a tank divided into two halves made by concrete slabs.

It stores urine separate from the faecal matter.

This is because if the tank has too much fluids, it disturbs the decomposition and causes the organic matter in the tank to smell.

After each use of toilet, a handful of ash and three handfuls of soil are added. The ash prevents human faeces from producing bad smell while the soil supplies living organisms that decompose the faecal matter.

When one of the toilets is full, it is closed for six months to allow for decomposition to take place.

Meanwhile the household starts using the other half.

The decomposed organic matter, which is now healthy compost is removed from the tank and applied to the soil in crop fields.

ADVANTAGES OF SKYLOO TOILET

- The Skyloo toilet does not pollute ground water which is a source of borehole water
- The Skyloo toilet saves space as one does not need to dig a new pit when one is full
- The Skyloo toilet does not produce smell and discourages flies that transmit diseases
- The Skyloo toilet improves agricultural productivity because what used to be wastes are now used to make organic fertilizer or manure that increases crop production

DISADVANTAGES OF SKYLOO TOILET

- The Skyloo toilet is too expensive to build
- The Skyloo toilet is difficult to separate urine from faeces
- Negative attitude of people to handle manure from human faecal matter

ARBORLOO TOILET

It is a shallow pit latrine with a moveable concrete slab and an outhouse on top.

When the toilet is full, the slab is removed and put on another pit latrine.

The filled pit latrine is covered with soil to allow the faecal matter to decompose.

When the material is decomposed, the farmer plants a tree on top that will use the manure.

ADVANTAGES OF ARBORLOO TOILET

- The Arborloo toilet is cheaper

DISADVANTAGES OF ARBORLOO TOILET

- Arborloo toilet requires a lot of land
- Arborloo toilet is labour-intensive to dig pit latrines frequently

The arborloo toilet helps improve agricultural productivity because it makes use of manure that would be wasted underground.

This improves the production of fruits around the home.

UNIT 10 THE IMPORTANCE OF FRUITS

THE IMPORTANCE OF FRUITS

- Source of food

- Source of income
- Source of raw materials
- Source of employment
- Source of foreign exchange
- Source of medicine

CLASSIFICATION OF FRUITS

Fruits can be classified into indigenous and exotic

INDIGENOUS FRUITS

These are fruits which grow naturally in an area.

These include: matowo, maye, masawu, mateme, bwemba (tamarind), malambe (baobab).

EXOTIC FRUITS

These are fruits which were introduced into the country from other countries or areas.

These include mangoes, peaches, pineapples, oranges, strawberries, tangerines, avocado pears, guavas, bananas and pawpaws.

UNIT 11 ENVIRONMENTAL CONDITIONS AND LAND PREPARATION FOR FRUIT PRODUCTION

ENVIRONMENTAL CONDITIONS

FACTORS TO CONSIDER WHEN SELECTING SITE FOR FRUIT GROWING

- Type of soil
- Climate
- Water availability
- Land preparation

TYPE OF SOIL

Fruits require deep, fertile and well-drained soils.

CLIMATE

Some fruits grow well under hot conditions.

Such fruits include mangoes, bananas, pawpaws, guavas.

Other fruits grow well in cool areas.

These include pineapples and avocado pears.

Fruits like peaches, apples and plums grow well in cold areas where the rainfall is well distributed throughout the year.

WATER AVAILABILITY

The site should be near a permanent water source for easy irrigation

LAND PREPARATION

Land preparation for fruit growing involves a number of activities such as:

- Clearing the land
- Measuring the distance between planting stations
- Digging planting holes 90cm long, 90cm wide and 90cm deep
- Filling planting holes with rich loam soil and manure

Land preparation should be done two months before the time of planting.

Different fruit trees have different recommended spacing.

Spacing for different types of fruits

FRUITS	SPACING
Apples	3m x 3m
Avocado	9m x 9m
Bananas	2m x 2m
Citrus	6m x 6m
Mangoes	9m x 9m
Pawpaws	3m x 3m
Pineapples	60cm x 30cm
Peaches	4m x 5m

The main fruit growing areas in Malawi

FRUIT	AREAS IN WHICH THEY ARE GROWN
Mangoes	Along the lakeshore and shire valley
Pawpaws	Along the lakeshore and shire valley

Orange, grape, lime	Along the lakeshore
Tangerines	Mwanza and Neno
Guava	Along the lakeshore
Bananas	Thyolo, Mulanje and Nkhatabay
Avocado pears	Thyolo, Mulanje, Zomba, Nkhatabay, Shire Highlands
Granadillas	Mwanza, Ntcheu and Zomba
Strawberries	Zomba
Apples, peaches, plums	Shire Highlands, Kirk Range, Ntchisi Hills, Phoka Hills and Michiru Hills
Pineapples	Mulanje, Thyolo, Ntchisi, Phoka, Songwe, Nkhatabay

UNIT 12 METHODS OF PROPAGATING FRUITS

Meaning of the term 'fruit propagation'
Fruit propagation is the process of producing new shoots or plants to be used as planting materials.

Fruit trees can be raised using seeds or vegetative parts such as suckers, buds, runners and cuttings.

METHODS OF SEED PROPAGATION

- Seed propagation
- Grafting
- Budding
- Use of stem cuttings
- Use of suckers

SEED PROPAGATION
Seed propagation is easy, cheap and quick but the resulting trees take a long time to start bearing fruits.

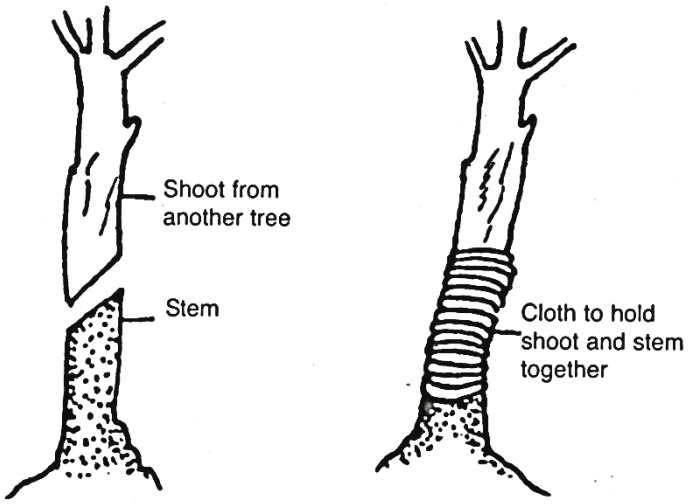
Seeds can be sown in pots, polythene pots and nursery beds.

GRAFTING
A shoot is cut and tied to a stem of a related plant so that the joined parts grow as one plant.

This is done in fruits such as oranges, mangoes, avocado pears, apples and peaches.

Procedure for grafting

- Select a young tree to be used as stem (root stock) to graft on
- Select a shoot from a similar fruit tree with the desired characteristics. This shoot must be of the same size as the root stock.
- Cut the chosen stems in a slanting manner so that the two stems fit well
- Join the shoot to the root stock
- Tie the two stems together using strips of plastic



Note: Any other shoot coming from the root stock should be removed.

BUDDING

A mature bud is attached to the stem of a related fruit stem.

This is done in fruits such as oranges, lemons and mangoes.

Procedure followed when budding

a. Choose a stem on which to join a bud
b. Make a T-slit on the stem
c. Cut off a mature bud from a desired variety of fruit
d. Fit the bud into the T-slit of the stem
e. Tie the bud on the stem using plastic strips



Note: Remove all shoots from the stem to which the bud has been attached so that most of the nutrients are used by the new bud.

USE OF STEM CUTTINGS

Stems are cut and planted in pots, packets or nursery beds to raise new plants for fruit trees like granadilla, grapes, mulberries and strawberry.

The procedure for propagating using stem cuttings is as follows:

a. Choose mature plants
b. Select healthy branches
c. Make cuttings of 15 to 20 centimetres long with 4 nodes or buds
d. Plant the cuttings in polythene pots, packets and nursery bed

USE OF SUCKERS

Suckers are used as planting materials in fruits such as bananas, plantains, pineapples.



The procedure to be followed in the use of suckers

a. Choose healthy suckers
b. Uproot the suckers with enough roots in readiness for planting

UNIT 13 THE ESTABLISHMENT OF AN ORCHARD

TRANSPLANTING FRUIT TREE SEEDLINGS

When fruit seedlings are ready, they should be transplanted in the field.

During transplanting, the steps below should be followed:

a. Dig a small hole in the middle of the planting hole
b. Dig out the seedlings together with soil around the roots if seedlings are raised in a nursery bed
c. Place the seedlings in the middle of the planting hole
d. Remove the polythene tube

e. Cover the seedlings with soil up to collar mark
f. Press the soil around the plant firmly
g. Mulch the seedlings

Fruit trees should be planted with the first rains.

Trees can be watered if planted in the dry season or when the rains are erratic.

UNIT 14 WEEDING, FERTILIZER APPLICATION AND PRUNING FRUIT TREES

WEEDING

WAYS OF WEEDING FRUITS

- Uprooting where the weeds are growing close to young trees
- Light hoeing when trees are young and weeds are not growing close to the trees
- Slashing when fruit trees are well-established

FERTILIZER APPLICATION

The rate of fertilizer application to fruit trees in gram per year per tree

Age of tree (year)	CAN	Triple superphosphate	Muriate of potash
1	100	20	125
2	200	40	250
3	300	60	375
4	400	80	375
5	500	100	625
6	600	120	750
7	700	140	875
8	800	160	1000
9	900	180	1125
10	1000	200	1250
11	1100	220	1500
12	1200	240	1625
13	1300	260	1750
14	1400	280	1875
15	1500	300	2000
16	1600	320	2000

PRUNING
Fruit trees should be pruned.

This improves the yield and quality of fruits since nutrients are not wasted by unproductive branches.

When pruning, dead, broken, rubbing and diseased branches should be removed.

The steps to follow when pruning fruit trees

a. Identify the dead, broken, rubbing and diseased branches
b. Cut the branches starting from the bottom going upwards using sharp tools such as pangas, saws and axes

UNIT 15 PEST AND DISEASE CONTROL IN FRUIT TREES

COMMON FRUIT PESTS AND DISEASES AND THEIR CONTROL

Common fruit pests and their control

Name	Fruit attacked	Signs/damage	Control
False coding moth	Citrus, avocado pears	Makes holes in the skin of the fruit	• Bury damaged fruits. • Trap them using a mixture of molasses, sugar and water
White fly	Citrus fruits	Sucks juice from fruits	• Introduce parasite wasps that destroy the larvae of white flies
Aphid	All fruits	Sucks juice from leaves	• Spray fruit trees with Carbaryl or malathion
Mealy bug	Citrus, pineapple, guavas	Sucks sap from leaves, fruits and stems	• Spray with diomethoate • Introduce natural enemy for example ladybird beetle
Fruit fly	Mangoes, peaches, citrus fruits	Premature ripening of fruits Shedding of fruits	• Spray with labaycid

Common fruit diseases and their control

Name	Fruit attacked	Signs/damage	Control
Bacterial spot	Mangoes	Small yellow leaf spots that turn brown or black on leaves or fruits	Spraying with copper oxychloride

Anthracnose	Mangoes, pawpaws	Small circular dark brown spots	Spraying dithane M45, Benomy 50% wp
Rusts	Peaches	Brown spots surrounded by a yellow band on the underside of leaves	Spray dithane M45 20g in 10 litres of water

UNIT 16 HARVESTING FRUITS

Fruits must be harvested at the right time and in the right way to avoid losses which occur when the fruits are harvested too early or too late.

When harvesting fruits, use appropriate methods to reduce bruising, cracking and breaking of fruits.

Signs of maturity and methods of harvesting different fruits

Fruits	Signs	Methods of harvesting
Citrus	Rind changes to either orange, yellow or light green depending on variety	Pick fruits by pulling individual fruits from the tree with a twisting motion
Mango	Colour of fruit skin changes to either purple, yellow or orange depending on variety	Pluck fruits by hand and put them in a harvesting basket or bag
Pawpaw	Colour of fruit skin changes to yellow	• Pluck fruits with hands. • Jog the fruit stalk. • Cut the stalk with a knife
Banana	Fruits become plump and round and some turn yellow. Fruits produce good smell	Cut the bunch stalk carefully and fell the stem
Pineapples	Fruits turn yellow. Fruits produce good smell	Cut the fruit at the base of the stalk
Avocado pears	Seed shakes inside the fruit	Pluck the fruits using hands
Guava	Colour of fruits change to yellow and light green depending on variety	Pick the fruit of the plant by hand
Strawberry	Fruits turn red	Pick fruits carefully with stalk attached

UNIT 17 THE IMPORTANCE AND TYPES OF FISH SUITABLE FOR FARMING

THE MEANING OF THE TERM 'FISH FARMING'

Fish farming is the practice of raising fish in ponds.

THE IMPORTANCE OF FISH FARMING

- Source of food
- Source of income
- It makes good use of the land
- It supplements fish caught in rivers and lakes
- Source of raw materials

CHARACTERISTICS OF FISH SPECIES SUITABLE FOR FARMING

- Must grow fast to search a harvestable size within a short period of time
- Must be able to feed on locally available feeds
- Must reproduce under pond conditions
- Must have eggs, fries and fingerlings which can survive under pond conditions
- Must have acceptable taste and flavour to consumers
- Must be easy to handle when harvesting
- Must be resistant to parasites and diseases

Some fish species suitable for farming:

- Makumba
- Mphende
- Mlamba
- Chambo
- Chilunguni
- Makakana

CHARACTERISTICS OF SOME FISH SPECIES THAT ARE SUITABLE FOR FARMING

Makumba

- Short reproduction cycles
- Adapts to a wide range of environmental conditions
- Makes its nests in shallow waters
- Breeds easily in ponds
- Takes a wide variety of food items

Chambo

- Favours fresh water
- Favours high lands
- Salinity tolerance
- Slow growth and maturity rates
- Favours large ponds
- Low survival rate
- Has its own breeding season

Mlamba

- Grows faster
- Resistant to handling stress
- Salinity tolerance
- Can withstand poor water quality
- Can withstand overcrowding
- It feeds on both plants and animals

Chilunguni

- Adapts to all water bodies in Malawi
- Tolerates wide range of temperatures
- Survives in salty water
- Feeds on green plants

Mphende

- Takes a wide variety of food items
- It has a wide range of feeds
- Adapts to a wide range of environmental conditions
- Favours low land to high land areas

The characteristics of fish types suitable for farming include:

- quick multiplication
- survival under pond conditions
- disease resistant.

UNIT 18 POND CONSTRUCTION

FACTORS TO CONSIDER WHEN CHOOSING A SITE FOR A FISH POND

- Water supply
- Soil type
- Slope of the land
- Nearness to school, home or market

MATERIALS FOR THE CONSTRUCTION OF A FISH POND

- ❖ Slashers
- ❖ Hoes
- ❖ Pangas
- ❖ Axes
- ❖ Tape measure
- ❖ Shovels
- ❖ Hammer
- ❖ Ropes
- ❖ Squares
- ❖ Watering cans
- ❖ Wheelbarrow
- ❖ Buckets
- ❖ Bricks
- ❖ Cement
- ❖ River sand
- ❖ Quarry stones

PLANNING A FISH POND

First the site must be surveyed to find out the presence of water supply and the type of soil available.

Second the pond should be designed.

Third construct the pond

Principles for designing a pond

- The pond needs to be of medium size because large are difficult to manage and small ponds are not profitable
- The deepest end of the pond should be about 1.5 metres and the shallow end about 1 metre deep. This depth allows the growth of water plants such as plankton and algae as sunlight is able to reach the bottom
- The pond should have an inlet and outlet in addition to the overflow pipe

- The pond needs to be sited considering the direction of the prevailing winds of the area. This helps to prevent the action of water waves in the pond which erode the walls of the pond.

STEPS TO FOLLOW WHEN CONSTRUCTING A FISH POND

- Select site
- Clear the land and level the area
- Measure the area with tape measure or rope
- Mark out the area with pegs
- Remove 30cm of fertile top soil and heap it aside. This soil is used to cover the pond walls to encourage the growth of grass to cover the pond walls
- The subsoil dug should be used to strengthen the walls. The walls should be strong enough so that they do not lose water
- Fix the inlet and outlet pipes at each end of the pond when it is being constructed
- Cover each end of the inlet and outlet pipes with a screen to prevent entry of foreign fish into the pond and passing out of fish from the pond
- The bottom of the pond should be plastered with lime to control parasites
- Fill and drain the pond at least twice before stocking. This helps to check whether the walls of the pond have holes or not

UNIT 19 STOCKING AND FEEDING FISH

STOCKING A FISH POND

Stocking means putting live fish into a pond.

Farmers usually stock ponds with fingerlings or fries.

Fingerlings are young fish ranging from 5 to 10 centimetres in size.

These weigh about 10 to 20 grammes while fries are newly-hatched fish.

The best time to stock ponds is during the cool weather because few fingerlings die.

PROCEDURE FOLLOWED WHEN STOCKING A POND

- Ensure the water in the container with fingerlings is at the same temperature as the water in the pond
- Mix the water from the pond into a container with fingerlings carefully to make the temperature in the container the same as that of the fish pond.

- Slowly put the container of fingerlings into the pond to let them swim out of the container into the pond

FEEDING THE FISH IN A POND

Fish in a pond should be fed properly.

Naturally fish can survive on water plants such as algae and plankton.

The growth of algae and plankton can be improved by applying organic and inorganic fertilizers such as DAP and 23:21:0+4S.

Farmers can give supplementary feeds to fish in ponds such as maize bran, wheat bran, brewery wastes, chopped vegetables and molasses.

The feeds need to be given to fish twice or three times a day.

It is important to feed fish in a pond at the same time and place each day for the fish to get used to when and where to get the feed.

AMOUNT OF FEED FOR FISH IN A POND

Farmers should always give fish the correct amount of feed to avoid overfeeding.

Fish must be fed at the rate of 5% of body weight daily.

For instance, if all fish in a pond weigh 50kg, the daily amount of fed feed will be as follows:

$$\frac{(50 \times 5)}{100} \text{ kg}$$

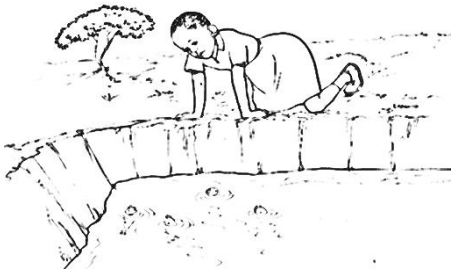
$$= \frac{50 \times 5}{100} \text{ kg}$$

Amount of feed = 2 ½ kg daily

= 2.5 kg per day

SIGNS OF OVERFEEDING FISH IN A POND

- Large amount of uneaten food float
- Foul-looking black or green water
- Fish swimming to the surface of water gasping for fresh air



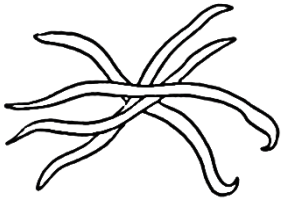
UNIT 20 PARASITES AND PREDATORS OF FISH

Fish do not usually suffer from diseases even though there are a number of diseases of fish.

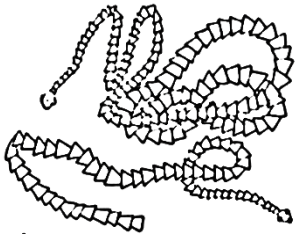
However, parasites and predators attack them.

Examples of parasites of fish include:

- round worms
- tape worms
- flukes



Roundworms



Tapeworms



Liver fluke

Flukes are usually found in the gills, under the scales or on the fins of the fish.

Roundworms are found in the stomach while tapeworms are found in the intestines of fish.

EFFECTS OF FISH PARASITES

- They reduce the growth rate of fish by absorbing the digested food
- They cause losses in fish farming enterprise

CONTROL MEASURES OF FISH PARASITES

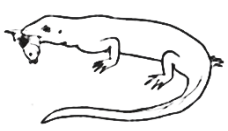
- Remove the fish and drain the pond when the parasites are identified
- After draining, apply lime to the pond to kill the parasites
- Expose the drained pond to the sun to kill the parasites

PREDATORS OF FISH

- Grey herons
- King fisher
- Monitor lizards (ng'azi)
- Otters (katumbu)



Grey heron



monitor lizard



king fisher



otter

THE MEANING OF PREDATOR

A predator is an animal that kills and eats another animal.

Predators cause losses in fish.

Birds are the most destructive predators of fish.

EFFECTS OF FISH PREDATORS

- Otters and birds cause loss of up to 75% of fish in a pond. Otters usually feed at night
- Some predators act as intermediate hosts of fish parasites
- Predators destroy fries, eggs in ponds and food reserves

CONTROL MEASURES OF FISH PREDATORS

- Setting otter traps as they generally follow the same track, as they feed t night
- Scaring them away as in the case of herons and kingfisher
- Destroying their nests, that is, nets for herons and kingfisher
- Fencing the pond appropriately

UNIT 21 POND MAINTENANCE

MAINTENANCE OF A FISH POND

Ponds should be maintained after harvesting fish and before re-stocking them.

WAYS OF MAINTAINING A FISH POND

- Maintain the water level in the pond by ensuring that the inlet, outlet and overflow pipes are functioning properly
- Check for cracks in the walls, the inlet and outlet
- Fill the cracks
- Re-build all damaged walls
- Repair all damaged drains
- Remove the excess soil from the pond to prevent the pond from becoming shallow and unsuitable for fish
- Repair the fence where necessary to keep out predators
- Keep short grass around the pond by slashing or raising dykes
- Plant new grass on the walls whenever necessary to prevent erosion of the walls

UNIT 22 HARVESTING AND MARKETING FISH

HARVESTING FISH

Fish must be harvested when they are ready.

It takes 5 to 8 months for fish to mature.

This depends on the type of feed and fish species.

METHODS OF HARVESTING FISH

- Use of a seine net
- Use of hook-and-line
- Draining water from a pond

PROCESSING FISH

Fish is processed to preserve and improve its quality.

METHODS OF PROCESSING FISH

- Sun-drying
- Smoking
- Salting
- Freezing

MARKETING FISH

Fish must be graded before pricing.

Grading involves sorting according to types, size and quality.

When selling the fish at the farm, it is important to advertise before harvesting so that people can come to buy the fish.

UNIT 23 THE IMPORTANCE AND BREEDS OF GOATS

THE IMPORTANCE OF GOATS

- Source of food in form of meat and milk
- Source of manure
- Source of income
- Source of raw materials

- Source of hides
- Source of social obligations
- Source of payment for dowry
- Source of payment for legal penalties in the communities

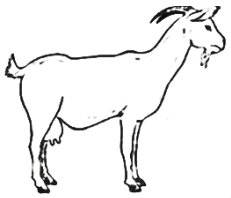
BREEDS OF GOATS

There are many breeds of goats.

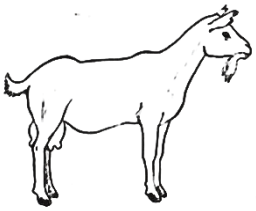
They are kept for different functions.

Breeds of goats and their functions

Breed	Function
Malawian goat	Meat
Boer goat	
Somali goat	
Anglo-Nubian goat	Milk
Toggenburg goat	
Saanen goat	
Angora goat	Mohair (wool)
Gaddi goat	
Kamori goat	



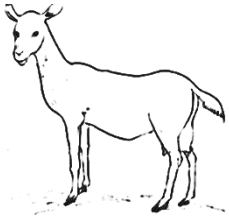
Boer goat



Anglo-Nubian goat



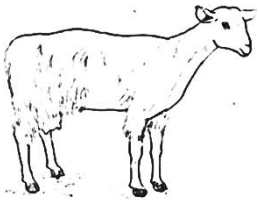
Angora goat



Toggenburg



Malawian goat



Saanen

CHARACTERISTICS OF GOATS SUITABLE FOR BREEDING

- Large in size
- High milk production
- High mohair production
- Well adapted to local conditions

METHODS OF IMPROVING LOCAL GOATS

- Selection
- Crossbreeding
- Outbreeding

UNIT 24 HOUSING AND FEEDING IN GOATS

HOUSING GOATS

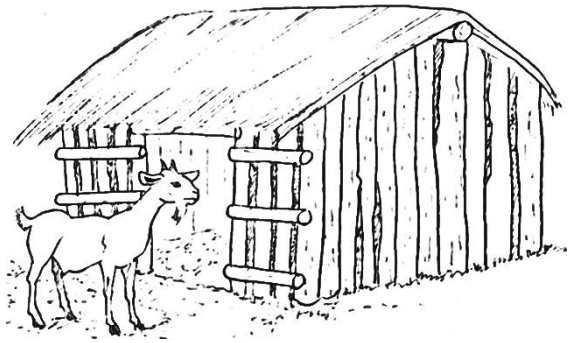
CHARACTERISTICS OF A GOOD GOAT HOUSE

- It should be easy to clean
- The roof should not leak
- Each goat should have enough space
- The house should be well ventilated

TYPES OF GOAT HOUSES

1. Unraised pole and thatch goat house
2. Raised pole and thatch goat house

UNRAISED POLE AND THATCH GOAT HOUSE



It is made with poles which are fixed in the ground. The ground forms the floor of the house.

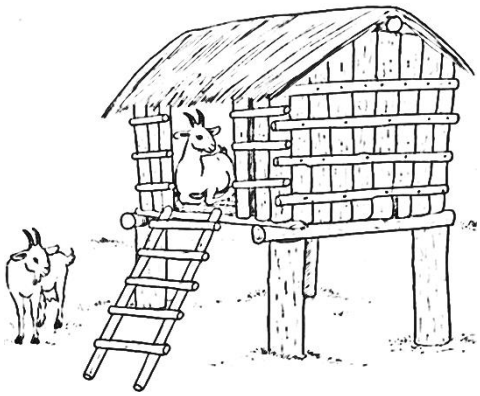
RAISED POLE AND THATCH GOAT HOUSE

The raised pole-and-thatch goat house is constructed on a raised platform.

The floor of the house is 1 metre or 1.5 metres above the ground.

It should have spaces big enough to allow droppings to fall down.

This house is similar to the unraised house except that it is constructed on a raised platform.



FEEDING OF GOATS

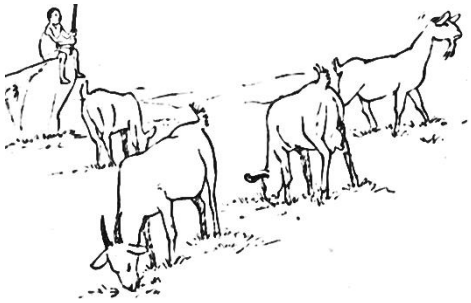
Goats must be fed on a balanced diet for them to produce more milk, meat and mohair.

A variety of feed stuffs for goats include grass, leaves of trees, shrubs, sweet potato vines, sugarcane tops and maize bran.

FEEDING HABITS OF GOATS

- Grazing
- Browsing

Grazing is the feeding on pasture land.



Browsing is the feeding on shrubs and tender leaves of trees.



Goats like climbing trees to feed on tender leaves.

UNIT 25 DISEASES AND PARASITES IN GOATS

DISEASES OF GOATS

Diseases of goats, their signs or symptoms and control

Disease	Cause	Signs/symptoms	Control
Anthrax	Bacteria	• High fever and depression • Swelling of the stomach • Blood comes through the anus, nose and mouth after death • Death after 1 to 2 days • Mouth and eye become purple or dark	• Treating with antibiotics • Vaccinate annually • Burying the dead animal deep in the soil • Not cutting any part of the dead animal
Foot and mouth disease	Virus	• High fever • Blisters on the mouth and feet • Saliva comes out of the mouth • Lameness as a result of the blisters on the mouth and feet • Severe loss of body weight • Dullness	• Vaccination • Restricting livestock movement • Burning and burying the dead animal • Quarantine
Pneumonia	Bacteria and virus	• Quick and short breathing • Fever • Coughing	• Providing enough ventilation in the house • Keeping the house clean, dry and warm

PARASITES OF GOATS

There are internal and external parasites of goats.

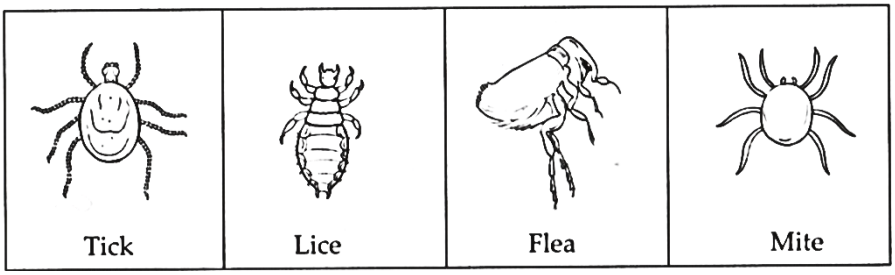
EXTERNAL PARASITES

These are parasites which are found outside the body of the host.

These include:

- ★ Ticks
- ★ Lice

★ Fleas
★ Mites



External parasites of goats, their effect and control

Lice	• Sucking blood • Skin irritation • Anaemia • Breaking the skin which allows entry of bacteria and protozoa	• Sanitation in the house • Dipping or spraying goats • Avoid overcrowding in the house
Fleas	• Sucking blood • Skin irritation • Anaemia • Breaking the skin which allows entry of bacteria and protozoa	• Dipping or spraying goats • Avoiding overcrowding in the house • Spraying chemicals or insecticides in the house to kill fleas
Ticks	• Sucking blood • Transmitting diseases like heartwater • Skin irritation • Anaemia • Reducing the skin quality • Breaking the skin which allows entry of bacteria and protozoa	• Dipping or spraying the goats with acaricides • Hand picking and destroying ticks
Mites	• Sucking blood • Skin irritation • Breaking the skin which allows entry of bacteria and protozoa	• Applying chemicals or drugs on the skin • General hygiene of the goat house • Spraying the animals with chemicals

INTERNAL PARASITES

These are the parasites which feed while inside the body of the animal.

These include:

- Roundworms
- Tapeworms
- Liver flukes

They are usually found in lungs, liver and intestines

Some internal parasites of goats

Parasite	Effect or damage	Control
Roundworms	• Feeding on digested food • Blocking the intestines • Stunted growth	• Deforming using piperazine and phenothiazine • Keeping the house clean and dry
Tapeworms	• Damaging the liver by causing cysts • Stunted growth • Causing diarrhoea • Feeding on the digested food in the intestines	• Use of drugs such as piperazine and phenothiazine • Keeping the house clean and dry
Liver fluke	• Causing damage in liver tissues • Sucking blood • Anaemia • Blocking the bile duct	• Killing the snails which host the worms either physically or using drugs such as copper sulphate • Avoiding grazing goats in dambo pastures and stream banks during wet season

UNIT 26 THE IMPORTANCE AND BREEDS OF CATTLE

THE IMPORTANCE OF CATTLE

- Source of food
- Source of income
- Source of employment
- Source of manure
- Source of power
- Source of raw materials

Raw materials and their end products

Raw materials	End products
Milk	Yoghurt, cheese, butter
Meat	Sausages, polony, minced meat
Hoofs and horns	Buttons, glue
Blood	Animal feed
Hides	Shoes, wallets, belts, bags

BREEDS OF CATTLE

The breeds of cattle can be grouped into two main types based on function.

These are

- dairy type
- beef type.

DAIRY TYPE

These are breeds of cattle which produce large quantities of milk.

Examples are: Fresian, Jersey, Arshire, Guernsey and Jamaica hope.

BEEF TYPE

These are the breeds of cattle which grow fast and produce a lot of meat.

Examples include: Brahman, Hereford, Charolais, Malawi Zebu, Boron and Africander.

THE CHARACTERISTICS OF CATTLE SUITABLE FOR BEEF PRODUCTION

- ★ Growing fast and maturing early
- ★ Rectangular
- ★ Short legs which are well spaced apart
- ★ Small udder
- ★ Body well filled with muscle

THE CHARACTERISTICS OF CATTLE SUITABLE FOR DAIRY PRODUCTION

- ★ Udder which carries little muscle (lean)
- ★ Thin large body
- ★ Large belly
- ★ Wide and well-set hind quarters
- ★ Triangular or wedge shaped body

THE CHARACTERISTICS OF THE MALAWIAN ZEBU

- High resistance to diseases
- Low milk production
- Low meat production
- Ability to walk long distances
- Small size
- Adaptable to local feeds

- Low growth rate
- Withstand hot weather

METHODS USED FOR CATTLE IMPROVEMENT

- ❖ Introduction
- ❖ Selection
- ❖ Cross breeding
- ❖ Out breeding

INTRODUCTION

Good breeds are brought into the country from other countries.

At local level, bulls and cows with desirable characteristics are brought into khola from other areas for breeding purposes.

SELECTION

The farmers select the animals with desirable characteristics for breeding.

The remaining animals are culled.

CROSS BREEDING

This refers to the mating of animals of different breeds.

The animals are cross-bred for a particular reason.

For example, a Malawi Zebu can be cross-bred with Fresian to improve milk production.

OUT BREEDING

This is the mating of animals that are not closely related but belonging to the same breed.

The animals selected for out-breeding must have the desirable characteristics such as high milk production and resistance to diseases.

UNIT 27 HOUSING AND FEEDING IN CATTLE

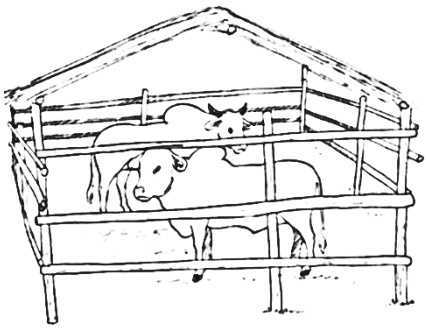
TYPES OF CATTLE HOUSES

- Pole and thatch house

- Barbed wire house
- Brick house

POLE AND THATCH CATTLE HOUSE

This is a type of house constructed using poles and thatched with grass.



Beddings are placed on the floor to absorb urine and dung.

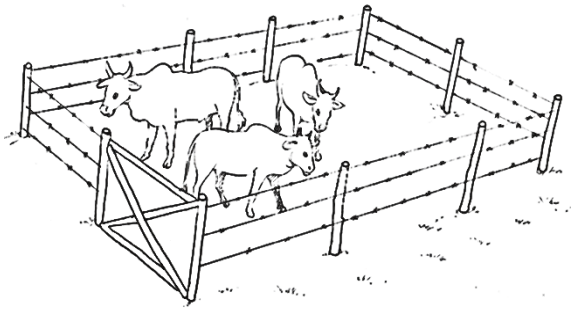
BARBED WIRE HOUSE

This type of house is made by using poles and barbed wire.

The house usually is not thatched.

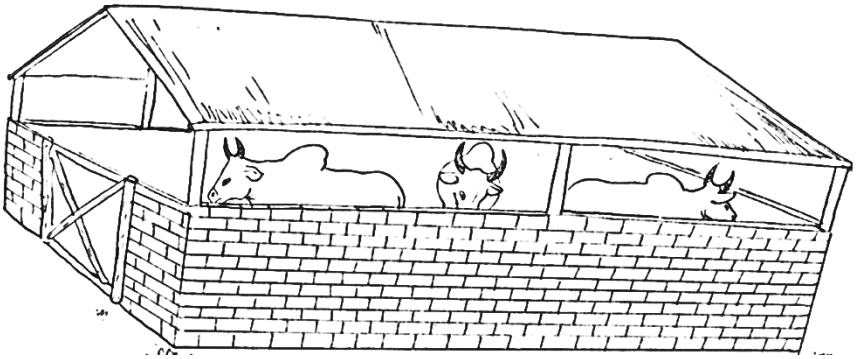
It is built on a high ground to allow rainwater to drain away.

In order to protect cattle from rains, construct a shade at one end of the house.



BRICK HOUSE

This is a type of house constructed using bricks and is roofed with iron sheets or grass.



The floor can be cemented.

Beddings are put on the floor to absorb urine and moisture from the dung.

THE CHARACTERISTICS OF A GOOD CATTLE HOUSE

- Strong enough to protect animals from predators
- Well thatched or roofed to protect cattle from rains
- Large enough for animals to have free movement and space for lying down
- Dry floor to make animals comfortable
- Well ventilated to ensure fresh air is always available

CLASSIFICATION OF CATTLE FEED

The feeds for cattle can be classified into two main groups: concentrates and roughages

CONCENTRATES

These are feeds with low fibre content and are high in nutrient content.

Such feeds include maize bran (madeya), maize meal, (mgaiwa), meat meal, cotton seed cake, groundnut cake and meat-and-born meal.

ROUGHAGES

These are feeds with high fibre content.

These include maize stalks, millet stalks, sorghum stalks, green grass, groundnuts haulm and rice straw.

UNIT 28 DISEASES AND PARASITES IN CATTLE

THE EFFECTS OF DISEASES AND PARASITES OF CATTLE

- Failure to eat
- Low milk production
- Low meat production
- Poor growth
- Poor fertility
- Irritation
- Poor quality meat
- Poor quality products such as meat, milk and hides
- Death of animals

Diseases of cattle, signs or symptoms and their control

Name of disease	Cause	Signs/symptoms	Control
Foot and mouth diseases	Virus	• High fever • Sores on feet and in the mouth • Excessive salivation • Lameness	• Regular vaccination • Restricting movement • Quarantine
East coast fever	Protozoa	• High fever • Rapid breathing • Swollen lymph nodes • Diarrhoea	• Regular dipping to control ticks • Vaccination
Tuberculosis	Bacteria	• Coughing • Loss of weight • Changes in body temperature	• Vaccination • Killing and bury infected animals
Sleeping sickness (trypanosomiasis)	Protozoa	• Sleeping sickness • Loss of weight	• Controlling tsetse flies • Vaccination

THE PARASITES OF CATTLE

Parasites can be found inside the body of the animal while others are found on the body of the animal.

Parasites of cattle, damage caused and their control

Parasite	Damage caused	Control
Lice	• Sucking blood • Causing skin irritation	• Dusting with chemicals • Spraying with chemicals • dipping
Liver fluke	• Damaging liver • Using up food in the intestines • Blocking bile duct	• Not grazing animals in dambos during rainy season • Deworming • Killing snails physically or using chemicals such as copper sulphate
Tapeworm	• Using up digested food • Blocking the digestive system	• Deworming with piperazine or phenothiazine
Roundworm	• Blocking intestines • Using up food	• Deworming • Avoiding contamination of food with dung
Ticks	• Sucking blood • Transmitting diseases • Causing irritation	• Dipping or spraying • Rotational grazing • Hand picking

UNIT 29 AGROFORESTRY PLOT ESTABLISHMENT

An agroforestry plot needs proper establishment to obtain good results.

The activities involved when establishing an agroforestry plot include designing, digging planting holes and planting the selected tree seedlings or seeds.

FACTORS TO CONSIDER WHEN DESIGNING AN AGROFORESTRY PLOT

- Type of trees and crops to be grown together
- Spacing
- Size of the plot
- Size of the plot

CULTURAL PRACTICES FOLLOWED WHEN ESTABLISHING AGROFORESTRY PLOT

- Digging planting holes
- Planting
- Planting large seeds
- Planting stem cuttings

UNIT 30 AGROFORESTRY PLOT MANAGEMENT

Agroforestry plot needs to be well managed in order to get maximum yields from both the trees and arable crops.

Management of an agroforestry plot involves weeding, pest control and harvesting.

WEEDING

Weeding is done at the same time that the arable crops are being weeded.

It is also done during land preparation for arable crops when the trees are young.

PEST CONTROL

Pests include goats, cattle and termites.

Some pests, the damage they cause and ways of controlling them

Pest	Damage	Control
Goats	Eat bark and leaves of trees	• Fencing • Scaring them away
Termites	Cut stems and roots of newly planted trees	• Inter-planting with garlic • Planting termite resistant tree species

HARVESTING

Trees in agroforestry plot are harvested by pruning.

REASONS FOR PRUNING

- To minimize shading the companion crop
- To provide green leaf manure and mulch to improve soil fertility
- To supply fuel wood
- To provide high quality fodder

Pruning in a newly established agroforestry plot starts at the beginning of the second season.

Another pruning may be done soon after harvesting the companion crop such as maize.

For improving soil fertility, the fresh prunings are distributed along the ridges of the companion crop.

Dry branches are used as fuel.

Leaves and tender branches are used as fodder for goats and other livestock.

REFERENCE

MIE (2008) Standard 8 Agriculture Teacher's Guide. Domasi; MIE.

BY CIDRECK MACHESO