

AGRICULTURE FORM 1 NOTES

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INTRODUCTION TO AGRICULTURE

The word Agriculture is derived from two Latin words **Ager** which means field and **culture** that means cultivation. Therefore agriculture can be defined as **field cultivation**.

Livestock are all the domesticated animals.

Definition of agriculture:

Agriculture is defined as the art and science of crop and livestock production.

As an art

Involves use of learned skills and performing them manually (by hand). E.g.

- Tilling of land.

- Construction of farm structures.

- Measuring distances.

- Machine operations.

- Harvesting of crops.

- Feeding and handling animals.

- Marketing of Agricultural produce.

As a science

It involves experimentation and application of scientific knowledge e.g. in areas such as:

- Soil science (pedology) ---study of soil.

- Crop pathology—Study of crop diseases.

- Entomology--- Study of insects and their control.

- Agricultural Engineering--- soil and water conservation and farm power.

- Genetics—Plant and animal breeding.

Production --- Are activities that increase the quality and quantity of something.

Crop production activities include: land preparation, planting, fertilizer and

manure application, weeding, pest control, disease control and harvesting.
Livestock production activities include:

- Selection and breeding.
- Feeding.
- Rearing the young stock.
- Parasite and disease control.
- Housing.
- Obtaining products from animals.

Branches of agriculture

- Crop production: e.g. Field crop farming, pomology, Floriculture, olericulture.etc.
- Livestock production: e.g. Apiculture, Poultry keeping, aquaculture.etc.
- Soil science.
- Agricultural Economics.
- Agricultural Engineering.

Crop farming or Arable farming: Is the cultivation of crops on cultivated land. E.g. In pure stands (monocropping) or mixed stands (intercropping).

Include:

Field crops: Are crops grown on large areas of land. Are either Annual crops like cereals and pulses or perennial crops e.g. coffee, tea, sisal, cane etc.

Horticultural crops: Are perishable crops and are exported to earn foreign exchange. Include:

Floriculture: Growing of flowers e.g. tuber rose, roses, and carnations.

Olericulture: Growing of vegetables e.g. French beans, cabbages, tomatoes.etc..

Pomology: Growing of fruits e.g. avocado, mangoes and citrus.

Livestock farming: Include:

Pastoralism (mammalian livestock farming). Is the rearing of farm

animals on pastures. E.g. cattle, goats, pigs, sheep, camels and rabbits.
Fish farming (Aquaculture); Is the rearing of fish in fish ponds. Fish is a cheap source of proteins.

Bee keeping: (Apiculture); Is the rearing of bees in bee hives. Bees provide ; Honey and Wax, income, Medicine, pollination of flowers.etc.

Poultry keeping; Is the rearing of birds for meat and eggs, manure, income. Etc. Include classes of birds such as chicken (most common), Ducks, geese, Ostrich, pigeon and Turkeys etc.

Agricultural Economics: Deals with utilization of scarce resources i.e. of land, labour, capital and management. It aims at maximizing output while minimizing costs.

Agricultural Engineering; Deals with use and maintenance of farm tools and equipment, farm machinery and farm structures.

FARMING SYSTEMS

A farming system is an organization of the farm and all the enterprises in relation to each other.

It can be extensive or intensive.

Extensive system

Characteristics

- Large tracts of land.
- Low capital investment per unit area.
- Low labour per unit area.
- Low yields per unit area.

Intensive system

Characteristics

- Small tracts of land.
- High capital per unit area.
- High labour investment per unit area.

High yields per unit area.

Extensive or intensive farming can be carried out on small or large scale of land.

The scale of production depends on:

Level of technology.

Land availability.

Capital availability.

Skilled labour available.

Large Scale Farming

Characteristics

Large tracts of land.

Heavy capital investment.

Skilled labour and qualified man power.

High level of management.

It's for commercial purpose.

Low operation costs per unit of production since it makes use of economies of scale.

Depends on efficient transport.

Requires good market system.

Most of the work is mechanized.

Provides more employment.

It includes plantation farming and Ranching.

Plantation farming.

Characteristics

Large tracts of land.

Production of only one crop.e.g. Tea plantations in Kiambu and Kericho, Coffee in Kiambu, Sugarcane in Muhoroni, Sisal in Mombasa, Pineapple in Thika.

Ranching : Is the keeping of livestock (beef animals) in marginal

range areas.

It is an improved pastoral-nomadism because:

Animals are enclosed in an area.

Diseases are controlled.

Pastures are improved.

Supplementary feeds and water are provided.

Pests and parasites are controlled.

There is provision of extension staff.

N.B The livestock carrying capacity is low because of limited pasture.

Ranching is becoming more and more common in Kenya because of:

High meat demand.

High population pressure on high potential areas.

Arable farming is becoming smaller.

Small Scale Farming

Characteristics

Small piece of land.

Use of improved technology. V

Production of crops and livestock is spread throughout the year.

Goods are produced for subsistence or commercial purpose I,e sale of surplus goods..

Does not require heavy capital investment.

Advantages

Little capital is required.

Source of livelihood to small scale farmers.

Methods of Farming

Mixed Farming

This is the growing of crops and rearing of animals on the same farm.

Advantages

It is a method of diversification whereby should one enterprise fail, the

farmer can benefit from the other.

There is mutual benefit between the crops and livestock where crops provide feed for livestock and animals provide them with farm yard manure. There is maximum utilization of resources.

Disadvantages

Labour intensive.

High initial capital required.

Farmer's attention is divided.

Nomadic Pastoralism

Pastoralism: This is the practice of rearing livestock on natural pastures.

Nomadism: This is the practice of moving from one place to another.

Pastoral –nomadism is therefore the moving of animals from one place to another in search of pasture and water.

This is common in the arid and semi-arid areas.

Shifting Cultivation

Farming on a piece of land continuously until it is exhausted after which the farmer moves to a new more fertile land.

It is applicable where;

Land is abundant

Population is sparse

Number of livestock per unit area is low.

Land is communally owned.

Advantages of shifting cultivation

It has low capital requirement

There is no pests and diseases build-up

Soil structure is maintained

No land disputes as land ownership is not individualized.

Disadvantages of shifting cultivation

Total yields per unit are is low

Farmers have no incentive to develop land and conserve water and soil

A lot of time is wasted when the farmer is shifting and building

structures.

Not applicable in areas of high population density or where there is high population increase.

iv) Agroforestry

Agroforestry - Involves growing of trees and crops and keeping of animals on the same piece of land at the same time.

Suitable tree species for agroforestry

Leucaena leucocephala

Gravillea robusta

Calliandra catothyrsus

Mangifera indica

Sesbania sesban

Lantana camara

Cajanus cajan

Advantages of Agroforestry

Saves labour since some operations can be done at once for both plants and trees

Gives higher combined yield

Provide wide variety of agricultural produce

Reduces the risks of total failure

Crops benefit from nitrogen fixing trees.

Trees help in holding the soil firmly

Some trees act as livestock fodder.

Provides a wider variety of agricultural produce.

Disadvantages of Agroforestry

Mechanization is difficult.

Use of pesticides and fertilizer may be difficult.

Productivity may suffer because the skills for managing the different trees

FACTORS INFLUENCING AGRICULTURE

HUMAN FACTORS.

They are factors in human beings or the way human beings do things.

The following is a list of human factors that influence agricultural production.

Levels of education and technology

This is translated as the ability of a producer who is a farmer to apply appropriate methods and techniques in production using available resources for example, Farmer weighing livestock food to ensure efficiency

Good education level makes a farmer able to understand and translate technical language in farming.

Health of the farmers

A healthy nation is a productive nation

The following are some of the diseases that contribute to lowering agricultural productivity

Malaria,

Tuberculosis,

Typhoid,

Pneumonia and HIV/AIDS

Effects of HIV/AIDS on farming

Loss of skilled labour

Time spent caring for the infected

Money spent on treatment

State of economic development

The capital earned from economic activities such as farming is used to raise economic growth in the country.

Transport and communication network

Good and efficient infrastructure is important for the smooth flow of farm produce from the farm to the consumer.

The improvement of technology in communication has improved farmers access to important information from the research stations and other fellow farmers

Government policy on agricultural input and produce taxation

The government of Kenya, through different ministries formulates guidelines to be followed by producers of different products. After the guidelines and proposals are legislated they become policies

Availability of storage facilities

Cultural and religious beliefs.

Local and International market forces

Human Factors which improve production

Good health of the farmer

Availability of money

High taxation on imported agricultural produce

Availability of ready market for agricultural produce

Availability of storage facilities

Liberalized market

Human Factors which lower production

Restrictive cultural and religious beliefs

Poor road network

BIOTIC FACTORS.

These are living organisms that affect agricultural production.

Biotic factors influencing agriculture can be divided into the following classes.

Crop pests: stalk borer damaging maize in the field

Decomposers: Cause rotting of organic matter there by releasing nutrients for crop growth.

They help in improving soil structure through incorporating organic matter into the soil.

Nitrogen fixing Bacteria: Nitrogen fixing bacteria are found in root nodules of leguminous plants. Improve crop production through increasing soil nitrogen content which crops require for proper growth.

Livestock parasites: suck blood and transmit diseases to animals

Pollinators: Bee pollinating maize flower. Pollination in crop production increases yields and viability of seeds.

Predators: Eagles can eat chicken, rabbits among other livestock. Eagle can also eat insects and pests for example rats, moles and birds which destroy crops.

Pathogens: Causes diseases in livestock and crops thereby lowering quality of produce. Increase cost of production when control measures are implemented. Introduce toxic substances into agricultural products thereby lowering the quality of the produce. Can cause death to crops and animals.

Effects of Biotic Factors on Agricultural Production

1. Pests

Feed on crops thereby lowering quantity of agricultural produce.

Feed on grains thereby affecting viability of the seeds

Act as disease vectors

Lower palatability of crop produce

Increase cost of production when control methods are applied

Create entry points for disease causing organisms

2. Parasites

Irritate livestock

Causes anemia in livestock

Some block alimentary canal

Lower rate of production in livestock

Increase cost of production when controlled

Some lower quality of hides and skins

Some absorb food meant for the livestock thereby lowering the level of production.

Some for example ticks transmit disease causing organisms.

CLIMATIC FACTORS.

Climatic factors include:

Rainfall

Poor rainfall distribution results to wilting of crops

Excess rainfall can cause soil erosion

Excess rainfall can result to crop failure due to flooding.

The four aspects of rainfall which affect agricultural production include:-

Rainfall Amount

Rainfall amount refers to quantity of rainfall received in a given area for a period of one year. Rainfall amount is measured using a rain gauge in millimeters per annum. The amount of rainfall determines the crops grown in an area.

Rainfall distribution

This refers to the spread of rainfall over the year. Rainfall distribution is very poor in Kenya and therefore irrigation is necessary to supplement the short supply.

Rainfall reliability

This refers to the certainty with which a given amount of rain is expected in a given place in the year.

Rainfall Intensity

This refers to the strength with which rain falls; it is therefore measured in terms of amount per hour.

Rainfall of low intensity is preferred as it improves water infiltration into

the soil and causes less soil erosion.

Temperature

Temperature is the coldness or hotness of a place.

Temperature is measured in degrees Celsius using a thermometer.

Temperature is influenced by altitude and topography.

Temperature decreases with increase in altitude, such that for every 300 meters rise in altitude above sea level temperature decreases by 1.7-2.2 degrees Celsius.

Each crop has a temperature range within which it can grow referred to as the cardinal range of temperature.

For crops to grow well and produce high yields, they require a narrow temperature range within the cardinal range referred to as optimum range of temperature

Effects of temperature on agriculture

Low temperature

Slow growth rate.

High incidences of disease such as CDB in coffee.

Improvement of quality in crops such as tea and pyrethrum.

High temperature

High evaporation rate hence wilting in crops.

Hasten the rate of maturity due to increased growth rate.

Improvement of quality in crops such as pineapples and oranges.

Increase incidences of diseases such as leaf rust in coffee.

Increased incidences of pest infestation such as aphids in vegetables.

Effects of altitude on agriculture

Kenya is divided into three ecological zones which include;

Low altitude zone 0 - 1500 meters above sea level

Medium altitude zone 1500 - 2500 meters above sea level

High altitude zone above 2500 meters above sea level

Crops perform differently when grown in each of these ecological zones and therefore each crop has its most suitable zone for maximum performance as illustrated below.

Wind

Wind refers to air in motion.

Below is a list of effects of strong wind on agricultural production.

Blowing and bringing rain bearing clouds

Destruction of farm structures

Strong wind may cause lodging in weak plants.

Wind erosion on bare land

Increases rate of moisture evaporation

Increase spread of pests and diseases

Agent of dispersal.

Pollination in crops.

Light

Light is the source of energy which plants require for photosynthesis.

During photosynthesis, plants manufacture food using water and carbon dioxide in the presence of sunlight and chlorophyll.

Aspects of light that influence agriculture

i). **Light intensity.**

This is the strength with which light hits the surface of the earth.

ii) **Light duration**

This is the period of time the plants are exposed to light recorded using a Campbell sunshine recorder

Photoperiodism

This is the response of plants toward light duration.

Long day plants

These are plants which require more than 12 hours of lighting to

flower and produce fruits or seeds e.g. some wheat varieties

Short day plants

These are plants which require less than 12 hours of lighting to flower and produce e.g Maize

Day neutral plants

These are plants which produce flowers regardless of the duration of lighting they have been exposed to e.g Tobacco.

iii) Light wavelength:

This refers to the type or quality of light. A wavelength is the distance between two corresponding points of a light wave.

Chlorophyll absorbs certain wavelengths of light which are not present in artificial light unless it is ultra violet or infra red.

NB/ Green houses can be used to control the temperature, relative humidity and light duration and intensity.

Relative Humidity.

This is the amount of water vapour held by air at a given temperature. At high humidity the rate of evaporation is low and vice versa.

EDAPHIC/SOIL FACTORS

Soil is a mixture of weathered rock and decayed organic matter.

It supports plant growth by providing anchorage nutrients and water.

Topsoil covers most of the earth and it contains minerals, organic matter, air, water and living organisms.

Soil Formation

Soil is formed through the process of weathering.

Weathering is the breakdown and alteration of the parent rock near the earth's surface.

Parent rock is first broken into smaller fragments and eventually into individual constituent minerals.

The individual minerals combine to form the soil.

Weathering is a continuous process and it takes hundreds of years to form a centimeter of the soil.

Weathering involves breakdown (disintegration) and building up (synthesis).

Weathering process is influenced by the following factors.

Climate.

Parent material.

Topography.

Living organisms.

Time.

Agents of The Weathering Process.

Physical agents.

In this case no chemical changes are involved.

These include wind, water, moving ice and temperature.

Strong winds carry materials which hit against each other and break into smaller fragments.

Raindrops hit the ground with some force causing soil erosion.

Moving ice causes rocks to disintegrate.

High temperatures in the arid areas cause the rocks to at different rates. During the night, temperatures drop making the rock to contract. The rock surface contracts faster than the inside. This unequal contraction causes the rocks to disintegrate.

In places with very low temperature, water gets into the cracks, freezes and becomes ice. As water turns into ice, it increases in volume pushing the rock apart hence disintegration.

Biological agents.

This involves living organisms.

Large animals like elephants and cattle exert pressure on rocks as they move causing them to break.

Mans activities such as mining, quarrying, road construction and earth moving breaks rocks into smaller fragments.

Bacteria and fungi help in the breakdown of plant and animal tissues (decomposition). These materials are incorporated into the soil.

Termites and moles bring to the surface large quantities of fine materials. This promotes weathering by aerating lower layers of the rocks.

Roots of plants force their way through rocks making them to disintegrate. They also produce acids during respiration which dissolves rock minerals. Decayed roots may mix with water forming organic acids which dissolves rock minerals.

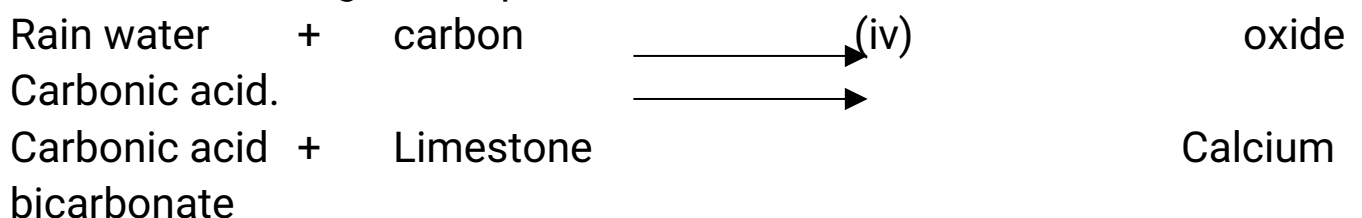
Chemical agents.

This is the decay or decomposition of the rocks. It involves the following processes.

Carbonation.

As the rain falls through the atmosphere, it dissolves some CO_2 forming weak carbonic acid.

Over time this acid reacts with the rock minerals particularly calcium carbonate causing decomposition.



The calcium bicarbonate formed in this reaction is soluble in water causing water to eventually dissolve the entire rock.

Oxidation.

Oxygen reacts with many elements found in rocks causing them to disintegrate.

Solution.

Hydrolysis.

Hydration.

Factors Influencing Soil Formation

Parent rock material

This influences the physical and chemical properties of the soil such as

The texture of the soil e.g. granite gives coarse grained soil.

Mineral composition of the soil e.g. rocks containing calcite, feldspar and ferro-magnesium minerals produce deep heavy soils rich in nutrients.

The rate of soil formation e.g. limestone is easily weathered in warm humid regions and the carbonates are easily soluble.

Since the parent material influences the physical and chemical properties of the soil, it therefore controls the type of vegetation in an area.

Climate

High temperature speed up the rate of chemical reactions.

Wind acts as a transport agent and carries the weathered materials from one place to another. Where a lot of weathered materials are deposited, the soils are deep and rich in nutrients.

Rainfall provides water which is an important reagent during the weathering process. A lot of rain may cause rocks to break hastening the weathering process.

Topography(Relief)

This is the shape of the land in relation to the underlying rock of the earth's surface.

It may quicken or slow the weathering process.

The slope affects the depth of the soil and kind of vegetation growing in an area.

Soils found in flat land and low lying areas tend to be more fertile than those found on higher slopes. Such areas have deeper soils.

On a steep slope, erosion is high and such areas have shallow soils.

Living organisms(Biotic factors)

The presence of the various agents of biological weathering speeds up the process of soil formation.

Time.

The process of soil formation is very slow and takes a lot of time.

Deep mature soils are found where soil forming processes have taken place over a long period.

If the parent material is resistant to weathering agents, more time is required for the soil to mature.

Areas with severe soil erosion have a poorly differentiated soil profile.

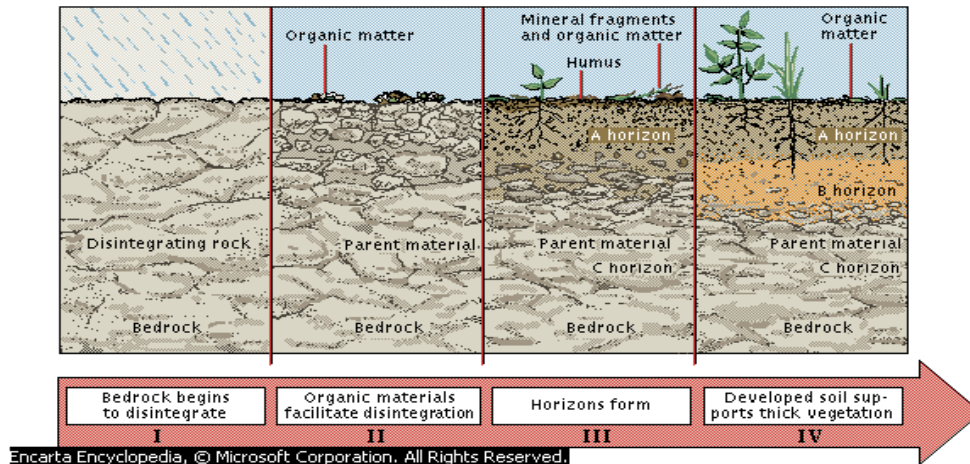
SOIL PROFILE

This is the vertical arrangement of the soil horizons (layers).

The horizons show soil layers at different stages of development.

Soil forming processes are continuous and the soil develops in depth resulting in the formation of the distinct sequence of soil layers.

The layers differ from each other in terms of colour, organic matter content, chemical composition, porosity, depth and the arrangement of soil particles.



The horizons are;

Superficial layer.

It's a thin layer consisting of dead decaying and decayed organic matter covering the soil.

Top soil (Horizon A).

It lies beneath the superficial layer.

It contains a lot of humus hence it's darker than the other layers.

It's well aerated and contains active living organisms.

It's well drained and rich in plant nutrients.

Most of the roots are found here.

Sub soil (Horizon B).

Found beneath the top soil.

More compacted and less aerated than top soil.

May contain an impermeable layer called the ***hard pan*** which may prevent drainage and root penetration.

Minerals leached from top soil accumulate here hence this layer is referred to as ***the layer of accumulation***.

It has clay deposits.

Substratum/weathered rock (Horizon C).

Made up of partly weathered rocks.

Has no humus.

Hard and impermeable to water.

Roots of big trees may reach this layer and draw water from it during the dry season.

Parent rock/Bed rock (Horizon D).

It's found beneath the weathered rock. Soil is formed from this rock. It may contain ponds of water.

NB/ . Between any two bordering soil layers, there is a transitional zone whereby one layer gradually merges into the next one in the series.

The soil profile influences agriculture in the following ways.

Topsoil contains most of the soil nutrients, well aerated and has soil microorganisms.

A well developed profile holds more moisture for plant use than a shallow one.

Loosely packed subsoil allows easy root penetration, drainage and aeration.

Nature and composition of the bedrock determines the mineral components of the whole soil.

SOIL CONSTITUENTS

Mineral matter.

The mineral composition of the parent rock determines the mineral constituents of the soil.

The mineral matter makes the framework of the soil.

It holds the roots firmly in the soil giving anchorage to plants.

Between the particles are spaces which are filled with water and air.

Diagram

Organic matter.

When the dead materials rot, they are decomposed by bacteria and fungi to form the soil organic matter.

Humus is dead organic matter which is in the state of continuous chemical decomposition, transformation and construction.

Humus in the soil improves the soil structure.

Humus contains plant nutrients such as sulphates, nitrates, phosphates, calcium, magnesium, potassium etc.

Air.

The soil contains all the gases such as nitrogen, oxygen, CO_2 and the rare gases.

Availability of air in the soil is influenced by the type of the soil and amount of water in the soil.

Oxygen is needed by plants during respiration. It is also required by microorganisms in the soil during decomposition and nitrogen fixation. Excess CO_2 in the soil is poisonous to plants and microorganisms.

For best crop performance, a balance of soil water and soil air has to be maintained.

Water.

Soil contains water. Soil water exists in three forms;

Superfluous water.

This is water occupying large air spaces (macro pores).

This water is loosely held by the soil and therefore easily lost.

The water is readily available to plants but not useful because excess water in the soil brings about poor aeration.

A lot of water in the soil causes leaching of nutrients.

Capillary water.

This is water occupying small pores (microspores).

It is held with greater force by soil particles.

It is available to plants and acts as a solvent for plant nutrients.

It is also referred to as available water.

It leaves most of the macro pores empty allowing aeration of the soil.

Hygroscopic water.

This is water that forms a thin film around the soil particles.

It is firmly held by soil particles making it not available to plants.

Clay particles have a lot of hygroscopic water but sandy soils contain very little hygroscopic water because sandy particles have weaker forces.

Importance of water to plants

A solvent for plant nutrients.

Raw materials for photosynthesis.

During transpiration plants lose a lot of water hence a cooling effect on them.

Water makes plant cells turgid hence support.

Living organisms (biotic factors)

They are important in the soil in the process of decomposition.

They are divided into ;

Soil microorganisms

They include bacteria, fungi and protozoa. They help in decomposition process.

Some bacteria e.g. Rhizobium spp helps in nitrogen fixation in legumes.

Some microorganisms are harmful because they cause diseases.

Soil macro organisms

They are larger organisms found in the soil such as moles, earthworms, termites, ants and plant roots.

They burrow in the soil aerating the soil and making it loose..

PHYSICAL PROPERTIES OF THE SOIL

Soil structure

This refers to the physical appearance of soil according to how the individual soil particles are arranged, packed or aggregated.

The ***soil structure type*** is determined by the general shape of the aggregates.

Soil structure class is determined by the size of the aggregates.

The ***soil structure grade*** is determined by the stability or cohesiveness of the aggregates.

Types of soil structures

Single grained structure.

There is no aggregation at all.

Particles are not cemented together. The particles are non-porous and spherical.

Mostly found in the top soil of sandy soils, arid climates and alkaline soils.

Crumby soil structure.

The aggregates are small, soft and porous irregular in shape.

Aggregates are not closely fitted together.

Granular soil structure.

The aggregates have irregular shape called granules.

Soil is very porous when wet.

Structure is found in the topsoil of cultivated soils and in the subsoil of soils under grass or bush.

Prismatic soil structure.

Aggregate are arranged vertically.

The vertical axis of each aggregate is longer than the horizontal axis.

When the tops are rounded, they are said to be columnar and when they have flat ends they are prismatic.

Platy soil structure.

The aggregates are arranged on top of one another in thin horizontal plates.

The structure has poor permeability, drainage and root penetration. Structure is mostly found in top horizon of soils in the forest and in clay soils.

Blocky soil structure.

Aggregates are arranged in rectangular blocks.

Aggregates easily fit together along vertical edges.

Importance of Soil Structure on Crop Production

Soil structure influences:

Soil aeration.

Soil drainage and water holding capacity.

Plants root penetrability and anchorage.

Microbial activities in the soil.

Circulation of gases in the soil.

The following farming practices improve the soil structure

Application of inorganic manure into the soil.

Tilling the land at the right moisture content.

Crop rotation.

Minimum tillage.

Cover cropping.

Mulching.

Soil texture

It refers to the relative proportion of the various sizes of the mineral particles of soil.

Also defined as the coarseness or fineness of the soil when felt between the fingers.

Different soil particles have different sizes as shown below.

Particle	Size (Diameter) in mm
Stones	Above 2.00 mm

(Gravel)	
Coarse sand	Between 0.20 – 2.00 mm
Fine sand	Between 0.02 – 0.20 mm
Silt	Between 0.002 – 0.02mm
Clay	Below 0.002 mm

Determination of Soil Texture

This can be done through;

Mechanical analysis.

Chemical analysis.

Mechanical analysis

Apparatus

Garden soil, sieves of different measured mesh diameter, containers and weighing balance.

Procedure

Put a known amount of soil sample into a container.

Crush the soil lumps without breaking the particles.

Pass the soil through the sieve with the largest mesh diameter (2.00 mm) and shake vigorously.

Weigh the soil that remains on the sieve and record.

Repeat the process using other sieves with mesh diameters of 0.2mm, 0.02mm and 0.002mm always using the soil that passes through the previous sieve.

Observation

Soil particles left on first sieve of mesh diameter 2.00mm are called gravel.

From the second sieve of 0.20mm; coarse sand particles.

From the third sieve (0.02 mm); fine sand particles.

From the fourth sieve (0.002 mm); silt particles.

All the particles that pass through the fourth sieve are clay particles.

Importance of soil texture on crop production

Influences soil fertility.

Affects the organic matter content.

Influences the drainage of the soil.

Influences soil aeration.

Influences water holding capacity

Influences the capillarity or movement of water in the soil.

NB/ Based on texture, soil can be classified as;

Sandy soil. (50-80% sand, 20-50% silt and clay and 0.1-3% organic matter).

Are made up of largely sand particles (coarse textured).

Have large air spaces hence poor in water retention.

Easy to till (light soils)

Low fertility due to leaching of minerals.

Easily eroded.

Free draining.

These soils can be improved by addition of organic matter and fertilizers.

Silty loam (20-30% sand, 70-80% silt and clay and 0.1-4% organic matter).

Fine textured

Well drained

Good water holding capacity.

Moderately fertile and aerated.

Area acidic to moderate pH.

Clayey loam soils. (20-50% sand, 20-60% silt and clay and 0.1 - 6% organic matter).

Poorly drained and aerated

Fine textured

High capillarity and water holding capacity.

Slightly acidic to slightly alkaline.

Rich in plant nutrients.

Difficult to work on when dry or wet.

Are suitable for flood irrigation of crops like rice.

Clayey soils. (> 40% clay content)

Made up of largely clay particles.

Have small pore spaces hence good in moisture retention.

Difficult to till (heavy soils)

Poorly drained.

Expand when wet, crack when dry.

High capillarity.

Rich in plant nutrients.

Are suitable for flood irrigation.

They can be improved by drainage.

Loamy soils. (30-50% sand, 50-70% silt and clay and 0.1 - 4% organic matter).

Moderately textured and drained.

Slightly acidic.

Do not erode easily.

Easy to work on.

Have a good water holding capacity.

They are the most suitable for crop production since they contain good amounts of plant nutrients and organic matter.

They can be improved further by planting cover crops to maintain fertility and by adding manures and fertilizers.

Soil Colour

This depends on the mineral composition of the rock and the organic matter content.

Soils containing a lot of iron are brownish, yellowish or reddish in colour.

Soils with a lot of silica are white.

Soils with a lot of humus are dark or grey.

Soil colour influences the soil temperature.

Dark soils absorb and retain more heat than light coloured soils.

Relatively high temperatures in the soil enhance microbial activity.

Soil pH

This refers to the acidity or alkalinity of the soil solution.

It is determined by the concentration of hydrogen ions (H^+) or the hydroxyl ions (H^-) in the soils solution.

pH is measured using the pH scale which ranges from 1-14.

A pH of less than 7 means that the soil solution is acidic.

A pH of more than 7 means that the soil is alkaline.

pH of 7 is neutral.

As the hydroxyl ions in the soil increase, the soil becomes more alkaline and vice versa.

Influence of Soil pH on Crop Growth

Determines the type of crop to grown in a particular area.

Affects the type of fertilizer to be used.

Affects the availability of some nutrients e.g. at low pH phosphorous and molybdenum are less available while high pH makes manganese, potassium, iron, boron and zinc less available.

Very acidic or very alkaline conditions affect activities of soil microorganisms.

Modifying Soil pH

The following are applied to the soil in order to lower its pH (Increase soil acidity)

Application of sulphur.

Application of acidic fertilizers such as sulphate of ammonia.
In raising its pH (increase alkalinity) the following is done.

Application of lime which is a basic compound which raises the soil pH after some time.

Application of basic fertilizers.

Agricultural Economics

Agricultural economics is defined as an applied science that aims at maximizing output while minimizing costs, by combining the limited resources of land, capital, labour and management to produce goods and services for use by the society over a period of time.

Basic Economic Concepts

Scarcity.

The factors of production such as land, capital, labour and management are scarce or limited.

The farmer therefore must decide on how to allocate the few/scarcce resources to the many competing production needs.

Preference and Choice

Since the available resources are limited and production needs are many, a farmer has to make a choice of how to allocate these resources.

A farmer therefore has to choose one or several enterprises from very many. The choice made is determined by factors such as needs of the society, farmer's preference and ecological conditions.

Opportunity Cost

Since a choice has to be made from very many competing enterprises, some revenue has to be foregone. For example, a piece of land may be suitable for the production of maize and wheat.

If a farmer chooses to grow maize, the returns that the farmer would have obtained from wheat is foregone.

The foregone returns are called the opportunity cost. Opportunity cost is the revenue foregone from the best alternative.

Farm Records

These are documents kept in the farm showing farm activities over a period of time.

They should be neat, concise and complete showing actual amounts, weights, measurements or dates.

Uses of farm records to a farmer

Help to determine the value of the farm/ determine assets and liabilities.

Provide history of the farm.

Assist in planning and budgeting in various fields.

Helps to detect losses or theft in the farm.

Assists when sharing losses or profits (dividends) for communal owned farms/ partnership.

Help to settle disputes in the farm among heirs.

Help to support insurance claim e.g. against fire and theft.

Provide labour information like terminal benefits, NSSF due, Sacco dues for all employees.

Help to compare the performance of different enterprises within a farm or other farms.

Help in the assessment of income tax to avoid over or under taxation.

Records help to show whether the farm business is making profit or losses. This information helps in obtaining credit.

Types of Farm Records

Production Records

They show the total yield and the yield per unit of each enterprise such as the total number of litres of milk from the whole herd and from each cow.

Name /No. of cow	Days in the month			et c	TOTALS
	1	2	3		

	A M	P. M	A. M	P M	A M	P M		
1								
2								
3								
4								
etc								
Totals								

Inventory records

They show all the assets on the farm e.g. livestock, machinery, buildings, crops etc.

They are divided into two;

Consumable goods such as animal feeds, fertilizers, fuel, pesticides etc.

Permanent goods such as machinery, farm tools and equipment, buildings etc.

Consumable Goods Inventory

Receipts			Issues			
Date	Commodity/Item	Quantity	Date	Issued to	Quantity	Balance in Stock

Permanent goods Inventory

Date	Commodity/Item	Quantity	Written off	Balance in Stock	Comment

Field Operations Records

They show all the activities being carried in the field such as date of ploughing, planting, fertilizer used etc.

They help to work out the cost of production for each field at the end of the season.

Breeding Records

They are kept to show the breeding activities and programmes for various animals on the farm.

There are different breeding records depending on the animals being reared.

Feeding Records

They show the type and amounts of feeds used to feed the animals.

Daily feeding record for the month of.....					
Enterprise					
Type of feed.....					
Date	No. of Animals	Amount Received (kg)	Amount Used (Kg)	Balance in Stock (Kg)	Remarks

Health Records

They show the health conditions of the animals. They show when actions such as vaccinations and deworming are to be done.

They help in the selection of the breeding stock. They also help in calculating the cost of treatment.

Date	Disease symptom	Animal(s) affected	Drugs used	Cost of treatment	Remarks

Marketing Records

They show the commodity, quantity, amount sold, date, rate per unit of the commodity, total value and where sold.

Commodity.....

Date	Amount sold	Price per unit (kshs)	Total Value (ksh)	Where sold	Remarks

Labour Records

They show the type of labour, date of employment, rate of payment, skilled and unskilled labour.

They are divided into two;

Muster Roll – this checks the number of days worked for and therefore determine how much to be paid to a worker.

This record shows the name of the worker, payroll number, days worked for, rate of payment, the amount of salary and signature.

Muster Roll

Name of Person	Pay Roll No.	Days					Days Worked	Rate of Pay (kshs)	Total Pay (Kshs)	Signature of Workers.
		1	2	3	4	5				
Mr. X	08							25	@100/-	2,500/-
Mr. Y	09							25	@100/-	2,500/-

-Labour Utilisation Analysis. They show how labour is utilized on the farm and helps to determine labour allocation; labour requirement for the

purpose of budgeting when labour is in peak demand or when to lay off unproductive labour.

No of hours Worked	Livestock Production	Crop Production	Machinery Maintenance	Date of Working	Remarks
Total cost					

CROP PRODUCTION 1

LAND PREPARATION

Land preparation involves all the activities that make land suitable for planting such as

- ploughing/digging
- harrowing
- ridging
- rolling etc

A piece of land that has been prepared for planting is called seedbed. In a seedbed the planting materials germinate and grow to maturity and are harvested from same place.

IMPORTANCE OF LAND PREPARATION

- To kill the weeds.
- Encourage water infiltration into the soil.
- To aerate the soil.
- Incorporate manure and other organic matter into the soil.
- To destroy stages of crop pests such as eggs, larvae, pupa or adults

burying them, exposing them to the sun's heat or predators and starving them.

- To encourage root penetration into the soil.

- To make subsequent operations possible e.g. planting, fertilizer application, rolling and ridging.

OPERATIONS IN LAND PREPARATIONS

They include;

- Land clearing.

- Primary cultivation.

- Secondary cultivation.

- Tertiary operations.

LAND CLEARING

This is the removal of vegetation cover from the surface before tillage. This is done to prepare land for cultivation and as a method of land reclamation.

Land clearing is necessary under the following conditions.

- When opening up a virgin land.

- Where a stalk growing crop was previously planted such as maize.

- Where land was left fallow for long time.

- Where the interval between primary and secondary cultivation is long such that the land has reverted to the original virgin state.

Methods of Land Clearing

Tree felling. Axes, pangas and power saws are used to cut down trees. Bulldozers and root rakers are used in felling trees on a large scale. Removal of stumps and trash later follows.

Burning. The vegetation cover is set ablaze. The method should be discouraged as it destroys the soil organic matter, soil micro organisms and plant nutrients.

Slashing. This is done to cut small bushes and grasses using slashers, pangas or tractor drawn mowers.

Use of chemicals. Chemicals used to kill weeds are called herbicides.

Primary Cultivation

This follows land clearing,

Small scale farmers use jembes or fork jembes during hand digging.

In Large scale framing ploughing is done using mouldboard or disc plough.

Other farmers use ox ploughs.

Primary cultivation should be done before the onset of the rains. This ensures that all other subsequent operations are done in good time.

Importance of Primary Cultivation

To remove weeds.

To bury organic matter for easy decomposition.

To facilitate water infiltration and aeration.

To destroy soil borne pests by exposing them to predators and the sun.

To make planting easy.

Methods of Primary Cultivation

Hand digging. This is done by use of jembes, mattocks and fork jembes to cut and turn the soil slices.

Mechanical cultivation. This is the use of tractor drawn implements such as mouldboard and disc ploughs. Subsoilers, cultivators and chisel ploughs are used to break the hard pan. Subsoiling is the process of cultivating the soil with the purpose of breaking up the hard pan. Hard pans may be formed due to continuous use of heavy machinery on the land.

Importance of subsoiling

Breaking up the hard pan hence improving drainage.

Improving soil aeration.

Bringing to the surface leached minerals.

Improve root penetration.

Use of an oxplough. This is the use of ploughs drawn by oxen, donkeys or camels. The method is faster and more efficient than hand cultivation. It's common in areas where land is fairly flat.

The following aspects should be considered when carrying out primary cultivation.

Time of Cultivation

Land should be prepared before the onset of the rains so as to;

Give enough time for the weeds to dry up and decompose into organic matter.

To allow CO₂ and other gases to diffuse out of the soil while being replaced by oxygen.

Give enough time for subsequent operations to be done hence giving way to early planting.

Depth of Cultivation

This is determined by;

Type of crop to be planted. Shallow rooted crops do not deep cultivation. Deep rooted crops require deep cultivation.

Type of the soil. Heavy soils are hard when dry making jembes and fork-jembes to dig shallowly.

The implements available. Tractor drawn implements give deeper depth than hand operated tools.

Choice of the Correct Implements

This is determined by:

Condition of the land. If the land has a lot of stones and stumps, a disc plough is preferred because it rolls over the obstacles without braking.

Type of the tilth required. Very fine tilth requires different types of implements.

Depth of cultivation. When deep cultivation is required heavy

implements are used. Light implements are used when shallow cultivation is needed.

Topography of the land. Tractor drawn implements cannot be used where the slope is very steep.

Implements available. A farmer can only use what is locally available.

Shape of the land. Some land shapes may not allow tractor drawn implements to be used efficiently e.g. where there are acute corners.

Size of the land.

Secondary Cultivation

This follows primary tillage.

This involves the refinement of the seedbed before planting.

It is also referred to as harrowing.

Small scale farmers can use pangas, jembes, fork-jembes, and garden rakes to break the soil clods and pulverize the soil.

Large scale farmers use tractor drawn harrows such as disc harrows, spike toothed harrows, spring tine harrows.

IMPORTANCE OF SECONDARY CULTIVATION

To remove any weeds that might have germinated immediately after primary cultivation.

To break the soil clods into small pieces for easy planting.

To level the field so as to obtain the uniform depth of planting.

Incorporate organic matter into the soil in order to encourage decomposition before planting.

Factors determining the number of times secondary cultivation is done.

Size of the planting materials. Small seeds require a fine tilth than large seeds.

Slope of the land. If the land is hilly, less number of secondary cultivations are preferred to discourage soil erosion.

Moisture content of the soil. In dry soils less operations are preferred

so as to conserve the soil moisture.

Condition of the land after primary cultivation. If after primary cultivation, a lot of trash is left, more harrowing operations should be carried out so as to incorporate the trash into the soil.

Tertiary Operations

They are carried out to meet the needs of certain crops.

They are conducted after land clearing, primary and secondary cultivations. They include;

Ridging

This is the process of digging soil in a continuous line and heaping it on one side to form a ridge (bund) and a furrow.

These ridges are used in planting crops such as Irish potatoes, cassava, groundnuts etc.

Ridges facilitate tuber expansion and easy harvesting of the root crops.

Furrows are made when planting sugarcane.

They help to conserve soil and water.

Rolling

This is done to compact the soil which is loose or of fine tilth.

This is done to *prevent small seeds from being blown away by the wind and to prevent soil erosion.*

This also increase seed soil contact.

Heavy rollers are used in large scale.

Leveling

This is making the soil surface flat and uniform to promote easy germination of small seeded crops.

Rolling ensures uniform germination of seeds.

MINIMUM TILLAGE

This is the use of a combination of farming practices that disturb soil the least. These farming practices include;

Application of herbicides in controlling weeds.

Timing cultivation/timely weeding of the previous crop.

Mulching. Mulch prevents weeds from growing.

Restricting cultivation to the area where seeds are to be planted.

Weeds in the rest of the field are controlled by slashing.

Establishing a cover crop on the field.

Uprooting or slashing weeds in perennial crops.

Reasons for carrying out minimum tillage

Reduce the cost of cultivation. By reducing the number of operations.

To control soil erosion.

To maintain soil structure.

To conserve soil moisture. Continuous cultivation exposes the soil to sun's heat hence evaporation of soil moisture.

To prevent root and underground structures disturbance.

To prevent exposure of humus to adverse conditions such as sun's heat that cause volatilization of nitrogen

Soil Fertility I: (Organic Manures)

Soil Fertility: This is the ability of the soil to provide the crops with the required nutrients in proper proportions for high production.

Characteristics of Fertile Soils

Good Depth: Deep soil gives plants greater volume to obtain nutrients and also provide anchorage.

Good water holding capacity: This ensures that water is retained well for plant use.

Proper drainage: Well drained soils are well aerated facilitating healthy root development.

Correct soil pH. Different crops have different nutrient requirements.

Adequate nutrient supply. It should supply the crops with the nutrients they require in adequate amounts.

Free from excessive infestation of soil borne pests and diseases.

How Soil Loses Fertility

Leaching. Soluble minerals are carried to lower horizons beyond the reach of plant roots.

Mono cropping. Growing one type of crop continuously for a long time leads to the exhaustion of certain minerals that the plant uses.

Change of soil pH. Changes in the soil pH affect the activity of the soil microorganisms and the availability of certain soil nutrients. Use of some fertilizers can change the soil pH.

Continuous cropping. Crops take up a lot of nutrients during their growth which are never returned to the soil. This makes the soil deficient of these plant nutrients.

Burning of vegetation cover. This destroys the organic matter hence destruction of the soil structure.

Soil erosion. When the fertile top soil is carried away, the soil loses its fertility.

Accumulation of salts. This is as result of irregular rainfall and insufficient removal of salts from the soil especially in the arid and semi arid areas. Accumulation of salts is called salinisation

Maintenance of Soil Fertility

Control of soil erosion to enhance soil infiltration onto the soil and reduce surface run off.

Weed control to prevent competition for nutrients. Water space and light with crops. It also reduces pests and diseases.

Carrying out crop rotation, this helps to control accumulation of crop pests and diseases on the farm. It also helps to ensure maximum utilization of nutrients.

Use of inorganic fertilizers helps to add nutrients to the soil e.g. CAN, DAP, Urea etc..

Use of organic manure helps to supply organic matter to the soil.

Minimum tillage which helps to maintain soil structure and prevent soil erosion.

Intercropping (Mixed cropping) of leguminous and non- leguminous crops fix nutrients and improve fertility.

Proper drainage by breaking hard pans or creation of water channels this ensures proper aeration.

Control of pH to almost neutral to ensure proper functioning of micro-organisms which help in decomposition of organic matter.

Organic Manures

They are obtained from plant and an animal remains after decomposition.

Role/ Importance of Organic Matter

Improves soil structure – aeration, drainage absorption and retention.

Improve water holding capacity of the soil.

Increases soil fertility e.g. carbon nitrogen etc.

It provides food and shelter to soil microorganisms.

Help to keep PH of soil stable (Buffers soil pH).

Reduces toxicity of plant poisons that have build up in the soil as a result of continuous use of pesticides and fungicides etc.

Humus gives soil dark appearance making the soil to absorb heat. This moderates soil temperature.

Problems Associated with the use of Organic Manures

Bulkiness – they have low nutritive value per unit volume hence required in large volumes.

Laborious in application and transportation – this is due to their bulkiness.

They spread diseases, pests and weeds – i.e. if they are made from materials that are contaminated.

Losses of Nutrients – if they are poorly stored, soluble nutrients are easily leached and some become volatilized when exposed to the hot sun.

If used when not fully decomposed the plant does not benefit from them.

Types of Organic Manures

They are of three types:

Green Manure.

Farm Yard Manure (FYM)

Compost Manure.

Green Manure

It is made of green plants which are left to grow until flowering and then are incorporated into the soil through ploughing. The crops used include; cowpeas, groundnuts, Lucerne, beans, sunflower etc.

Characteristics of Plants used as Green Manure

Should be leafy or highly vegetative.

Should have high nitrogen content hence leguminous ones are preferred.

Should have a fast growth.

Must be capable of rotting quickly.

Should be hardy i.e. Capable of growing in poor conditions.

Reasons Why Green Manure is not Commonly Used

Most crops used for green manure are food crops

Takes time for the manure to decompose delaying planting

Most of the nutrients are used up by micro-organisms in the process of decomposing the green manure

Green manure might use most of the soil moisture and leave very little for the next crop

Farm Yard Manure (FYM)

This is mixture of animal waste (urine and dung) and crop remains used as animal beddings.

The quality of Farm Yard Manure is determined by the following factors.

Type of the animal used –

Dung from fattening animals has a high level of nutrients than that from a dairy cow.

Non ruminants such as hens and pigs give very rich dung in terms of nutrients.

Type of food eaten - nutritious feedstuffs give manure with more nutrients.

Type of litter used – wood shavings and sawdust are slow to

decompose and contain very little nutrients as compared to leguminous ones which give manure rich in nutrients.

Method of storage – for manure to retain its nutritive status, it must be stored in place with a leak proof roof and a concrete floor.

Age of the farm yard manure –well rotten manure is rich in nutrients and is easy to apply.

Preparation of the farm Yard Manure

Provide materials such as grass or wood shavings in the animal house to serve as bedding.

Animals deposit their droppings and urine on the bedding and mix them by trampling.

After some time Collect the used animal bedding/litter and other rotten plant residues;

Store collected materials under roof/shed to prevent leaching and oxidization of nutrients;

Turnover the materials regularly;

Sprinkle water if dry;

Leave the material to rot completely before use

Compost Manure

This is a type of manure made from decomposed materials such as kitchen refuse, plant and animal remains.

The following factors are considered when selecting the site for making compost manure.

Well drained place – this avoids waterlogging which may cause leaching of nutrients.

Direction the prevailing wind – this aims at preventing bad smells from being blown to the homestead.

Size of the Farm –the site should be centrally placed on the farm.

Accessibility – this makes transportation of the manure possible.

Preparation of Compost Manure

There are two methods of preparing compost manure;

Indore Method (pit Method)

Four Heap System (Stack Method).

Indore Method (pit Method)

A pit 1.2m long by 1.2m wide and 1.2m deep is made.

The materials to be composted are placed in layers in the following order;

Fibrous materials such as maize stalks form the foundation.

They are followed by a layer of grass, leaves or any kitchen refuse material.

A layer of well rotten manure is then applied to provide nutrients for the microorganisms.

A thin layer of wood ash is applied to improve the level of phosphorous and potassium in the manure.

A layer of top soil is then added to introduce microorganisms that are required to decompose the organic materials..

The above sequence of layers is repeated until the pit is full.

A layer of soil is added to cover the pit.

During the dry season, the materials should be kept moist by adding water.

OR

Introduction to Agriculture

Definition of Agriculture

- Agriculture is the science and art of cultivation of crops and rearing of livestock.
- **As a science**, it involves *experimentation* and *application of scientific knowledge* in such areas as;
 - Soil analysis,
 - Control of pests and diseases,

- Farm machinery and structures,
- Crop and livestock breeding.
- ***As an art, it involves the use of learned skills in;***
 - Tilling the land,
 - Construction,
 - Measurement,
 - Harvesting of crops,
 - Feeding and handling of livestock
 - Marketing.

Branches of Agriculture

Crop Farming (Arable Farming)

- The practice of growing crops on cultivated land.

It is subdivided into:

- ***Field crops Cultivation:***
 - maize, beans, potatoes, coffee, tea, cotton to name but a few.
- ***Horticulture:***
 - It involves the growing of perishable crops which have high value.
 - It is further subdivided into:
 - ***Floriculture*** - the growing of flowers.
 - ***Olericulture*** - the growing of vegetables.
 - ***Pomoculture*** - the growing of fruits.

Livestock Farming

- This branch deals with the rearing of livestock for various products.

It is further subdivided into:

- ***Pastoralism:*** This is the rearing of mammalian livestock such as cattle, sheep, goats, rabbits, pigs and camels.
- ***Fish Farming (Aquaculture):*** This is the practice of rearing fish and other aquatic organisms, in ponds.
- ***Bee Keeping (Apiculture):*** This involves the rearing of bees in structures known as beehives.
- ***Poultry Keeping:*** This is the keeping of domesticated birds.

Agricultural Economics

- It deals with the allocation of scarce resources (land, labour, capital and management) for agricultural production.

Agricultural Engineering

- This branch of agriculture deals with the use and maintenance of farm tools, machinery and structures.

Farming Systems

- A farming system is the organization of the various enterprises in a farm.

It is determined by the following factors:

- Resources available (land, labour, capital and management).
- Skills of the farmer.
- Environmental factors such as climate, soil type and topography.
- Government policy.
- Farmer's choice and preference.
- Enterprise requirement.
- Social-cultural factors.

The following are systems of farming:

Extensive System:

- It is a system where a large piece of land with low investment of resources per unit area is carried out.

Advantages

- It is cheap.
- Does not require high level of management.
- Requires less labour.

Disadvantages

- Low profit per unit area.
- Cannot be practiced where land is limited.
- Low output per unit area.
- The land is under-utilized,

Intensive Farming:

- This system utilizes the factors of production to the maximum and involves high level of management.

Advantages

- Maximum utilization of the resources.
- Can be practiced even where land is a limiting factor.
- Results in high yields.

Disadvantages

- Labour intensive.
- High capital investment is required.
- Requires high level of management.
- Can lead to high losses in case of poor management.

Large Scale Farming

- Refers to the farming practice under large areas of land over 20 hectares.
- It is used mainly for commercial purposes.
- The system is highly mechanized.

Advantages

- Results in high yields.
- Due to economics of scale high profit is realized.

Disadvantages

- Lack of diversification may lead to total failure in case of unfavorable conditions.
- High level of management is required.
- Heavy capital investment.
- Requires skilled and qualified manpower.

Small Scale Farming

- Refers to farming carried out on a small area of land less than 5 hectares.
- Family or casual labour can be engaged during the peak periods.
- Most of the Kenyan farmers are small scale due to unavailability of farmland.

Advantages

- Requires low capital investment.
- Possible where land is a limiting factor.
- Does not require high management level unless under intensive system.

Disadvantages

- Uneconomical to mechanize due to small size.
- Low production.
- Provides limited employment.
- Labour intensive.
- Difficult to specialize.

Methods of Farming

- A method of farming is an established way of carrying out farming activities.
- The following are the common methods of farming:

Mixed Farming

- It is the practice of growing crops and keeping of livestock on the same land.
- Its common in high potential areas.

Advantages

- Mutual benefit between crops and livestock.
- Crops supply feed for animals while animals supply manure for crops.
- Acts as an insurance against total loss by the farmer.
- The farmer is assured of an income throughout the year.
- There is maximum utilization of the resources.
- Animals can be used in the farm activities particularly draught animals.

- Ensures proper utilization of labour and land throughout the year.

Disadvantages

- High initial capital.
- Lack of specialization.
- Land can be a limiting factor if both enterprises are to be raised.
- Requires high level of management for both enterprises.

Nomadic-Pastoralism

- This is the practice of livestock rearing whereby animals are moved from one place to another in search of water and pastures.
- It is practiced in the arid and semi-arid areas where in most cases beef animals are kept.

Nomadic pastoralism is gradually changing to ranching with the introduction of:

- Improved pasture species, improved livestock breeds and supplementary feeding.
- Efficient disease and parasite control measures.
- Improved infra-structure such as roads, water supply, cattle dipping facilities.
- Extension services.

Advantages

- Serves as the backbone of beef industry in Kenya.
- Proper way of utilizing the arid and semi arid areas.
- Source of income to the pastoral communities.

Disadvantages

- It encourages the spread of livestock pests and diseases due to communal watering points, grazing and dipping facilities.
- There is a tendency to increased soil erosion and land degradation.
- Source of conflicts and ethnic tension among the nomadic communities for the control of good pastures and water.
- Difficult to control breeding and breeding diseases.
- High rate of inbreeding leading to poor quality livestock.
- Low production of milk, meat, hides and skins due to wastage of energy in traveling from one place to another in search of pastures and water.
- High death rates as a result of walking for long distances.

Shifting Cultivation

- It is a traditional method of cultivating a piece of land until the soil is exhausted and crop yields decline.
- The land is abandoned and the farmer shifts to a new field as the previous land is left fallow to regain its fertility.

Advantages

- Land is allowed to rest and regain its fertility.
- No build up of pests and diseases.
- Soil structure is restored.
- The cost of production is low since inorganic fertilizers and pesticides are not used.
- Crop produce are chemical free.

Disadvantages

- Not practical where land is a limiting factor.
- Farm planning and acquisition of credits for land development is 'not possible.
- It is a cumbersome method due to constant movement.
- Lack of soil conservation measures
- Not possible to grow perennial crops.
- Low output per unit area due to poor farming methods.
- Where fire is used to clear the land organic matter is destroyed.

Organic Farming

- It is a farming method where crops are grown and livestock reared without the use of agro-chemicals.
- It is a method of farming which has been adopted to reduce the long term effect of the agro-chemicals on crops which may eventually end up in man and livestock.
- Agro-chemicals are also expensive thus organic farming reduces the cost of production. Organically produced goods fetch high market prices.

Advantages

- Cheap and cost effective.
- Make use of the locally available materials
- Useful in improving the soil structures.
- No side effects from the crops and livestock products.
- No environmental pollution.

Agro-Forestry

- This is the practice of integrating trees and crops on the same piece of land.
- With land resources becoming more scarce, agroforestry is becoming more important.

Examples of common agroforestry trees and shrubs include:

- *Cajanus cajan*
- *Grevillea robusta*
- *Sesbania sesban*
- *Calliandra calothyrsus*
- *Casuarina equisetifolia*
- *Leucaena leucocephala*

Trees selected for agroforestry should have the following characteristics:

- Able to grow fast.
- Deep roots to minimize competition for nutrients.
- Should be preferably leguminous.

Advantages

- Trees reduce soil erosion in a given area.
- Leguminous trees add nitrates into the soil thus improving the *soil* fertility.
- Some trees can be used as livestock fodder to provide a high level of proteins.
- They are important sources of wood fuel and timber.
- There is maximum utilization of land.

Importance of Agriculture to the Economy of Kenya

- Provides **food** to the population to meet nutritional requirements and to enable man to engage in other activities of farming.
- Provides **employment**. This for example can be direct as a labourer in the farm, tea plucker or indirect for example, working in agricultural based industries.
- Source of **raw materials** for industries for example cotton lint for textile industry.
- Provides **foreign exchange** - through exporting agricultural produce.
- Provides **market for industrial goods** -agriculture is a consumer of the finished goods from agro-based industries.
- Source of **income** - farmers as well as the government get revenue from the sale of agricultural produce and tax payment.

Factors Influencing Agriculture

Introduction

Agricultural production is influenced by external factors:

- Human factors
- Biotic factors
- Climatic factors
- Edaphic factors.

Human Factors

These are human characteristics which affect the way decisions are made and operations carried out.

- ***Level of education and technology:***
 - Skills
 - Technological advancement.
- ***Human health/HIV-AIDS:***
 - These affect the strength, the vigour, vision and the determination to work.
 - HIV/AIDS is the biggest threat to human health today and has long lasting effects on agriculture, such as;
 - Shortage of farm labour.
 - Loss of family support.
 - Low living standards leading to despondency and hopelessness.
 - Increased criminal activities.
 - More time spent by the Government and NGO's in caring for the sick.
- ***Economy;***
 - Stability in the countries' economy affect agricultural production.
- ***Government Policy:***
 - These are governmental laws which have been enacted to protect farmers, land and livestock.

They include:

- Food policy
- Policies on control of livestock parasites and diseases.
- Policies on marketing of both local and export products and others.
- **Transport and communication:**
 - For agricultural goods to move from the farm to the consumers.
- **Cultural practices and religious beliefs:**
 - These activities hinder important changes in a society that may bring agricultural development.
- **Market forces:**
 - Demand and supply forces which affect prices of commodities in a free market.

Biotic Factors

These are living organisms which affect agricultural production.

- **Pests** - Destructive organisms which destroy crops.
- **Parasites** - These are invertebrates which live in or on other living organisms.
- **Decomposers** - Organisms which act on plants and animal tissues to form manure.
- **Pathogens** - Micro-organisms which cause diseases.
- **Predators** - Animals that kill and feed on other animals.
- **Pollinators** - They transfer pollen grains from the stamens to the pistil of a flower.
- **Nitrogen fixing bacteria** - They are micro-organisms which convert atmospheric nitrogen to nitrates ready for use by the plants.

Climatic Factors(weather elements).

- Rainfall,
- Temperature,
- Wind,
- Relative humidity
- Light.

Weather - Atmospheric conditions of a place at a given time period.

Climate - weather conditions of a place observed and recorded for a period of 30-40 years.

Rainfall

Supplies Water:

- Which is necessary for the life process in plants and animals.
- Which makes the plant turgid hence provides support.
- Acts as a solvent for plant nutrients.
- Cools the plant during transpiration.
- Which is used as a raw material in photosynthesis.

When plants lack enough water they respond in different ways as follows:

- By closing the stomata to restrict water loss.
- Hastens maturity.
- Some will roll their leaves.

Other plants have developed permanent adaptation to water stress such as:

- Growing needle like leaves.
- Develop fleshy leaves for water storage.
- Develop long roots.

- Wilting and death in extreme conditions.

Important Aspects of Rainfall:

- ***Rainfall reliability,***
 - This is the dependency on the timing of the onset of the rains.
- ***Amount of rainfall,***
 - Quantity of rain that falls in a given area within a given year.
- ***Rainfall distribution ;***
 - The number of wet months in a year.
- ***Rainfall intensity,***
 - Amount of rainfall that falls in an area within a period of 1 hour.

Temperature

- This is the degree of hotness or coldness of a place measured in degrees Celsius.
- ***Cardinal range*** of temperature - is the temperature required by plant to grow and thrive well.
- ***Optimum range of temperatures*** - the best temperature for the best performance of plants.

Effects of Temperatures on Crop Production:

Low temperatures:

- Slow the growth rate of crops due to slowed photosynthesis and respiration.
- High incidences of disease infection.
- Improves quality of crops such as tea and pyrethrum.

High Temperatures

- Increase evaporation rate leading to
- Wilting.
- Hastens the maturity of crops.
- Increase disease and pest infection.
- Improves quality of crops such as pineapples, oranges and pawpaws.

Wind

Wind is moving air.

Good effects of wind include:

- Seed dispersal
- Cooling of land
- Pollination in crops
- Brings rain bearing clouds

Negative effects of wind:

- Increases the rate of evaporation of water.
- Causes lodging of cereals and distorts perennial crops.
- Increases evapo-transpiration.
- Spreads diseases and pests.
- Destroys farm structures.

Relative humidity

- The amount of water vapour in the air
- Affects the rate of evapo-transpiration.
- Forms dew which supplies soil with moisture under dry conditions.
- High humidity induce rooting in cuttings.
- Increases disease multiplication and spread.

Light

- Provide radiant energy harnessed by green plant for photosynthesis.

Important aspects of light:

- **Light intensity;**
 - The strength with which light is harnessed by chlorophyll for photosynthesis.
- **Light duration;**
 - The period during which light is available to plants per day.
 - Plant response to light duration is known as **photoperiodism**.
 - **Short-day plants** - require less than 12 hours of daylight to flower and seed.
 - **Long-day plants** - require more than 12 hours of daylight to flower and seed.
 - **Day-neutral plants** require 12 hours of daylight to flower and seed.
- **Light wavelength;**
 - This is the distance between two - successive crests of a wavelength.
 - It dictates the difference between natural and artificial light.
 - Chlorophyll absorbs certain wavelengths of light.

Edaphic Factors Influencing Agriculture

- These are soil factors.
- Soil is the natural material that covers the surface of the earth,
- Made of weathered rock particles and decomposed animal and plant tissues, and on which plants grow.

Importance of Soil

- Provides anchorage to the plants by holding their roots firmly.
- Provides plants with mineral salts/ nutrients which are necessary for their growth.
- Provide the plants with water.
- Contains oxygen necessary for respiration of the plants and soil micro-organisms.

Soil Formation:

- Soil is formed through weathering process.
- Weathering is the breakdown and alteration of the parent rock near the surface of the earth to a stable substance.

- Weathering process is a combination of disintegration (breakdown) and synthesis (build up) process.
- Weathering process is continuous.

Types of Weathering

- Physical weathering
- Chemical weathering
- Biological weathering

Agents of Weathering

Physical Agents of Weathering

- Include wind, water, moving ice and temperature.
- **Wind** - carry materials which hit against each other to break into fragments.
- **Water** - intensity of rainfall causes breakdown of rock.
- **Moving ice** - has grinding effects which tear off rock particles.
- **Extreme temperature** cause rocks to expand and contract suddenly peeling off their surface.

Chemical Weathering

- Affects the chemical composition and structure of the rock.
- Involves processes such as ;
 - Hydrolysis,
 - Hydration,
 - Carbonation
 - Oxidation.
- **Hydration;**
 - The process by which soluble minerals in the rocks absorb water and expand weakening the rock thus leading to disintegration.
- **Hydrolysis;**
 - The process whereby water dissolves soluble minerals in the rock weakening it.
- **Oxidation;**
 - The reaction of rock minerals with oxygen to form oxides which break easily.
- **Carbonation;**
 - The process whereby carbonic acids formed when rain water dissolves carbon dioxide,
 - It reacts with calcium carbonates in limestone causing it to disintegrate.

Biological Weathering

This involves the action of living organisms, plants and animals on the rocks.

- **Burrowing animals**, for example, termites and moles bring soil particles to the surface exposing them to other agents of weathering.
- **Big animals** like, elephants, buffaloes, camels and cattle exert a lot of pressure on the rocks as they step on them due to their heavy weights causing the rocks to disintegrate.
- **Earthworms** take part in the decomposition of plant matter with the soil particles.
- **Man's activities** like, mining and quarrying expose rocks to the surface during excavation.

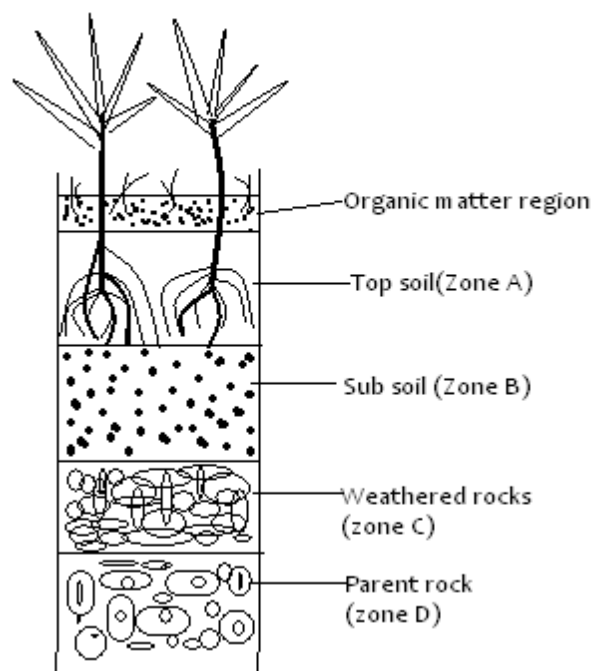
These activities breakdown large rocks into smaller rock particles.

- **Plant roots** force their way through the cracks in the rocks thus widening and splitting them.
- **Humic acids** formed when plant tissues decompose react with the rocks weakening them further.
- **Plant remains**-decompose adding humus into the soil.

Factors influencing soil formation

- **Climate**- (rainfall, temperature and wind)
- **Biotic factors** - living organisms.
- **Parent material**- Nature and properties of the original rock from which the soil is formed.
- **Time** - length of time during which the soil forming processes have taken place.
- **Topography**- influences the movement of disintegrated materials.

Soil Profile



- It is the vertical arrangement of different layers of soil from the ground surface to the bedrock.
- These layers are also referred to as **horizons**.
- The layers show differences in their contents and physical properties such as colour, texture and structure.
- The layers include: organic matter region, top soil, sub-soil, weathered rocks and parent material.

Organic Matter Region

- First layer of the soil found on the surface.

- Made up of leaves and other plant remains at various stages of decomposition.
- Some soil organisms may also be found here.

Top Soil

- Has a dark colour due to the presence of humus.
- Is rich in plant nutrients and well aerated.
- It is a zone of maximum leaching (zone of eluviations)

Sub-Soil

- It is compact and less aerated.
- It is a zone of accumulation of leached material (zone of aluviation) from the top layers.
- Deep rooted crops have their roots growing up to this region.
- Hard pans normally form in this layer

Weathered Rocks

- It is also called substratum.
- Rocks at various stages of disintegration are found in this zone.
- Most of the materials found in this zone originate from the parent rock.

Parent Rock

- It exists as a solid mass which is un-weathered.
- It is the source of the inorganic composition of the soil.
- The water table is on the surface of this rock.

Soils Formed in Situ and Soils Deposited

- Soil formed in the same place and remains there is said to be *in situ*.
- However, soil can be formed due to deposition of soil particles carried from its original site of formation to another area which is usually in the lower areas of slopes.
- Such soils are said to have been formed through deposition.

<i>Soil Formed in Situ</i>	<i>Soil Deposited</i>
1. Has the colour of the parent rock	1. Has the characteristics of when: it came from
2. Shallower	2. Deeper
3. Less rich in plant nutrients	3. Richer in plant nutrients
4. Easily eroded	4. Not easily eroded
5. Less silty	5. More silty
6. Have the same chemical composition as that of the underlying parent rock.	6. Differ in chemical composition from the underlying parent rock.

Soil Depth

- This is the distance between top soil layer and the bottom soil layer in a profile.
- It dictates root penetration and growth
- Deep soils are more suitable for crop growth since they contain more nutrients.
- Have a larger surface area for root expansion.
- Deep soils facilitate good drainage and aeration.

Soil Constituents

- **Organic Matter** - Dead and decaying plants and animal remains
- **Living Organisms** - Soil organisms and plant roots.
 - Micro-organisms (bacteria, protozoa and fungi)
 - Invertebrates - termites,
 - Earthworms and molluscs.
 - Higher animals - rodents and others.
- **Inorganic or Mineral Matter**
 - Formed from the parent materials.
 - Supply plant nutrients
 - Form the skeleton and framework of the soil.
- **Air**
 - Found in the pore spaces of the soil.
 - Used for root and organism respiration
 - Used for germination of seeds.
 - Helps in decomposition of organic matter.
 - Regulates soil temperature.
 - Regulates the movement of water through capillary action.
- **Water**
 - Dissolves mineral salts
 - Maintain turgidity in plants.
 - Used for germination of seeds
 - Used by soil organisms.
 - Regulate soil temperature
 - Dictates the amount of air in the soil.

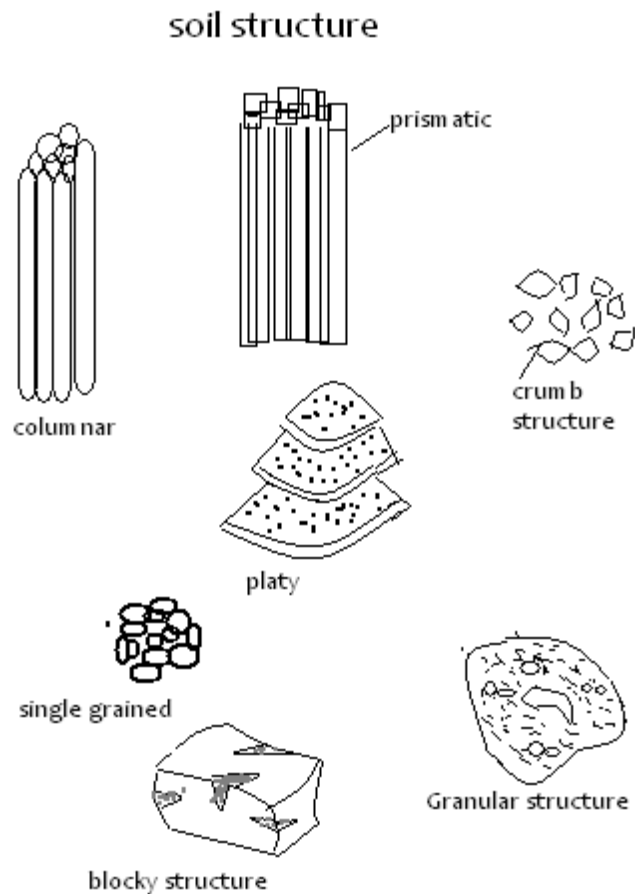
Water in the soil exists in three forms namely:

- **Superfluous/Gravitational Water**
 - Found in the large spaces (macro-pores) in the soil particles.
 - Held by gravitation forces.
 - When the pores are saturated, the soil is said to be waterlogged.
 - It moves and may cause leaching.
- **Hygroscopic Water**
 - Water found in thin films on the soil particles.
 - Held by strong adhesive forces between water and soil particles.
 - Does not move and hence not available for plant use.
- **Capillary Water**
 - Occupy micro-pores in the soil particles.

- Held by cohesive forces between water molecules.
- Moves through capillary action
- Available to plants for use.

Soil Structure

- This is the arrangement of soil particles in a soil horizon.
- **Types of Soil Structure –**
 - Single-grained
 - Crumbly
 - Granular
 - Prismatic
 - Columnar
 - Platy
 - Blocky



Importance of Soil Structure on Crop Production

Soil Structure Influences

- Soil aeration
- Soil drainage and water holding capacity.
- Plants root penetrability and anchorage.

- Microbial activities in the soil.
- Circulation of gases in the soil.

Farming practices which improve the soil structure are:

- Application of inorganic manure into the soil.
- Tilling the land at the right moisture content.
- Crop rotation.
- Minimum tillage.
- Cover cropping.
- Mulching.

Soil Texture

- It refers to the relative proportion of the various sizes of the mineral particles of soil.

Importance of Soil Texture on Crop Production;

- Influences soil fertility
- Affects the organic matter content
- Influences the drainage of the soil.
- Influences soil aeration.
- Influences water holding capacity.
- Influences the capillarity or movement of water in the soil.

Soil Textural Classes

Sandy Soils

- Made up largely of sand particles.
- Have large pore spaces hence poor in water retention.
- Easy to till (light soils).
- Freely draining.
- Low fertility due to leaching of minerals.
- Easily erodible.

Clayey Soils

- Made up largely of clayey particles.
- Have small pore spaces hence good in moisture retention.
- Difficult to till (heavy soils).
- Poorly 'drained'.
- Expand when wet, crack when dry.
- High capillary.
- Rich in plant nutrients.

Loam Soils

- About equal amounts of sand and clay.
- Moderately good in both moisture and air retention.
- Fertile soils.

Soil Colour

- This depends on the, mineral composition of the parent rock and the organic matter content.

- Soils containing a lot of iron are brownish, yellowing and reddish in colour.
- Soils with a lot of silica are white.
- Soils with a lot of humus are dark or grey.

Soil pH

- This refers to the acidity or alkalinity of the soil solution/the concentration of hydrogen ions in the soil solution.
- Soil pH is determined by the concentration of hydrogen ions (H⁺) or the hydroxyl ions (OH) in the soil solution.
- A pH of less than 7 means that the soil is acidic.
- A pH of more than 7 means that the soil is alkaline.
- As the hydroxyl ions (OH) in the soil increase the soil becomes more alkaline.

Influence of Soil pH Crop Growth

- It determines the type of crop to be grown in a particular area.
- Most crops are affected by either very acidic or very basic soil pH.
- Soil pH affects the choice of fertilizers and the availability of nutrients to crops.
- At low pH the concentration of available iron and aluminium in the soil solution may increase to toxic levels, which is harmful to plants.
- Very acidic or low pH inhibit the activity of soil micro-organisms.

Farm Tools and Equipment

Introduction

- Farm tools and equipment perform specific jobs in the farm.
- They make work easier and more efficient.
- They can be classified according to their uses as follows:

Garden Tools and Equipment

Tools	Uses
Panga	Cutting and shallow cultivation, making holes.
Jembe/hand hoe	Cultivation, digging, shallow planting holes and trenches.
Fork jembe	Cultivation, digging out roots, harvesting of root crops.
Rake	Collecting trash, breaking large clods, levelling, removing stones from a seedbed and spreading organic manure.
Spade	Scooping and carrying of soil, sand, concrete mixture and manure.
Spring balance	Measuring weight.
Trowel	Scooping seedlings during transplanting and digging planting

	holes for seedlings.
Pruning hook	Bending tall branches when pruning.
Secateur	Cutting young stems and pruning branches.
10. Tape measure	Measuring distances.
11. Axe	Cutting big trees and roots and splitting logs of wood.
12. Soil auger	Making holes for fencing posts.
13. mattock	Digging hard soils
14. sprinklers	Overhead irrigation.
15. Watering can	Watering plants in nursery bed.
16. Wheel barrow	Transportation of soil, fertilizers, farm produce, tools and equipment.
17. Levelling board	For levelling a nursery bed.
18. Pruning saw	Cutting old wood stems and pruning big branches.
19. Hose pipe	For conveying water from a tap to where it is need.
20. Knap sack sprayer	Applying agro-chemical by spraying.
21. Garden shear	Trimming hedges.
22. Pruning knife	Removal of small shoots.
23. Meter ruler	Measuring distances.
24. Garden fork	Shallow digging.

Tools	Uses
Drenching gun	Administering liquid drugs to animals orally.
Bolus gun/dosing gun	Administering solid drugs or tablets to animals orally.
Wool Shears	Cutting off wool from sheep.
Hypodermic syringe	Administering drugs by injection for example in vaccination.
Stirrup (bucket) pump	Application of acaricide by hand spraying.
Thermometer	Taking body temperatures of farm animals.
Burdizzo	Used in bloodless method of castration.
Halter	Rope designed to restrain the animal.
Trimming knife	Cutting short the overgrown hooves.
Elastrator	Stretching rubber ring during castration, dehorning and docking of lambs.
Iron dehorner	Applies heat on the horn bud to prevent growth of horns.
Nose ring	Fixed into the nose of a bull to restrain it.
Strip cup	Detecting mastitis in milk products.
Trocar and cannula	Relieving a bloated animal of gases particularly ruminants.
Hard broom	For scrubbing the floor.
Ear notcher	Making ear notches in livestock.
Bucket	For holding milk during milking.

Milk chum	For holding milk after milking.
Milk strainer/sieve	Removing foreign particles from milk for example hairs and sediments.
Rope	Tying or tethering animals.
Milking stool	Used by the milker to sit on while milking.
Weighing balance	Weighing milk after milking.
Teeth clipper	Removal of canine teeth of piglets soon after birth.
Chaff cutter	Cutting fodder into small bits.
Dehorning wire	Cutting grown horns.

Workshop Tools and Equipment

Tools	Uses
Spanner	Tightening and loosening nuts and bolts.
Pliers	Cutting small wires and thin metal and gripping firmly.
Files	Sharpening tools, smoothing or shaping edges of metal.
Rasps	Smoothing and shaping of wooden structures.
Chisels (wood)	Making grooves in wood.
Cold chisel	Cutting and shaping metal.
Screw drivers	Driving screws in or out of wood or metal.
Saws	
Cross cut saw	Cutting across the grain of wood.
Rip saw	Cutting along the grain of wood.
Hack saw	Cutting metals.
Bow saw	Cutting branches of trees.
Tenon/back saw	Cutting joints on wood and fine sawing.
Coping saw	Cutting curves on thin wood.
Compass/keyhole	Cutting either along or across the grain of wood when cutting key holes.
Tin snip	Cutting metal sheets.
Braces and bits	Boring holes in wood.
Drill and bits	Boring holes in metal work and woodwork.
Hammer	
Claw hammer	Driving in, removing and straightening nails.

Ball peen	Driving in nails, rivets and straightening metal. Also used on cold chisel
Mallet	Hammering or hitting wood chisel.
Jack plane	Fine finishing of wood.
Scrappers/spokesha	Smoothing curved surfaces of wood such as handles
Measuring equipment	jembes, axes.
Metre ruler	Measuring short length -
Try square	Measuring length angles and to ascertain squareness.
Marking gauge	Marking parallel lines to the edge of wood.
Fencing pliers	Cutting wires, hammering staples when fencing.
Vice and clamps	Firmly holding pieces of work together.

Tools	Uses
Spirit level	Measuring horizontal or vertical levels.
Soldering gun	Melting soldering rods when repairing or fabricating metal sheets.
Wire brush	Brushing rough surfaces.
Divider	Marking and laying out.
Centre punch	Marking the point of drilling.
Paint brush	Applying paint on surfaces.
Sledge hammer	Ramming hardware, breaking stones.
Wire strainer	Tightening wires during fencing.
Riveting machine	Fix rivets when joining pieces of metal.
Claw bar	Removing long nails from wood, straining fencing wires and digging fencing holes.

Plumbing and Masonry Tools

Tools	Uses
Pipe wrench	Holding, tightening and loosening metallic pipes.
Pipe cutter	Cutting PVC pipes.
Levelling rod	Levelling the floor during construction.
Mason's trowel	Placing mortar between construction stones and bricks.
Wood float	Create a level surface on walls and floors.
Mason's square	Ascertain verticalness.

Plumb bob	Spreading screed over floors and walls.
Shovel	Mixing and scooping concrete or mortar, measuring cement.

Care and Maintenance of Tools and Equipment

Reasons for Maintenance

- To increase durability.
- To increase efficiency.
- Reduce costs of replacement.
- For safety of the user/avoid accidents.
- Avoid damage to the tool.

Methods

- Use tools for the right work.
- Proper handling when using tools or equipment.
- Clean and oil tools after work.
- Keep tools in their right place.
- Replace and repair worn-out parts
- Sharpen cutting or digging edges
- Grease moving parts to reduce friction
- Use safety devices in the workshop to reduce accidents and breakages

CROP PRODUCTION 1

(Land Preparation)

Introduction

- A piece of land which is prepared is known as seedbed.
- A seedbed is a piece of land that is prepared ready to receive planting materials.

Seedbed Preparation

Reasons for Seedbed Preparation;

- To enable water to infiltrate.
- To kill weeds
- To improve soil aeration.
- To destroy pests and diseases.
- To incorporate organic matter in the soil.
- For easy planting.

- To facilitate root penetration.

Operations in Land Preparation

Land Clearing

- Clearing of land is necessary when:
- Opening up a virgin land.
- A stalk growing crop was previously planted.
- There is long interval between primary and secondary cultivation.
- Land was left fallow for a long time.

Procedure

- Tree felling and removal of stumps and roots.
- Burning
- Slashing
- Use of chemicals.

Note: Burning should be avoided where possible since it;

- Leads to loss of organic matter,
- Kills soil organisms
- Destroys soil structure and plant nutrients.

Primary Cultivation

- This is the initial breaking of land.
- It is done early before the onset of the rains to:
 - Give time for soil organisms to act on organic matter.
 - Allow gaseous exchange to take place, thus carbon dioxide diffuses out of the soil while oxygen enters into the soil.
 - Allow other operations to take place in time.

Reasons for primary cultivation:

- Remove weeds.
- Bury organic matter.
- Open up soil for infiltration of water and air.
- Expose pests and disease causing organisms.
- Soften the soil for easy planting.

Operations in primary cultivation

- ***Hand digging;***
Use of hand tools ;
 - Jembes,
 - Mattocks,
 - Fork-jembes.
- ***Mechanical cultivation ;***

Use of mouldboard ploughs;

- Disc ploughs,
- Chisel ploughs,
- Subsoilers
- Rippers.
- ***Use of Ox-Ploughs ;***
Which can be drawn by;
 - Oxen,
 - Donkeys,
 - Camels

Depth of Cultivation

Depends on:

- The type of crop to be planted/size of seed.
- The implements available.
- The type of soil.

Choice of Implement

Determined by:

- The condition of land.
- The type of tilth required/type of crop.
- Depth of cultivation.

Secondary Tillage

- These are refinement practices on the seedbed that follow primary cultivation.
- It is also known as harrowing.

Reasons for secondary Tillage:

- To remove the germinating weeds.
- To break soil clods to produce required tilth.
- To level the seedbed for uniform planting.
- To incorporate organic matter/manure into the soil.

Factors determining number of secondary cultivation:

- Soil moisture content.
- Size of the planting materials.
- Condition of the soil after primary cultivation.
- Slope of the land.

Tertiary Operations:

- ***Ridging ;***

- The process of digging soil on a continuous line and heaping on one side to produce a furrow and a bund (ridge).
- It is important for root crops, to allow root expansion and for soil and water conservation.
- **Rolling:**
 - It is the compaction of the soil to produce a firm surface which increases seed-soil contact and prevents wind erosion.
- **Levelling;**
 - Production of an even, uniform surface which promotes uniform planting.

Subsoiling:

- This is deep cultivation into the subsoil layer to break up any hardpan which might have developed.

It is done for the following reasons:-

- To facilitate drainage.
- Bring up leached nutrients to the surface.
- Increase aeration of the soil.
- To improve root penetration.
- The implements used include *chisel plough* and *subsoilers*.

Minimum Tillage:

- This is the application of a combination of farming practices with the aim of reducing the disturbance of the soil.

Examples of which include:

- Use of herbicides.
- Mulching and cover-cropping.
- Timely operations to prevent weed infestation.
- Strip cultivation.
- Uprooting and slashing of weeds.

Reasons for Minimum Tillage

- To reduce cost of cultivation.
- To control soil erosion.
- To preserve soil moisture.
- To prevent root exposure and damage.
- To reconstruct destroyed soil structure.

Water Supply, Irrigation and Drainage

Introduction

- Water is a very important natural resource.
- It is necessary for both crops and livestock.

Uses of water in the farm;

- Cleaning equipment.
- Irrigation in dry areas.
- Processing farm produce, for example, coffee.
- Drinking by livestock and man.
- Mixing agro-chemicals such as acaricide, fungicides and herbicides.
- Providing power in water mills to grind grain crops.
- Cooling engines.
- Construction work.

Sources of Water in the Farm

Three major sources of water in the farm:

- ***Surface water:***

Includes water from;

- Rivers,
- Streams
- Dams.

- ***Ground water:***

Includes water from;

- Springs,
- Wells
- Boreholes.

- ***Rain water:***

This is water tapped in various ways such as;

- Rooftops
- Rock surface, when it is raining and stored in various ways.

Collection and Storage of Water

- ***Dams:***

- These are structures constructed across rivers and channels.
- They collect and store water for use during the dry season.

- ***Weirs:***

- These are structures constructed across rivers to raise the water level for easy pumping.
- Unlike in the dams water flows over the barrier created across the river.

- ***Water Tanks:***

- These are structures made of concrete, stone, metal sheets and plastics.
- They store water from rain or that which has been pumped from other sources.
- Tanks should be covered to prevent contamination from dust.

Pumps and Pumping of Water

- Pumping is the lifting of water from one point to another by use of mechanical force.

- Water is pumped from the various sources and then conveyed to where it is required for use or storage.

Types of Water Pumps

Used to lift water from its source.

- Centrifugal pumps
- Piston or reciprocating pumps
- Semi-rotary pumps and
- Hydram

Conveyance of Water

- This is the process of moving water from one point, usually the source or point of storage to where it will be used or stored.
- ***Piping;***
 - This is where water is moved through pipes.
 - The common types of pipes include:
 - Metal pipes
 - Plastic pipes
 - Hose pipes
- ***Use of Containers:***
 - In this case water is drawn and put in containers .
 - drums, jerry cans, pots, gourds, tanks and buckets .
 - Which are carried by animals, bicycles, human beings and vehicles.
- ***Use of Canals:***
 - In this case water is conveyed from a high point to a lower one along a gradual slope to avoid soil erosion.
 - Water conveyed through this way is mostly used for irrigation and livestock.

Water Treatment

- Raw water contains impurities which may be dissolved, floating or suspended in water.

These impurities are grouped into three categories, namely:

- ***Physical impurities:*** these are dissolved impurities detected by colour, taste and smell.
- ***Chemical impurities:*** these are dissolved impurities detected by use of chemical analysis.
- ***Biological impurities:*** these are microorganisms in water such as bacteria, viruses and algae.

Importance of Treating Water

- To kill disease causing microorganisms such as cholera and typhoid bacteria that thrive in dirty water.
- To remove chemical impurities such as excess fluoride which may be harmful to human beings.
- To remove smells and bad taste.
- To remove sediments of solid particles such as soil, sand and sticks.

Methods of Treating Water

- ***Aeration:*** this is the removal of smell and odour from water by fine spraying or bubbling of

air.

- **Sedimentation:** this is where water is put in large containers so that solid particles such as sand, metal and others can settle at the bottom.
- **Filtration:** this is passing water through fine granular materials to remove solid particles and biological substances.
- **Coagulation:** addition of chemicals which precipitate impurities and help in softening of hard water.
- **Chlorination:** Sterilization to destroy disease causing organisms.

Irrigation

- It is the artificial application of water to crops in dry areas or where water is not enough.
- It is one of the methods of land reclamation in case of arid and semi arid areas.

Factors to Consider in Identifying and Assessing the Potential of Land for Irrigation Development

- Topography of the land
- Soil type
- Type of crop to be grown
- Water availability
- Human factors such as skill, capital availability and economic activities.

Types of Irrigation

- **Surface irrigation:**
 - This includes flood irrigation and basin irrigation.
 - It is used in flat areas.
 - The problem with this method is loss of water through seepage.
 - It also increases soil salinity.
- **Sub-surface Irrigation:**
 - This involves the use of porous pipes or perforated pipes.
 - It is used in slopy areas and where water is inadequate.
- **Overhead or Sprinkler Irrigation:**
 - It is used in any area which is not steep.
- **Drip or Trickle Irrigation:**
 - It is used where water is little and in relatively sloppy and flat areas.

Drainage

- This is a method of removing excess water or lowering the water table from a marshy water-logged land.
- It is also a method of land reclamation.

Importance of Drainage as a Method of Land Reclamation

- To increase soil aeration.
- To raise soil temperature.
- To increase microbial activities in the soil.
- To reduce toxic substances from the soil.
- To increase soil volume for exploitation by plant roots.

Methods of Drainage

- Use of open ditches.
- Use of underground drain pipes.
- French drains.
- Cambered beds.
- Pumping out water from the soil.
- Planting tree species which absorb a lot of water for example eucalyptus.

Water Pollution

- This is the process by which harmful substances get into the water.
- The harmful substance is referred to as a **pollutant**.

Agricultural practices which pollute water include:

- Use of inorganic fertilizers.
- Use of pesticides.
- Poor cultivation practices such as over cultivation, cultivating along the river banks.
- Overgrazing which leads to erosion of soil thus causing siltation in water sources.

Methods of Preventing Water Pollution

- Soil conservation measures which minimize soil losses through erosion.
- Fencing off the water sources.
- Adopting organic farming practices for example controlling pests and weed using non-chemical techniques.
- Planting grass along river banks to minimize siltation in rivers.
- Proper disposal of empty chemical containers.

Soil Fertility I (Organic Manures)

Introduction

- Soil fertility is the ability of the soil to provide crops with the required nutrients in their proper proportions.

Characteristics of a Fertile Soil

- **Good depth** - Good soils give roots greater volume to obtain plant nutrients and provide

strong anchorage.

- **Good aeration** - for the respiration of plant roots and use by soil organisms.
- **Good water holding capacity** - ensures provision of adequate water for plant growth.
- **Proper drainage** - ensures provision of adequate air for plant growth.
- **Correct soil pH** - different crops have different soil pH requirements.
- **Adequate nutrients supply** - it should supply the required nutrients in the correct amounts and in a form available to plants.
- **Free from excessive** infestation of soil borne pests and diseases.

How soil loses fertility

- **Leaching**: vertical movement of dissolved minerals from the top to the lower horizons of the soil profile.
- **Soil erosion** - The removal and carrying away of the top fertile soil from one place to another.
- **Monocropping** - This is the practice of growing one type of crop on a piece' of a land over a long time.
- **Continuous cropping** - crops take away a lot of nutrients from the soil which are never returned.
- **Growing crops continuously** without giving the soil time to rest makes the soil infertile.
- **Change in soil pH** - changes in soil pH affect the activity of soil microorganisms as well as the availability of soil nutrients.
- **Burning of vegetation** - burning of vegetation cover destroys organic matter. It also exposes the soil to the agents of soil erosion.
- **Accumulation of salts** - soils with a lot of salts are said to be saline. State of having too much salt in the soil is referred to as soil salinity.
- Salts accumulation cause water deficiency in plants. It may also lead to change in soil pH.

Maintenance of Soil Fertility

Soil fertility is maintained through the following methods:

- **Control of Soil Erosion ;**
 - Terracing,
 - Contour cultivation,
 - Strip cropping,
 - Cut off drains
 - Planting cover crops.
- **Crop Rotation ;**
 - Practice of growing different crops on the same field in different seasons in an orderly sequence.
- **Control of Soil pH:**

- Application of liming materials such as ***limestone, quicklime, magnesium carbonate and slaked lime if the soil is acidic.***
- Application of acidic fertilizers if the soil is alkaline.
- Application of manures.
- ***Proper drainage;***
 - Done through:***
 - Breaking hard pan.
 - Construction of water channels.
 - Growing crops on cambered bed
 - Pumping out water from the soil.
- ***Weed control:***
 - Use of herbicides.
 - Slashing
 - Uprooting.
 - Mulching
 - Use of proper farming practices such as early planting, correct spacing and cover crops.
- ***Intercropping –***
 - Farming practice where different crops species are grown together in the field.
- ***Minimum Tillage;***
 - Use of herbicides.
 - Uprooting of weeds.
 - Slashing weeds
 - Mulching
 - Strip cultivation.
- ***Use of Inorganic Fertilizer;***
 - Chemical compounds manufactured to apply specific plant nutrients for example calcium ammonium nitrate (CAN).
- ***Use of Manure;***
 - Well decomposed manures release nutrients into the soil and increase its water holding capacity.

Organic Manures

- Manures are derived from plants and animal remains.
- They supply organic matter to the soil which after decomposition releases plant nutrients.
- The end product of this decomposition is known as humus.
- It influences soil chemical properties and soil temperature.
- Manures supply a wide range of essential plant nutrients.

Importance of Organic Matter in the Soil

- Increases the soil water holding capacity of the soil.
- Improves soil fertility by releasing a wide range of nutrients into the soil.
- Provides food and shelter for soil micro-organisms.

- Improves the soil structure.
- Buffers soil pH/moderates soil pH.
- Reduces the toxicity of plant poisons in the soil.
- Moderates soil temperature by its dark colour.

Limitations in the Use of Manure

- They are bulky - low nutritive value per unit volume.
- Laborious in application and transport.
- They spread diseases, pests and weeds.
- Loss of nutrients if poorly stored.
- If not fully decomposed crops may not benefit from them.

Types of Organic Manures

- Green manure.
- Farm yard manure.
- Compost manure

Green Manure

- Made from green plants which are grown for the purpose of incorporating into the soil.

Characteristics of plants used for preparation for green manure:

- Have fast growth rates.
- Have high nitrogen content.
- Capable of rotting quickly.
- Capable of growing in poor conditions.

Preparation of Green Manure

- Plant the green manure crop in the field.
- Allow the crop to grow up to flowering stage.
- Incorporate it into the soil through ploughing.
- Allow the crop to decompose for two weeks.
- Prepare the field for planting the major crop.

Reasons why green manure is not commonly used/limitations:

- Most of the plants used as green manure are food crops.
- Green manure crops may use most of the soil moisture.
- Most of the nutrients are used up by soil micro-organisms in the process of decomposing the green manure.
- Planting of the major crop is delayed.

Farm Yard Manure (FYM)

- Is a mixture of animal waste and crop residues used as beddings in animal houses.

Factors that Determine the Quality of FYM

- The types of the animals used.
- Types of food eaten
- Types of litter used.
- Method of storage.

- Age of farmyard manure.
- Age of the animals used.

Preparation of FYM

- Provide beddings in the houses of farm animals.
- Animals deposit their droppings and urine on the beddings.
- Animals mix them through trampling.
- The beddings together with dung are removed and heaped under shed to decompose.
- After sometime, the materials decompose and FYM is formed.
- It can then be used in the farm

Compost Manure

- Is manure prepared from heaped (composted) organic materials.

Factors to consider in selecting site for making compost manure:

- A well drained place.
- Direction of the prevailing wind.
- Size of the farm.
- Accessibility.

Preparation of Compost Manure

Two methods:

- *Four heaps method*
- *Indore Method (Pit Method)*

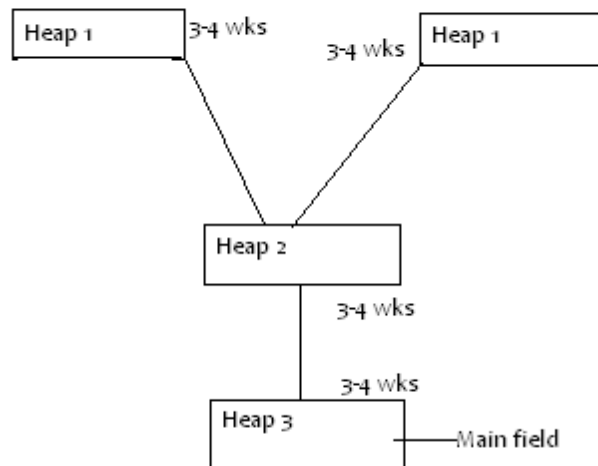
Indore Method (Pit Method)

Procedure ;

- Select a sheltered place with a shade and near the field.
- Dig a pit with the dimension 1.2m x 1.2m x 1.2m.
- Place the materials in the following order:
- Hedge cuttings or maize stalks to a depth of 30cm as a foundation
- A layer of grass, green weeds or leaves and kitchen wastes to 30cm.
- A well rotten manure/poultry droppings.
- Wood ash and phosphatic fertilizers.
- A layer of topsoil to introduce micro-organism for the decomposition of organic remains.
- **Note:** Some water should be sprinkled to the materials to initiate the decomposition process and regulate temperatures.

Four heaps method:

Compost Heaps



Procedure

- Clear the site.
- Level the site
- Four posts 2m high are fixed 1.2m apart from four corners of the heap.
- Fix wood planks on the sides.
- Materials are placed in two heaps as in the pit method,
- The two heaps make up heap 1.
- After 3-4 weeks, the decomposed material from heap 1 is transferred to heap II.
- After another 3 - 4 weeks the material is transferred to heap III.
- After 3-4 weeks it is ready for use in the farm.

Indicators of well decomposed manure

- Absence of bad odour.
- Materials are lighter.
- Manure is brown in colour.

Advantages of Compost Manure

- One does not have to own livestock in order to prepare it.
- A lot of manure can be produced within a short time.
- A variety of materials can be used in its preparation.
- Uses locally available materials thus cheaper than the artificial fertilizers.
- Improves the soil structure.

Limitations of Compost Manure

- It releases nutrients slowly into the soil.
- Large quantities of compost manure are required to supply enough plant nutrients.
- Its preparation is labour intensive.
- It may induce soil-borne pests and diseases.

Livestock Production:

(Common Breeds)

Introduction

- The term livestock is used to refer to all domesticated animals.
- These animals include cattle, sheep, goats, poultry, pigs, rabbits, camels, bees, fish and donkeys.

The importance of keeping livestock:

- Source of food.
- Source of income.
- Cultural values.
- Source of animal power.
- Provision of raw materials for industries.
- Farmyard manure from the animals is used in maintaining soil fertility.
- Cattle dung is used in the production of biogas.

Cattle Breeds

- Cattle can be classified into two groups based on their origin.

These are;

- Indigenous cattle.
- Exotic cattle.

Indigenous Cattle

- ***Zebus*** –

They are small in size and with a distinct hump and include:

- Nandi,
- Bukedi
- Maasai cattle.

- ***The Borana***

- These are the cattle kept in the Northern parts of Kenya.
- They are larger than the Zebus.

- Indigenous cattle are hardy hence able to tolerate the harsh environmental conditions in the tropics.
- They are the major suppliers of beef in Kenya.

Exotic Cattle

- Foreign cattle from the temperate regions.
- They have distinct breed characteristics and are classified into various breeds.

General characteristics:

- They have no humps.
- They have low tolerance to high temperatures hence popular in cool climates of the Kenya highlands ..
- They are highly susceptible to tropical diseases.
- They have fast growth rates leading to early maturity.
- They are good producers of both meat and milk.
- They cannot walk for long distances.
- They have short calving intervals of one calf per year if well managed.

Exotic cattle breeds fall under the following groups:

- Dairy cattle breeds.
- Beef cattle breeds.
- Dual purpose breeds.

Dairy Cattle Breeds

- They include;
- Friesian,
- Ayrshire,
- Guernsey
- Jersey.

Characteristics of Dairy Cattle

- Wedge or triangular in shape.
- Large stomach.
- Docile with mild temperament.
- Large, well suspended udders and teats.
- Lean bodies.
- Lean and smooth neck.
- Large and long mammary milk wells and veins.
- Cylindrical; uniform and well spaced teats.
- Wide and well set hindquarters to accommodate the udder.

Friesian-Holstein (largest of all dairy breeds)

- ***Origin:*** Holland
- ***Colour:*** Black and white
- ***Size:*** Cow weighs 550-680kgs Bull weighs 950 kg.
- Highest milk producers of all dairy breeds about 9150 kg per lactation but with least butterfat content; 3.5%

Ayrshire

- ***Origin:*** Scotland
- ***Colour:*** White with brown markings.
- ***Size:*** Cow weighs 360-590kgs Bulls weighs 500-720kg.

Conformation:

- Straight top lines, horns are long and face upwards.
- Milk production is second to Friesian about 6100kg per lactation with butter content of about 4%.

Guernsey

- **Origin:** Guernsey Island off the coast of France.
- **Colour:** Yellowish brown to red with white legs, switch and girth ..
- **Size:** Bulls 540-770kg. Cow weighs 450- 500kgs

Conformation:

- Udders are less symmetrical.
- Average milk production is about 5185kg per lactation with a butterfat content of 4.5% hence the yellow colour of milk.

Jersey (smallest of all the dairy breeds)

- **Origin:** England
- **Colour:** Yellow brown with black muzzle and switch.
- **Size:** Bulls weigh 540-700kg. Cow weighs 350-450kgs

Conformation:

- Dished forehead, have straight top-line and level rumps with sharp withers.
- Have protruding black eyes.
- Average milk production 1270kg per lactation of butterfat content 5%.
- They tolerate high temperatures.

Beef Cattle

Examples:

- Aberdeen Angus,
- Hereford,
- Shorthorns,
- Galloway,
- American Brahman,
- charolais
- Santa Getrudis.

Characteristics of Beef Cattle

- Blocky or square conformation.
- Have thick muscles or are well fleshed.
- Early maturing.
- Deep chest and girth and short legs.
- Straight top and lower lines.

AberdeenAngus

- **Origin:** North East Scotland.

- **Colour:** Black
- **Shape:** Cylindrical, compact and deep; It is polled.

Size:

- Mature bulls weigh 900kg.
- Mature cows weigh 840kgs.
- It is found in Timau area of Kenya

Hereford

- **Origin:** England.
- **Colour:** Deep red and white-faced.
- **Size:** Average weight of bulls is 1000kg.
- Cows weigh 840kgs.
- It is found in areas such as Naivasha.

Shorthorn

- **Origin:** England.
- Has easy fleshing ability
- **Colour:** Red, Roan or white
- **Shape:** Cylindrical, compact and deep.
- It is polled.

Size:

- Bulls weigh 700-900kg,
- cows weigh 545-630kgs.

Galloway

- **Origin:** Scotland.
- **Colour:** Black
- Kept in the highland areas like Molo in Kenya.

Charolais

- **Origin:** France.
- **Colour:** Creamy white.
- **Size:** Bulls weigh 1200kg, cows weigh 1000kgs.
- It is found in ranches in Laikipia District.

Dual Purpose Breeds

Examples: Sahiwal, Red Poll and Simmental.

Sahiwal

- **Origin:** India and Pakistan ..
- **Colour:** reddish brown.
- **Size:** Bulls weigh 650kg, and cows 400kg.
- Milk production averages 2700-3000 per lactation with a butter fat content of 3.7%.
- It has a pendulous udders which does not let down milk easily.

- It is therefore said to be a difficult milker.
- It is kept in semi-arid areas such as Naivasha.

Red Poll

- **Origin:** England.
- **Colour:** Deep red with a white nose.
- **Conformation:** Polled-deep girth and short legs.
- **Kept in semi-arid** areas such as Nakuru, Mogotio.

Simmental

- **Origin:** Switzerland.
- **Colour:** Light red and white patches on the head.
- **Conformation:**
 - It has broad and straight back, with well-sprung ribs and deep girth.
 - It is well fleshed at rear quarters, well suspended udders and large teats.

Sheep Breeds:

Purpose of Keeping Sheep;

- Meat (mutton).
- Wool production.

Exotic Sheep

- **Wool breeds** -for example merino.
- **Dual purpose**- for example Corriedale, Romney marsh.
- **Mutton breeds** -for example Hampshire Down, Dorpers.

Merino

- **Origin:** Spain

Characteristics:

- It has white face and its lips and nostrils are pink in colour.
- Rams have horns which are spiral in shape.
- It is susceptible to foot rot, worm and respiratory diseases.

Corriedale

- **Origin:** New Zealand.
- **Size:** Rams 85 - 90kg. Ewes 60-- 85 kg
- This is a dual-purpose breed with white open face and white spots on the legs.
- It is hornless and hardy.

Romney Marsh

- **Origin:** England.
- **Size:** Rams 100 - 115kg.
- Ewes 84- 100 kg

- It is a dual-purpose breed which is hornless with wide poll and black nostrils and lips.
- It is average in prolificacy.
- It is resistant to foot rot diseases and worm infestation.

Hampshire Down

- **Origin:** England.
- **Size:** Rams 125kg.
- Ewes 80-100 kg
- It is a mutton breed which is early maturing, hardy and prolific.
- Fleece is of poor quality because of the black fibres.
- Lambing percentage is 125-140.

Dorper

- Is a crossbreed of Dorset horn and black head Persian sheep.
- It is mutton breed.

Dorset Horn

- Dual purpose breed of sheep.
- Indigenous Breeds of Sheep
- Their bodies are covered with hair.
- Their classification is based on their tails and their names vary according to different tribes.

Characteristics;

- Thin tailed sheep found in West Africa.
- Fat tailed such as Maasai sheep.
- Fat rumped sheep.

Maasai Sheep

- Found in South Western Kenya and Northern Tanzania.
- Size: Ram 38kg,
- Ewe 20-30kg.
- Colour: Red and brown.
- These are early maturing with long legs and small pointed horns.

Black Head Persian Sheep

- **Origin:** South Africa
- **Colour:** White with black head and neck.
- It is polled with a big dewlap, fat rump and a curved tail..

Goats

Goats well adapted to a wide range of environmental conditions because of the following characteristics:

- They feed on a wide range of vegetation.
- They require very little amount of water.
- They are tolerant to high temperatures.

- They are fairly resistant to diseases.
- They can walk long distances without losing weight.

Indigenous Goat Breeds

- Galla (white in colour). Adult female can weigh 25kg.
- Somali (Boran): Found in Northern Kenya (white in colour).
- Turkana/Samburu: (Long hair and bearded).
- Mubende: (Black) (40-45kg). These are small and hardy and are kept for meat and milked by the pastoralists.

Exotic Breeds

Boer goat

- ***Origin:*** South Africa
- ***Colour:*** White
- Has long ears and long hair on their bodies.

Anglo-Nubian

- ***Origin:*** North East Africa
- ***Colour:*** Roan and White
- These have long legs, lopped ears and are polled.
- They produce 1-2 litres of milk per day.

Jumnapari

- ***Origin:*** India
- ***Colour:*** White, black and fawn.
- They are horned, have large lopped ears
- Produce 1-1.5 litres of milk per day.

Toggenburg

- ***Origin:*** Switzerland
- ***Colour:*** White patches on the body, white stripes on the face and neck.
- Erect forward pointing ears and polled.
- Can produce 2-3 of milk per day.

Saanen

- ***Origin:*** Switzerland.
- ***Colour:*** White
- They have erect, forward pointing ears and polled.
- Can produce 2-3 litres of milk per day.

Angora

- **Origin:** Angora in Asia.
- **Colour:** White
- It is kept for wool production.

French alpine. Pigs

Characteristics:

- They are sparsely haired and therefore cannot withstand cold.
- Pigs wallow when it is hot due to absence of sweat glands.
- They breathe fast when it is hot.
- They have bristles instead of hair.

Breeds

Large White

- **Origin:** Britain
- _ Kept for bacon and pork production.
- Long, large and white in colour.
- Ears straight and erect.
- Has dished face and snout.
- Most prolific and with good mothering ability.
- Fairly hardy.

Landrace

- **Origin:** Denmark
- White and longer than large white. _
- Ears drooping.
- Good for bacon production.
- Very prolific with good mothering ability. _
- Requires high level of management.

Wessex Saddle

- **Back Origin:** England
- **Colour:** Black with white forelegs and shoulders.
- Straight snout and drooping ears. _
- Good for bacon and pork.
- Good for keeping outdoors.
- Excellent mothering instincts.

Other pig breeds include:

- Berkshire,
- Middle-white
- Duroc Jersey pig.

Pigs can be crossed to obtain hybrids or crosses.

Advantages of Crosses

- Increased litter size. _
- Early maturing.
- _ Increase in body length.
- _ High proportion of lean meat to fat.

Poultry Breeds

There are three types of chicken breeds:

- The light breeds kept for egg production.
- The heavy breeds kept for meat production.
- Dual purpose breeds - kept for both eggs and meat production.

Characteristics of Light Breeds

- Never go broody hence poor sitters.
- Excellent layers (over 220 eggs per year).
- Poor meat producers (hens can attain 2kg; cocks 3kgs)
- Very nervous and exhibit high degree of cannibalism.
- Hen's comb is large and bent over one eye and cock's comb is large with 5 - 6 serrations.

Examples:

- Leghorns,
- Anconas,
- Silkies,
- Minorcas.

Characteristics of Heavy Breeds

- Can lay few eggs and provide good meat as broilers.
- Can go broody.
- Heavier and bigger in size.
- Grow fast.

Examples:

- Light Sussex,
- Cornish Dark
- White.

Characteristics of Dual-Purpose Breeds

- Go broody.
- Have good meat.

- Disease resistant (do not require high standard of management).
- Rarely exhibit cannibalism.

Examples: Rhode Island Red.

Hybrids

- These are developed by crossing two different breeds.
- They are superior in performance.
- Can attain 2kg in 56 days for broilers and layover 200 eggs per year for layers.

Examples:

- Shavers,
- Thombers
- Isabrown.

Rabbits

Kept for the following reasons:

- To provide meat, fur, hair or wool.
- To provide skin for leather.
- To provide manure.
- As pet animals.
- Used for research purposes.

Breeds

- **Californian white**: white, very prolific black ears, nose and feet).
- **New Zealand white**: (white with pink eyes - good for meat).
- **Flemish giant** (dark grey - good for meat).
- **Angora rabbit** (white, kept for wool production).
- **Chinchillah** (greyish, kept for its fur).
- **Earlops** (white with droopy ears).
- **Kenya white** (white, smallest of breeds).

Camels

Kept for;

- Transport,
- Racing,
- To provide milk, meat and wool.

There are two species of camels.

Dromedary (*Camelus dromedarius*)

- **Origin**: Arabia and Syria
- Are single humped, have light body
- Good for racing and rapid transport.

Bacterian (*Camelus bacterianus*)

- **Origin:** Central Asia
- Has double humps, heavier and has shorter legs.
- Can live in cold regions hence its thick and long coat acts as insulation.
- Capable of shedding the coat during spring.

Terms used to describe livestock in different age, sex and use.

<i>Livestock</i>		<i>Adult</i>	<i>Replacement Stock</i>		<i>Young</i>	<i>Users)</i>
<i>Species</i>	<i>Male</i>	<i>Female</i>	<i>Male</i>	<i>Female</i>	<i>One</i>	
Cattle	Bull	Cow	Bullock	Heifer	Calf	Dairy - milk Beef-meat
Sheep	Ram	Ewe	Ram	Hogget	Lamb	Mutton - meat Wool sheep -wool
Goat	Buck or	Doe or	Buck Billy	Doe Nanny	Kid	Dairy - milk Mutton - meat
Pigs	Boar	Sow	Boar	Gilt	Piglet	Pork - meat Bacon -cured
Poultry	Cock	Hen	Cockerel	Pullet	Chick	Broilers - meat Layers - eggs
Rabbits	Buck	Doe	Buck	Doe	Kindling	Meat
Camel	Bull	Cow	Bull	Heifer	Calf	Pack, trained for riding, racing milk, meat, fur

Agricultural Economics I (Basic Concepts and Farm Records)

Introduction

- Economics is the study of how man and society chooses to allocate scarce productive resources to produce various commodities, over time, and distribute them among various consumers in society.
- It attempts to explain how man can best use the limited resources to produce goods and services which satisfies his needs with minimum wastage or loss of these resources

Example;

- food,
- clothing
- shelter
- Agricultural economics is therefore defined as a science that aims at maximizing output while minimizing costs by combining the limited supplies of goods and services for use by the society over a certain period of time.
- These are;

- land,
- capital,
- labour
- management

Basic economic Principles

Scarcity

- Economic scarcity means resources are limited in supply relative to demand.
- This principle implies that there is no time that man can have enough resources to satisfy all his need or desires

Choice/Preference

- Human wants are many and varied and means of satisfying them are limited.
- Therefore, man has to make a choice among the alternatives in order to use the resources available.
- Man does this by satisfying the most pressing needs first.
- This is called **scale of preference**.

Opportunity Cost

- Opportunity cost is the revenue forgone from the best alternative.
- It exists only where there are alternatives.
- Where there are no alternatives the opportunity cost is equal to zero.
- Opportunity cost helps in decision making.

Farm Records

- Farm records are documents kept in the farm
- They show farm activities carried out over a long period of time
- Or information kept in the farm in written form, about the farm and all activities in it.

Uses of Farm Records

- Show the history of the farm
- Show whether the farm is making a profit or loss.
- Show all the assets and liabilities of the farm which can be used to value the farm.
- Help in supporting insurance claims on death, theft, fire or loss of farm assets.
- Help in tax assessment to avoid over taxation.
- Used as a guide in planning and budgeting.
- Helps to detect losses or theft in the farm.
- Make it easy to share profits or losses in partnerships.
- Help in settling disputes among heirs to estate if the farmer dies without a will.
- Provide labour information on terminal benefits for a worker.

Type of Farm Records

- **Production Records** - Show the total yield and yield per unit of each enterprise.
- **Inventory Records** - A record of all permanent and consumable goods in the farm.

Consumable Goods Inventory

Date	Commodity Item	Quantity	Date	Issued to	Quantity	Balance Stock
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- **Field Operation Records** - Show in details all field practices carried out together with the input used for all the crop enterprises.
- **Breeding Records** –
 - Show all the breeding activities in the farm.
 - From these records it is possible to select the prolific animals and cull the infertile ones.
- **Feeding Records** – A record of the types of feeds used in the farm and their quantities.
- **Health Records** –
 - Indicates the health conditions of the animals in the farm.

From these records it is possible to:

Select and cull animals on health grounds.

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- [lasso](#)
- [land reform](#)
- [liming](#)
- [lister](#)
- [loam](#)
- [loess](#)

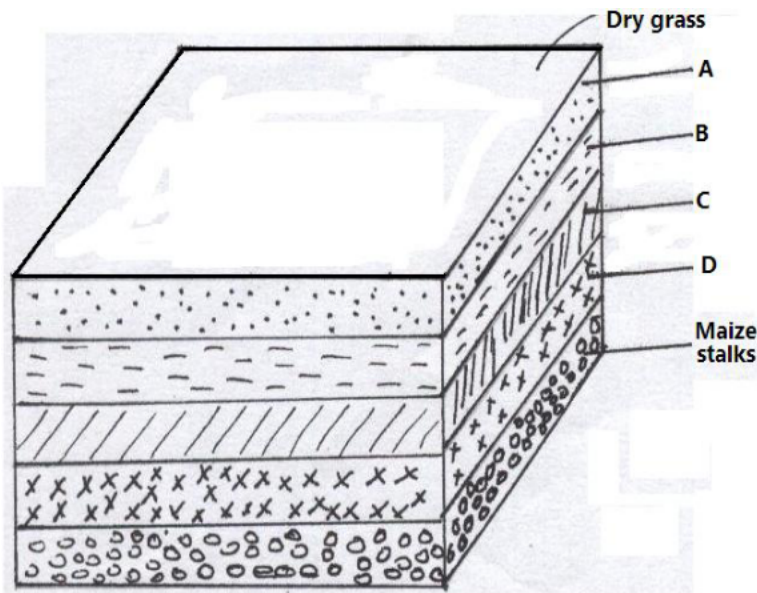
- [manure](#)
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- [middlebuster](#)
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- [mower](#)
- [mulch](#)
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- [picker](#)
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- [plow](#)
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- [rake](#)
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- [reaper](#)
- [reclamation of land](#)
- [root crop](#)
- [rotation of crops](#)

- [Rothamsted](#)
- [sericulture](#)
- [share](#)
- [sharecropping](#)
- [separator, cream](#)
- [silage](#)
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- [silviculture](#)
- [soil](#)
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- [soilless gardening](#)
- [straw](#)
- [strip cropping](#)
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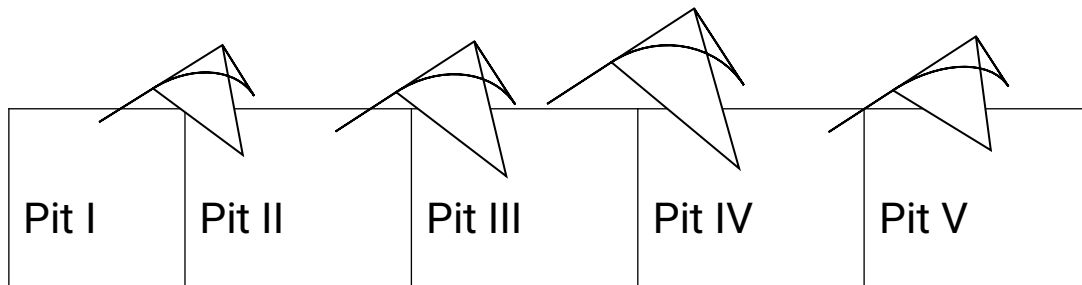
Plants & Animals

- [Agriculture and Horticulture](#)
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Five pits are dug in series and materials filled as follows:
Pits I, II, III and IV are filled with the materials as described above.
After 3-4 weeks, the materials in pit IV are transferred to pit V, materials in pit III to IV, in pit II to pit III and in pit I to pit II.
Process is repeated until the materials are well rotten then taken to the field as compost manure.



Four Heap System (Stack Method)

In this method four heaps are used.

The materials used are similar to those used in the pit method.

Construction

Vegetation is cleared from the ground.

Posts 2m high are fixed at a spacing of 1.2 by 1.2m forming the corners of the heap.

Wood planks are fixed on the sides to form the walls and materials are

arranged as in the Indore method.

Materials are placed in the heaps labeled X and after 3-4 weeks they are transferred to pit Y.

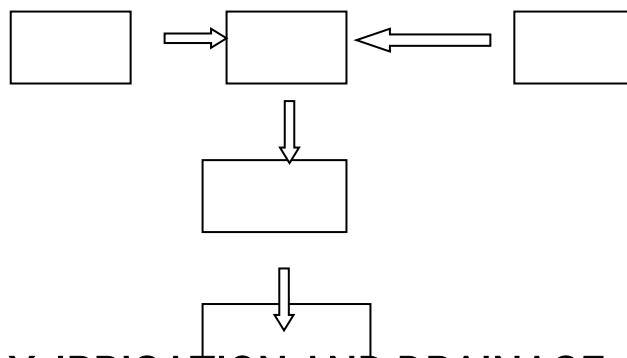
After another 3-4 weeks, the compost materials are transferred to pit Z where they stay for some 3-4 weeks before they become ready to be taken to the field.

The manure should be turned occasionally to facilitate air circulation.

A stick is driven into the stack an angle to check the temperature.

If the temperature inside is high, it is corrected by adding water.

Diagrams



WATER SUPPLY, IRRIGATION AND DRAINAGE

WATER SUPPLY

The Hydrological Cycle

Water from the surface evaporates up the atmosphere, cools and condenses to form clouds.

Saturated clouds fall down to the earth as precipitation in form of rain.

This water returns back to the atmospheres through the process of evapo-transpiration.

The circulation of water from the earth's surface to the atmosphere and back again is called the

Hydrological Cycle

Sources of Water

They include; surface water sources, underground water sources and rain.

Surface water sources

They include;

Rivers, streams and dams.

Lakes

Underground water sources

They include:

Springs.

Wells.

Boreholes.

Assignment.

Make short notes on the various sources of surface and underground water.

Rain water.

This is collected from rooftops and stored in tanks. Ponds can also be dug to collect the runoff. Rain water is very pure compared to the other sources.

Water Collection and Storage

Dams.

A dam is a barrier constructed to store water. Dams can be made of earth or concrete.

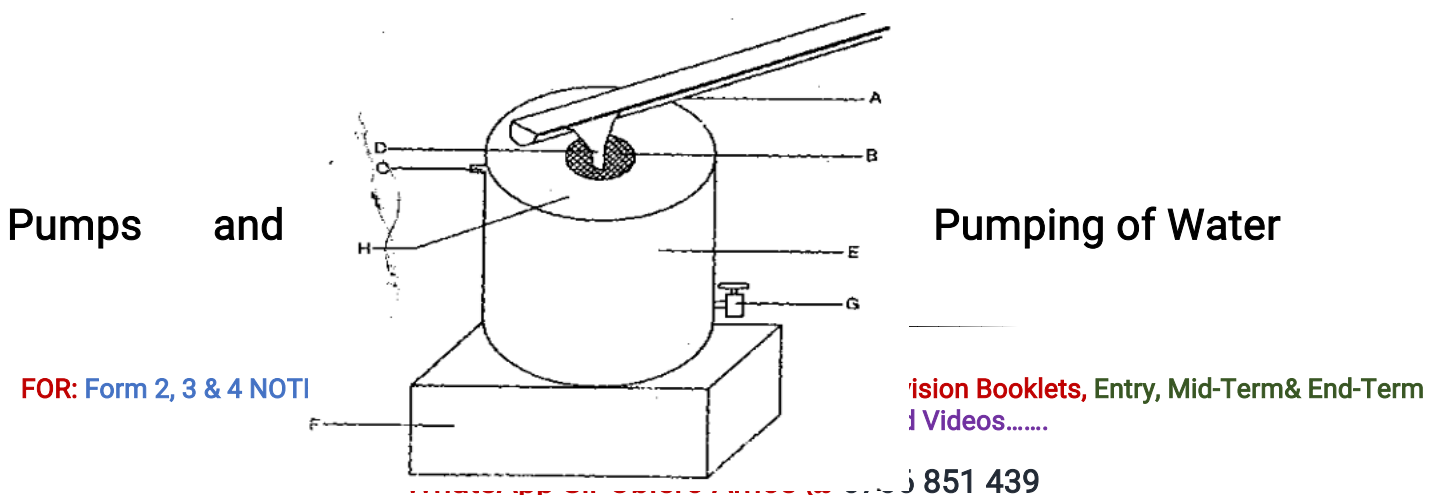
Grass should be planted on the embankment to prevent soil erosion.

Weirs.

Weirs are used to raise the water level in a river to facilitate pumping.

Water tanks.

These are made of concrete, stone, metal sheets, plastic or rubber. They should be covered to prevent water contamination.



Pumping is the lifting of water from one point to another by use of mechanical force.

Types of water pumps

Centrifugal/rotodynamic pumps.

Piston/reciprocating pumps.

Semi-rotary pumps.

Hydram.

Conveyance of Water

This is the process of moving water from one point (source or storage point) to where it will be used or stored. This can be done through;

Piping

In this case water moves through pipes.

Types and choices of pipes

Metal pipes

These are expensive but durable. They also can withstand high pressure.

Plastic pipes

They are cheap and easy to install. However they can burst under high water pressure, can break when exposed to the sun and can be gnawed by rodents such as moles.

Hose pipes

They are either made of rubber or plastic. Rubber ones are more expensive and more durable than the plastic ones.

Use of containers

Containers such as jerry cans, drums and pots are used to draw water and are carried by various means such as bicycles and animals.

Use of canals

Water is conveyed from a high point to a lower point along a slope especially for irrigation purposes.

General Uses of Water on the Farm

Domestic use – cooking, drinking, washing

Cooling animals

Rearing fish

Watering/ irrigation plants

Cleaning calf pens, milking sheds

Watering livestock / drinking

Diluting / dissolving chemical used to control pests, parasites and weeds

Mixing concrete in construction

Cooling and running machine engines

Processing farm produce eg coffee hides, carrots

Recreation eg swimming pools

WATER TREATMENT

Importance of Water Treatment

Kill disease causing microorganisms.

Remove chemical impurities such as excess fluoride.

Remove bad smells and bad tastes.

Remove sediments of solid particles such as soil and sand.

Process of Water Treatment

Stage I: Filtration of water intake.

- Water from Source River is made to pass through a series of sieves.

- Large particles of impurities are trapped by the sieves.

- Water then enters into the large pipe to be directed to the mixing chamber.

Stage II: Softening of the water

Water circulates in the mixing chamber and doses of soda ash to soften the water.

Stage III: Coagulation and sedimentation

Water is passed through coagulation tank where fresh air enters to remove bad smell/ chloride of lime used.

Water stays for 36 hours thus solid particles settle and bilharzias causing organisms killed.

Alum is added to coagulate solid particles which settle at the bottom.

Stage IV: Filtration

Water is passed through filtration tank with layers of sand and gravel to filter it.

Water leaving the filtration tank is clean.

Stage V: Chlorination

Water is passed through chlorination tank where chlorine is added.

Micro-organisms in the water are killed by chlorine.

Stage VI: Storage - The treated water is stored in large overhead tanks before distribution and use.

Diagram

Water Treatment by Boiling

Boiling kills germs in water such as those causing bilharzias, cholera and typhoid.

IRRIGATION

This is the artificial application of water to the soil to supply crops with sufficient moisture for growth.

It is usually practiced;

In dry areas.

During dry periods.

In the growing of paddy rice.

General importance's of Irrigation.

Enable crop production during dry season

Reclaim arid and semi arid land for farming

Supplement rainfall in crop production

Help provides enough water to crops that require a lot of water like rice

Creates favourable temperature for proper plant growth

Enable supply of fertilizer in irrigation water

Make possible to grow crops in special structures like green house

Types of Irrigation

Factors considered when choosing type of irrigation system

Capital availability- this determines the type of irrigation systems to be used. Drip and overhead irrigation systems require high capital for installation and maintenance

Topography- Surface irrigation requires flat areas

Water availability- Surface irrigation requires a lot of water. Drip and overhead irrigation requires less water

The type of soil- Surface irrigation is best suited for clay soils because they retain water for a long time.

The type of crop / value of the crop / benefit analysis. Crop to be irrigated should be of high value to justify the irrigation cost

The availability of clean water – drip and overhead irrigation requires clean water to prevent blockage of the systems

Surface Irrigation

Water is brought to the crop fields from the source by use of canals or furrows. The following method are used here; Flood Irrigation, Furrow Irrigation and Basin Irrigation.

The following factors are considered when choosing the method to use in surface irrigation.

Topography- Surface irrigation requires flat areas

Water availability- Surface irrigation requires a lot of water.

The type of soil- Surface irrigation is best suited for clay soils because they retain water for a long time.

Flood Irrigation

The entire field is flooded with water.

The method is cheap to establish and maintain but there is uneven distribution of water to crops and a lot of water is wasted.

Furrow Irrigation

Irrigation water flows from canals into furrows..

Furrows should be maintained by repairing when eroded or worn out, removing the weeds and silt.

Advantages

Cheap to establish and maintain.

Requires little skill to maintain.

Reduces fungal diseases such as blight since there is no wetness on the leaves.

Disadvantages

Soil erosion may occur.

A lot of water is lost through evaporation and seepage.

Basin Irrigation

An area enclosed by walls called embankments/levees is flooded. The method is common in the rice growing areas. Such as Mwea Tebere, Ahero, Bunyala etc.

Sub-Surface Irrigation and Drip/Trickle Irrigation

This involves laying perforated pipes underground to allow water to pass out through tiny holes and wet the soil around the zones of the crop.

Advantages

Minimizes labour requirement especially in changing of water pipes.

Minimizes possible theft of water pipes.

Economizes on the use of water.

Can be practiced on both sloppy and flat land.

There is no soil erosion.

No growth of weed between the rows.

Water under low pressure can be used as long as it can flow along the pipes.

Controls fungal diseases such as blight because water does not accumulate on the leaves.

There is no need of constructing dykes, leveling or making

Disadvantages

Expensive to install.

Pipes can be broken during weeding or land preparation.

Nozzles can get blocked making irrigation inefficient hence the method requires clean water.

Overhead/Sprinkler Irrigation

In this case water is applied to the plants in form of spray using sprinklers or watering cans.

The sprinklers and pipes used must be maintained as follows.

Lubricating the rotating parts to reduce friction.

Repairing any broken parts.

Cleaning to unblock the nozzles.

Advantages of sprinkler irrigation

There is even distribution of water over the area required

Less water is required / less water wastage

Can be practiced on sloppy land

It is possible to apply foliar fertilizers with irrigation water / fertigation

Irrigation pipes / sprinklers can easily be moved from one area to another

Irrigation water cleans off dust from plant leaves for better functioning

Helps to control aphids.

Disadvantages

Expensive to install.

Encourages fungal diseases such as blight and coffee berry disease due to wetting of the leaves.

Can cause soil erosion if not well controlled especially on sloppy ground.

May require the establishment of a wind break.

Maintenance is expensive as it requires a lot of skill

Factors considered in choosing irrigation water pipes

Durability- Shown by the quality of the materials the pipes are made of

Length of the pipes- This is determined by the size of the farm and the source of water / water supply point.

Diameter of the pipe- Determines the volume of water to be conveyed in the pipes

Water pressure- High water pressure requires strong pipes to prevent bursting

Resistance to heat from the sun- Pipes crack and become brittle if exposed to the sun

Resistance to pest damage- Plastic pipes are easily damaged / gnawed by rodents

Cost of the pipes- Aluminium pipes may be expensive when used for irrigation

Drainage

This is the removal of excess water from waterlogged land. It is done to reclaim marshy areas for agricultural production.

Importance of Drainage

To increase soil aeration. When excess water is removed from the soil, plant roots get enough air for growth.

Increase soil volume. Drainage increases the amount of soil around the root zone making it possible for plants to obtain nutrients.

Raise soil temperature. Drainage improves the rate at which the soil becomes warm for maximum plant growth.

Increase microbial activities. Proper aeration as a result of drainage increases the number of microorganisms in the soil.

Reduce soil erosion. Well drained soils have high water holding capacity which helps to reduce surface run-off increasing the infiltration rate.

Remove toxic substances. When there is water-logging, salts accumulate to toxic levels in the soil. Drainage removes such salts from the soil.

Methods of drainage

Use of open ditches/channels/furrows.

Ditches are dug for water to flow by gravity lowering the water table.

Use of underground pipes

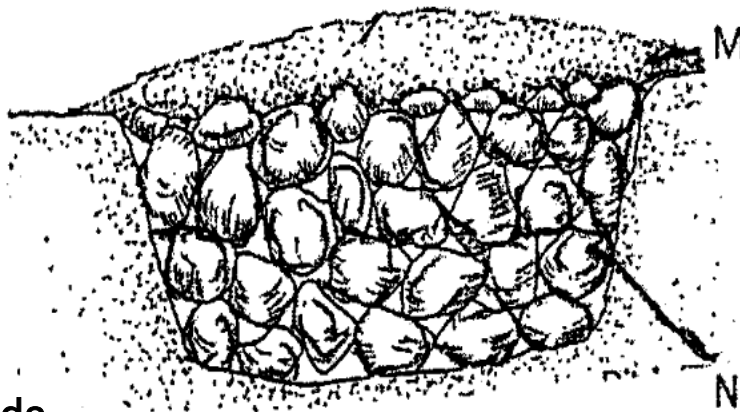
Perforated pipes are laid underground and water seeps into them, then

flows to a water way. The pipes are made of plastic, metal (steel) or clay.

French drains

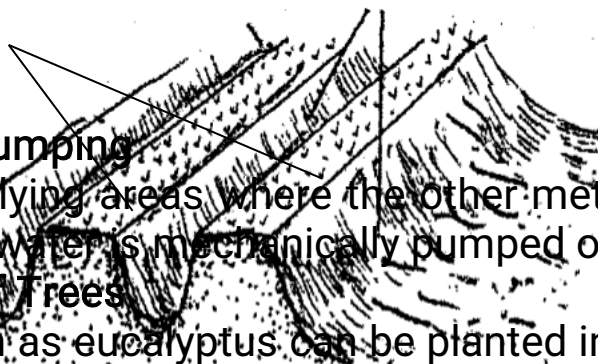
Ditches are dug and filed with stones and gravel and then covered with soil.

Water from the surrounding area seeps into them and flows to a water way.



Cambered beds

Raised beds are constructed in combination with ditches in the poorly drained soil such as the black cotton soil.



Mechanically pumping

In the low-lying areas where the other methods of drainage cannot be practiced, water is mechanically pumped out of the soil.

Planting of Trees

Trees such as eucalyptus can be planted in water-logged areas as they lose a lot of water through transpiration.

Water Pollution

This is the introduction of harmful substances into the water.

Agricultural Practices that Pollute Water

Use of inorganic fertilizers

Fertilizers used get leached through the soil and are carried to water bodies.

Use of pesticides

Excess pesticides seep into the soil and find their way to the water bodies causing pollution.

Poor cultivation practices. These practices include:

Over cultivation. This causes soil erosion hence siltation in water bodies.

Overgrazing. This also causes soil erosion hence pollution in water bodies.

Cultivation along the riverbanks. Also causes soil erosion hence siltation in water bodies.

Methods of Preventing water Pollution

Soil conservation measures to minimize soil erosion.

Fencing of water sources to minimize pollution by animals.

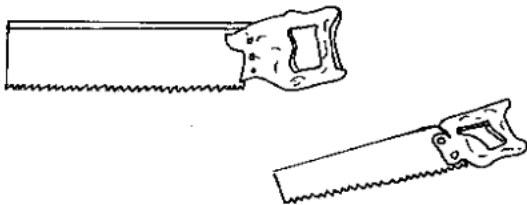
Enforcing integrated ways of controlling pest and weeds that do not use chemicals such organic farming.

Planting vegetation along the river banks to avoid siltation.

Using adequate storm control methods in the areas experiencing heavy rains.

FARM TOOLS AND EQUIPMENT REVISION QUESTIONS

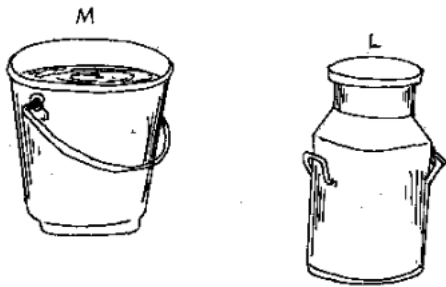
- 1 The diagrams below are of farm tools and equipment. Study them and answer the questions that follow



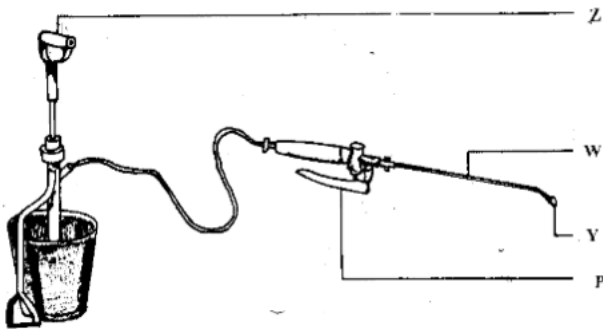
- i) Identify the tools

1 mk

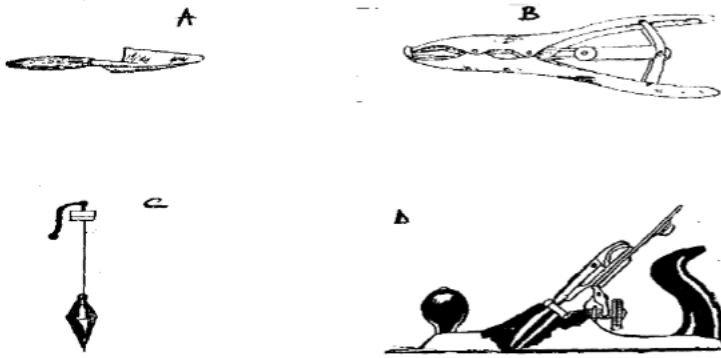
- ii) Give one functional difference between the tools above. 1 mk
2. The diagram below show farm equipment. Use them to answer the questions that follow.



- a) Identify the equipments M and L. (1mk)
- b) State the functional difference between M and L. (2mks)
- c) State TWO common maintenance practices carried out on both M and L. (2mks)
3. The diagram below shows a farm equipment study it and answers the questions that follow.



- [a] Identify the equipment. [1mk]
- [b] Name the parts labeled. [2mks]
W; X ; Y; Z
- [c] What is the function of the part labelled Z. [1mk]
4. Study the diagrams below and answer the questions that follow.



(a) Identify the tools. A-B-C-D
(2mks)

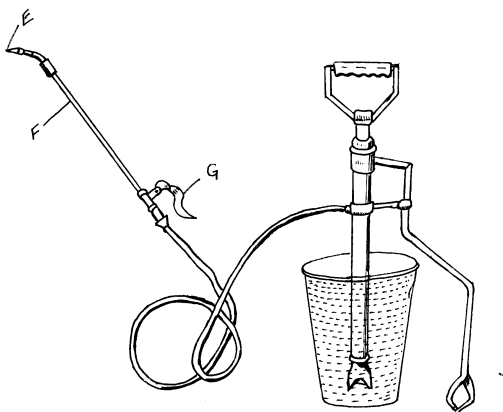
(b) State the correct use of each of the tools above.
(2mks)

(c) Give two maintenance practices carried out on tool D for efficient use.
(1mk)

5 (a) Name four types of tools used in smoothing wood.
(2mks)

(b) Give three reasons why farm tools and equipment should be well maintained. (1½mk)

6. Below is a diagram of farm equipment. Use it to answer the questions that follow.

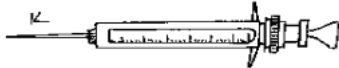


a) Identify the equipment. (½ mk)

(b) State two reasons for your choice in (a) above

(1mk)

- b) State the use of the equipment (1mk)
 c) Name the parts labelled G,E and F. (1 ½ mks)
 d) Identify two draw backs in using this equipment compared to others that may be used for the same purpose. (2mks)
7. Identify the farm tool and equipment illustrated in the diagram labeled k and L and give one use of each equipment.



Use
(a) K

Equipment

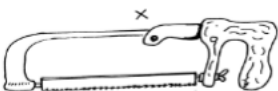
Identity

.....

 L

- (b) Give the care and maintenance of L (1mk)

8. Observe the tools X and Y illustrated below and answer the questions that follow:-



- a) Identify the tools. X ; Y (2 mks)
 b) State one use of each of the following tools. X;Y (2 mks)
 c) State three maintenance practices carried out on tool X. (3 mks)

9. The diagram below illustrate a workshop tool

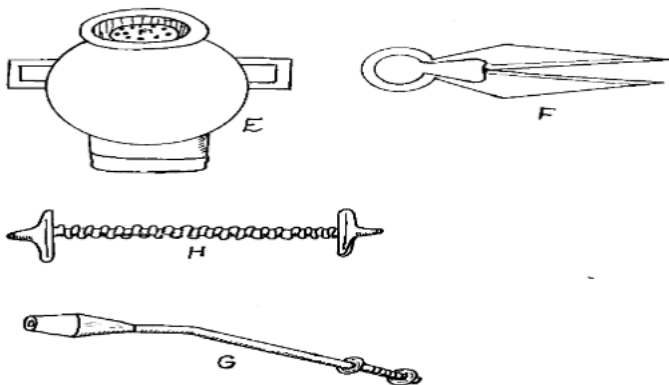


Identify the tool.....(1mk)

Name the parts labeled S, T and U (3mks)

State the use of the tool (1mk)

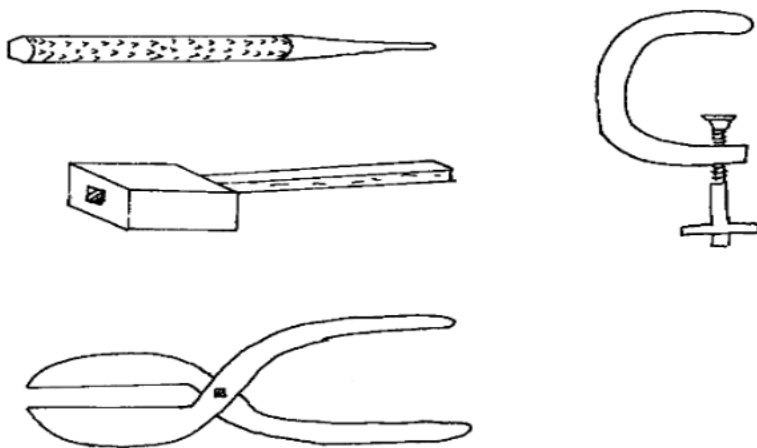
10. Study the diagrams of livestock production tools below and answer questions that follow.



a) Identify the tools E, F, G and H. (4mks)

b) State two maintenance practice of the equipment E. (2mks)

11. Below are diagrams of workshop tools.



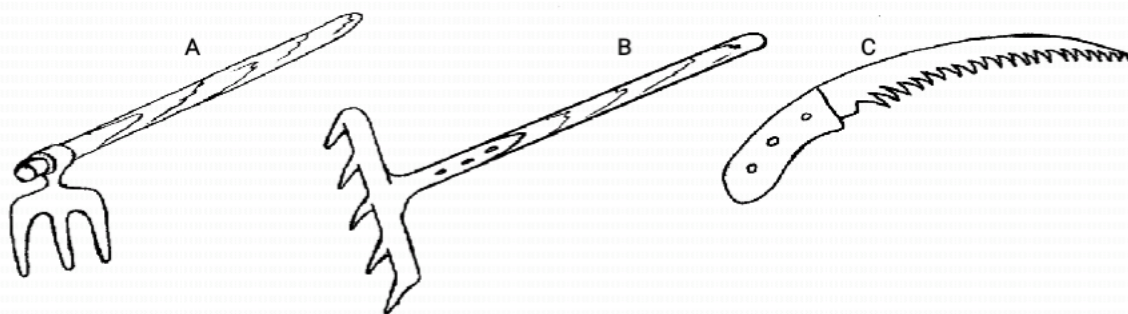
State the functions of tools.

(4mks)

- (i).....
- (ii).....
- (iii).....
- (iv).....

b) What is the name given to the metallic brush which is used to clean out wood chippings from tool (i) above.

Study the diagrams of garden tools shown below and answer the question that follo



(i) **State two** field conditions under which tool A would be more suitable for use in crop

Production

(2mks)

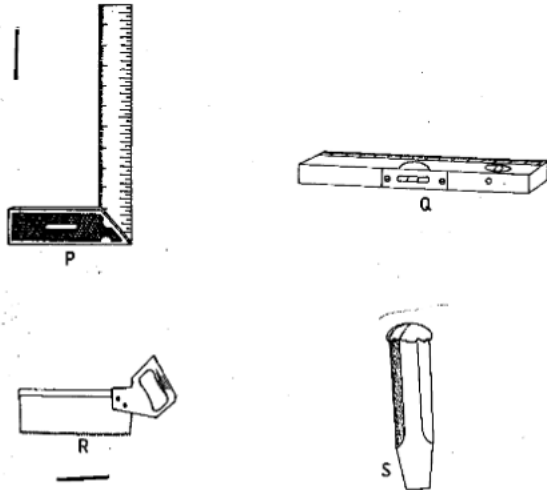
(ii) Give the function of the tool labelled C.

(1mk)

(iii) **State two** maintenance practices of the tool labelled B.

(2mks)

13. Study the diagrams below labeled P,Q,R and S representing some workshop tools and then answer the questions that follow.



a) identify the tools

2mks

Tool	Name
P	
Q	
R	
S	

b) Give one use of tools P and R in the construction of a wooden feed trough. 1mk

P

R

c) How would the tool labelled Q be used in the construction of a calf pen? ½ mk

d) Give two maintenance practices carried out on tool S. 1mk

14. Study the diagram below of farm tools and equipment and answer questions that follow.



- (i) Identify tool M and N (1mk)
 M.....
 N.....
- (ii) State **one** functional difference between M and N (1mk)
- (iii) State **two** maintenance practices of tool M. (1mk)

FARM TOOLS ANSWERS

1 A)

Tenon / back saw

Cross – cut saw/ rip saw/ hand saw (1 mk)

b) Tenon saw- For cutting tenon joints / fine sawing reject cutting joints alone

Cross cut- saw cutting across the grains of wood (2 mks)

2 a) M – milking bucket / pail (reject milk bucket / pail)

L- Milk churn / can (reject milking churn) $2 \times \frac{1}{2} = 1\text{mks}$

b) M – used for holding milk during milking $2 \times 1 = 2\text{mks}$

L – Used for holding milk during transportation

c) i) Washing thoroughly with hot water $2 \times 1 = 2\text{mks}$

ii) Sterilizing using recommended detergent

4 .(a) A-garden trowel

B-elastrator

C- Plumb bob/ plumb line

D- Jack plane

($\frac{1}{2}$)

x 4)

(b)

Tool	use
A	-for lifting seedlings from the nursery during transplanting.

B	-for applying/ fixing the rubber ring during castration docking or dehorning
C	-checks the vertical straightness of a stone wall during castration.
D	-for smoothening rough wood surfaces.

(c)
 Sharpening the blades regularly
 Replacing broken handles and knob
 Tightening loose parts (screws)
 Adjusting appropriately the lever cap. (½ x 2)

6. a) - Stir-up pump. $\sqrt{1/2}$
 b) - Spraying livestock $\sqrt{1}$
 c) - E-Trigger $\sqrt{1/2}$
 - F-Nozzle $\sqrt{1/2}$
 - G-(Brass) lance. $\sqrt{1/2}$
 $\frac{1}{2}mk$
 d) - Need two people to operate. $\sqrt{1}$
 - Not easy to carry about during operation. $\sqrt{1}$
 $1 \times 2 = 2mk$

1

Equipment	Identify	Use
K	- Hypodermic syringe / syringe And needle	- Inject Animals to introduce Drug or vaccine

L	- Adjustable spanner	- Holding different sizes of nuts and bolts (Accept tightening / loosening)
---	----------------------	--

9. (i) Auger bit (1 x 1 = 1mk)
 (ii) S – shank
 T-Twist threads
 U-Spur (3 x 1 = 3mks)
 (iii) Making holes (boring holes on the wood (1mk)

12 (i) Conditions under which tool labeled A is used

Hard ground/ soils
 A stony field
 Field with rhizomes/stolons/ roots
 A field with sticky soils(2x1 =2mks)

(ii) Functions of the tool labeled C

Cutting pruning undesirable branches/ stems of trees/fruits/coffee/
 Cutting pruning excessive vegetative parts(1x1 =1mk)

(iii) Maintenance practices of tool labeled B

Clean /remove soil/trash after use
 Straighten the prongs if bend
 Replace the handle if broken
 Fix the handle firmly on the rake(2x1 =2mks)

13.a)

Tool	Name
P	Try square
Q	Spirit level
R	Tenon saw/back saw

S	Cold chisel
---	-------------

$\frac{1}{2} \times 4 = 2$ MKS

Use of tools P and R in the construction of a wooden feed trough

P-Measuring angles/ layout of angles/ measuring lengths

R- Cutting timber to make joints/ used for joinery work

-Fine cutting/ sawing

$\frac{1}{2}$

$x1 = \frac{1}{2}mk$

Use of Q in the construction of a calf pen

To determine if the floor level/ the walls are vertical.

$\frac{1}{2} x1 = \frac{1}{2} mk$

Maintenance practices on tool S

-Sharpening the cutting edge

-Removing the mushroom head

$\frac{1}{2} x2 = 2mks$

i) M- hack saw

N- hand saw

ii) Functional differences between M and N

- hack saw (M) is used for cutting metal rods and plates while (N) hand saw is used for cutting wood/timber

$(1x1 = 1mk)$

iii) maintenance practices

tighten loose screws and nuts (ref.bolt)

replace worn out blade

regular cleaning

hang properly to avoid possible damage

maintain correct tension of the blade

OTHER REVISION QUESTIONS

- a). What is Agriculture?
- b). State the roles played by agriculture in national development
- d). i) Briefly outline the problems that have hindered agricultural development in Kenya.
- ii) Suggest ways in which these problems can be alleviated
- a) i) What are the characteristics of shifting cultivation?
- ii) State the problems associated with shifting cultivation.

What is pastoralism?

State the factors to consider in choosing a type of farm

What is arable farming?

- i) State the advantages of mixed farming
- ii) State the limitations of mixed farming
- i) Give the types of farming practised by small scale farmers
- Name the types of large scale farming
- Why does the Kenya government put a lot of emphasis on ranching?
- State the common features of ranching as a farming system:
- i) State the advantages of plantation farming
- State the disadvantages of plantations.
- State the major characteristics of plantation farming.
- a) List the ecological factors affecting agriculture.

Mention the aspects of rainfall which are important in crop production

- i) What is optimal temperature?
- ii) State the effects of high temperature on crop production.

State the negative effects of wind to crops.

- a). i. Define the term soil
- ii). Name the ways in which soil is important to growing plants.
- b). i) State the factors which influence the soil forming process
- ii). What biological agents influence the speed of the soil forming process?

- i) Define the term soil Profile
 - ii) How does soil profile influence plant growth?
- i) List the constituents of a fertile soil.
 - ii) What role do micro-organisms play in soil?
- i) What is soil structure?
 - ii) State the farming practices that improve soil structure.
 - iii) Why is a good soil structure desirable for growing crops.

i) What is soil texture?

State the properties of soil that are influenced by its texture.

Give the types of soil based on texture.

a) State the advantages of using farm tools.

List the factors that determine a farmer's choice of tools and equipment.

- i) Why should tools and equipment be maintained well?
 - ii) How should tools and equipment be maintained?

List the safety precautions necessary for tools and equipment

Name the categories of farm tools and equipment.

a) State the importance of land preparation.

b) i) What is primary cultivation?

ii) Which factors influence choice of tools for primary cultivation.

i) What is secondary cultivation?

ii) Give reasons for secondary cultivation?

i) Define minimum tillage

iii) State reasons for practising minimum tillage.

Name the factors that determine the number of tillage operations during seedbed preparation.

a) List the sources of water on the farm.

How is water conveyed from one point to another?

i) Name the types of water pipes.

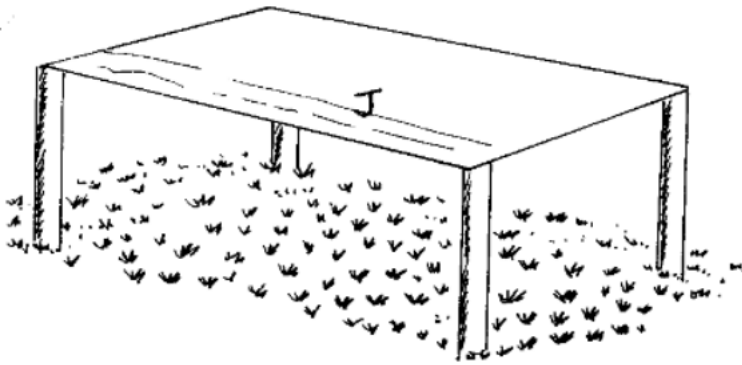
iii) What features are considered when buying plastic pipes?

Name the types of water pumps to be used on the farm.

i) Why should water be treated before use?

ii) State the methods of treating water on the farm.

- iii) How is water used on the farm?
- a) i) What is irrigation?
 - ii) List the factors to consider in deciding to irrigate crops.
- b) List the major types of irrigation
- a) i) What are the uses of farm records
- List types of records kept on mixed farms.
- List types of records kept by crop farmers.
- , goat, pigs, bees, fish, donkey, camel
- 10 b) i) Explain the role of livestock in human life
 - ii) List factors that affect livestock industry in Kenya.
- c) i) List dairy breeds of cattle
 - ii) State their characteristics.
- i) Name beef cattle breeds.
 - ii) What are the characteristics of beef cattle.
- Name the important rabbit breeds in Kenya.
- Name the major breeds of sheep in Kenya and indicate the purpose they are kept for
- Name important goat breeds and their uses
- Name important pig breeds kept in Kenya.
- i) Give the meanings of exotic and to indigenous breeds.
 - State the characteristics of exotic cattle that make them better suited to marginal areas than exotic cattle breeds.
 - What are the advantages of keeping a Jersey cow instead of Friesian for production of milk?
- i) State the general characteristics of exotic cattle breeds.
 - ii) Give the characteristics of indigenous cattle
- 11. Below is a diagram of a nursery for raising the seedlings.



(a) State two advantages of having the part labeled J
(2mks)*NrK*

(b) State any 3 management practices that should be carried out on the nursery from the time seedlings emerge to the stage of transplanting
3mks)*NrK

12. a) i) What is soil fertility?

State the characteristics of a fertile soil.

How can a fertile soil loss its fertility

iv). State the ways of maintaining or improving soil fertility

i) What are plant nutrients?

ii) Name the major plant nutrients (macro-nutrients)

State the roles and deficiency of the following nutrients in plants.

i) Nitrogen uses

Deficiency.

Excessive supply

Phosphorous used.

Deficiency

Potassium uses.

Deficiency.

i) What is soil sampling?

List the methods of soil sampling.

State the reasons for soil testing:

Explain the procedure of soil sampling:

State precautions necessary during soils sampling

Name the methods of detecting nutrient deficiency in crops:

State the importance of soil PH to a crop:

13 a) i) Differentiate between manure and fertilizer:

List the common organic manures

b). i) What is organic matter?

State the importance of organic matter

How can organic matter be added to soil?

c) i) Describe how to make farm Yard manure:

ii) State the factors determining quality of farm yard manure

iii) Give the advantages of using Farm Yard Manure over fertilizer:

Give the disadvantages of using farm yard manure

d) i) State the factors to consider when citing a compost pit.

Describe how to make compost manure

i) How is green manuring done on the farm?

List the characteristics of green manure crops:

What are the advantages of green manuring?

14a) Classify fertilizers by nutrient content.

b) i) Name the common nitrogenous fertilizers.

State properties of nitrogenous fertilizers/ (characteristics)

When are they applied and why at that time?

c) i) Name the common phosphatic fertilizers:

When are they applied and why at the time?

i) Name the common potassic fertilizers

Characteristics:

i) What is fertilizer application?

List the methods of fertilizer application:

What is top dressing?

i) Calculate the amount of K_2O (potassium chloride) contained in 400 kg of a compound fertilizer 25:10:5 – 5kg of K_2O is contained in 100kg of 25:10:5

A farmer is to apply a compound fertilizer 20:30:10 on a vegetable plot measuring 5 metres long by 4 metres wide, at the rate of 200kg per

hectare.

Calculate the amount of the fertilizer the farmer would require for the plot.
(show your working)

What do the figures 20, 30 and 10 in the fertilizer stand for

How much of a fertilizer labeled (20:20:10) should be applied to a plot which requires 30 kg P_2O_5 ?

15. a) i) State the importance of the nitrogen cycle

Describe the nitrogen cycle:

What happens to nitrogen in the soil?

b) i) State the importance of carbon cycle

Describe the carbon cycle

How is carbon lost?

How can carbon be restored to the atmosphere?

16. a) i) Define crop propagation.

What are the methods of crop propagation?

b) i) List the different methods of vegetative propagation:

State advantages of vegetative propagation.

State its disadvantages.

i) What are the advantages of seed propagation

State the disadvantages of seed propagation

i) Give the advantages of early planting

State the factors to consider when selecting seeds or other planting materials for planting

What are the reasons for seed selection?

What practices are carried out for seeds to ensure that they germinate?

i) List the methods of planting

State the advantages of row planting.

State the factors which influence planting depth.

What factors determine crop spacing?

State the advantages of correct spacing

Why is correct plant population necessary?

Name the treatments necessary on planting materials before planting?

17a) What is a nursery?

State the reasons for using a nursery.

State the nurseries management practices.

Explain the following nursery practices.

i) Pricking out.

Hardening off.

Rogueing.

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