**FORM I**

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**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 loses 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 10 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 fanning method where crops are grown and livestock reared without the use of agro­chemicals.
* 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 ad van cements .
* ***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 Carring 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****;*
* *T*he reaction of rock minerals with oxygen to form oxides which break easily.
* ***Carbonation****;*
* *T*he process whereby carbonic acids formed when rain water dissolves carbon dioxide,
* It reacts with calcium carbonates in limestone causing it to disintegrate.

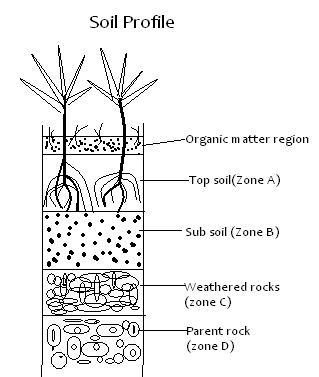
***Biological Weathering***

***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.



* 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.

|  |  |
| --- | --- |
| ***Soil Formed in Situ*** | ***Soil Deposited*** |
| l.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 | 6. Differ in chemical composition from the |
| as that of the underlying parent rock. | 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 are 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.

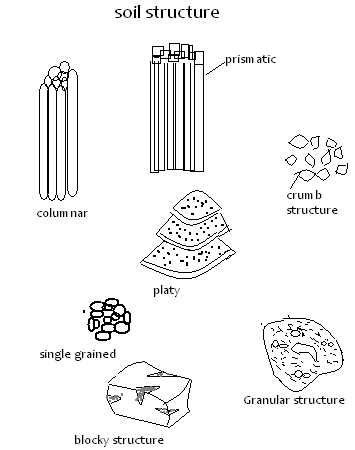
***Water in the soil exists in three forms namely:***

* ***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
* Crumby
* 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 |
| 1. | Panga | Cutting and shallow cultivation, making holes. |
| 2. | Jembe/hand hoe | Cultivation, digging, shallow planting holes and trenches. |
| 3. | Fork iembe | Cultivation, digging out roots, harvesting of root crops. |
| 4. | Rake | Collecting trash, breaking large clods, levelling, removing stones |
|  |  | from a seedbed and spreading organic manure. |
| 5. | Spade | Scooping and carrying of soil, sand, concrete mixture and |
|  |  | manure. |
| 6. | Spring balance | Measuring weight. |
| 7. | Trowel | Scooping seedlings during transplanting and .digging planting |
|  |  | holes for seedlings. |
| 8. | Pruning hook | Bending tall branches when pruning. |
| 9. | 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. |

***Livestock Production Tools and Equipment***

|  |  |  |  |
| --- | --- | --- | --- |
|  | Tools | Uses |  |
| 1. | Drenching gun | Administering liquid drugs to animals orally. |  |
| 2. | Bolus gun/dosing gun | Administering solid drugs or tablets to animals orally. |
| 3. | Wool Shears | Cutting off wool from sheep. |  |
| 4. | Hypodermic syringe | Administering drugs by injection for example in vaccination. |
| 5. | Stirrup (bucket) pump | Application of acaricide by hand spraying. |  |
| 6. | Thermometer | Taking body temperatures of farm animals. |  |
| 7. | Burdizzo | Used in bloodless method of castration. |  |
| 8. | Halter | Rope designed to restrain the animal. |  |
| 9. | 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 |  |  |
| 1. | Spanner |  | Tightening and loosening nuts and bolts. | |  |
| 2. | Pliers |  | Cutting small wires and thin metal and gripping firmly. | | |
| 3. | Files |  | Sharpening tools, smoothening or shaping edges of metals, | | |
| 4. | Rasps |  | Smoothening and shaping of wooden structures. | |  |
| 5. | Chisels (wood) |  | Making grooves in wood. |  |  |
| 6. | Cold chisel |  | Cutting and shaping metal. |  |  |
| 7. | Screw drivers |  | Driving screws in or out of wood or metal. | |  |
| 8. | Saws | .- |  |  |  |
|  | Cross cut saw |  | Cutting across the grain of wood. | |  |
|  | Rip saw |  | Cutting along the grain of wood. | |  |
|  | Hack saw Bow saw |  | Cutting metals. |  |  |
|  | Tenonlback saw |  | Cutting branches of trees. |  |  |
|  | Coping saw |  | Cutting Joints on wood and fine sawing. | |  |
|  | Compass/keyhole saw |  | Cutting curves on thin wood. | |  |
|  |  |  | Cutting either along or across the grain of wood especially | | |
|  |  |  | when cutting key holes. |  |  |
| 9. | Tin snip |  | Cutting metal sheets. |  |  |
| 10. | Braces and bits. |  | Boring holes in wood. | , |  |
| 11. | Drill and bits |  | Boring holes in metal work and woodwork. | | = |
| 12. | Hammer |  |  |  |  |
|  | Claw hammer |  | Driving in, removing and straightening nails. | |  |
|  | Ball pein |  | Driving in nails, rivets and straightening metal. Also used | | |
|  |  |  | on cold chisel |  |  |
| 13. | Mallet |  | Hammering or hitting wood chisel. | |  |
| 14. | Jack plane |  | Fine finishing of wood. |  |  |
| 15. | Scrappers/spokeshave |  | Smoothening curved surfaces of wood such as handles of | | |
|  |  |  | jembes, axes. |  |  |
| 16. | Measuring equipment |  | ~ | |  |
|  | Metre ruler |  | Measuring short length -. |  |  |
|  | Try square |  |  |  |  |
|  |  |  | Measuring length angles and to ascertain squareness. | | |
| 17. | Marking gauge |  | Marking parallel lines to the edge of wood. | |  |
| 18. | Fencing pliers |  | Cutting wires, hammering staples when fencing. | |  |
| 19. | Vice and clamps |  | Firmly holding pieces of work together. | |  |

|  |  |  |
| --- | --- | --- |
| Tools | | Uses |
| 20. | Spirit level | Measuring horizontal or vertical levels. |
| 2l. | Soldering gun | Melting soldering rods when repairing or fabricating metal |
|  |  | sheets. |
| 22. | Wire brush | Brushing rough surfaces. |
| 23. | Divider | Marking and laying out. |
| 24. | Centre punch | Marking the point of drilling. |
| 25. | Paint brush | Applying paint on surfaces. |
| 26. | Sledge hammer | Ramming hardware, breaking stones. |
| 27. | Wire strainer | Tightening wires during fencing. |
| 28. | Riveting machine | Fix rivets when joining pieces of metal. |
| 29. | Claw bar | Removing long nails from wood, straining fencing wires and |
|  |  | digging fencing holes. |

*Plumbing and Masonry Tools*

|  |  |  |
| --- | --- | --- |
| Tools | | Uses |
| l. | Pipe wrench | Holding, tightening and loosing metallic pipes. |
| 2. | Pipe cutter | Cutting PVC pipes. |
| 3. | Levelling rod | Levelling the floor during construction. |
| 4. | Mason's trowel | Placing mortar between construction stones and bricks. |
| 5. | Wood float | Create a level surface on walls and floors. |
| 6. | Mason's square | Ascertain verticalness. |
| 7. | Plumb bob | Spreading screed over floors and walls. |
| 8. | 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 there 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.
* Burry 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:***

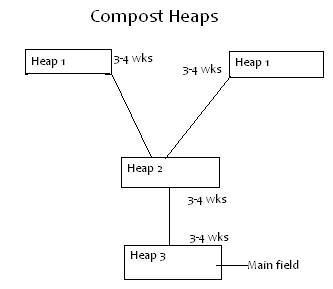
* ***Four heaps method***
* ***Indore Method (Pit Method)***

***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 micro­organism 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:***



***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 61OOkg 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****: r*eddish 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 s 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 Iitres 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.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| *Livestock* |  | *Adult* | *Replacement Stock* | | *Young* | *Users)* |
| *Species* | *Male* | *Female* | *Male* | *Female* | *One* |  |
| 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 | Doe | Kid | Dairy - milk |
|  |  |  | Billy | Nanny |  | 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* | *Quantity* | *Date* | *Issued to* | *Quantity* | *balallce* |
|  | *Item* |  |  |  |  | *Stock* |

* **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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