AGRICULTURAL SCIENCE---SS1

Week One

TOPIC: **AGRICULTURAL ECOLOGY**

CONTENT

Meaning of Agricultural Ecology

Components of Farm Ecosystem

Interactions Among the Components of Agro-ecosysytem

MEANING OF AGRICULTURAL ECOLOGY

Agricultural Ecology is defined as the study of crop plants and farm animals in relation to their environment. Ecology is derived from a Greek word "Oikos" which means home or dwelling place. In order words, agricultural ecology can be defined as a field of study which deals with the relationship of living organisms with one another and with the environment in which they live.

Agricultural Ecology is divided into:

A. Autecology

B. Synecology.

Autecology is concerned with the study of an individual organism, or a single species of organism and its environment. For example, the study of a single cattle and its environment.

Synecology is concerned with the stud of the inter-relationships between groups of organisms or species of organisms living together in an area. For example, the study of different fishes in a fish pond in relation to their aquatic environment.

Ecosystem refers to a community of crop plants and farm animals functioning together with their non-living environment. In other words, ecosystem consists of living factors (plants and animals) interacting with the non-living factors in a farm environment.

COMPONENTS OF FARM ECOSYSTEM

The farm ecosystem is made up of two main components. These are:

Biotic (living) components

Abiotic (non-living) components

BIOTIC COMPONENTS: The biotic components include the living things i.e. crop plants and farm animals. The biotic components can be grouped into two classes which are; Autotrophism and Heterotrophism.

(i) Autotrophism: This is a group of organisms which makes use of sunlight or chemicals to manufacture their food from inorganic substance during the process of photosynthesis. In other words, autotrophs are organisms mainly crop plants which are capable of synthesizing their own food, hence they are called producers.

(ii) Heterotrophism: This is a group of organisms mainly farm animals which cannot manufacture their own food but depend directly or indirectly on plants for their food, hence they are called consumers. Farm animals that feed directly on green plants (producers) are called herbivores or primary consumers e.g. cattle, sheep, goat and rabbit.

ABIOTIC COMPONENTS: The abiotic components of an ecosystem include the non-living things which are:

Climatic factors like rainfall, temperature, wind, humidity and sunlight.

(iii) Inorganic materials and nutrients such as carbondioxide, oxygen, nitrogen, calcium and phosphorus.
(iv) Edaphic factors like soils, rocks, topography.
(v) Other factors like dust, storm, fire and water.

INTERACTION AMONG THE COMPONENTS OF AGRO-ECOSYSTEM IN SOME FARM SETTINGS

In Mono-cropping/Sole Cropping: Mono-cropping is a system of cropping where one type of crop is grown on a farmland at a particular time. For example, oil palm farm, kolanut farm, maize farm, etc. The interaction between the biotic and abiotic factors in the environment include:

Crop plants absorb nutrients from the soil to grow.

Crop plants also absorb water to grow and produce fruits.

Crop plants also take in carbondioxide from the air to carry out photosynthesis.

In Mixed Cropping System: Mixed cropping is a system of cropping which involves the growing of two or more crops on the same piece of land at the same time. Crops like maize, cassava, cowpea etc can be cultivated at the same time on the same farmland. Their interactions include:

Crops like cowpea is capable of adding nutrients to the soil.

Crops like cassava obtain nutrients from the soil to grow and produce fruits.

The leaves of all crops which fall on the ground, decayed and add nutrients to the soil through decomposition by soil microorganisms.

In Mixed Farming: Mixed farming involves the cultivation of crops and rearing of animals simultaneously on the same piece of farmland. The farm may be divided into two parts: one part for growing crops and the other for growing grasses and keeping of livestock. Their interaction include:

The grasses or the remains of crops serve as food for the animals.

The animal dungs and droppings are used as organic manure to improve the soil fertility for the crops.

Some crops like cowpea and crop residue may decay to release nutrients to the soil.

WEEK TWO

TOPIC: ROCK FORMATION AND TYPES E LEARNING NOTE

CONTENT

Meaning of Rock

Types of rock

ROCK

A rock is any mineral material of the earth. It may be a combination of different mineral elements such as silica (silica contain silicon and oxygen).

TYPES OF ROCKS

Rocks can be classified into three major groups based on how they are formed and their appearances. These include

1. Igneous rock
2. Sedimentary rock
3. Metamorphic rock

MODE OF FORMATION OF IGNEOUS ROCK

They are formed as a result of cooling and solidification of molten magma erupted from the earth crust. Magma occurs from high temperature and pressure underneath the earth and forces itself towards the earth surface through the cracks. As the magma approaches the earth surface, it cools as a result of lower temperature of the earth surface and solidify to form igneous rocks.

TYPES OF IGNEOUS ROCK

PLUTONIC [OR INTRUSIVE] IGNEOUS ROCK: These are rocks formed when molten magma solidifies slowly before it gets to the surface of the earth to form large crystals. Prolonged erosion makes the rock to be exposed later to the surface. Examples include granite, gabbro, and diorite.

VOLCANIC [EXTRUSIVE] IGNEOUS ROCK: These are formed when the molten magma cools and solidifies rapidly when it gets to the surface to form crystals. Examples include basalt, pumice.

CHARACTERISTICS OF IGNEOUS ROCKS

They have glassy appearance

They contain crystals i.e they are crystalline in nature.

They do not occur in layers.

They do not contain fossils.

They are hard and impervious

They are resistant to erosion

MODE OF FORMATION OF SEDIMENTARY ROCKS

They are rocks formed from deposits of organic materials and existing weathering rocks which accumulate and consolidate over time. They are cemented together after a long time to form sedimentary rocks. The sediments are deposited by natural agents such as water, wind and ice and settle down in layers one on top of another.

There are three types of sedimentary rocks based on the process of formation.

Mechanically formed sedimentary rocks: These are rocks formed from sediments of other rocks that are accumulated and cemented over a long period of time. Examples include sandstones, shale, clay, breccia, and conglomerate.

Organically formed sedimentary rocks: These are rocks formed from the remains of living organisms. When the rocks are formed from the remains of animals like coral or shellfish, they are called calcareous rocks e.g. lime stone and chalk. When the rocks are formed from vegetable matter such as swamps and forest are called carbonaceous rocks e.g. coal, peak, and lignite.

Chemically formed sedimentary rocks: These are rocks formed from precipitated chemically from rock solution. Examples include gypsum, potash, and dolomite.

CHARACTERISTICS OF SEDIMENTARY ROCKS

They occur in layers or strata.

They are not in crystal form i.e they are not crystalline in nature.

They contain fossils of plants and animals.

They are not resistant to erosion

They may be coarse, fine soft or hard

MODE OF FORMATION OF METAMORPHIC ROCKS

These rocks result from igneous or sedimentary rocks due to combined effect of pressure and heat. The composition and texture of unstable parent rock minerals are changed under pressure and heat. Examples are marble, quartzite, gneiss, schist, graphite and slate.

Slate is formed from clay (sedimentary)

Marble is formed from limestone (sedimentary)

Quartzite is formed from sandstone (sedimentary)

Gneiss is formed from granite (igneous)

Schist is formed from shale (sedimentary)

Graphite is formed from coal (sedimentary)

CHARACTERISTIC OF METAMORPHIC ROCKS

Some may occur in layer or strata

The rock may be hard or soft

They are not in form of crystals

They exist in different colours and texture

They may contain fossils

WEEK THREE

TOPIC: ROCK WEATHERING

CONTENT

Meaning of rock weathering

Types/Processes of rock weathering

ROCK WEATHERING

The process of soil formation is referred to as weathering.

Weathering is defined as the disintegration of rocks into smaller particles to form soil.

PROCESSES OF ROCK WEATHERING

The processes of soil formation (rock weathering) include:

Physical process

Chemical process

Biological process

PHYSICAL PROCESS OF ROCK WEATHERING

Agents of physical weathering include temperature, ice, rainfall, wind and pressure.

Temperature: The rise and fall of temperature brings about the expansion and contraction in rocks respectively. After a long time, rocks begin to crack and break down which later give rise to soil.

Ice: When rivers overflow their banks or when it rains, water collects in the openings. At a cool temperature or freezing point, the water in the openings freezes and increases in volume, the force of expansion makes the rock to expand thereby cracking them to particles. As the temperature rises, ice melts and carries the rock particles away from their origin to a different place to form soil.

Rainfall /water: The splash of rainfall exerts force on the rock surfaces. Flowing water also carries and hits rock particles against one another turning them into fragments.

Wind: heavy winds carry particles of rock, hitting them against one another or against hard surfaces to form smaller fragments.

Pressure: high pressure on hanging rock may cause such rocks to fall and the process break into smaller particles to form soil.

CHEMICAL PROCESS OF WEATHERING

Agents of chemical weathering include solution, hydration, hydrolysis, carbonation and oxidation.

Solution: This is when water dissolves soluble minerals present in the rock and the minerals taken from one place to another while flowing.

Carbonation: Carbon (iv) oxide reacts with water to form trioxocarbonate (iv) acid, a weak acid which weakens and dissolves rock minerals.

Hydration: This is the reaction of water with rock minerals which result in chemical alteration of the mineral. Example is the conversion of iron (ii) rocks to hydrated rocks.

Hydrolysis: This is the reaction of water with rock minerals to produce a rock that is different from the original one.

Oxidation: This is the reaction of rocks with oxygen from the atmosphere which then weakens the rocks.

BIOLOGICAL PROCESS OF WEATHERING

This is the activities of plants and animals in the breaking down of rocks to form soil.

The action can be brought about by some animals such as termites, earthworms, millipedes and other soil organisms.

Movement of some organisms /heavy animals like cattle can cause small fragments of rocks to disintegrate.

The roots of some crops penetrate through cracks in rocks making them to expand and break to form soil

Activities of man during tillage can break small rocks into tiny pieces.

WEEK TWO

TOPIC: FACTORS OF SOIL FORMATION

CONTENT

Climate

Parent materials

Topography

Biotic factors

Time

FACTORS OF SOIL FORMATION

The factors that control soil formation include; climate, parent materials, topography, biotic factors (living organisms) and time.

CLIMATE

Climate refers to the average weather condition of a place measured over a long period of time. Elements of climate include sunlight, temperature, wind, relative humidity, rainfall and pressure.

Rainfall: Running water as a result of from rainfall causes gradual wearing away of rocks during erosion giving rise to soil. Impact of raindrops can also break rocks to form soil.

Temperature: The alternate heating and cooling of rocks give rise to continuous expansion and contraction of rocks. This causes cracks in rock and over time lead to formation of soil.

Wind: High wind velocity most especially in desert regions carries tiny rocks which hit themselves or other rocks leading to breakdown of rocks into tiny pieces to form soil.

Pressure: High pressure in a hanging rock may cause the rock to fall down and break into tiny pieces to form soil.

PARENT MATERIAL

The physical and chemical features of parent materials determine the type of soil that can be obtained from such material. Parent of predominantly quartz mineral give rise to sandy soil while that of micas and feldspars give rise to clayey soil.

TOPOGRAPHY

Soil erosion is more pronounced on sloppy area than flat land. Wind or water easily wears away the soil and rock surfaces in sloppy area. As the rock particles are washed down to the bottom of the slope, the particles further break up into smaller particles due to combined effect of other processes of weathering.

BIOTIC FACTORS [LIVING ORGANISMS]

The action of microorganisms, plants and animals plays active part in rock formation.

Termite and earthworms mix the minerals and organic matter together resulting in the formation of soil.

The burrowing activities of earthworm and crickets permit the air and water movement in the soil which reacts with rock to cause breakdown into soil.

Activities of man during tillage operation break rock into tiny pieces to form soil.

Penetration of plant roots cause weathering of rocks.

The decaying of falling leaves of the trees with the aid of bacteria result in the formation of humus rich in plant food.

Time also plays an important role in soil formation. It takes a long time for mature soil to be formed. It takes time for small pieces of rocks to disintegrate into grains of soil. It also takes a long time for plants to decay and become part of the soil.

Soil is the uppermost layer of the earth's crust which provides support and nutrients for plant growth.

COMPONENTS OF THE SOIL

I. Inorganic(mineral) matter

ii. organic matter

iii. soil water

iv. soil sir

v. living organisms (biological components)

Percentage of soil component by volume

Mineral matter -. 45%

Water. -. 25%

Air. -. 25%

Living organisms. -. 5%

1.Mineral Matter

The mineral matter represents small rock fragments of the soil (gravel, stones, sand, silt and clay).

.Importance of Mineral Matter on Agriculture

i. It forms the solid part of the soil and provides support for plants
ii. It is the main source of plant nutrients (N, Ca, Mg e.t.c)

iii. Home or habitat of all soil living organisms.

2.Organic matter

Remains of the decomposition of plants and animals

i. Rich in plant nutrients
ii. Habitat of many soil micro-organisms
iii. Improve soil aeration

iv. Increases water-holding capacity of the soil

iv. Improves the structure of the soil by binding the particles of coarse texture soil together
v. Moderates the soil temperature
vi. Prevents soil erosion and evaporation of soil water

viii. Allows for good drainage and holds

3.Soil water

Water in the soil which is usually obtained either from rain or irrigation. Soil water is usually found in the soil within the pore spaces. When there is too much water in a soil, the soil is said to be waterlogged, which can be improved by drainage to make such soil more productive. Lack of water

In the soil for s very long time, to the extent that plants cannot absorb water even when supplied again results in Permanent Wilting Point. The plant at this stage can die.

Types of soil water

a. Hygroscopic Water

This water is tightly held by the soil particles such that it is never available to the plant.

b. Field capacity

This is the type of water left in the soil after excess water has been drained off, following heavy rainfall. This water is available to the plants.

c. Capillary water

This is the water which rises above the water table in the soil and it is held in the fine and medium pores of soil particles by surface tension. Capillary water is available to plants.

d. Gravitational Water

This is the water which can drain from the soil under the influence of gravity. It is available to plants but is often pulled down beyond the reach of the roots.

Importance of soil water on Agriculture

i. Important agent of weathering of rocks in the soil
ii. Dissolve plant nutrients into solution form which can easily be absorbed by p

lant roots.

iii. Essential raw material for photosynthesis
iv. Promotes the activities of soil organisms

v. It is needed for the germination of seeds

vi. Aids the turgidity of cells my

vii. Aids easy tillage of the soil, also helps to improve the soil structure.

viii. Provides the medium for soil reactions.

4. Soil air

This refers to the gases present in the soil pores found between the soil particles. The amount of soil air varies, depending on the amount of soil water, the sizes of the pore spaces, the type of soil and the amount of living organisms in the soil. The percentage of air is about 25% of the total volume of the soil. The ability of air to circulate freely in the soil is called **aeration.**

IMPORTANCE/ EFFECTS OF SOIL AIR ON AGRICULTURE

1. Soil air, especially oxygen, is necessary for the growth and development of plants.
2. Oxygen in the soil promotes easy germination of seeds.
3. Soil organisms require oxygen for respiration.
4. Excess of carbon dioxide in soil, when combined with water can cause acidity and aid weathering of rocks.
5. Some plant-disease organisms such as fusarium which causes damping- off are favoured by poor aeration.
6. It is needed in soil reactions, particularly carbon and nitrogen cycles.

5. Living organisms: These refer to plants and animals which inhabit the soil. They range from microscopic organisms to bigger organisms. Some are beneficial while others are harmful to crops and livestock. The most commonly found groups of soil organisms include bacteria, fungi, virus,

nematodes, insects (e.g, termite, soldier ants), millipede, centipede, earthworm, snails, reptiles, mammals (e.g. rats and rodents).

IMPORTANCE/ EFFECTS OF LIVING ORGANISMS ON AGRICULTURE

Soil organisms are very useful in many ways, especially in soil formation and improving the soil for the growth of crops. Their effects are:

1. Soil organisms improve soil structure and granulation.

2. They also improve the aeration of the soil.

3. They help to decompose organic materials in the soil to form humus.

4. They improve soil water percolation or drainage.

5. They also increase the colloidal properties of the soil.

6. Some organisms like bacteria help to fix nutrients into the soil.

7. Some soil micro- organisms produce acidic materials which help to break down rocks.

8. Soil organisms enhance the cation exchange capacity of the soil.

9. Through burrowing, they leave holes for crop root penetration.

10. They increase the mineral or nutrient status of the soil.

11. They stabilizer soil pH through the increase in soil organic matter and buffering.

SOIL TYPES AND THEIR PROPERTIES

There are three main types of soil. These are Sandy soil, clay soil and loamy soil.

i. Sandy soil

Soil is said to be Sandy if the proportion of sand particles in a sample of the soil is very high,

Properties of Sandy soil

i. Coarse, grained and gritty
ii. It is loose with large pore spaces
iii. It absorbs and loses water easily.

iv. It is well aerated with low water holding capacity

iv. Percolation in Sandy soil is high but capillarity is low
v. Sandy soil heats up easily during the day and cools down quickly during the night
vi. Sandy soil has grey or brownish colour

Methods of Improving Sandy soil

a. Planting cover crop

Help to provide shade, prevent erosion and add more nutrients to the soil.

b. Application of compost manure

Helps to bind the sand particles together and also add humus (nutrients) to the soil

c. Application of farmyard manure

This improve the structure of the soil as well as add nutrients to the soil.

d. Mulching the soil

Prevents water loss through evaporation and nutrients loss by water erosion.

e. Avoidance of bush burning

Promotes soil erosion, kills soil organisms and removes organic matter which can contribute to the fertility of the soil.

Economic Importance of Sandy soil

i. It is good for the cultivation of few crops (cassava, groundnut, cotton e.t.c)
ii. It is useful in building construction

Clay soil

The proportion of clay in a sample of the soil is high

Properties of clay soil

a. Fine, powdery and smooth when dry.

b. Sticky and mouldy when wet

c. Poorly aerated with high water holding capacity

d. Low percolator and high capillarity

e. Hard when dry, sticky when wet

f. Form a ribbon or cast when moulded

g. Supports water-logging and erosion

h. Structure is granular, does not lose water easily

i. Grey or brownish in colour

Methods of Improving clay soil

a. Liming

b. Addition of organic matter

Differences between Sandy and clay soil

	Sandy soil	***Clay soil***
i.	grained	Fine-grained
iii.	Gritty .	Smooth to the touch me
iv.	Low capillarity action	High capillarity action
ii.	High percolation rate.	Percolation is low
v.	Not sticky when wet	Highly sticky when wet
vi.	Has large pore spaces.	Has small/fine pore spaces
vii.	Well-drained and poorly aerated	poorly aerated
viii.	Low water-holding capacity.	High water- holding capacity
ix.	Low plasticity.	High plasticity

Loamy soil

A mixture of sand and clay particles with high proportion of organic matter.

Sandy loam-Proportion of sand is high

Clay loam-Proportion of clay is high, while that of sand is low.

Properties of Loamy soil

i. It has non-powdery and non-sticky texture

ii. Contains lots of organic matter (humus)

iii. Well aerated and it can hold water

iv. Moist, loose with moderate-sized pore spaces

iv. The structure breaks easily when wet and friable when dry.

Properties of soil

1.Soil texture

2.Soil structure

3.Soil temperature

4.Soil colour

5.Soil pH

6.Porosity

7.Water-holding capacity

The properties can be grouped into:

a) Physical properties of the soil

Soil texture

Soil structure

Soil temperature

Porosity

Soil colour

Water holding capacity

b.Chemical properties of the soil

Soil pH

Cation exchange capacity

SOIL PROFILE

Soil profile is defined as the vertical section of the soil, showing series of horizontal layers(horizons) of different types of soil.

A soil profile in an area of the humid tropics (e.g. forest zones) may have about four fairly distinct horizons. The first thing that is noticed in a soil profile is soil colour. The horizons show different colours. The top soil may be dark, followed by brown below. After colour texture is noticed which increase from the top to the bottom. These two characteristics enable the different horizons to be identified.

Horizons of soil profile

1) The A-Horizon(the top soil)

The surface layer of the soil profile, it contains more organic matter than other horizons. The A-Horizon is the most weathered and leached of all the soil horizons. Most shallow-rooted food crops(vegetables, legumes e.t.c) derive their nutrients from this horizon.

2) The B-Horizon(sub-soil)

This is the next horizon immediately after the topsoil. It is Rich in minerals which are carried or leached down by percolating water. The B-Horizon is suitable for the cultivation of deep-rooted crops (cocoa, rubber, orange, oil palm e.t.c)

3) C-Horizon (parent materials)

The type of material from which topsoil and sub-soil are derived. This are small fragments of rocks that are unweathered and found at the bottom of the soil profile.

4) D-Horizon (Bedrock)

It represents the unweathered rock materials. This horizon is found at the bottom of the profile and they are usually of large soil particles.

Importance of Soil Profile

The suitability of a soil for agriculture is determined by looking at the soil profile.

Importance of soil profile

a) Soil profile determines the level of soil fertility. A thick top soil represents high level of soil fertility.

SOIL TEXTURE

Soil Texture refers to the relative proportion of the particules of soil. In other words, it refers to the degree of fineness or coarseness of the various soil particles.

The particles that make up a soil sample include gravel, sand, slit and clay. Sand, slit and clay are usually referred to as the primary particles of the soil

The name and sizes of the various soil particles are shown in the table below

Name of particles.	Range of particles in diameter (mm)
Clay.	below. 0.002mm
Silt	0.002-0.02mm
Fine sand.	0.02-0.2mm
Coarse sand.	0.2mm
Gravel.	above 2.0mm.

Determination of soil texture: Soil texture can be determined by various method. These methods include:

(1). By feeling: Take a little sample of soil and rub them between the four finger and the thumb. A sharp feel represents the presence of sand while a smooth or powdery feel represents the presence of clay.

(2). By mechanical analysis through sieving: The various sizes or fractions present in a sample of dried soil can be separated by putting the into a series of various measure mesh diameters and shaken vigorously.

One start s with the sieve which has the smallest mesh diameter and progresses up the table to the sieve with the largest. The particles which can pass through a particular mesh belongs to the corresponding grade of soil.

(3). By sedimentation: A sample of soil is placed inside a glass jar and large volume of water is added and the mixture is vigorously shaken and Allow to settle. At the end large particles like coarse sand and gravel setlle at the bottom , while the organic material float on top of water in the glass jar.

(4). By moulding: Mix a sample of soil with little water and try to mould the mixture. If the mixture is sticky, it shows that clay is present but if it not sticky and cannot form a ribbon or cast it that sand is present.

Importance of soil texture

Soil texture is very important, especially to farmers in the following ways:

(1). It is useful in the evaluation of soil ability to supppy mineral nutrients.

(2).it supports soil micro organisms essential for plant growth

(3). It determines the type of crop to grow on the land

(4). It enables the farmer to know the type of soil in his farmland

(5). It determines the relative proportion of air and water in the soil

Soil texture

Soil structure is refers to the way in which the different particles of the soil are packed or arranged. It also refers to the shape and arrangements of primary particles to form compound particles.

Soil structure has direct effect in crop the yield. If the soil structure is good, air Will circulate well while water-logging, erosion leaching will be reduced. The structure of the soil can be preserved in the following ways.

(1). Planting cover crops.

(2). Mulching.

(3). Application of manure (green manure and lime).

(4). Avoidance of overgrazing and erosion.

(5). Avoidance of clean clearing with machine.

Types of soil structure.

(1). Single grain structure: this structure, the primary exist in a single form and are not cemented together. It is found in Sandy soil.

(2). Crump structure: There exist large gravel or stone embedded within the primary particles which are cemented together. It is found in the top soil.

(3). Plate like structure :The primary soil particles are arranged horizontally and flat ,resembling plate or leaflet on top of each other. It is commonly found in the sub soil.

(4) Sheroidial structure: This is also refered to as granular structure. The particles are cemented together in a circular with lot of air space. It is çommonly found in top soil.

(5). Prismatic structure: This could be columnar or prismatic. they are just like spheroidal structure with air spaces. when the top one are round, they columnar, but when they are flat just like a prism they are prismatic, they are found in the sub-soil.

(6) Block like structure: The aggregates are blocks whose edges are irregular and may be either Sharp or rounded. It is çommonly found in the sub soil.

Importance of soil structure

i. It determines the level of soil fertility
ii. A good soil structure support aeration
iii. It supports the growth of crops

Iv .A good soil structure promotes the activities of micro-organisms

SOIL TEMPERATURE

This refers to the temperature within the soil.

Importance of soil temperature to crop growth

i. Determines the rate of formation and decomposition of soil organic matter
ii. It affects the level of soil moisture
iii. Low temperature causes a decrease in metabolic activities and reduction in Enzymatic reactions in plants.

iv. It affects the absorption of water and nutrients by roots

iv. Optimum temperature promotes seed germination
v. High temperature cause the wilting of crops
vi. Optimum temperature promotes the activities micro-organisms

SOIL pH (Pondus Hydronium)

A measure of acidity or alkalinity of the soil. It is a measure of hydrogen ions in the soil.

A higher hydrogen ions concentration indicates soil acidity while a lower concentration of hydrogen ions indicates soil alkalinity. Soil pH below 7 is said to be acidic and above 7 is alkaline while 7 is neutral.

Causes of soil acidity

1) Leaching

- Washing away of plant nutrients beyond the reach of plant roots

2) Use of acid fertilizers (ammonium sulphate ammonium nitrate)

3) Presence of acid parent materials which results in the easy dissolution of the rocks.

4) Nutrient uptake by plants

5) Presence of sulphur in the soil

Removal of soil acidity is by application of liming materials which are rich in calcium.

Examples of liming materials

i.-Slaked lime-Ca (OH)

ii Quick lime-CaO

iii. Wood ash

Iv. Basic slag

iv. Dolomite or calcite

vi. Gypsum

Effects of soil Acidity

i. It reduces the activities of soil micro-organisms.
ii. It reduces the formation of pods in legumes.
iii. Presence of hydrogen ions may have adverse effects on the roots of plants

iv. Low pH causes the accumulation of aluminum and manganese which may be toxic to plant roots.

iv. Low pH (high acidity) causes the disintegration of clay minerals which are leached from the soil.
vii. It reduces growth/yield of crops

Causes and removal of soil alkalinity

This occur when there are excessive quantities of soluble minerals in the soil (usually found in the study or semi-arid areas).

Soil alkalinity removal is by:

i. Application of sulphur to the soil
ii. Application of some acid fertilizers
iii. Application of irrigation to dissolve some of the salts

Crops that can do well in each of the soil types

1) Acid soil-Cocoa, banana maize, oil palm, rubber e.t.c

2) Alkaline soil-Millet, sorghum, coconut, cotton, groundnut, cowpea, onion e.t.c

3) Neutral soil-Cassava, yam, maize, potatoes, oranges e.t.c

SOIL CLASSIFICATION

Three major groups of soil based on climate, vegetation, topography, nature of soil profile, presence of salt and soil types:

i. Zonal soil
ii. Intra-zonal
iii. Azonal soil

Zonal soil

This is matured soil which has recognizable soil profile as a result of the influence of climate and vegetation.

Sub-division of zonal soil:

I. Pedalfers: This is non-lime accumulating soil

ii, Pedocals : This is lime-accumulating soil.

Examples of zonal soil

a) podsol soil

b) Grey brown soil

c) chemozem soil

d) Sierozem soil

e) latosol or red soil (e.g. laterite).

Intra-zonal soil: This soil is formed under special circumstances and conditions such as inadequate drainage which results in water-logging or salt accumulation, leading to alkalinity.

Types of intra-zonal soil

i. Hydromorphic soil: This is characterized by excess of soil moisture which results in water-logging that may give rise to peat soil

ii. Holomorphic soil: Have high concentration of salt.It is found in drier areas of low rainfall.

ii. Calcimorphic soil (calcisols) : Have high lime content e.g. limestone.

Azonal soil : This soil is formed by nature of it's parent material rather than by climate. It is a young soil and does not exhibit any profile

Types of Azonal soil

i. Lithosols: These are types of soil formed around mountainous areas.

ii. Regosols : These are types of soil formed on deep, soft, unconsolidsted area with deposit of mineral matter.

Iii. Alluival soil : These are soil types formed through the deposition of materials by rivers.

WEEK FOUR

TOPIC: SIMPLE FARM TOOLS

These are simple, handy tools used mainly by peasant farmers. They are designed to help the hands to apply force in farm operations. Some common simple farm tools and their functions are discussed below.

(1) **Cutlass**

Description: This is the tool most used by farmers. There are two main types- one has a lightly curved blade with a short wooden handle, while the other has a straight metal blade and short wooden handle. One edge of the metal blade is sharp and the other is blunt.

Functions/Uses

(1) For cutting down and clearing bushes and trees.
(2) For transplanting seedlings.
(3) For planting seeds and harvesting crops.

(4)For weeding farmlands.

Maintenance practice

1) Cutlass should be sharpened regularly
2) Keep it dry and cool place
3) Metal parts should be oiled or greased before storage.
4) It should not be left lying about.

(2) **Hoe:**

Description: the hoe consists of a metal blade which may either be rounded or slightly rectangular in shape with a wooden handle which can be long or short.

Functions/Uses

(1) Hoe is used for land preparation.
(2) It is used for making ridges and heaps.
(3) For planting or transplanting some crops.
(4) For harvesting some crops.
(5) It is used for weeding.

Maintenance practices

(1) Sharpen blunt blades.
(2) Keep in dry and cool places.
(3) Oil or grease metal blade before storage.
(4) Clean or wash after use.

(3) **Spade**

Description:

Spade has a long wooden handle and a broad metal blade. The edge of the metal blade is sharp so that it can easily be driven into the soil.

Functions/Uses

(1) Spade is used for lifting the soil and completely turning it over.
(2) It is used for levelling the soil.
(3) For digging holes during transplanting.
(4) For mixing cement/concrete for Farm structures

Maintenance practices

1) Store in dry and cool place.
2) Keep away from rain and termite attack on wooden handles.
3) Sharpen the blade regularly.

(4) **Shovel**

Description: Shovel is just like the spade. It has a long wooden handle, but the blade of a shovel is hallow and broad with a rectangular or round edge.

Functions/Uses

1) It is used for lifting or transferring soil from one place to another.
2) To load materials from ground level into wheelbarrow.
3) For making garden paths.
4) For levelling the ground and removing stones or rubbish.

Maintenance practices

1) Store in a dry place.
2) Oil, grease or paint metal parts.
3) Keep the wooden part away from the attack of termites.
4) Clean after use.

(5) Garden Fork

Description: garden fork usually has four prongs or teeth which taper to a point. The prongs, made of hard metal are about 20cm long, mounted on a long wooden handle of about 70-80cm.

Function/Uses

1) It is used for turning manure during compost making.
2) It is used for loosening the soil before transplanting.
3) It is used for loading manure.
4) It is used for loading hay.

Maintenance Practice

1) Apply grease to avoid rusting.
2) Clean after use.
3) Keep in dry and cool place.
4) Paint metal parts before long storage.

(6) Hand Fork

Description: the hand fork consists of a piece of metal with three or four short flat prongs. Some have short wooden handle while others are entirely made of metal. It is mainly used in squatting position because of its small size.

Functions/Uses

1) It is used for loosening surface soil or breaking soil clods.
2) It is used for light weeding.
3) For mixing small quantity of soil or manure.
4) For working manure into the soil.

Maintenance Practice

1) Store in a dry cool place.
2) Paint, oil or grease to prevent rusting.
3) Clean or wash after use.

(7) Hand Trowel

Description: hand trowel is a small hand tool consisting of a short handle and a scoop-shaped blade. Like the hand fork.

It is mainly used in squatting position because of its small size. The curved metal blade makes it possible for a small ball of earth to be carried with seedling during transplanting.

Functions/Uses

1) It is used for transplanting seedlings;
2) It is used for nursery practices or light weeding.
3) For fertilizer or manure application.
4) It is used for digging holes for planting.
5) It is used for sampling soil/mixing soil and fertilizers.

Maintenance practice

1) Clean or wash and dry after use.
2) Straighten bent blade.
3) Sharpen blunt blade.
4) Store in a termite-free area.
5) Store in a cool, dry place.

(8) Rake

Description: Rake consists of a long, wooden handle and a strong metal head with several stout prongs.

Functions/Uses

1) It is used for levelling or spreading soil surface after hoeing;
2) For removing stones and weeds from seed-beds.
3) For covering vegetable seeds when they are broadcast.
4) For breaking up soil lumps into finer particles.

Maintenance Practices

1) Clean or remove dirt after use.

2) Store in a dry, cool place.
3) Keep away from termite attack on the wooden handle.
4) Oil metal part.

(9) Axe

Description: Axe consists of a strong wooden or metal handle onto which a solid, flat and heavy metal blade with a sharpened edge is inserted. Larger axes are held in both hands when in use.

Functions/Uses

1) It is used for felling trees,
2) For slicing wood/splitting wood,
3) For cutting wood,
4) For uprooting stumps,
5) For cutting firewood and logs.

Maintenance practice

1) It should be sharpened regularly.
2) Store in a dry, cool place.
3) Paint, grease or oil metal parts before being put away for a long time.
4) Clean after use.
5) Keep wooden from termite attack.

(10) Pick Axe or Digger

Description: Pick axe or digger consists of a long wooden handle and a metal head with double blades. One blade is sharped to form a short and rather narrow hoe while the other side of the head is sharped into a small narrow axe like blade.

Functions/Uses

1) It is used for removal of roots of trees (stumping);
2) For tilling of every hard soils;
3) For making ridges;
4) For tilling soil for farm-building erection.

Maintenance Practices

1) Clean or wash after use.
2) Sharpen blade regularly.
3) Keep in cool, dry place.
4) Keep away from rain to avoid rusting.
5) Store in termite free areas.
6) Paint, grease or oil metal parts.

(11) Headpan

Description: Head pan is a metal container with small circumference at the bottom but a larger one at the top. It has two handles which are opposite to each other.

Functions/Uses

1) It is used for the collection of harvested crops.
2) It is used for transplanting seedlings;
3) For carrying and mixing manure/fertilizers.
4) For carrying farm inputs and outputs.

Maintenance practice

1) Wash or clean after use.
2) Paint or oil before stored for a long time.
3) Keep in a cool, dry place.

4) Keep away from rain.

(12) Watering Can

Description: This is a metal or plastic can fitted with a spout which has perforated metal sheet calle rose, over its mouth. The rose is removable after use and replaceable when needed. It's also has two handles used for lifting or carrying the can.

Functions/Uses

1) It is used for light irrigation, like, application of water to crops during the dry season.
2) It is used for the application of liguid fertilizers.
3) Application of water to seedlings in the nursery or vegetable beds.
4) It is used for watering cement blocks used for constructing farm house.

Maintenance practice

1) Wash and keep dry or clean after use to prevent rusting.
2) Store or hang upside down.
3) Keep the nozzles free from blockages.
4) Store/keep in a cool- dry place.
5) Rinse with water if used for liquid fertilizers.

(13) Mattock

Description: mattock consists of a small wooden handle and a double-headed metal head. The mattock is essentially a small axe and hoe combined in one.

Functions/Uses

1) It is used for digging and uprooting small stumps.
2) It is used for loosening of stones, roots and hard plants in the soil and digging of soil.
3) It is used in clearing bush and weeding farms.

Maintenance Practice

1) Clean after use.
2) Store in a cool, dry place.
3) Sharpen metal blade.
4) Paint, grease or oil metal parts before storage for a long time.

(14) Pruning Saw

Description: The pruning saw is flat and made of flexible metal, its handle is wooden. Both edges of the saw have sharp pointed teeth.

Functions/Uses

1) It is used for cutting wood or log,
2) For pruning operations,
3) For falling of trees,
4) It is also used for cutting of budded seedlings.

Maintenance Practices

1) Sharpen the teeth regularly.
2) Grease or oil metal before storage.
3) Store in a cool, dry place.

(15) Sickle

Description: The sickle has a curved blade fitted to a short handle. The inner edge of the metal blade is sharp while the outer edge is blunt.

Function/Uses

1) It is used for harvesting fruits/cereal crops
2) For cutting grass pasture for animals.
3) It can be used for lighting weeding of vegetable plants.

Maintenance Practices

1) Sharpen the inner edge/blade regularly.
2) Store in a dry, cool place.
3) Paint or oil before storage for a long time.

(16) Harvesting Knife

Description: Harvesting knife has a long wooden pole or handle with a small curved metal blade close at one end. It also has a short, strong blade close to the curved end.

Functions/Uses

1) It is used for harvesting some crops, e.g. cocoa, oil palm, mango, orange, kolanut, etc.
2) It is also used for light pruning.

Maintenance Practices

1) Keep away from rain to avoid rusting.
2) Keep in termite free area.
3) Sharpen the blade regularly.
4) Oil or grease the metal parts before storage.

(17) Root-Loading Fork

Description: this tool is similar to the garden fork except that the prongs are usually bent at angle to the wooden handle.

Functions/Uses

1) It is used mainly to load roots, hays or silage into carts or wheel barrows.

Maintenance practices

1) Store in a dry, cool place.
2) Clean after use.
3) Keep away from rain or moist place to avoid rusting.
4) Grease or oil metal parts before storage for a long time.

(18) Hay Fork

Description: hay fork has two or three long, round and curved tines (or prongs) with a long wooden handle.

Functions/Uses

The tool is used for collecting and removing hay and livestock bedding. The fork is inserted vertically in the middle of the load and the load is carried with the prongs held upwards.

Maintenance Practices

1) Store in a dry, cool place.
2) Clean or wash after use.
3) Grease or oil metal parts before storage for a long time.

(19) Manure Drag

Description: This tool has four or five tines, sharped like those of a garden fork but with the pointed ends at right-angles to the handle to facilitate digging.

Functions/Uses

1) It is used for digging farm-yard manure.

2) It is also used for uploading farm-yard manure.

Maintenance Practices

1) Keep in a dry, cool place.
2) Oil or grease metal parts before storage.
3) Keep away from rain or moist places to avoid rusting.

(20) Wheelbarrow

Description: The wheelbarrow is a large metal or wooden container with one wheel at the front, two handles at the rear and below these, are two legs which support the container. It is pushed by raising the rear end slightly so that the main weight is taken up by the front wheel. Tools which can perform the same function as the wheelbarrow include head pan, bucket, tractor- mounted container and container driven by work animals.

Functions /Uses

1) It is used for carrying farm inputs, e.g. fertilizers, seeds, etc.
2) It is used for carrying farm outputs, e.g. harvested crops, slaughtered animals, etc.
3) It is used for transplanting seedlings.
4) It is also used for carrying load/materials to market.

Maintenance Practices.

1) Clean the tool after use.
2) Replace worn-out parts.
3) Paint the tool if necessary.
4) Store in a dry, cool place.
5) Tighten bolts and nuts on wheels properly.

(21) Crowbar

Description: this is an iron bar 90-120cm long and bent slightly at one end.

Functions/Uses

1) By inserting the pointed end underneath a load and pushing the long end down wards, the load can be gradually moved.
2) It is also used for digging holes for planting seeds.

Maintenance Practices

1) Keep in dry, cool place.
2) Grease or oil the metal part before storage for a long time.
3) Keep away from rain to avoid rusting.

(22) Bradawl

Description: This is a small tool with a wooden handle. It has a short, round blade with a small, narrow cutting edge.

Functions/Uses

1) It is used for boring holes in wood.

Maintenance practices

1) Store in a cool, dry place.
2) Keep away from rain and sun.
3) Sharpen the tool regularly.

(23) Budding Knife

Description: Budding knife is a small knife with a short, wooden handle and a short, metal blade which is sharpened at one edge. Budding.

Functions/Uses

Budding knife is used mainly in budding by vegetative propagation in citrus, cocoa, rubber, etc.

How the tool is used

An inverted T- shaped cut is made with a budding knife in the bark of the stock plant, about 20cm above the ground level. The bark on either side of the cut is lifted slightly to admit the bud, which is pushed into position so that the layers of both the scion and the stock are in close contact.

Maintenance Practices

1) Sharpen the metal blade regularly.
2) Store in a cool, dry place.
3) Use for the purpose for which it is meant.

(24) Emasculator

Description: This is an instrument used for castration of some farm animals. It consists of a pair of powerful pincers with plastic or metal handles. The pincers press the neck of the scrotum to crush the spermatic cord which supplies blood to the testes.

Functions/Uses

1) The emasculator is used to castrate some farm animals, especially the males, e.g; bull, ram, doe (goat).

Maintenance Practices

1) Keep clean always
2) Use according to instructions
3) Employ the service of an expert.
4) Keep in cool, dry place.

(25) Shears

Description: The shears are an enlarged pair of scissors or, are scissors-like in shape.

They possess two long metal blades and two handles which may be wooden, metal, rubber or plastic. The blades are sharpened at one edge and are connected to the pivot by bolt and nut.

Functions/Uses

1) Shears are used for pruning operations.
2) They are also used for trimming flower hedges.
3) They can be used for cutting flowers.

Maintenance Practices

1) Store in a cool, dry place.
2) Sharpen the blades properly.
3) Keep away from rain to prevent rusting.
4) Clean or wash after use.

(26) Secateurs

Description: It is scissors- like in sharpe but small in size.. It consists of two short, metal blades- one with a concave curve and the other with a convex curve joined at a pivot by bolt and nut. It possesses two short wooden or metal handles. It usually has a spring between the handles.

Functions/Uses

1) It is used for pruning shrubs, ornamental plants and for weeding.
2) It is used for trimming hedges or shrubs.
3) It is used for cutting bud, wood or scion and the root stock.

Maintenance Practices

1) Metal blades should be washed or cleaned after use.
2) Blades should be sharpened when necessary.
3) Keep in termite-free area to protect wooden handles.
4) Tighten bolt and nut when loosened.
5) Store in a cool, dry place.

(27) Hammer

Description: Hammer is a tool with heavy, metal head on a short wooden handle. The metal head has two ends-one is the flat-ball end and the other is prong-like.

Functions/Uses

1) Hammer is used for straightening damaged or bent components of farm implements.
2) It is used for driving nails into the wooden parts of farm structures/equipment.
3) The ball end is used for riveting.
4) The pronged end is used for removing nails from wood.

Maintenance Practices

1) Keep in dry, cool place.
2) Store in termite-free area to protect wooden handle.
3) Grease or oil metal part before storage for a long time.

(28) Mallet

Description: This is wooden hammer with a short handle and large wooden head. This shape is just like the normal hammer except that it is larger but lighter than the metal hammer.

Functions/Uses

1) It is used for driving a chisel while cutting or shaping wood.
2) For hammering materials that would be damaged by a metal hammer.

Maintenance Practices

1) Keep in a cool, dry place.
2) Use only for intended function(s).
3) Keep away from rain and termite infested area.
4) Store in tool box.

(29) Pliers

Description: A pair of pliers is a small metal tool with jaws which normally have parallel-toothed surfaces, used for gripping.

Functions/Uses

1) It is used for gripping firmly and for twisting wires;
2) For holding or handling boils and nuts;
3) For handling small objects;
4) For cutting, especially wires and other cables.

(30) Spanner

Description: A spanner is a hand tool which consists of a small bar or steel having an open or close grip or jaw at once or both ends. This fits over or clamps the head of a bolt and can be used either to turn it or hold it in position. Some spanners are adjustable.

Functions/Uses

1) It is used for loosening nuts/ bolts on farm machineries.
2) For tightening nuts on farm machineries.

Maintenance Practices

1) Keep in dry, cool place.
2) Keep away from moist areas or rain to avoid rusting.
3) Grease or oil before being put away for a long time.

(31) Screw Driver

Description: This is a small tool with a wooden or plastic handle and a pointed or narrow rod. It has a blunt end which is either flat and straight or star-shaped.

Functions/Uses

1) It is used for turning or screwing nails or screws into or out of wooden or metal surfaces.
2) Some are used to detect the presence of electric current.

Maintenance Practices

1) Keep away from rain to avoid rusting.
2) Keep in a cool, dry place.
3) Oil or grease metal parts, if it is to be stored for a long time.

(32) Nut and Bolt

Description: A bolt is a piece of metal consisting of a rod with a head at one end and a threaded area at the other end. It is used often with a nut.

Functions/Uses

Both bolt and nut are used for holding two pieces of metals or wood in position in farm machineries or structures.

Maintenance Practices

1) Keep properly in toolbox.
2) Keep bolt and nut in a cool, dry place.
3) Keep away from rain to avoid rusting.
4) Use the appropriate bolt for a nut.

(33) Screw

Description: A screw is a piece of metal consisting of a pin threaded 2/3 with a pointed end. The other bigger end has a narrow hole or cut on top in which a flat screw driver can fit in during use.

Functions/Uses

1) It is used to hold two or more pieces of metals or wood in position in farm machineries, equipment and structures.

Maintenance Practices

1) Keep tool in a cool, dry place.
2) Rub with oil or grease to prevent rusting.
3) Use appropriate plier to screw in or screw out to avoid it wearing out.

(34) File or Chisel

Description: This has a straight steel blade with a sharp cutting edge. It is about 20-30cm long with a wooden handle.

Functions/Uses

1) It is used for sharpening blades of farm tools.
2) It is used for smoothening rough surfaces of farm implements.

Maintenance Practices

1) Keep in a cool, dry place.
2) Store in termite-free area to protect wooden handle.
3) Grease or oil metal parts before storage for a very long time.

GENERAL MAINTENANCE OF SIMPLE FARM TOOLS AND IMPLEMENTS

The following maintenance practices or precautions are to be adopted to prolong the "life span" and effective use of farm tools.

1) Tools should be washed or cleaned after use.
2) Oil, grease or lubricate movable joints to reduce friction.
3) Turn or store upside-down for water to drain out where necessary, e.g. watering can.
4) Sharpen (blunt) edges or blade where necessary.
5) Paint, oil or grease metallic parts against rusting where necessary.
6) Store in a cool, dry place.
7) Replace worn-out parts.
8) Check and tighten loose nuts and bolts daily or periodically.
9) Follow manufacturer's instructions before using implement.

WEEK FIVE

FARM MACHINERY AND IMPLEMENTS

Farm MACHINERY are various types of machines and implements used In the farm.

Examples of farm machine: Tractor, bulldozer, tree puller, sheller, dryer, incubator, milking machine,ploughs,harrows,cultivators,Rodgers,planters,harvesters, sprayers.

1) Tractors

The tractor is a powerful and expensive multi-purpose motor vehicle used for lifting or pulling farm Implements, equiped with a governor system, has a power-take off shaft used in drawing farm implements (ploughs, harrows ,harvesters, planters e.t c.),has hydraulic control system which lifts mounted implements under the control, consists of an internal combustion engine which uses diesel or petrol without spark plugs. It had 4 wheels with rubber tyres.

Functions of the Tractor

i. Transportation of farm inputs, materials and farm produce.

ii. Lifting of coupled implements through the hydraulic system.

iii. Pulling of farm im0lements.m
iv. Stationary power source for equipment like shellers and grinders.

Daily maintenance of Tractor

a) Keep the tractor clean

b) Check water levels daily, top when necessary

c) Check oil level daily

d) Check Tyre pressure daily before operations

e) Check electrolyte of battery every day, top when necessary.

Periodic maintenance of Tractor

a) Service at regular intervals,

b) Worn-out tyres should be replaced and tyre pressure gauge regularly.

c) Ensure that nuts, screws and shield are checked and tightened at regular intervals

d) Replace worn-out or weld broken parts of the tractor.

e) Air filter should be cleared, oil filter should be changed during each service.

Bulldozers

Machines with broad steel blade at the front, has tract-type metal chains used for its movement. It consists of internal combustion engine which uses diesel or petrol. The bulldozer moves by the aid of sprocket, track rollers and idle rollers.

Functions of bulldozer

i. Used for clearing bush

ii. For felling trees and stump

iii. For leveling the ground.

iv. To construct roads on the farm and in rural areas.

Disadvantages of using Bulldozers for land preparation

i. Destroys the structure of the soil
ii. Leads to reduction of soil fertility
iii. Causes compaction of the soil.

iv. Cause air and noise pollution

v. Cause soil erosion and water-logging.

Tree pullers

Tree puller has a unique feature of pulling up trees from their stands with minimal disturbances of the rich top soil.

It is recommended for use instead of the bulldozer.

Advantages of using the Tree puller over Bulldozer

a) Tree puller does not compress the soil.

b) It does not remove the top soil which is very fertile.

c) Land is less prone to erosive forces.

d) The organic matter content of the soil is retained.

e) It leads to non-destruction of soil structure.

Shellers

These are machines operated electrically, mechanical or manually. It is made up of a hopper, bucket, a winder and a drum with rubber or metal spikes. It is a processing machine used to separate dry grains at 10% moisture content from the cob of maize.

Functions of sheller

-Separate the seeds from the husk or cob.

- Shellers are used in removing of nuts, grains (rice, maize, cowpea),e.t.c.

Dryers

Used to reduce moisture content of commodities, it operates by electricity.

Functions of Dryers

i. Used for drying plant materials.

ii. Used for drying animal products

Incubators

They use different types of fuel (e.g. oil lamp, electricity, e.t.c.) to supply the heat required.

Functions of incubators

Machines used for hatching fertilized eggs artificially. It takes 21 days for fertilized eggs of domestic fowl to develop and hatch in incubators.

Types of incubators

a) Natural draught or table type

b) Forced draught or cabinet type

Conditions for incubator to function

Before fertilized eggs are placed, the incubator should be run for 12-24 hours. For incubators to function properly, they require the following conditions.

i. Temperature range of 37C - 39C

ii. Relative humidity of 50-70%; an optimum level being 60%.

iii. Adequate ventilation

Components of an incubator

An incubator is made up of a setter and a Hatcher. The fertilized eggs are kept in the setter for 18 days while for the remaining three days before hatching the eggs, they are placed in the Hatcher.

a) Heater (lantern, electric heater).It supplies heat to incubator.

b) Control unit (damper or thermostat).It regulates the temperature of the incubator.

c) Heat distribution be unit

d) Hygrometer (Basin of water, cotton wool or humidifier) : It regulates the relative humidity of the incubator. It is the relative humidity mediation.

e) Felt tray (egg racks or egg trays)- Hold eggs and reduce cracking.

f) Thermometer - To detect the degree of hotness or coldness of the machine.

g) Fan or air circulation unit or vent- For ventilation

h) Egg turning device- For regular turning of eggs

i) Insulator -To prevent heat loss

Brooder: The device used in which the newly hatched chicks are tended by the provision of heat until they develop enough feathers

j) Egg tray- Eggs are arranged in it .

Problems Associated with the functioning of the components

a) If it is electrical incubator- Power failure, irregular power supply

b) Thermostat: High or low voltage or current

c) Fan- Irregular power supply, over heating through over- usage .

d) Thermometer: Loss of sensitivity, cracking or breakage of the bulb/ thermometer

e) Ventilation: Blockage of vents

f) Water basin: leakages, drying up of water contents.

g) Insulator : Malfunctioning of the insulator unit.

h) Turning device for egg tray, Loose nuts

To ensure uniforming if Hatching of Eggs in Incubator

i. Setting eggs uniformly in the tray
ii. Timely and regular turning of eggs
iii. Ensure suitable environmental condition.
iv. Properly handling of the eggs.
v. Setting eggs at the same time
vi. Select eggs at the same time

Holding period for eggs before setting should not be more than 14 days.

Operations needed after the hatching of Eggs in the Hatchery

- Sexing of chicks

- Drying of chicks

- Intra-ocular (1) NDV vaccination

-Sorting out abnormal chicks

- Packing normal chicks

Milking machines

The milking machine is made up of an electric motor. vacuum pump, source of power, trap pail, vacuum controller. gauge, gap, milk tank and four teat cups.

Functions of milking machines

Milking machines are used for extracting fresh milk mechanically from the udder of cattle (cow), sheep (ewe) and goat (doe).

How the machine works

The milk is removed is removed from the teat when the vacuum is applied to the outside of the test cup liner. When the teat cup liner collapses, the teat is massaged and this action helps to prevent congestion in the test walls and ensure regular flow of milk be from the udder into the teat cups.

Milking machines are more efficient. They save labour and reduce the danger of contamination.

The main substance that is extracted by the milking machine from farm animals is milk. The process by which milk is collected with the milking machine bis made fit for human consumption is called pasteurization.

Economic Importance of milk

i. It is a source of protein in food

ii. It can be used in raising foster calves, lambs or children.

iii. Used in the preparation of baby food.

iv. It is used as an extender in artificial insemination practices.

v. It is used bin the preparation of dairy products e.g. butter, cheese, yoghurt e.t.c.

Other Tools/Equipment used in Dairy cattle farm

i. Burdizzo
ii. Buckets
iii. Milking pail

iv. Milk testcup

v. Auger

vi. Drenching bottles

vii. Cheese cloth
viii. Water trough

Harmful contaminants of Milk in a Dairy Farm

i. Stones/pebbles

ii. Bacteria

iii. Urine

iv. Excrets

iv. Body hair

vi. Droplets from sick animals

viii. Dirts from tools

viii. Dusts

Precautions to be Ta I'll During Milking

a) Thorough cleaning of animals before milking.

b) Fore- milk must be tested with test cups

c,) Handle milking with care

d) Milk animals in clean environment.

,e) Observe hygienic or sanitary rules.

TRACTOR- COUPLED IMPLEMENTS

These are inol which are coupled or attached to a tractor in order to enable it to perform it's work.

Examples of tractor- coupled Implements

- Ploughs

- Harrows

-Ridgers

- Planters

- Cultivators

- Harvesters

- Sprayer

- Mower

- Harvester.

The ploughs

The plough is a primary tillage (or soil cultivation) implement .It is the first implement required in land preparation. It is mainly driven by work animals or tractor.

Types of ploughs

a) Disc plough

b) Mouldboard plough

Disc plough

It is a strong implement adapted to tropical environment where the soil contains stones, hard pans and roots of plants. Parts of disc plough include beam or frame, coupling point or hinge, linkage point and scrapper, sledge or knife, concave disc, rotating hubs or disc bearing, furrow wheel or balancing disc, spring, standard and beam cap.

Mouldboard plough (primary tillage implement)

It is used for land preparation. It is adapted for use in temperate or light soil where there are no rocks, hard pans and plant roots. The mouldboard is not as strong as the disc plough. Parts of the mouldboard plough include beam or frame, coultier or vertical disc, share or share point, mouldboard and standard.

General functions of Disc and mouldboard ploughs

i. Bite the soil and turn it over to form soil clods or lumps.
ii. They help to mix the soil together
iii. They can be used to control weeds.
iv. They bury plants and crop residues, thereby Improving the fertility of the soil.

Reasons why disc ploughs are preferred to mouldboard ploughs for soils in West Africa

a) The soil often contains many obstacles (rocks, stumps)

b) Soil surface are generally hard in West Africa

c) Disc plough cuts deeper than mouldboard plough.

Harrows

It is a secondary tillage implement used for land preparation, driven by work animals or tractor. It is used after ploughing and before ridging. Harrow breaks up soil lumps and level the surface after ploughing. The popular type of harrow is the disc harrow, it works on the same principle as the disc plough. The disc harrow consists of numerous small discs, spaced closer on a common shaft to a gang. There may be one or two pairs of gangs working in the same direction or in opposite direction.

Important parts of a harrow are handle, drawbar, scrappers, steel discs or discs and wheels.

Spring-tine Cultivator (secondary tillage implement used for land preparation).

This implement can be used immediately after ploughing and before harrowing or ridging

It consists of a rectangular beam in which strong, pointed and vertical stalks are attached. The vertical stalks are bent forward to enable it to till the soil and withstand obstacles within the soil. The vertical stalks help the time to overcome obstruction because it is strong, pointed and bent forward.

Ridgers (secondary tillage implement used for land preparation).

The ridger is used after harrow and before planter

Types of ridgers

a) Disc ridger

b) Mouldboard ridger

Both work on the same principle, but disc ridgers, like all disc implements, are better adapted to tropical environments. There are five discs in each part facing each other. It has a strong metal beam linking all the discs. The beam is connected through strong frames to a point of attachment to the tractor..

The implements is made entirely of strong metal. Important parts of the disc ridgers include coultier, scrapper, standard and coupling point.

Maintenance of ploughs, Harrows, cultivators and Ridgers

i. Keep implements clean
ii. Ensure that nuts, caps, screws or shields are tight.
iii. Grease metal joints or bearings regularly.
iv. Replace worn-out parts.
v. Keep implements in cool and dry sheds.

Planters

The planter has a large container or hopper. It also has a ratchet and an agitato inside the container. Also present are spaced couters or furrow openers in front of the hopper. There is also a furrow- covering device behind the hopper and a roller behind the furrow- covering device. There are two long handle ls for the operator. The whole equipment is mounted on two wheels.

Functions of planter

These are machines designed primarily to plant seeds of crops such as cotton, maize, Guinness corn, rice, cowpea.

Types of planter include; Broadcast crop planter, Row crop planter, Precision planters, Grain Drill planter.

Maintenance of the planter

i. Dismantled and washed or cleaned after use.
ii. Stored under cool, dry environment.
iii. Metal parts should be oiled or greased to prevent rusting.
iv. Bolts and nuts should be inspected and tightened regularly.
v. Replace worn-out parts.

Harvesters

These are machines designed primarily to facilitate the process of harvesting various crops,

Types of harvesters

Mower (clear weeds)

Forage Harvester (To harvest and chop green row crops)

Combined Harvesters (Harvesting and threshing of grain crops).

Sprayers

Equipment designed to spray certain chemicals in various farm operations.

Types of sprayers include knapsack sprayer, motorized sprayer, tractor-mounted sprayer, helicopter-mounted sprayer.

Maintenance of sprayer

i. Properly rinsed with water after use to get rid of left over chemicals
ii. Clean the nozzle and rinse with water to remove left- over chemicals

Iii. Keep in cool, dry place.

iii. Turn upside-down after use or cleaning.

WEEK SIX

TOPIC: PROBLEMS AND PROSPECTS OF MECHANISATION – NOTE

MEANING OF MECHANISATION

Farm mechanization is the application of principles and technology in agricultural production, storage and processing on the farm.

Farm mechanization is applicable to land preparation, planting, fertilization application, weeding and crop harvesting, rearing, care and feeding of animals as well as processing and storage of farm produce, using appropriate farm machinery.

Problems of farm mechanization

a) Land tenure system: The type of land tenure system (communal) does not allow for large farm holdings suitable for mechanization.
b) Scattered farm holdings: Scattered farm holdings are also not conducive or economical for mechanization, especially in West Africa.
c) Poverty of farmers: Most farmers, especially in West Africa are very poor and cannot afford the cost of tractors and farm implements.
d) Inadequate facilities (machinery): The facilities or machinery for fabricating and repairing farm implements are grossly insufficient where they are available.
e) Bad topography: The topography of most West African landscape is too rough and unconducive for farm mechanization.
f) Varied soil types: Soil types are extremely varied and the machines to use on them have not been developed locally. West African countries, Nigeria for instance, still depend on imported machinery which is too suitable for our soil.
g) Inadequate spare parts: Availability of spare parts is a major problem as these parts are still being imported.
h) Inadequate technical manpower: Available technical manpower to operate or service the implements and machines is not adequate.
I) Problems of stumps and logs: During clearing, heavy stumps and logs are usually left behind, and they constitute additional problems in mechanization.

Advantages of farm mechanization

Farm mechanization has the following advantages:

1) Timeliness of operation: Farm mechanization ensures that all farm operations are done and completed within a short period of time.
2) It saves labour: In farm mechanization, most human are substituted with machines. Hence, labour saved could be employed elsewhere.
3) It reduces health hazards: These include those posed by knives, hoe, stumps, pest, etc.
4) It reduces drudgery: Farm mechanization makes it easy to avoid unpleasant manual jobs.
5) Increase in farm revenue: As a result of mechanization, farmers become richer due to high yield.
6) It encourages large scale farming: Farmers are capable of working on large farms and, hence, reap heavy harvest.
7) Increase in output: Mechanization makes it possible for farmers to have increase in output (production, harvest or yield).

8) It promotes specialization of labour: Farm mechanization enables people to become specialized in certain operations within the farm.
9) Co-operation among farmers: Mechanization enables many farmers to come together and pool their resources together, thereby promoting or encouraging co-operation among farmers.
10) It saves time: Mechanization translate quickly the products of man's brain into reality.
11) Reduction in cost of operation: Mechanization leads to reduction in the cost of agricultural operations per unit output.
12) Improvement in quality of produce: Farm mechanization usually improves the quality of some farm produce, e.g. rice processing.
13) Availability of labour for other sectors: mechanization also helps to release labour to other sectors of the
14) Use of less human labour: Mechanization helps to accomplish lots of work with less human labour.

Disadvantages of farm mechanization

Farm mechanization has the following disadvantages:

1) High cost: farm mechanization, due to the numerous machines involved, is usually expensive to operate.
2) Displacement of workers: in farm mechanization, very few workers are required; hence, many people will be out of job when mechanization is introduced.
3) Compaction of soil: mechanization leads to compaction of soil due to the movement of heavy machines.
4) It causes environmental pollution: mechanization causes environmental pollution due to smokes emanating from machines, chemicals and fertilizer usage.
5) Degradation of landscape: mechanization ensures the degrading of landscape as a result of continuous excavation.
6) Land tenure system: land tenure system may hinder efficient of tractors due to small holding of farmlands.
7) Destruction of soil structure: the soil structure can easily be destroyed due to continuous movements and usage of machines.
8) Redundancy of farm labour: with farm machines working on the farm, the work can easily be completed, and this situation can create redundancy in farm labour.
9) Few crops can be mechanized: very few crops like maize, rice, guinea corn, millet, etc. can easily be mechanized.
10) Inadequate technical know-how: there is always inadequate technical know-how on the use and handling of the farm machines and equipment.
11) Damage to crops: most crops are usually damaged during mechanized farm operations, especially if care is not taken.
12) Inadequate spare parts: most spare parts or replaceable parts are not always available. Therefore they may be scarce or inadequate.
13) High cost of maintenance: there is usually high cost of maintenance involved, especially for heavy machines.
14) Spread of pests and diseases: mechanization helps to spread pests and diseases through contaminated machines.
15) Human control: mechanization needs human labour to control it.
16) Unstable fuel supply: unstable supply of fuel affect the working of machines.

LIMITATIONS OF FARM MECHANIZATION

Factors limiting agricultural mechanization in Nigeria can be discussed under the following major headings:

Economic limitation

- Machines are not readily available in the country.
- Most farmers are poor and cannot afford them.
- Cost of hiring the machines is high/exorbitant.
- Cost of maintenance is high.
- Operators of machines demand high pay/wages which most farmers cannot afford.

Technical limitation

- There is lack of technical know-how of the machines.
- Experts on these machines are not readily available.
- Mode of operations of most machines are not known
- Most of the machines are not adapted to our local environment/needs.
- Very few schools exist for the training of machine operators.
- Lack of maintenance
- Most machines are imported.
- Replacement parts are not available.
- Inadequate trained personnel to repair farm machines.
- Facilities for repair and maintenance are lacking.
- The very few trained personnel are not always available when machines breakdown.
- Small farm holdings
- Land tenure system encourages fragmentation of land which cannot be mechanized.
- Fragmentation of land discourages mechanization.
- Agriculture is practice by peasant farmers.
- Peasant farmers have small area of farmland.

POSSIBLE WAYS OF IMPROVING AGRICULTURE THROUGH MECHANIZATION

1) Farmers should be educated to accept modern system of farming, especially in the areas of mechanization.
2) Government should provide loans to enable farmers to purchase farm machines.
3) The land tenure system should be reviewed to enable farmers to acquire large hectares of land.
4) Simple and less expensive machines should be developed.
5) Farmers should form co-operative societies to enable them to pool their resources together to buy farm machines.
6) Government should establish agricultural engineering schools or institutions to train personnel and fabricate simple machines. Functions of the forms and parts of the body. It is very important for the farmer to understand the anatomy and physiology of farm animals because it will enable him to know more about the nutrition, reproduction, and management of the animals.

WEEK SEVEN

TOPIC: SOURCES OF FARM POWER – NOTE

Power is defined as the rate of doing work or the rate of expenditure of energy. Farm power can be obtained from the following sources:

- Human power
- Animal power
- Mechanical power
- Electrical power
- Solar power
- Wind power
- Water power
- Biogas.

HUMAN OR MANUAL POWER

Human power is derived from the power provided by human beings (fig.9.1). it is the most common source of power in farm operations. With the aid of his intelligence, man uses his hand to perform certain farm operations. Human labour is used with traditional tools. It involves more people than all other sources of power. Human labour can be hired; it may be skilled or unskilled.

Farm operations which require human power

Human power is required in all farm operations. In crop production, for example human power is required in:

- Land clearing,
- Stumping
- Land preparation, e.g. ploughing, hallowing and ridging
- Weeding
- Harvesting
- Storage
- Food processing

Advantages of human power

1) Man uses his intelligence to control the work he does.
2) It is easily available in all farm operations
3) It has control over all other sources of farm power.
4) It is the most intelligent source of power used for precision jobs.
5) It is easy to control and readily available
6) It is used with traditional tools.
7) It can be used for a job that requires precision.

Disadvantages of human power:

1) Human power is not stable. A normal human power is about 75W and decreases to about 20W when it is used continuously; that is, output is low.
2) It cannot perform tedious farm operations like land preparation, planting, weeding, etc. without being exhausted
3) Poor state of health of the individual may affect his performance.
4) It may be expensive.
5) Human labour can easily get fatigued.
6) Human beings can easily die
7) Efficiency decreases with age.
8) It consumes time and is less efficient.

ANIMAL POWER

This is the type of power derived from some animals which are used to perform certain farm operations. Animals like the bull (fig. 9.2), are used for pulling ploughs, harrows, planters, ridgers while donkeys, camels and horses are used for transportation of farm produce. Animals can be hired.

Draught animals such as oxen, bullock, etc. are yoked. The yoke is attached to any farm implement. Animal drags the implement while man controls the direction of the implement for the tillage of soil.

Qualities of a good draught animal

1) It must have a good body size or deep barrel.
2) It must have strong hind limbs and a sloping rump.
3) It must have strong hooves, good stride and stance (gait).
4) It should be preferably male or castrated.

5) Draught animal must be docile.
6) It should be healthy.
7) It must be energetic or strong or powerful.

Precautions to be observed when using draught animals

1) Treat animals fairly to prevent them from being hostile.
2) Apply muzzle.
3) Do not overwork draught animals.
4) The best time to use them to work is early in the morning or evening.
5) Make sure that animals are healthy.
6) Keep them in a healthy environment.
7) Feed and provide them with adequate water.

Farm operations which require animal power

Animal power is required in the following farm operations:

1) For carrying people.
2) For drawing ploughs.
3) For drawing harrows.
4) For drawing ridgers.
5) For transporting loads e.g. farm produce, fertilizers, chemicals, etc.
6) For drawing planters.

Advantages of animal power

1) It can perform more tedious jobs than man, because the output is about 500W for a bull, for instance.
2) It can handle many farm operations.
3) Initial outlay is cheap relative to cost of machines, i.e. it is cheap to purchase.
4) It can be controlled or easy to operate.
5) It has a relatively low maintenance cost compared to machines.
6) Animal do not get fatigued easily, compared with man.
7) It can operate in rugged terrains.
8) It can be used in evacuation of produce from inaccessible areas.
9) Animal power removes drudgery or it makes work easier.

Disadvantages of animal power

1) Huge amount of money is needed to feed and maintain the animal.
2) It cannot perform at certain periods of the day such as in the afternoon.
3) Diseases may affect the efficiency of the working animals.
4) Poor handling of the animals by the operator may result in poor performance and even refusal to work.
5) The use of animal is restricted to certain climatic zones, e.g., tsetse fly-free zones.
6) Unsuitable for processing agricultural produces as they may eat up the products.
7) It is not suitable for large scale production.
8) Animals can die and get fatigued easily.
9) Power output is very low.

MECHANICAL POWER

Description: This requires the use of machines and engines like planters, harvesters, ploughs, harrows, ridgers to carry out various farm operations like ploughing, harrowing, weeding, planting, harvesting, processing and transportation. They facilitate the cultivation of large hectares of land. Machines are used in tractions, grinding, food processing and others. Examples are tractors , generators, water pump, bulldozers, etc.

Farm operations which requires mechanical power:

Mechanical power is required in many farm operations which include:

- Ploughing
- Stumping
- Planting
- Harrowing
- Ridging
- Harvesting
- Weeding
- Traction
- Grinding
- Food processing
- Transportation of inputs and outputs.
- Feed milling.

Advantages of mechanical power

1) It can handle more land area per unit of time.
2) It works faster and more efficiently
3) It reduces labour cost and overall cost of production.
4) It is not prone to diseases.
5) It can perform a wide range of farm operations.
6) They reduce farm drudgery or they make farm work less tedious.
7) They make farm operations timely.

Disadvantages of mechanical power

1) It requires high capital investment or it is costly to purchase.
2) It requires lots of technical skills to operate.
3) It can lead to displacement of labour (unemployment).
4) It cannot be used by small scale farmer.
5) It can cause air pollution through gases from exhaust pipe.
6) It is not easily available.
7) It requires high cost of maintenance.
8) It can destroy soil structure.

ELECTRICAL POWER

Electrical power is the type of power derived from electricity or generator. Electricity is used for many purposes. It is a neat or clean source of energy. It is efficient and reliable, but expensive.

Farm operations which requires electrical power

Electrical power is required in the following farm operations:

- Refrigeration
- Incubation
- Milking machines
- Drying of products
- Brooding of chicks
- Shelling of fruits/seeds
- Feed milling/grinding/mixing
- Most processing operations e.g. par boiling, threshing, winnowing, etc.
- Defeathering/plucking
- Debeaking
- Candling
- Egg grading.

Advantages of electrical power

1) It cannot contaminate products, thus making them safe for human consumption.
2) It is a cheap source of power
3) It is very versatile, i.e. it can be used for various services and at different times.
4) It is very neat.
5) It aids fast operation or increases production.
6) It is very dependable.
7) It is easy to operate
8) It is efficient or it saves labour.

Disadvantages of electrical power

(vi) Its supply is not always regular, especially in developing countries, e.g, Nigeria.
(vii) It is dangerous or fatal, if carelessly handled.
(viii) It must be strictly controlled or regulated.
(ix) Its maintenance cost may be high.
(x) It is very expensive.
(xi) It can cause fire hazards.
(xii) It cannot be widely used in field operations.

SOLAR POWER

Solar energy is derived from the radiation light and heat reaching the earth's surface from the sun. The energy from the sun is the ultimate source of energy. Solar energy is converted into electrical energy by solar panels installed in buildings.

In other words, solar energy is trapped by photo-voltaic cell or solar collectors or panels. It is then converted to electrical energy which can be stored in batteries. It can be used directly.

Farm operations which requires solar power

Solar power is required in the following farm operations:

1) Generation of electrical power.
2) It is used in heating of farmstead.
3) Processing of farm produce, e.g. drying of materials such as melon, cocoa, maize, meat, fish, etc.
4) Electricity generated can be used for several farm operations.
5) Solar energy by crops for photosynthesis.

Advantages of solar power

1) It is a cheap source of energy.
2) It is free.
3) It is easily available.
4) It is a neat source of energy

Disadvantages of solar power

1) It is only available during the day.
2) It cannot be adjusted and stored.
3) Its supply cannot be controlled.
4) It is expensive to harness and store.
5) Excess of it can cause transpiration and evaporation.
6) It fluctuates in supply.

WIND POWER

Wind power is generated by wind movement. Its use in windmill helps to pump water out of a borehole to a generating set for the production of electricity. Wind power can be converted to mechanical power.

Farm operations which requires wind power

Wind power is required in the following farm operations:

1) Operation of windmills in which the force of the wind is converted into electricity.
2) It is used in winnowing, i.e. separation of chaff from grains.
3) It is used for drying produce.
4) It can be used to generate electrical power.
5) It can be used for propelling ships.
6) It may be used in pumping water out of a borehole.

Advantages of wind power

1) It can serve as alternative to electrical power .
2) It is cheap.
3) It is available everywhere.

Disadvantages of wind power

1) Its supply is sporadic and uncertain as power depends on the wind.
2) Its operation is expensive compared with the energy it generates.
3) It is limited to certain farm operations.
4) It cannot be stored and it is difficult to control.
5) Efficiency is highly varied.

WATER POWER

Water power is the power derived from water flowing in rivers, streams and dams. Water is used in hydro-electric stations to drive the turbines.

Farm operations which required water power

Water power is required for the following farm operations:

1) In hydro-electric power stations water is used to drive turbines that generate electricity.
2) The electricity so generated can be used for many farm operations.
3) It is used in transportation, e.g. logs, farm goods, etc.
4) It is used to operate steam engines.
5) It is used by crops for normal growth.
6) It can be used for processing farm products.

Advantages of water power

1) It is very cheap.
2) It is easy to be harnessed.
3) It can easily be converted to other forms of energy.

Disadvantages of water power

1) Low level of water can hinder low electricity output.
2) It is not available in all areas.
3) Supply is affected by weather.
4) It does not supply power directly.
5) It must be harnessed to generate power.
6) It could be destructive if carelessly handled.

Biogas

Biogas is a new method of generating power by making use of farm wastes, especially animal dung. Animal dung is carefully collected and processed through scientific means to produce certain gas that provides power.

Animal droppings mixed with water are accumulated in air tight device called digester or dome. As it decays anaerobically by microbes, hydrocarbon (methane) which is a colourless and odourless gas is released. This hydrocarbon is stored and used for heating and lighting.

Advantages of Biogas

2) It constitutes a cheap source of power.
3) It can convert chemical power in dung to heat power.
4) Power derived from biogas can be used as source of heat for brooding chicks.
5) The power can also be used for cooking and drying.
6) It can easily be controlled.

Disadvantages of biogas

1) It is not a common source of power.
2) It requires expertise which may not be easily available.
3) It may be expensive to set up and maintain.
4) It is only limited to where animals are reared on commercial basis, where dung is easily available.

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