

**PIVOTAL TEACHER TRAINING PROGRAMME  
[PTTP]**

**COURSE BOOK**

*ON*

**AGRICULTURAL SCIENCE**

<b>Module 1</b>	<b>MEANING, HISTORY AND IMPORTANCE OF AGRICULTURE</b>
<b>Module 2</b>	<b>PLANT FORMS, CLASSIFICATION AND USES OF CROPS</b>
<b>Module 3</b>	<b>AGRICULTURAL IMPLEMENTS AND FARM MACHINES</b>
<b>Module 4</b>	<b>SOIL</b>
<b>Module 5</b>	<b>METHODS OF TEACHING AGRICULTURAL SCIENCE</b>
<b>Module 6</b>	<b>FARMING, CROPPING SYSTEMS AND ANIMAL PRODUCTION</b>
<b>Module 7</b>	<b>PRACTICAL AGRICULTURE</b>
<b>Module 8</b>	<b>FORESTRY AND WILD LIFE MANAGEMENT</b>

**National Teacher's Institute, Kaduna**

**JUNE, 2013**

## **FOREWORD**

The National Teachers' Institute was established by the Decree No. 7 of 1978 to organize programmes for training, developing, upgrading and certification of teachers at all levels. In pursuance of this mandate, the NTI has trained and or upgraded over two million teachers at various levels (PTTP, NCE, ADE, and PGDE) through Open and Distance Learning (ODL) since its inception.

Following Federal government's introduction of the Universal Basic Education (UBE), And the mandate for the Institute to train teachers to meet the nation's urgent need for a large number of qualified teachers through Pivotal Teacher Training Programme (PTTP), the Institute produced course books in Education, English language, Mathematics, Integrated Science, Social Studies, Physical and Health Education, Hausa, Igbo, Yoruba, Christian Religious Studies, Islamic Religious Studies, Home Economics, and Agricultural Science in 2000. Since then, thousands of teachers have benefitted from this broad-based laudable programme and a growing number of states are demanding for it.

In the light of the above, and the need to include more up-to-date developments in pedagogy, the Institute deemed it necessary to revise the course books as well as make them reader-friendly and much less cumbersome. These 2013 second editions are also closely tailored to the latest NCE curriculum. Most of the authors are very seasoned teacher educators from the university faculties of education and colleges of education. The course books combine meaty substance in subject matter and effective current teaching methods.

Without any breach of modesty, we believe that our PTTP trainees will benefit immensely from these course books. All those who have contributed, in one way or the other, deserve special commendation for this effort.

*Dr. Aminu Ladan Sherehu*

**Director General & Chief Executive**

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## **MODULE 1: MEANING, HISTORY AND IMPORTANCE OF AGRICULTURE**

### **UNIT 1 MEANING OF AGRICULTURE**

#### **INTRODUCTION:**

Many people look at Agriculture as mere cultivation of land and rearing of animals. This view of agriculture is very narrow. Agriculture is application of science to produce crops, livestock and forestry resources.

The food we eat, the clothes we wear and the house we live in come from the produce of the farm. As agriculture develops, more agro-based industrial new materials will be produced.

#### **OBJECTIVES:**

At the end of Unit 1 you should be able to:

- a. Explain what Agriculture really is;
- b. Identify what Agriculture involves and its branches;
- c. Explain agriculture as a business provider of industrial raw materials and a profession.

#### **HOW TO STUDY THIS UNIT**

Read through this unit with care.

Study the unit step by step as the points are arranged.

**NOTE: ALL ANSWERS TO ACTIVITIES AND ASSIGNMENT ARE AT THE END OF THIS BOOK. THIS APPLIES TO EVERY OTHER UNIT IN THIS BOOK.**

#### **WORD STUDY**

**Land:** The gift of nature which is the outer covering of the earth surface used for production of food and cash produce for human use.

**Farm Input:** These are the materials utilised in agricultural production e.g. chemicals, seeds, manure (fertilizer, farmyard manure), animals and plant species.

**Produce:** These are farm products e.g. Yam, cotton, palm oil, latex hides and skin, eggs, meat etc. They are also called farm outputs.

**Occupation:** One's work for earning a living.

**Industry:** An established firm or company that utilises the agricultural products e.g. Feed mill, processing plant (e.g. vegetable).

**Machinery:** The machines and implements used for production e.g. tractor, Plough, ridger, combined harvester.

Agriculture is quite a difficult subject to define because of its extensiveness. Plato said "Agriculture is the mother and nurse of all other activities because when agriculture flourishes, all other things would flourish, when agriculture fails civilization fails.

A broad and simple definition of agriculture states that it is the science and art of cultivating the land to produce plants and raising of animals for human consumption; and production of forest resources. Agriculture as an occupation provides employment.

As a profession it strives to develop and keep farmers informed of new and better methods of farming e.g. individuals, Agriculture Science Teachers, Agriculture, Research Specialists, Agricultural extension

officers and so on. In order for Agriculture to develop into modern industry, farmers must make use of those who supply the inputs of production namely: machinery, chemicals, breeds of animals, finance and insurance. This is where agriculture starts.

### ACTIVITY I

1. Analyse the definition of agriculture
2. Discuss agriculture as an occupation and as a business
3. Name agricultural professions you know

### SUMMARY

In this unit you learnt that:

- A proper understanding of what agriculture is shows that it is
  - a. an art
  - b. a science
  - c. an occupation and profession
  - d. a business
  - e. an industry
- Farming as an aspect of agricultural activity is the production of plants, animals, a business and occupation and a way of life
- Farm inputs are fertilizers, chemicals, insecticides, vaccines, seeds, breeds of animals. Farm output are produce like maize, cotton, hides and skin, eggs, meat, palm oil, latex etc.

### ASSIGNMENT

1. Explain the term Agriculture
2. Agriculture as an industry has farming as its centre. Explain
  - I) What are the occupations or opportunities provided by agriculture.
  - II) Name some professions in Agriculture.

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## UNIT 2 THE HISTORY OF AGRICULTURE

### INTRODUCTION

From the beginning of time, the first concern of man has been food clothing and shelter in that order. Agriculture being one of the oldest industries, had its origin traced to the earliest human societies. The existence of man from the pre-historic era up to the era of the ancient civilization depended on the ability of the individual to hunt and get the food for consumption. The evolution or the development of modern man from about 50,000 years ago marked the beginning of the era of hunting and gathering of food by man.

The aim of this unit is to keep you informed of how agriculture started and the trends of development or changes and the activities associated with early agriculture.

### OBJECTIVES

By the end of this unit, you should be able to:

- I. Narrate how agriculture came into being;
- II. State the two periods In the history of agriculture and their distinct features:
- III. Enumerate the pre-historic time when animals and crops were domesticated
- IV. List the tools used for hunting and crop cultivation

### WORD STUDY

Paleolithic age:	Old Stone age
Neolithic age:	New stone age
Prehistoric era:	Era before agriculture started.

The beginning of mankind was about one million years ago. There are two periods in the history of agriculture namely the Paleolithic age and Neolithic age.

The prehistoric age of agriculture's a stage food cultivation and hunting. It lasted from the earliest man to about 10,000 years ago. It covered the following two periods,

#### **Paleolithic Periods**

This is the Old Stone Age. People lived by hunting and fishing, and gathering of wild berries, nuts and fruits. They had no idea of fire hence they ate their food and animal raw. They move from place to place in family group in quest of food. They have no property except their weapons made of horns, bones of animals and wooden club. Neither plants nor animals were domesticated.

People did not settle in villages they wandered from place to place, searching for food.

#### **Neolithic Period (New Stone Age)**

This marks the beginning of the era when man started the domestication of plants and animals. The roaming about for food came to an end.

Domestication of crops was probably not thought of by man from the beginning. It was by accident that agriculture was discovered by a woman who went out to gather berries. Some fell out and later germinated, She was surprised to find them germinated, grew and bore fruits.



Thence forth people settle down to cultivate crops and stopped roaming about as before. Increasingly, men began to turn to farming instead of hunting. With his more settled way of life, man learned to cook, weave clothes, make pottery, and produce stone tools for grinding. They produced fire by striking stone by metal. The Neolithic type of agriculture started in the Nile valley of Egypt. It reached central Europe at about 3000 B.C. and to Scandinavian countries. Some of the animals domesticated were mainly goats, sheep, cattle and horses. The horses were used for riding and chariot races.

### ACTIVITY I

1. The history of agriculture is phased to two periods. Name the period. Discuss briefly each period bringing out their distinctive features.
2. Describe how early agriculture was discovered.
3.
  - a. List out the animals and crops reared at the early agriculture
  - b. What are the first sets of tools used in agriculture?

### SUMMARY

In this you have learnt that:

- The Prehistoric age of agriculture was from 1,000,000 to 5000 B.C.
- The history of agriculture is made of two period namely:
  1. **Paleolithic age** known as the **old stone age**.
  2. **Neolithic age** known as the **New stone age**.

Paleolithic age (old stone age) 8000 - 10,000 years:

- People lived by hunting, fishing and gathering of wild berries, nuts and other fruits.
- There was no idea of making fire
- Animals were eaten raw
- People wandered from place to place in quest of food.
- There were no villages, people just wander about, no properties except weapons made of horn, bones, wooden clubs and stones.

Neolithic Age (new Stone Age)

This was a period crops and animal were domesticated.

- Agriculture was accidentally discovered. People settled make homes to cultivate and rear animals.
- Neolithic period probably started from the Nile valley of Egypt, spread to (central Europe and then to Scandinavian countries.
- Animals reared were mainly goats, sheep, cattle and horses.
- Crops grown were millet, Wheat, barley, oath, nee, sorghum, tobacco and peanut.
- Shifting cultivation was practiced.
- Wood ashes bones of animals were source of manure.
- Tools used were jaw bones of animals, sharpened clipped flint with cutting edges.
- Grains were threshed by flail or trampled by cattle or human feet.

### ASSIGNMENT

Trace the trends of development in Agriculture from early farmers to the present farmers indicating the changes that has taken place.

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## UNIT 3 TOOLS OF EARLY FARMERS

### INTRODUCTION

The history of agriculture started when man wandered from place to place to gathering fruits, berries and hunting wild animal to satisfy his need for food. This early man gradually learned very crude and primitive ways of planting, cultivating and harvesting and processing. The early man had no property than weapon used for hunting and fishing. But on the discovery of agriculture, the early man settled down at a place for domestic plants and animals. This was the Neolithic age. In addition to the crude weapons for hunting and fishing, the early man also own crude tools that eased their manual work on the farm land.

### OBJECTIVES

At the end of unit 3, you should be able to:

1. List out the Early farming tools;
2. State the uses of the different tools;
3. Identity and differentiate these tools from the modern farmers' tools;
4. State the care and maintenance of the tools.

### WORD STUDY

Neolithic	New stone age
Polished	Smooth and shining
Flint	hard kind of stone that can produce sparks when stuck against metal.

### TOOLS OF EARLY FARMERS

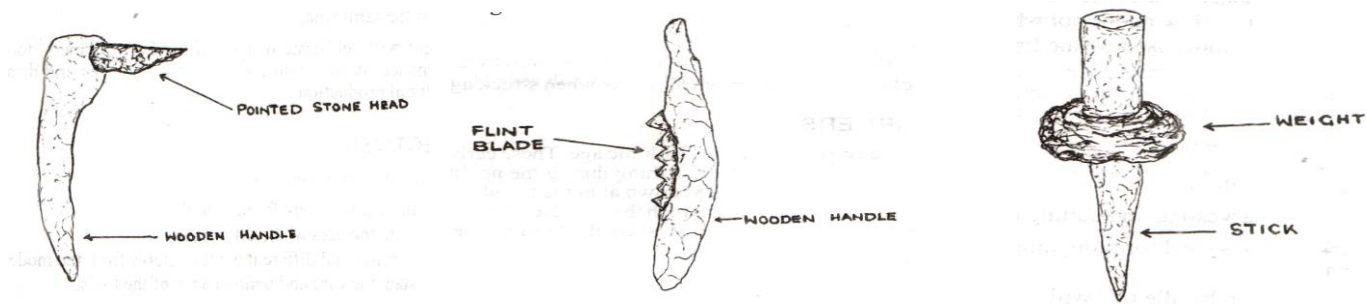
Agriculture was accidently discovered during the Neolithic age. These early farmers had no property except weapons used for hunting and fishing during the Neolithic age. But as soon as agriculture was discovered, they settle down at home to cultivate plants for their food. They fashioned out or fabricated tools which they used to carry out the cultural operations involved in farming, harvesting and processing the farm products.

The early farmers tools include:

- (a) Neolithic hoe.
- (b) Neolithic sickle.
- (c) Wooden digging stick.

**NEOLITHIC HOE:** This is a simple hoe, made of wooden handle and pointed stone. The sharpened pointed stone head tied at the oval fore end of the wooden handle that is tapped towards the tail end. It is used for breaking the soil clods and opening up of the sod before the actual digging. It is also used in breaking soil into pieces, after works, the stone is removed. The stone and the wooden handle are washed with water. They are kept in a dry place preferably on a plot form to avoid a termite attack on the wooden handle. The stone is sharpened from time to time. Carving stones are mainly used as they are hard and not easily worn off and do not stick to the mud.

Drawing of a Neolithic hoe.



**NEOLITHIC SICKLE:** This has a wooden handle pointed at the head and a wooden broadened at the base. There is a groove fixed with chipped flint blades with cutting edges of the centre. It is used in harvesting, slashing or cutting of grasses. It is also used in weeding. This should be handled with care because of the flint blades. After use, the blades are cleaned, oiled to avoid rust. The blades are sharpened from time to time using stones. The flint cutting blades are changed from time to time.

### WOODEN DIGGING STICK

The digging stick was the first tool of the Early farmer. It serves as hoe, It is made of a long pointed wooden stick. There is a weight hung halfway on the stick to enhance proper penetration into the soil during digging. It is also used for digging, planting and harvesting.

### ACTIVITY I

1. Mention the early farming tools.  
Discuss each of them, stating their features and their uses.
2. Draw and label any three main tools used by the Early farmers.

### SUMMARY

In this unit you have learnt that:

- The Early farmers tools were
  - (i) Neolithic hoe - used for ploughing.
  - (ii) Neolithic sickle - used for harvesting and cutting or weeding of grass.
  - (iii) Wooden digging stick - This is used for ploughing, digging, cultivating and harvesting root crops.

**Note:** While Neolithic hoe has a wooden handle tied with sharpened pointed stone, Neolithic sickle has a wooden handle with groove lined with flint cutting blades. The wooden digging stick is tied. with weight halfway the stick for deep penetration during digging or ploughing.

### ADVANTAGES

The tools are generally cheap, easy to construct and maintain. Though damages easily, it is easy to operate as there is no special training required.

It has a poor economic efficiency in terms of productivity, time and area of coverage.

### ASSIGNMENT

1. Construct the early farmers tools, as a practical assignment

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## **UNIT 4      IMPORTANCE OF AGRICULTURE**

### **INTRODUCTION**

In spite of the limitations which agriculture is facing, it still remained the most important sector of the world's economy. Agriculture is a basic industry that supports all industries and in all aspects of needs can be justified from its role and contributions to nation building.

This unit will help you to appreciate the importance of agriculture to mankind in general. And also make you to appreciate the great opportunities offered by agriculture in terms of occupation and employment.

### **OBJECTIVES**

By the end of unit 4, you should be able to;

1. State the opportunities available in agriculture in terms of employment;
2. State the contributions of agriculture toward the good standard of living;
3. State also the contributions of agriculture towards industrial development;
4. Identify the general importance of agriculture to mankind.

### **WORD STUDY**

Food                    - eligible substance we eat to maintain the body health and growth

Employ                - to give work to someone

Income                - amount of money earned or received regularly

Invest                 - to put money into (something) agricultural produce

### **THE IMPORTANCE OF AGRICULTURE**

#### **1.      Provision of Food**

Agriculture offers production of food. The food provided is for growth and good health. Food provided are mainly the sources of carbohydrates, Carbohydrates eg rice, sorghum, maize, cassava, potatoes and yams.

Proteins are from fish, beef, egg, soya beans and cow pea and vitamins and minerals are from fruits and vegetables.

Fats and oil are from groundnut, palm oil, soya bean oil, animal fat, and so on.

#### **2.      Provision of Employment**

Between 75 - 80% of the working population in the rural areas are engaged in agricultural production (farming). Some are provided with jobs in the industries that utilize the agricultural produce, be it processing or manufacturing industries. For example, Textile industries utilize cotton. Feed mills utilize groundnut cake, blood and bone meal. Breweries utilize grains, sugar, barley, and so on. Shoe industries utilize hides and skin.

Agriculture offers employment opportunities in areas of marketing and distribution of agricultural products, inspection of quality control, research, education, finance and insurance

#### **3.      Provision of Industrial Raw Materials**

Agriculture provides the raw materials needed in most industries. Textile mills require cotton, plastic industries use rubber/latex, breweries require cereal grains and sugar. Beverage company like Cadbury utilize cereal grains, sugar, butter/fat and milk, cocoa, coffee and tea.

Also shoe and tannery utilize hides and skin.

Feed mill utilize blood meal, groundnut cake bone meal, maize, guinea corn, soya bean cake, palm kernel cake, fish meal oyster shell, and so on.

#### **4. Development of Industries:**

Agricultural productions have given life to the establishment of industries that make use of agricultural produce.

- a) shoe industry make use of hides and skin tanned into leather.
- b) soup industries like PZ and Lever Brothers make use of palm oil and other vegetable oils.
- c) Beverage industries like Cadbury Plc. Made use of cocoa, sugar, butter, cereal grins.
- d) Confectioneries make use of wheat, egg, butter (for example: Nestle Plc make use of coffee and tea fir their products.)
- e) Processing plants like Vegfru make use of fruits for the production of fruit juices.

#### **5. Income:**

Individuals engage in agricultural production sell their products for money or even exchange their products for money, too.

#### **6. Foreign Earnings**

Most countries engage in international trade from their export of agricultural raw materials. For example, Nigeria export palm oil, cocoa, groundnut, rubber, hides and skin, palm kernels, and so on,

#### **7. Rural Development**

Agriculture aids in rural development. With the location of industries that utilize agricultural produce in an area other investors go to rural areas to set up factories, trade and operate business centres. People are employed and paid to earn their living. These industries and investments attract facilities like good roads, electricity, water and other good communication channels like telephone services, postal services, telex and son on. Also Institutions like schools, markets are also established. Health care centres and cottage hospitals are also established. Recreational facilities are also provided. These go a long way to minimize rural-urban migration.

### **ACTIVITY I**

1. List any four Importance of agriculture to people.
2. Discuss any four factors that make agriculture a key factor to rural development
3. Discuss the importance of agriculture in terms of food production, foreign exchange earnings and education.

### **SUMMARY**

In this you have learnt that:

- Before the time of petroleum oil, agriculture remained the main stay of Nigerian economy.
- Agriculture has the following:
  - i. provision of food
  - ii. provides income to rural people.
  - iii. supply of labour force (employment)

- iv. Provide capital for the development of social services and industries
- v. supply of industrial raw materials
- vi. stimulates marketing activities
- vii. provides foreign earnings
- viii. Agriculture serves as a key to rural development.

### **ASSIGNMENT**

1. What role does agriculture play in rural development programme?
2. Discuss the importance of agriculture in terms of provision of industrial raw materials and supply of labour force.
3. As a practical exercise, undertake a visit to an Industry that utilises agricultural produce. Write a report on the visit.

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## **UNIT 5      DIFFERENT AREAS OF AGRICULTURE**

### **INTRODUCTION**

Agriculture has been explained as a process of producing plants and livestock to meet human needs. Unit 1 has focused more on the meaning of agriculture while unit 4 has dealt with the importance of agriculture. From the definition of agriculture we found that agriculture is both a science and an art. Agriculture has many areas of coverage for effective production which makes it a complete system "AGRICULTURE".

If any of the areas in the system is ignored it will not make agriculture a complete and effective practice. This unit will get you informed of the different areas of agriculture, and opportunity available for students within each area.

### **OBJECTIVES**

At the end of the study of the unit, you will be able to:

- i) Identify the different areas of operation or different areas of study in agriculture
- ii) State the functions of each area.
- iii) Identify the opportunities opened for study in each of the areas.

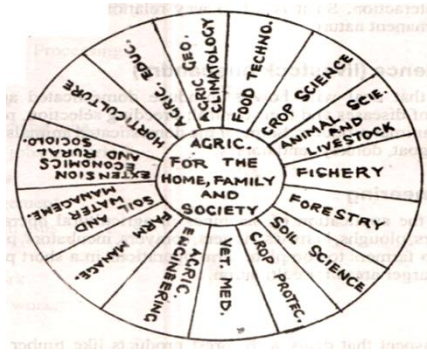
### **WORD STUDY**

Raw materials	-	unprocessed, products of agriculture
Extension	-	stretch out (informal education given to farmers to improve their products)
Dissemination	-	spreading out of information
Aquatic animals	-	animals that live in water
Sociology	-	the study of the society

### **AREAS OF AGRICULTURE**

Agriculture involves the cultivation of crops, trees and rearing of animals both terrestrial and aquatic for human consumption. It involves production and consumption. From these, it entails that agriculture has many areas or disciplines. The broad areas of agriculture include:

- crop Science
- soil science
- horticulture
- animal science
- agricultural extension and rural sociology
- agricultural engineering
- forestry
- fisheries and wild life
- home economics
- food technology
- Agric economic



*Scope of Agric. Science*

### **Crop Science**

It is a branch of agriculture that deals with the production of crops which are of economic importance to mankind.

### **Soil Science**

This is the aspect of agriculture that deals with understanding of crop nutrients. The role of manure and fertilizer in the improvement and maintenance of soil fertility and the danger inherent in the misuse of the soil. It also deals with the nature of the soil, interaction between tools and soil, and water relationship.

### **Horticulture**

It is an area in agriculture that deals with the production of vegetable and fruits which are vital source of minerals and vitamins to man. It also deals with the production of flowers for beautification and landscaping of an environment.

### **Extension and Rural Sociology**

Extension is concerned with the basic assignment of dissemination of useful information and practical agricultural information relating to farming families in rural areas. It provides knowledge and skills to enable farmers to increase productivity. Rural sociology is the study of rural society. It involves the way people live together their behaviour and beliefs.

### **Agricultural Education**

It is an area in agriculture that is concerned with helping people to develop a desire to learn and teach agriculture. It involves interaction. So it is a two way relationship to bring about changes in a relatively permanent nature.

### **Animal Science (livestock husbandry)**

It is the field that deals with how to produce domesticated animals. This involves management of diseases and their control; breeding selection, processing, storage and marketing of animal products. Some of the domesticated animals in Nigeria are poultry, cattle, sheep, goat, donkeys and horses.

## **Agric Engineering**

It deals with the application of machines in agricultural operations. Such machines include tractors, ploughs, harrows, ridgers, sprayers, incubators, pumps, and so on. These machines help farmers to complete farm operations in a short period of time and also help to open larger areas for cultivation.

## **Forestry**

Agricultural aspect that deals with forest products like timber used for building and furniture. It also takes care of wild life. Some trees in the forest produce herbs and some essential oils that give fragrance.

## **Fisheries**

This is an agricultural production that deals with water living organisms, their management, storage, processing and marketing.

## **Food Technology**

It deals with processing of agricultural produce for industrial and human consumption. It handles safety of foods, preservation and storage aspect of agriculture.

There are many other areas of agriculture as shown in Fig. 1.5 (Scopes of Agricultural Education)

## **Agricultural Economics**

It involves the use of minimal input to obtain high amount of output, it is also a science of choice among the alternatives and profitable marketing of agricultural products.

## **ACTIVITY I**

1. In a pie like chart show the areas that make up agriculture and discuss any two of the areas.
2. State the occupations available in agricultural science
3. Explain the term Agricultural Engineering. What are the objectives of Agricultural Engineering.

## **SUMMARY**

- There are about 17 areas of Agricultural Science. The areas of study in Agricultural Science are Crop Science, Animal Science, Soil Science, Agric Extension Economics, Agricultural Engineering, Crop Protection, Forestry, Fisheries, Farm Management, Soil and Water Management, Horticulture, Agric Science Education.
- The occupations available in agriculture are:
  - Agric Production job      -Agric Produce – Processing      -Marketing jobs
  - Research jobs              -Agric Engineering jobs      -Civil Service jobs in Agric
  - Teaching jobs              -Home Management              -Animal Health jobs
  - Breeding job              -Extension work              -Conservation work.

Crop Science	-	Husbandry of crops
Animal Science	-	Husbandry of animals
Horticulture	-	vegetable, flowers and fruit production
Climatology	-	Weather of an area
Agric Extension	-	Transmitting of new techniques in Agriculture to the farmers

Fisheries	-	Husbandry of fish
Forestry	-	Conservation of natural resources e.g. land, animals
Soil Science		soil fertility.
Agricultural Engineering		Ease of drudgery in farm operation and productivity

### **ASSIGNMENT**

1. List out any five areas of Agriculture.
2. At what educational level are the following areas of agriculture studied:  
Vet medicine,  
Animal Health and Diseases,  
Food and Animal Technology,  
Agricultural Engineering?
3. What are the relationship between Agricultural Science and other areas of study?

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## UNIT 6      PROBLEMS OF AGRICULTURE IN NIGERIA

### INTRODUCTION

Many developing countries in West Africa are faced with numerous problems which militate against the development of agriculture.

### OBJECTIVES

By the end of the study of the unit, you will be able to:

- Outline some of the problems of agriculture in Nigeria.

### WORD STUDY

Land	- earth's solid surface (farms)
Finance	- provision of money
Network	- system of crossing lines

### PROBLEMS OF AGRICULTURE IN NIGERIA

#### 1) Inadequate Land or Land Tenure System

Land cannot be pledged, sold or used as collateral by an individual

Those with means, but who are not members of the community, find it difficult to get land for farming activities. That is, non-indigenes of the community cannot acquire land or have access to it.

There is tendency to neglect parcels of useful land as no one readily considers it his/her interest to protect it from

It is characterized by litigations and misunderstanding

#### 2) Inadequate Finance or Credit Facilities

Most subsistence farmers are poor and do not have the capitals to make the purchase of:

- i. Land and agricultural tools and machinery;
- ii. Improved seeds, fertilizers and other chemicals;
- iii. Livestock, Livestock feeds and drugs;
- iv. Materials for construction of farmstead or house etc.

#### 3) Poor Transportation Network.

Presence of bad roads or total lack of it makes distribution of produce to market very difficult, and this leads to wastage. Some roads may be rendered useless during rainy season.

#### 4) Inadequate Storage and Processing

Lots of produce are wasted due to inadequate storage and processing facilities.

Improper storage reduces the quantity and quality of farm produce.

Storage and processing facilities are expensive, leading to high cost of production. There is lack of technical know-how on food storage and processing.

#### 5) Inadequate Farm Inputs

Farm inputs like chemicals, Fertilizers, tools and implements are grossly inadequate. Farm inputs are expensive to purchase and maintain

Available farm inputs are of inferior quality, outdated and crude.

#### 6) Poor Marketing System

There are no organised marketing channels for farm produce

There is lack of proper pricing for agricultural produce.

The negative activities of middlemen worsen the marketing of agricultural products.

### **7) Inadequate Agricultural Education and Extension Services**

Improved/better farm management decision making

Improved procurement of farm inputs

### **8) Problems of Pests and Diseases**

Pests and diseases reduce the yield of agricultural produce.

They also reduce the quality of the produce.

Pests and diseases also reduce the income of farmers.

Farmers are thereby discouraged from production.

## **ACTIVITY I**

Enumerate six problems facing agricultural development in West Africa.

## **ASSIGNMENT**

Explain briefly how the above problem affect agriculture production.

## **SUMMARY**

In this unit, you have learnt that the problems affecting agriculture are:

- a. Inadequate Land or Land Tenure System
- b. Inadequate Finance or Credit Facilities
- c. Poor Transportation Network.
- d. Inadequate Storage and Processing
- e. Inadequate Farm Inputs
- f. Poor Marketing System
- g. Inadequate Agricultural Education and Extension
- h. Problems of Pests and Diseases

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## UNIT 7 SOLUTIONS TO THE PROBLEMS TO AGRICULTURE

### INTRODUCTION

#### OBJECTIVES

By the end of the study of the unit, you will be able to:

- Suggest solutions to the problems of Agriculture in Nigeria.

#### WORD STUDY

Tenure – system where certain laws are assigned to use a particular piece of land

Policy – course of action formulated, adopted and executed by the government of a country.

### SOLUTIONS TO THE PROBLEMS TO AGRICULTURE

#### a. Inadequate Land or Land Tenure System

The Land Use Decree of 1978 should be fully implemented to minimize the problems of land tenure.

#### b. Inadequate Finance or Credit Facilities

Agricultural banks like Nigeria Agricultural and Co-operative Bank (N.A.C.B.) should make loans available to farmers.

Farmers should also form co-operative societies for easy procurement of loan from commercial banks.

Banks should reduce their high interest rate to encourage borrowing.

#### c. Poor Transportation Network.

Construction of new feeder roads to open up the rural areas.

Construction of water ways to link up the riverine areas

Construction of railways to connect rural areas to urban centres

#### d. Inadequate Storage and Processing

Storage facilities should be provided by the government at subsidised rates.

Farmers should be trained on the technology of food storage and processing.

Government should buy excess produce and store for future use.

Provision of silos in the rural areas for storage of grains by government.

Farmers should be encouraged to construct cribs, barns and rumbus for proper storage of farm produce after harvesting.

Provision of cold stores for perishable produce and livestock products.

#### e. Inadequate Farm Inputs

Farm inputs, like fertilizers, pesticides, feeds, drugs, etc., should be made available in adequate quantities to farmers.

Government should subsidise the cost of farm inputs.

Farm inputs should be supplied at the right time to farmers.

Local sourcing of these inputs should be encouraged.

Establishment of tractor-hiring unit at affordable costs to farmers.

Establishment of seed service for the production and distribution of improved seeds to farmers.

#### f. Poor Marketing System

Government should buy excess produce from farmers.

Government should stabilise prices of farm produce.

**g. Inadequate Agricultural Education and Extension**

Mass literacy programme should be embarked upon by the government, e.g. nomadic education.

Rural farmers should be trained on modern systems of farming.

Adequate and qualified extension officers should be employed to teach peasant farmers new innovations and techniques in agriculture.

**h. Problems of Pests and Diseases**

Insecticides and other chemicals used in the control of pests and diseases should be supplied at subsidised rates.

Pests and diseases control units or departments should be established to control pests and diseases.

## **ACTIVITY I**

Enumerate the solution to the problems in Unit 1.7.

## **ASSIGNMENT**

Discuss the solution to the problems

## **SUMMARY**

In this unit, you have learnt that the solutions to:

- a. Inadequate Land or Land Tenure System
- b. Inadequate Finance or Credit Facilities
- c. Poor Transportation Network.
- d. Inadequate Storage and Processing
- e. Inadequate Farm Inputs
- f. Poor Marketing System
- g. Inadequate Agricultural Education and Extension
- h. Problems of Pests and Diseases

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## UNIT 8 LAND AND ITS USES

### INTRODUCTION

Definition: Land may be defined as the uppermost layer of the earth's crust on which agricultural and non-agricultural activities are carried out. In other words, land can also be defined as the solid part of the earth's surface which has as its components water, air, soil, rock, minerals, natural vegetation and animal life and suitable for agricultural production.

Land is a factor of agricultural production. Land is immobile and limited in supply. It is a free gift of nature.

### OBJECTIVES

At the end of the study of the unit, you will be able to:

- Enumerate some uses of land.

### WORD STUDY

Minerals	- natural substances dug from the ground
Immobile	- at a stand still/ inability of an object to move
Solids	- substance that is neither liquid nor gas/ not hollow but hard and firm
Nature	- world around us

### Uses of Land

- Land is used for the production of food crops like yam, rice, maize, cassava, cowpea, etc., as well as production of cash crops like cotton, rubber, cocoa, groundnut, etc.
- It aids the development of towns where commercial agriculture is practised.
- Land is also used for natural grazing for livestock like cattle, sheep and goats. Large areas of land are set aside in savanna belts where there are abundant grasses for grazing by livestock.
- It is also used for the construction of residential houses and buildings. It also involves the development towns, housing estates and all other forms of settlements. In urban areas, a large proportion of land is needed for the construction of residential buildings.
- Land is also used for construction of many forms of roads, railway line as well as airports. Transportation by road alone constitutes one of the uses of land, especially in urban areas
- Land where minerals are found are used for mining. In Nigeria, most of the land where petroleum, coal, tin and other minerals are located are used mainly for mining purposes .
- Industries are also located on land. Majority of the industries are located in industrial estates which constitute a large proportion of urban land.
- 

### ACTIVITY I

State five (5) uses of Land

### ASSIGNMENT

Discuss the importance of land for mining.

## **SUMMARY**

- Provision of food e.g. maize, yam, cassava, etc.
- It aids the development of towns where commercial agriculture is practised.
- Land is also used for natural grazing for livestock like cattle, sheep and goats. Large areas of land are set aside in savanna belts where there are abundant grasses for grazing by livestock.
- Land can be used for pasture production.
- Land is used for construction of residential houses, roads, railways and store natural resources.

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## UNIT 9 LAND DECREE

### INTRODUCTION

Land Use Decree of 1978, Reversed Land Use Act 1990. The Land Use Decree was enacted on 28<sup>th</sup> of March, 1978 by the Federal Military Government.

### OBJECTIVES

By the end of the study of the unit, you will be able to:

- State the Land Use Decree.

### LAND DECREE

It states that:

1. All the land in Nigeria belong to the government
2. The right to allocate land is vested in the hands of the state governor.
3. The state governor or any person delegated by the governor is the only one who can issue "certificate of occupancy" to an individual and with this certificate, the person can now have or lay claim to the land.
4. The period of ownership of land will not exceed ninety-nine years.
5. Crop production is allotted 500 hectares while grazing is allotted 5,000 hectares
6. Adult Nigerians of twenty years and above have a right to acquire land.

Aims of the Land Use Decree

1. This decree is aimed at reallocating land in order to make more lands available to intending farmers for large-scale agricultural production.
2. To also remove the bad effects and arguments which land has generated in Nigeria.
3. It facilitates planning of programmes for a particular land use.
4. It allocates land and creates opportunity for enterprising farmers to acquire more land for large scale farming.

Advantages of Land Use Decree

1. People can acquire land outside their tribe or state, that is, anywhere within Nigeria.
2. Large hectares of land can be acquired for agricultural purposes.
3. Certificate of occupancy can be used to source for loan from banks.
4. Land can be used efficiently and properly.
5. It has made land acquisition relatively easier for new entrants into agriculture.
6. It has reduced the number and frequency of court cases over land ownership.
7. It prevents fragmentation of land since land acquired under the decree cannot be shared into bits.

Disadvantages of Land Use Decree

1. It makes it difficult for the federal government to acquire land.
2. Land acquisition now lies on the few rich individuals.
3. It makes land use difficult.
4. It creates room for irregularities as many land speculators may backdate land agreement before the decree.

### ACTIVITY I

State the advantages and disadvantages of Land Use Decree.

## ASSIGNMENT

What is the aim of Land Use Decree?

## SUMMARY

In this unit, you have learnt that: Land Decree states that:

1. All the land in Nigeria belong to the government
2. The right to allocate land is vested in the hands of the state governor.
3. The state governor or any person delegated by the governor is the only one who can issue "certificate of occupancy" to an individual and with this certificate, the person can now have or lay claim to the land.
4. The period of ownership of land will not exceed ninety-nine years.
5. Crop production is allotted 500 hectares while grazing is allotted 5,000 hectares
6. Adult Nigerians of twenty years and above have a right to acquire land.

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## **UNIT 10     SUMMARY**

### **INTRODUCTION**

In this unit, you will review all that you have studied in the earlier units of this module, that is module 1-9. The purpose of this unit is to enable you clearly understand some concepts and practices you did not yet understand.

### **OBJECTIVES**

By the end of this unit you should be able to:

- Define and describe the History of Agriculture
- List the type and importance of Agricultural tools used by the early farmers.
- List the different areas of Agriculture
- List the problems and solutions of Agriculture
- State use of land and explain land decree?

The History of Agriculture is divided into two periods namely:

1. Paleolithic and
2. Neolithic period also known as the Stone Age.

The two periods are characterized by some features check units 2 of module 1 for these features.

### **ACTIVITY 1**

- What is Agriculture?
- The History of Agriculture is looked at two periods. Name the periods bringing out their distinct features.

### **Tools used by early farmers**

In unit 3 you were introduced to different types of tool used by the early farmers. The tools are classified as:

- i. Neolithic hoe for ploughing
- ii. Neolithic sickle for harvesting and cutting grasses
- iii. Wooden digging sticks for digging and planting. Check unit 3 to know the structure of these tools.

### **The importance and areas of Agriculture**

In unit 4 and 5 you studied the importance and areas of agriculture. Go through unit 4 again for proper understanding of the importance of Agriculture. The areas of Agriculture is discussed in unit, go through it again. Units 6 – 9 discussed the problems of agriculture solution, land use and land use decree.

## **SUMMARY**

Agriculture is the science and art of cultivating the land to produce plants and rearing of animals for human consumption and raw materials for agro allied industries.

The early farmers were using Neolithic hoe sickle and wooden stick for their Agricultural activities.

Agriculture is important as it provides food raw materials for industries.

## **ASSIGNMENT**

- State three importance of Agriculture
- List 5 problem of Agriculture
- List 4 uses of Land
- State what is land use decree

## **REFERENCES**

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## MODULE 2: PLANT FORMS, CLASSIFICATION

### UNIT 2.1 FEATURES OF MONOCOTYLEDONS AND DICOTYLEDONS

#### INTRODUCTION

Monocotyledons (abbreviated: monocots) and dicotyledons (abbreviated: dicots) belong to the group of plant kingdom called "Angiosperm" or flowering plants: This is because they all produce true flowers. Flowering plants include herbs, grasses, shrubs and trees from which most of our food stuffs and industrial materials are produced.

#### OBJECTIVE

At the end of this unit you are expected to:

1. be familiar with examples of monocots and dicots;
2. be able to classify any plant either as a monocots or a dicots;
3. list the differences between monocots and dicots

#### WORD STUDY

Cotyledon	-	the first seed leaf in the embryo
Angiosperm	-	flowering plants. They usually have their seed enclosed in a vessel e.g. Bean seed inside a bean-pod
Embryo	-	immature plants resulting from fertilization of the egg of higher plants.
Nodes:	-	Portion of stem where leaves and branches originate.
Internodes:	-	Portion of stem between two nodes.
Petiole	-	a stack (mini stem) which joins the leaf to a stem or branch.

#### A. EXTERNAL FEATURES OF MONOCOTYLEDON

Monocotyledons are plants which possess only one cotyledon in the embryo contained inside the seed. Monocots include familiar plants like Lilies, Grasses, Bamboo Trees, cereals like sorghum, maize, rice millet as well as palm tree, and so on.

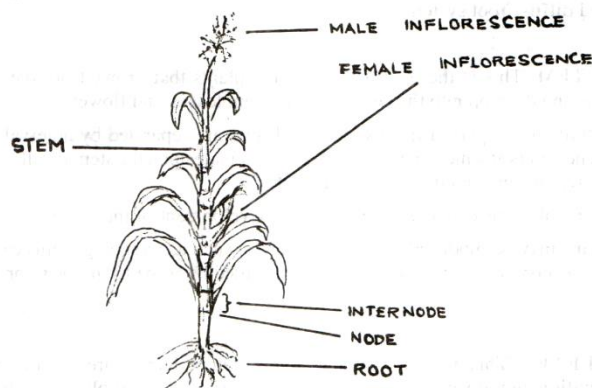
Let us now take a look at the external features of monocots. You would note that the plant, which you are holding as you are reading this unit, consists of two major parts.

- I. The vegetative parts: this is made up of
  - **The Root:** Note that the root of monocots forms a fibrous system and are called adventitious roots.
  - **The Stem with nodes**, that is point where the leaf is formed or a branch on the main stem. The distance between two successive leaves is called internode.
  - Look at the leaf of the plant in your hand very well. You will note that the leaf is either oblong or linear in shape, with or without a petiole. The leaf has parallel veins, with one major midvein.
- II. **Reproductive Part:** This is the flower part. Note also that the flowers are unusual in that they are generally small in size and are not bright - Because of their small size it may be difficult for you to examine critically their external features.

However, you should know that like dicots the reproductive parts of monocots are made of

- i. Androecium: which is the male flower.
- ii. Gynoecium: the female flower.

The male and female flowers may be separate but borne on the same stem, as in the case of maize (Fig. 1.). A close examination of the flower also reveals that they are usually three in number or multiples of three.



*External feature of monocotyledon*

### ACTIVITY I

1. Without looking at the text, describe the external features of a monocotyledon
2. What are the distinguishing features of monocots?

### B. FEATURES OF DICOTYLEDONS

Dicots do not differ in this feature. Therefore the external feature of dicot can also be divided into two major parts.

- i) Vegetative part: this is also made of the root, stem and leaves.
- ii). Reproductive parts.

Let us now look at each of these parts in dicot in details.

**THE ROOT:** This part of the plant emerges from the germinating seed as a cylindrical structure: forming the first or primary root. This may produce branches called secondary roots after a period of time, which may also produce its own branches, all of them forming a root network.

There are two types of root system found in cotyledon. If the primary root remains dominant in which case all the branches from it are smaller in size, in comparison the root system is described as tap-root e.g. carrot.

On the other hand, the primary root may lose its dominance as a result of exaggerated growth of its branches, all of them having roughly the same size. This type of root system is called diffuse root system.

**THE STEM:** This is the main branch of the plants that grows from the soil surface upwards and develops into the shoot system (stem, leaves and flowers).

In a fully grown part of most stems, the leaves are separated intervally from each other. The points at which one or more leaves originate upon the stem is called the 'nodes' and the region between them the 'Internodes'. Branching of stems occurs as a result of the development of the nodes. The stems may be



modified into various forms, such as creeping stems called stolons e.g. strawberry, yam or underground stems called rhizome as in potato or as tubers in carrots.

**THE LEAF:** This is found at the nodes. Dicot leaves are usually broad with net-venation and of various shapes. The leaf consists of a leaf blade which is joined to the stem through a petiole. The central part of the leaf is made of a conspicuous mid-vein from which other smaller veins depart.

Depending on the pattern of arrangement on the stem the leaf arrangement may be :

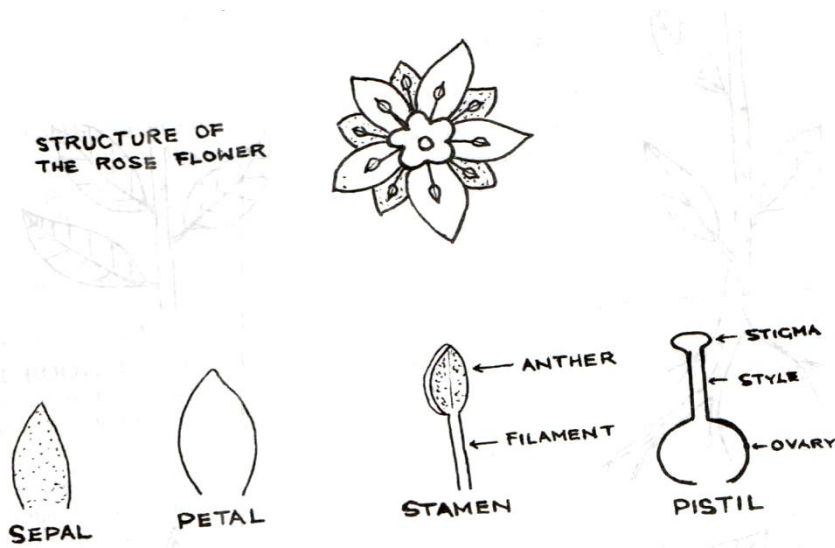
- alternate:** here, there is only one leaf at each node
- opposite:** posses two leaves at each node
- whirled:** posses three or more leaves at each node.



*Leaves arrangement of dicots*

**REPRODUCTIVE PARTS:** This is the floral (flower) part. Examination of various flower from different samples show that they differ in size, shape, colour and arrangements. However, the basic structure common to all dicot flowers which you can easily locate on your sample include the followings:

- (i) **Sepals:** these are leaf-like structure at the base of the flowers. They may be green or white or brightly coloured, combination of sepals from the calyx. (count the number of sepals on your flower sample).



*Structure of a Dicotyledonous flower*

- (ii) **Petals:** These are located above the whorls of sepals. often brightly coloured and usually the most noticeable in flowers. Combination of petals form the corolla. Note that the number of sepals and petals are the same and are structures that attract insects for pollination.
- (iii) **Stamens:** these are club-shaped structures above the corolla. It consists of filament (stalk) or filament and an anther bearing pollen grains (male gamete).
- Pistil:** this is flask-shaped located in the central position of a flower. It consists of an ovary bearing eggs (female gamete) a style and stigma that receives and transport pollen grains to the ovary for pollination.

## SUMMARY

In this unit you have learnt that

- monocots and dicots belong to the class Angiosperm which are called flowering plants.
- you have also learnt the comparison of monocots and dicots which are summarized in tabular form as follows:

Monocotyles	Dicotyledon
a. Embryo posses one Cotyledon	a. Embryo possess two cotyledons.
b. Root system is usually fibrous as the primary root is not developed.	b. Primary root often well developed and from tap root system.
c. Leaves are usually narrow linear or oblong in shape usually without petiole.	c. Leaves are usually broad shaped with petiole commonly developed.
d. Leaf veins are usually parallel with one major mid vein.	d. Leaf veins are usually net-like in distribution and may have more than one main vein
e. Flower parts are usually in threes or multiples of three.	e. Flower parts are usually in fours or fives or multiples of four and five.

## **ASSIGNMENT**

1. Briefly describe a flowering plant
2. List the differences you found in the external features of monocotyledon and dicotyledon

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## UNIT 2 CLASSIFICATION OF CROPS, BEVERAGES & SPICES

### INTRODUCTION

Crops are plants intentionally cultivated by man for his, multipurpose use e.g. feeding (consumption), industrial use, and so on. In unit 1 of this module, you learnt about major characteristics of monocotyledon and dicotyledon and you have been able to classify plants into these two classes, you will now focus your study mainly on crops, that is, plants that are cultivated by man, their uses and classification.

### OBJECTIVES

By the end of this unit, you should be able to:-

- 1) Classify crops into their various classes
- 2) Describe their uses or purposes
- 3) Mention the botanical names of common crops.

### WORD STUDY

Agronomy: -Aspect of agriculture dealing with crops

Leaching -Washing away of soil particles usually by water percolating through the soil.

Latex -A form of sap (liquid exude) that come from some cash crops e.g. rubber.

There are well over 400.000 different plant species that have been identified and classified. This include all crops.

Classification is putting a crop/plant in a particular group which has certain properties and or characteristics common to them all.

We said examples of mono cotyledon and dicotyledon include most of crops cultivated by man. Recall also that these crops are classed as Spermatophytes or Angrosperms.

Generally crops as a group of plants are classified different ways, the most important of them are:

1. Classification according to life cycle
2. Agronomic classification.

Let us now look at each of these classifications in more details.

### CLASSIFICATION ACCORDING TO LIFE CYCLE:

This is based on how long it takes a crop to complete its life cycle from germination to harvesting. Based on this, a crop may be.

a) **Annual crop:**

These are crops that complete their life cycle in one growing season. Examples include maize, rice, and wheat.

b) **Biennial crops:**

These are crops that take two years or two growing seasons to complete their life cycle. In their first season they produce vegetative parts while the seeds are produced in the second growing season or year. Examples include cassava and pineapple.

3. **Perennial Crops:**

These crops live for many years and once fully developed, they produce seed each year examples are cash crops like Cocoa, Coffee, and Palm trees.

## **ACTIVITY I**

1. In what ways can you classify crops?
2. Define the following: Annual, biennial and perennial crops.

## **ASSIGNMENT**

1. Classify crops based on their life cycle.
2. Give examples in each classification.

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## UNIT 3      AGRONOMIC CLASSIFICATION OF CROPS

### INTRODUCTION

This is classification based on nature of the produce or ways in which such crop is used. However, there are many crops that have more than one use. A readily available example is maize which is often grown as a cereal and also used as forage crop.

We shall pay more attention to Agronomic classification, but before we start, pause for a moment and recall different types of crops you know, such as, cereals, legumes, tubers, and so on.

### OBJECTIVES

By the end of this unit, you should be able to:

- Classify crops on the basis of their agronomy.

**PAUSE:** Can you give an example of such crops?

### AGRONOMIC CLASSIFICATION OF CROPS

#### 1.      **Cereals:**

These are grain crops or grasses grown for its edible seed. They are very important as they form staple food in tropical Africa and Asia. Examples are wheat (*Triticum Vulgare*), Millet (*Pennisetum SPP*) Rice (*Oryza Sativa*), Guinea corn (*Sorghum SPP*), and so on.

#### 2.      **Forage:**

These are crops grown as feeds for animals. They include hay, (dry grasses) pastures (mixtures of grasses and legumes), silage (cut maize or guinea corn stalks stored in wet condition) and so on. You can now see that a crop could be a cereal as well as a forage depending on what is used for.

#### 3.      **Oil Seeds**

These crops are primarily grown for oil production. Examples include oil palm (*Elaeis guineensis*), castor oil (*Ricinus communis*), coconut (*Cocos nucifera*), ground nuts (*Arachis hypogea*).

#### 4.      **Legumes**

Those are usually trifoliolate crop known for its symbiotic nitrogen fixation. They are grown either as edible crops such as cowpea, soya bean or as forage when fed to animals before reaching maturity.

#### 5.      **Fibres**

These are cash crops that produces fibres for texture use or ropes and twines. Example include cotton (*Gossypium SPP*), hemp (*Hibiscus canaticus*).

#### 6.      **Storage Crops**

These are crops that store food in special or modified organs which may be stem or roots. They are known for their economic importance as staple food after cereals. Examples are sweet potato (*Ipomoea batatas*), cassava (*Manihot Esculeta*), Yams (*Dioscorea SPP*), and cocoyams (*Colocasia*).

#### 7.      **Sugar Crops**

They are grown for sweet syrup. these include sugar cane (*Saccharum officinarum*), sorghum and so on.

## **8. Green manure**

These are crops especially legumes which are grown and then ploughed or incorporated under in the green state so as to improve soil properties. Examples are soya bean, cowpea (*Vigna unguiculata*), *Pueraria*, *Centrosema* and so on.

## **9. Silage:**

These are crops grown and cut down to be preserved in succulent condition for animal feed. Examples are maize, sorghum, elephant grass, and so on.

## **10 Catch crop:**

These are short-seasoned crops used to fill-in when the main crop or regular crop have failed. They are often referred to as emergency crops. Here, examples include millet, and sudan grass.

## **11. Cover Crops:**

These are grown over a land that needs protection from agents of erosion: wind and water and also to prevent leaching they often serve as green manure. Examples are soyabean, cowpeas, *Stylosanthes*, and so on.

## **ACTIVITY I**

1. Classify the following crops based on their agronomic use: millet, maize, potato, rice, cowpea, yam, cotton.
2. What is the difference between silage and green manure?

## **12 Supplement Crops:**

These are crops grown as secondary (minor) crops after the primary (major) crop has been seeded. A typical example is planting of soyabean or cowpea in corn - field.

## **13. Companion or Nurse Crops:**

They are crops of minor importance but planted with another crop (of major importance) to protect or nurse the latter. A good example is that found in the cocoa belt of Nigeria where banana (*Musa SPP*) is used to shade and protect cocoa seedlings.

## **14. Rubber:**

These are crops grown for latex production (a special sap or fluid) in their stem. Latex is used to produce rubber. Examples include Para rubber and India rubber.

## **15. Beverages and drugs:**

Are produced and used as stimulants by man. Examples are Cocoa (*Theobroma Cacao*), Coffee (*Coffea arabica*), Tobacco (*Nicotiana tabacum*) and Tea (*Camellia Sinesis*).

## **16. Spices:**

These are special crops whose products are used in small quantity in other foods/produce. They have the ability of giving specific taste or aroma to the medium where they are added. A good example is Pepper (*Capsicum SPP*) and ginger (*Zingiber Officinale*).

### **17. Fruits:**

Examples are pineapple (Ananas Comosus), Mango (Magnefera Indica) and Paw Paw (Carica papaya).

### **18. Cash crops:**

Are crops grown specifically for economic use solely to provide income Examples are oil palm, cocoa, cotton, and tabacco.

## **SUMMARY**

In this unit you have learnt that

- Crops are plants intentionally cultivated or planted by man.
- Crops are classified according to
- Length of their life cycle or uses (agronomic).
- ways in which such crops are used.

## **ASSIGNMENT**

1. Make a list of fifteen crops grown in you locality. Give their. agronomic as well as their life-cycle classification. Show your workings to your course Tutor.
2. Without consulting the unit. give two examples each of the following classification found in this unit. Spices. beverages. supplement and companion crops.

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## UNIT 4 ANNUAL, BIENNIAL AND PERENNIAL CROPS

### INTRODUCTION

In units 1 and 2 of this module you learnt about external features and classification of crops respectively. In this unit you will learn more about types of Crops life cycle. You will also learn to identify a crop according to their life cycle. All examples here will be limited to crops only.

### OBJECTIVES

By the end of this unit you should be able to:

1. Define annual, biennial and perennial crops.
2. Identify the importance of these crops.
3. List examples of these crops and classify them accordingly.
4. Describe the life cycle of annual, biennial and perennial crops.

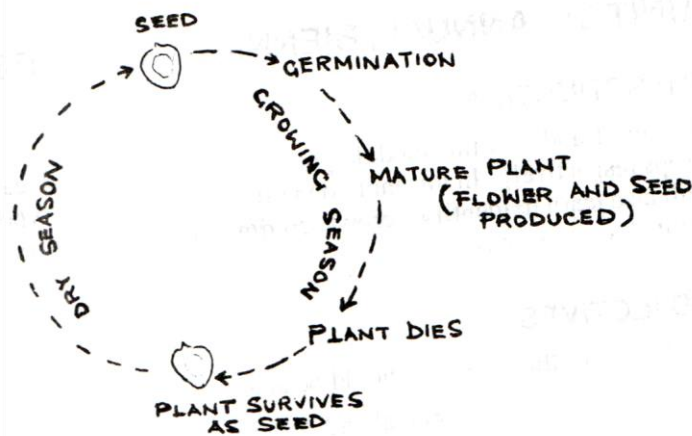
### WORD STUDY

Life Cycle: Stages of growth from germination to production of seed.

Growing Season: A particular period of time that a plant shoot out to produce green before it dies back.

### ANNUAL CROPS

These are crops that complete their life cycle within one growing season. Within this period the plant germinate, form flowers and produce seeds. The growing season may be a few months or at most one year. When the plant dies down it is the seeds that survive until the next growing season. Diagrammatically, the life cycle of annual crop is shown below:



*Life cycle of annual crop*

Annual crops are very prominent in the world and cut across so many types of crop. Examples include:

- i. Cereals: Like maize, millet, sorghum, oat, barley, rice, and other grasses.
- ii. Legumes: Like groundnuts, cowpeas, soyabean,
- iii. Vegetables: Like spinach, tomato, papers.

## **IMPORTANCE OF ANNUAL CROPS.**

1. They make up the staple food in many regions of the world for example Rice in Asia, Other cereals in Africa.
2. They are good source of carbohydrates (e.g. Cereals), proteins (e.g. the Legumes) and vitamins (e.g. vegetables).
3. They have the advantage of high yield relative to the seed plant. For example planting 25.30kg/ha of maize seed may yield up to 4 ton/ha. They are also consumed as rations by livestock.

## **BIENNIAL CROPS**

These are crops which need two growing seasons to complete their life cycle and then die. Such crops germinate but do not form flowers during their first growing season but store up reserve materials in the underground parts, while the aerial part dies. The reserve materials are used up in the next growing season to produce new leaves, form flowers and produce seeds which can now germinate and produce new plants. The cycle is then repeated.

The life cycle of biennial crop can be represented as shown below:

Examples of biennial crops include cassava and pineapple.

## **IMPORTANCE OF BIENNIAL CROPS**

1. Source of vitamins, carbohydrates and minerals
2. Life cycle can be terminated and product used after first growing season. for example, carrot.

## **ACTIVITY I**

1. Define annual and biennial crops. Give examples of these crops found in your locality.
2. Give two reasons why you think annual crops is very important to man.

## **PERENNIAL CROPS**

These are crops which live and grow for three or more years. They may be trees, shrubs bulbs or rhizomes.

## **TYPES OF PERENNIAL CROPS**

Depending on the type of **perennating** organ, there are two major types of perennial crops:

### **(A) HERBACEOUS**

They have their aerial parts dying down every growing season and storing their food in underground organs which produce new shoot in the next season and the cycle begins again. Example is onion.

Depending on the type of underground storage organ, herbaceous perennials may be:

#### **i. Rhizomes:**

This has swollen stem with food reserves, for example. Ginger.

#### **ii. Corm:**

These have swollen stems that grow vertically in the soil, for examples, cocoyam.

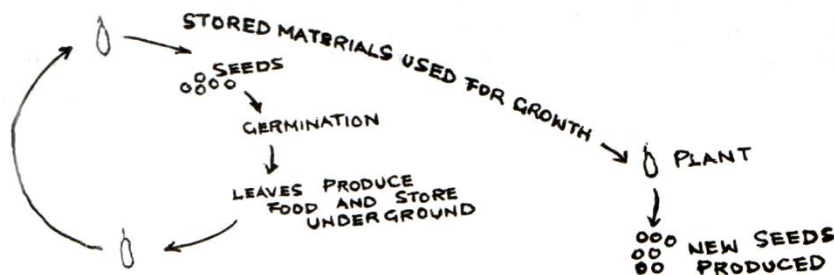
#### **iii. Bulbs:**

These are underground leaves that are swollen and store food materials. Example is the Onion.

#### **iv. Tubers:**

Are plants with fibrous root system that swell up and store food in form of root-tubers examples include sweet potato and cassava.

The Life Cycle of a herbaceous perennial is shown below:



*Life cycle of Biennial Crop.*

### (B) DECIDUOUS PERENNIAL

These crops have their aerial part surviving from season to season. They shed their leaves during dry season. An example of deciduous is cashew.

(C) Evergreen perennial: Those that do not shed their leaves are called “evergreen” eg mango, cocoa and enalapthus.

### IMPORTANCE OF PERENNIAL CROP

1. They produce world cash crops which generate income, for example cocoa, Cashew and Rubber.
2. They have the added advantage of not having to be replanted every growing season.
3. They are used as building materials eg timber trees.
4. They are used as food eg fruit trees
5. They are used as wind breakers to convert desertification etc.

### ACTIVITY II

1. Define perennial crops.
2. List different types of perennating organs you have come across in this unit.

### SUMMARY

In this unit you have learnt that:

- Annual crops complete their life cycle in one growing season.
- Biennial crops complete their life cycle in two growing season producing flowers and seeds only in the second growing season.
- Perennial crops: Jive and grow for many years.
- Depending on the type of perennating organ, perennial crops may be herbaceous, deciduous and evergreen.

### ASSIGNMENT

1. Name the three classes of crops based on their life cycle.
2. Classify the following crops based on their life cycle mango, maize, cowpea, carrot, cabbage, onion and Ginger.

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## UNIT 5      AGRICULTURAL CROPS I: CEREALS

### INTRODUCTION

Cereals fall under the family: Graminae. They have good vegetative growth and this enable them to withstand drought to some extent. They produce tiller or branches from the basal buds.

Cereals are one of the most important groups of food items for man and animals in the world. They can be cultivated both in tropical and the temperate area. In Nigeria the common careals grown include maize, rice, sorghum and millet. Cereals have high starch content usually varying amount of protein. The grains are used for man and livestock feeding while the stalks are used for roofing, animal beds and foders

### OBJECTIVES

By the end of this unit you should be able to:

1. list at least four cereal crops produced in Nigeria
2. list the cultural practices peculiar to specific cereals,
3. name some pests and diseases of cereal crops
4. describe methods of harvesting and storage of some cereals
5. describe uses of cereal crops.

### MAIZE

Local Name:            Hausa-Masara, Yoruba-Agbado, Igbo-Oka

Family:                Graminae

Botanical Name:      *Zea Mays*

Maize or corn is one of the main cereal staples of West Africa. It originated in the American Continent, probably in Guatamala or Mexico. In Nigeria the crop is an important food crop cultivated in almost every part of the country where rainfall is higher than 760mm a year. In the drier areas guinea corn is grown instead of maize.

The maize grain is prepared in different ways for eating by man. It can be boiled or roasted, or made into paste eaten by adults and by weaned children.

### Climatic and Soil Requirement

The crop grows well on rich, well-drained neutral or alkaline soil. This is because it uses large quantity of nutrients from the soil. A rainfall of between 760-1520mm per annum is adequate.

### Varieties

The best known varieties used in breeding programmes in Nigeria are Lagos white, NS-1, NS-4, NS-5, and so on. Some high breeds are Oba I, and so on. Maize types may however be classified for commercial purposes as follows:

- i) dent maize
- ii) Floury maize
- iii) flint maize
- iv) popcorn, and
- v) sweet maize.

## **Cultivation**

The first operation is land clearing followed by tillage operation. Tractors ploughs and harrows are used for cultivation on large farms. In most maize producing areas in Nigeria, tillage is manually done by the use of big hoes to make ridges.

### **ACTIVITY I**

1. Investigate and briefly explain the methods used in tillage operation for maize production in your local area.
2. Find out the varieties of maize that are suitable for your local area and compare their yields, and suggest the best variety.

*Compare your answers with those of your study group mates.*

## **Planting:**

The seeds are planted 1-3cm deep. The spacing varies from one areas to another. Generally, the spacing is 30-75cm depending whether sole or inter cropping is adopted. When maize is to be interplanted with another crop the spacing should be wider. It is sometimes interplanted with yams, cowpea, guinea corn, cotton, and so on. The planting date for early maize is between March -April in the south and May/June in the Northern part of Nigeria. In the south, maize is planted in August-September as second cropping.

## **Weeding**

The first weeding is done 2 to 3 weeks after planting and two more weedings are done at equal intervals of 15 days. The method is to hoe upwards from the furrows to ward the top of the ridges, so that soil is healed up around the plant. Chemical weeding can be done by applying herbicides such as Atrazine, Simazine, Gramaxone, and so on. Chemical weed control is usually more expensive because of the cost involved.

## **Fertilizer Application**

This is an important operation because it increases the yield of the crop. Three applications are ideal for the crop. Inorganic fertilizer for maize include NPK, C.A.N. while the organic are the farm yard manure and animal droppings especially those of the poultry.

## **Storage**

The cobs are stored in rhumbus crips or beams or huts. Dry grains re stored in silos or bags after treatment against insect pests. Air-tight containers can be used for storage.

## **Diseases:**

The major diseases of maize are as follows:

1. **Maize rust:** a fungal disease caused by puccinia polysora
2. **Maize smut:** Fungal disease caused by ustilago zea. Attacks the leaves, stems, tassels and cob by forming turmours of black spores
3. **Maize streak:** viral disease cause by maize streak virus. Transmitted by leaf hoppers

Other disease of maize are leaf blight and leaf spot.

**Pests:**

- a) Stem Borer - It is a field pest (larva) that destroys young stems
- b) Army worm - field pest that destroy the young seedling
- c) Grasshopper: a field pest that destroys the vegetative parts of the plant
- d) Weevil: - both field and storage pest.

**Harvesting**

Maize can be harvested either as vegetable or when fully riped. Mostly it is harvested when dry (riped) by the use of combine harvester or by hand. When production is on large scale it is advisable to use the combine harvester, but on small scale it should be manually harvested by plucking the cubs with hands.

**ACTIVITY II**

1. Visit a local farm and try to identify some diseases of maize. Suggest the causes of the identified diseases.
2. Compare damages done by stem borer and that done by maize weevil. Which parts of the maize plant are destroyed by each of the pest?

**RICE**

Local Name: Hausa - shinkafa, Yoruba - iresi, Igbo - Osikapa

Family: Framinae

Botanical Name: *Oryza satua*

Rice is an important crop in most parts of the world because it forms the basis of the diet of about half or more of the world population. It originated from an area extending from central India to China.

The crop is eaten by man and animals and is also used in the manufacture of starch and Beer.

**Climatic and Soil Requirements**

Rice is a crop of tropical, sub-tropical and temperate regions. It grows well on light or heavy soils with a PH ranging from 4.0 - 8.0, provided that adequate quantity of water is available. The upland types of rice will grow better in areas with 760-1270mm of annual rainfall.

**Varieties**

Rice varieties differ in shape, size and colour of the grain. The main types grown are:

- i) swamp rice
- ii) Upland rice.

Swamp rice: Varieties of this rice require plenty of water to grow well. Some of the recommended varieties are Far D15, 16, 19,21, IR20 and SML 140/10

Upland Rice: The varieties of upland rice can grow under conditions which support most arable crops with adequate rainfall. Some of the recommended varieties are: Agbede, E-125, IRAT.IO, Oshodi, OS6 etc.

**Cultivation**

The bush is cleared and the soil is hoed or ploughed 10-13cm deep. Machines can be used on large farms. For the swamp rice, there is the need for a nursery to produce enough seedlings for transplanting.

### **Planting:**

For the upland rice, direct seeding may be done by drilling or dibbling at the spacing of 15cm x 15cm. It can also be planted by broadcasting the seeds on prepared field.

For the swamp rice, the seeds can be broadcasted at the inset of the rains. For transplanting, a fertile nursery beds may be prepared. The seedlings can be transplanted after 4 weeks of sowing. At this stage the field must be flooded with water.

### **Weeding**

Hand pulling, on several occasions as the crop is growing must be done to remove such common weeds as sedges, swamp grasses and hygrophila. This type of weeding is very hard and is best done by a team of

people in a line. Control of weeds with herbicides have given an encouraging results. Herbicides such as M.C.P.A. Dalapon, Diuron, Tamarice, and so, are used for this purposed.

### **Fertilizer Application**

Rice response positively to fertilizer application in all conditions. Recommended fertilizer applications are 170-230kg/ha sulphate of ammonia, 174-195 kg/ha simple superphosphate and 32kg/ha or muriate of potash.

### **Disease**

The two major diseases of rice are:

- i) **Rice blast:** a fungal disease cause by **Piricularia Oryzea**. It can be controlled by the use of resistant varieties, the use of clean seeds and the use of relevant fungicides.
- ii) **Rice smut** - Another fungal disease cause by **Ustilaginoidea** virus. This disease turns grains into a mass of black spores. The control is by practicing farm sanitation.

### **Pests**

The pests of rice include: borers, army worms, rodents, birds, and so on.

## **ACTIVITIES III**

1. Go to a rice farm in your locality and identify a rice plant affected by rice smut, and damage done to rice plant by borers and rodents and birds.

## **SORGHUM**

Local Names: Hausa - Dawa, Yoruba - Oka baba.

Family: Graminae

Botanical Name: (Sorghum spp)

Sorghum (guinea corn) originated in tropical Africa. It forms the staples food of people living in the northern part of Nigeria. It is used mainly for making 'tuwo' and also for brewing local beer called 'burkutu ' or 'pito '. Sorghum is higher in protein and starch than maize but lower in fat content. Sorghum grains are eaten by horses and poultry, while cattle feed on dry leaves of the plants after the grains have been harvested.

### **Climatic and Soil Requirements**

It requires an annual rainfall of between 350-640mm during the period of growth. The plant grows well on a wide variety of soils with a PH of 5.5-8.5 with the exception of pure sands and clays. A mean temperature of about 28°C is ideal



### **Varieties Grown:**

The recommended varieties include:

- i) Fatevita type
- ii) Dura type
- iii) kafir type
- iv) short kaura

### **Cultivation and Planting**

It is necessary to plough and harrow lands before making ridges on which the seeds will be planted. Where mechanization is not possible ridges should be constructed using big hoe. The seeds must be sown 3-4cm deep, dropping 3-4 seeds per stand and later thinned to 2 per stand.

The seed-beds should be kept free from weeds since the seedlings remain small for several weeks after germination. Generally, two weeding are required before harvest. The first is when the plants are 3 weeks old.

Application of fertilizer will increase the yield.

### **Harvesting and Storage**

Harvesting is done manually using cutlass. The heads are cut off, tied together and dried to a moisture content of about 12%. It is stored in bags after treatment with storage chemicals. It can also be stored in home-made earth granaries with openings at the top.

### **Diseases and Pests**

The diseases of sorghum include:

- i) loose or open smut
- ii) grain or covered smut
- iii) downy mildew

The pests are:

- i) weevils
- ii) stem borers
- iii) birds
- iv) midge larvae

### **SUMMARY**

- The main aim of this unit is to enable you acquire some of the skills involved in the production of cereal crops. Weeding and fertilizer application are important operations in cereal production. This is because they increase the yield if properly done.
- The control of pests' diseases are also vital in the production of any cereal crops.
- Both maize and rice require a well-drained fertile soil, but sorghum requires a wide range of soil.

### **ASSIGNMENT**

1. List all the cereal crops produced in your locality.
2. If you have to explain to a local farmer in your area the need to apply fertilizer in your maize farm, list the reasons you would give.

3. List two diseases and pests of maize, rice and sorghum studied in this unit.
4. Give botanical names of the following crops:
  - i) maize
  - ii) Rice
  - iii) Sorghum

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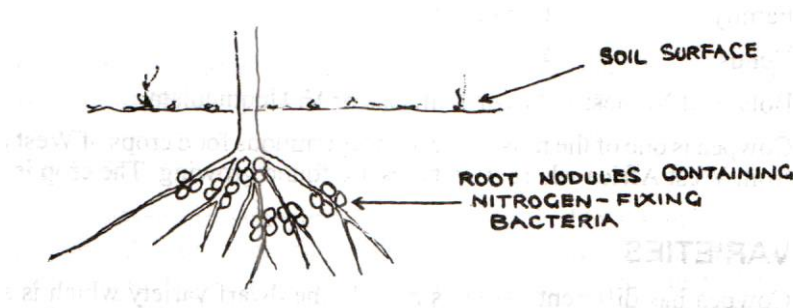
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## UNIT 6      AGRICULTURAL CROPS II: LEGUMES

### INTRODUCTION

Legumes or pulses belong to the family of **leguminosae**. All crops under this family are rich in plant protein and thus have great nutritive value. They are cheap sources of protein to both human beings and animals. Apart from protein they contain some amount of calcium and phosphorus which are necessary in a balance diet. Legumes are also source of vitamins A and D. Apart from their food value, they are very important in farming because of the following reasons.

1. The root system of legumes contain nodules (fig7•1) which house the nitrogen-fixing bacteria called **Rhizobium**. These Rhizobium can convert nitrogen in the atmosphere into nitrates which can be used by the plants.
2. Many leguminous plants are used as green manure and their residues also contribute in increasing soil fertility.
3. They can also be used as cover crops.
4. They are used in crop rotation because they have the ability to replace the lost nitrogen.



*Leguminous roots with nodules*

### OBJECTIVES

By the end of this unit, you should be able to:

1. Differentiate a leguminous crop from other crops.
2. Identify the environmental requirements for the production of leguminous crops.
3. Enumerate importance of leguminous crops.
4. Describe the cultural practices used in the production of legumes.
5. List storage methods for the crop.

### WORD STUDY

Legumes (Pulses): crops belonging to the family of **leguminae** they produce seeds in pods and have root system containing nodules.

Nodules: growth on the root system of legumes which houses the rhizobium bacteria

Family: A group of plants or animals having the same characteristics.

Pathogens: Small living things that can cause diseases.

## **COW-PEA**

Local Name: Hausa - wake, Yoruba - Ewa, Igbo - Agwa.

Family: Leguminosae

Genus: *Vigna*

Botanical Names: *Gigna senensis* or *V. unguiculata*

Cowpea is one of the most important leguminous food crops of West Africa. It originated from West Africa where wild types are found growing. The crop is an annual crop.

### **Varieties**

Cowpea has different varieties namely the dwarf variety which is short and erect, and the creeping and climbing variety. The size of the seeds and pods varies from variety to variety.

Cowpea can be cultivated in a variety of soils, but it grows better on an average loam soil and in areas with moderate or light rain fall. Cowpea will mature in three to four months from planting. It is not advisable to cultivate cowpea in soils rich in nitrogen because cowpea can use atmospheric nitrogen.

### **Planting Dates**

The planting date varies from one area to another and also according to the variety. In savanna areas, cowpea is planted between April and August.

## **ACTIVITY I**

1. When is the planting date for cowpea in your own locality?
2. Plant some leguminous crops in the school farm or garden and note the difference in growth habit of the various varieties.

### **Spacing**

The spacing varies according to the varieties (erect, creeping or climbing). The erect type is planted 30 - 70 cm while the creeping type has a bigger spacing or 60 - 175 cm.

### **Weeding**

Herbicides can be used to control weeds. Traditionally hand hoes are used for weeding. Two to three weeding will be ideal for weed control. Weeding the creeping varieties with a hoe after the vines have developed is NOT recommended to avoid damage to the vines. Hoeing is not advisable during flowering.

### **Growth Period**

The plant starts flowering 9-12 weeks after planting and matures 6 weeks later.

### **Harvesting**

Selective harvests are normally necessary since all the pods do not ripe at the same time. It is possible to allow all pods to get ripe before harvesting.

### **Storage:**

The threshed grains are better stored after treating it with insecticide to avoid attack by insects. DO NOT treat the one for immediate consumption with insecticide.

### **Pests and Diseases**

The crop is a host of many insects and pathogens. Cowpea is attacked by insect both on the field and in storage place. A visit to the market place will give you the opportunity to see the damage done by these insects. Before flowering, the crop can be attacked by beetles, grasshoppers and some kinds of moth that feed on the cowpea leaves. To control these insects the crop should be sprayed with insecticides at regular intervals.

## **GROUND NUT**

Local Name: Hausa, Gyada, - Yoruba – Epa, Igbo - Ahuekere  
Family: Leguminosae  
Genus: *Arachis*  
Botanical Name: *Arachis hypogaea*

Groundnut originated from Brazil, but now cultivated throughout the tropics. In the 50s and 60s Nigeria was well known in the production of this crop. It is an important source of plant protein and oil. Groundnuts prefer light loamy soils and are successfully cultivated in the savanna areas of Nigeria.

### **Planting**

They are planted in mid-march to April in Southern Nigeria and in June in the North. The spacing varies from variety to variety. It is 24-170cm for the erect type and 30-170 for the spreading type.

### **ACTIVITY II**

You should uproot some leguminous plants to observe the root nodules.

### **Weeding and Earthing up**

Weeding is necessary for high yield and should be done 2-3 times before harvesting. Earthing up is done to ensure that the soil around the roots is protected from erosion by rainfall.

Groundnut should be harvested four to five months after planting. The nuts should be dried either in the sun or in a hot air drier after harvesting.

### **Storage**

Groundnut pods are stored in Jute bags. Big bans could be used for storage purpose.

### **Pests and Diseases**

This crop is prone to the attack of rodents like rats and squirrels, but goats and sheep may also feed on the groundnut plant. The major disease of this crop is Rosette disease which is caused by a virus. It can be controlled by early and close planting, and by the use of resistant varieties and crop sanitation.

## **SOYA BEAN**

Local Name: Hausa-waken soya, Yoruba-Ewa soya.  
Family: Leguminous  
Genus: *Glycine*  
Botanical Name: *Glycine max*

Soya bean is a source of plant protein. The crop grows well in fertile well-drained loam soil, free from root-knot nematodes.

The crop is planted during the first to third week in June either by broadcasting, or in rows. If planting is in rows, then a spacing of 15-170cm should be observed. Two seeds per hole. It should be weeded two to three times before harvesting to increase the yield.

### ACTIVITY III

Visit a nearby market to sample various leguminous seeds and compare them.

### SUMMARY

- The roots legumes contain nitrogen fixing bacteria, which convert the atmospheric nitrogen to soil to make it available to plants.
- Pulses are used as food and also as cover crops, their leaves and seeds have high levels of protein.
- The seeds of some legumes contain oil;.
- Legumes respond well to loam soils and moderate rainfall.
- The pods of legumes are considered mature when they become partially dry.

### ASSIGNMENT:

1. Explain why legumes should be included in crop rotation?
2. What are the main precautions you would adopt to protect legumes from attack by insects both in the field and during storage?
3. State the main difference between the root system of a leguminous plant and a cereal.
4. Give the botanical names of the following crops:
  - i) Soya bean
  - ii) Cowpea, and
  - iii) Groundnut

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## UNIT 7      AGRICULTURAL CROPS III: ROOT CROPS

### INTRODUCTION

Root crops develop swollen underground tubers or roots. They are the source of edible carbohydrate to the greater part of the tropical population. These crops are not all that important in the world market but they are of immense help locally. They are less susceptible to pests attack and yet has high yielding capacity. Among the most important of these root crops are the yams, cassava, sweet potatoes and cocoyams.

### OBJECTIVES

By the end of this unit you should be able to:

1. List some Nigerian root crops
2. Describe cultural practices peculiar to specific root crops
3. Describe the propagation of some root crops.
4. Describe methods of harvesting, processing and storage of some root crops.
5. List uses of some root crops.

### WORD STUDY

**PROPAGATION:** The reproduction of a new generation of plants from parent stock.

**YAM SETT:** Large tubers cut in pieces. It could also be a whole tuber.

**ASEXUAL OR VEGETATIVE PROPAGATION:** The use of a plant part propagation.

**SEXUAL PROPAGATION:** The use of seeds to reproduce a new generation of plant.

### YAM:

**LOCAL NAMES:** Hausa-Doya, Ibo-Ji, Yoruba-Isu

**GENUS:** *Dioscorea*

**BOTANICAL NAME:** *Dioscorea spp*

### Species of yam:

White Yam (*Dioscorea rotundata*)

Yellow Yam (*Dioscorea cayenensis*)

Water Yam (*Dioscorea alata*)

Bitter Yam (*Dioscorea dumetorum*)

Aerial Yam (*Dioscorea bubifera*)

All Yam species develop their tuber below the soil surface, except the aerial yam which develop its tuber on the tendril. Yam is produced in many parts of Nigeria where the soil rainfall and temperature are favourable e.g. Benue, Kwara, Oyo, Akwa Ibom, Cross River, Rivers, Imo, Osun, Kaduna, and so on.

### ACTIVITY I

Draw the map of Nigeria indicating the states where yams are mostly cultivated and explain why.

### **Growing Conditions**

Yam requires a well drained fertile soil, the rainfall requirement is about 150cm per annum and a temperature of about 30C.

### **Cultivation Methods**

You should first clear the site, then prepare mounds, heaps or ridges. The size of the mounds, heaps or ridges varies with soil type and size of setts. Yams can be planted on flat land where the soil is loose.

### **Propagation and Time of Planting**

Yam is mostly propagated by vegetative or asexual means using yam setts. Early planting is carried out in late October to early December while late planting takes place between February - April.

### **Preparation of Yam Setts**

To prepare yam setts you need a large tuber. You then cut the tuber into smaller pieces to form yam setts. Seed-yams on the other hand are gotten from the tubers harvested from late planted yams or from the second harvest obtained from early - planted yams. The cut sett should be allowed to dry for 2 - 3 days. To prevent infection by fungal diseases, you should treat the surface of the cut yam sett with sulphur. Note that farmers do dip their yam setts in solution of wood ash and water to ensure rapid sealing of cuts. The setts are kept until they produce short solution shoots or sprouts before they are planted. Planting distance is 90-100cm apart.

### **ACTIVITY II**

- 1) Investigate and briefly explain the methods used for planting yams in your locality.
- 2) When is the preferred period of planting in you locality? Why? Discuss your answers with your Peer-help-mate.

### **Mulching (Capping)**

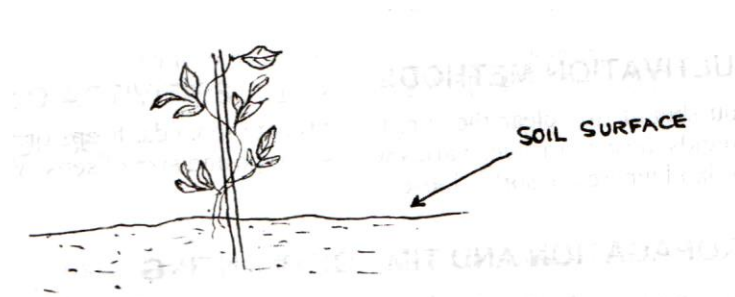
This is the placing of dried leaves or dried grass over the planted yam sett. This is necessary to prevent excessive heat from the sun to affect the yam sett. This also reduces the rate of evaporation of the soil moisture from the area of the yam sett. Capping increases the rate of germination. Uncapped yams may have a low rate of germination.

### **Staking**

Staking is the use of a stick to support the yam plant. The methods of staking vary from one locality to another and also with the type of yam planted. Some type required tall stakes while others require short support.

In some areas both the light and heavy staking methods are used. The light stakes are used to train the individual vines so that they are eventually supported by stronger and heavier stakes. The stakes range in size from 2.5in to 3m and 5.0cm to 8.0cm in diameter. The stake should be inserted deeply and firmly enough to support the total weight of the foliage produced. If the yam plant is left without support, some of the leaves will fall prematurely, and this will lead to reduction in yield.





*Staking of yam*

**Weeding:**

Weeding is done two or three times to reduce competition between the crop and the weed. During weeding, build up the ridges or heaps to prevent them from being eroded during heavy rainfall.

**Harvesting:**

For the early yams, harvesting start in late May and continue until mid-July depending on the locality and the type of yams. The crowns of yams harvested from July to mid August encourage the production of the second crop of tubers. Harvesting can be done by the use of hoes, cutlass or long strong pegs. Care should be taken not to damage the tubers or else they will be exposed to fungal and bacterial attack.

The harvested tubers are stored in a well ventilated place.

**Pests and Diseases:**

Pests of yams include nematode, yam beetle and yam shoot beetle. The diseases are mainly virus diseases e.g. mosaic virus.

**CASSAVA**

Local Names: Hausa-Rogl, Yoruba-Ege, Igbo-

Botanical Name: (Manihot esculenta)

It is an important food crop cultivated in many parts of Nigeria. It is used in the preparation of gari, cassava flour, fufu starch, tapioca and industrial starch.

Two main kinds of cassava are commonly grown in Nigeria, they are-

- 1) Sweet Cassava (Manihot palmata) and
- 11) Bitter Cassava (Manihot utilisiiima).

The bitter cassava which is used in processing Gari contains a bitter juice which is poisonous to human and livestock. This juice called hydrocyanic acid must be extracted before the cassava is safe for consumption.

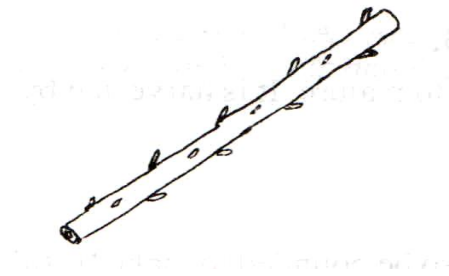
The commonest varieties in Nigeria are: Nwangoye, Nwaiwa, Karagba, Dan WaITi, and so on.

**Cultivation:**

Ridges are prepared about 90cm to 1 m apart. They are always very high about 40-45cm Mounds can be prepared in place of ridges.

**Propagation and Planting Time**

Cassava is propagated by vegetative means by the use of stem cuttings. The cuttings are inserted in to the soil in a slopping position at an angle of about 45° to the surface of the soil. The spacing is 90cm on 90cm ridge.



*Cassava Cutting*

The planting time is between May and early June or from September to December. Weeding and surface cultivation during growth or vegetative period will enhance the formation of tubers.

### **ACTIVITY III**

- (1) List other root crops cultivated in your area in order of their importance  
Discuss your answers with your study group.

### **Maturity and Harvesting**

The maturity time varies with the variety used, the soil fertility and the amount of rainfall which occurs during the growing period. It takes between six to eighteen months for the crop to mature.

Once harvested, cassava roots will not keep long. It is therefore advisable to harvest only the quantity required for use within a relatively short period. However, fresh cassava can be converted to Gari or Cassava flour in which form it will remain edible for some time.

### **COCOYAMS**

LOCAL NAMES: Hausa - Gwaza. Ibo - ede, Yoruba - koko

BOTANICAL NAME: (Xanthosarna sagittifolium and colocaisa esculente)

Cocoyams are commonly cultivated in the wetter areas of Nigeria but are also grown in the 'fadamas' of the north. They require high humidity throughout their growth and a soil with high humus and moisture content.

#### **Cultivation:**

The corms are usually cut into setts which are covered with dry leaves for two to four weeks to encourage sprouting before planting. Planting is done in the month of May to June. Planting distances are usually in ridges of 90 x 90cm apart.

#### **Maturity and Harvesting**

It takes six to eight months for the crop to mature. It is harvested by the use of hoes and the crop can be lifted by hands.

#### **Uses**

Can be eaten when roasted or boiled. It can also be pounded to make 'fufu' which is eaten with soup.

### **SUMMARY**

- Root crops form an integral component of the food production resources of Nigeria. They include Yam Cassava. Cocoyam, Sweet potato and Irish potato.

- The characteristics of Yam, Cassava and Cocoyam make these crops difficult to harvest by using mechanization methods.
- All the root crops considered contain a high proportion of soluble carbohydrates.
- Yams require capping, staking and training in addition to routine cultivation requirements. Cassava can be produced in poor soil. It is also more resistant to drought than the other root crops discussed in this unit.
- Preservation and storage of tubers or their products still remains a problem.

### ASSIGNMENT

- 1) List the tuber crops discussed in this unit and compare their relative planting distances.
- 2) Explain to a local farmer in your area the need to mulch and stake his/her yam farm.
- 3) List any four root crops cultivated in your locality and state their propagation methods.
- 4) Give the botanical names of the following root crops.
  - I) White Yam
  - II) Water Yam
  - III) Aerial Yam
  - IV) Bitter Cassava
  - V) Bitter Yam and
  - VI) Cocoyam.

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## UNIT 8      AGRICULTURAL CROP IV: VEGETABLE CROPS

### INTRODUCTION

A vegetable may be defined as the edible portion of an herbaceous annual or perennial crop. The edible portions may be the leaf, fruit, and root may be served raw or a-little cooked. The edible portions of vegetable crops have high content of water, fibre and cellulose which provide roughage. Vegetable crops are major source of vitamins and minerals for man. The major vitamins found in vegetables include vitamin A, Thiamine and vitamins C; however, the amounts and types of vitamins differ from crops to crops. Onions and sweet potatoes are high in iron, Chinese cabbage is also high in potassium, and there is a high level of calcium in Okro. Vegetables are also a source of carbohydrates and protein. There are three ways of producing vegetable crops namely: (i) Back yard farming (ii) Intensive farming and (iii) Extensive farming.

### OBJECTIVES

By the end of this unit you should be able to:

1. List vegetables produced in Nigeria.
2. Describe ways of producing vegetables.
3. Describe the cultural practices peculiar to specific vegetable crops.
4. Describe methods of propagating vegetables.
5. List the uses of some vegetables.

### WORD STUDY

Irrigation	- artificial application of water to plant.
Site	- Place (farm)
Organic matter	- Crop residue & animal droppings
Stalk	- a stick use to support a plant
Spacing	- distance between plants & Ridges.

### WAYS OF PRODUCING VEGETABLES

Basically there are three ways of producing vegetable crops in Nigeria. They are:-

- i) Back yard gardening;
- ii) Intensive gardening for markets;
- iii) Extensive vegetable farming.

Backyard gardens are usually established at the back of houses and managed by families. The area for gardening is usually very small and the types of crops grown are those the family likes. Such gardens are normally labour - intensive and can be managed even in the dry seasons because they are normally irrigated.

The Intensive vegetable production is usually done on a small area of land of about 0.2 to 0.4 hectare. The gardens are usually sited near cities or in the urban areas for easy marketing. The vegetables produced for the local markets are determined by the taste of the buyers. Irrigation is very important in this form of vegetable production, as such the source of water is also very important. The source may either be streams, gutters, wells or Water pipes. Organic matter are used to help maintain the fertility of the soil.

**It has advantages as follows:-**

- i) The ease with which erosion is controlled,
- ii) Specialization in the production of specific crops, and
- iii) The few specific tools required for the production of the crops.

**The disadvantages are.-**

- i) The exhaustion of the land and its nutrients due to its small size.
- ii) The danger of diseases and pest outbreak in the garden.
- iii) The inability to mechanize operations in the garden, and
- iv) The possibility of crop failure during unfavourable condition.

Extensive vegetable production is done on a large scale and many vegetable crops are usually grown. Farm operations can be mechanized depending upon the size of the farm, the volume of produce and the amount of work to be handled. Such vegetable production is usually carried out far away from cities and marketing of produce is usually done through middlemen. Large quantities of organic matter will be required to maintain the soil fertility and its physical structure.

**FACTORS INFLUENCING VEGETABLE PRODUCTION**

They include the following:-

- a) Rainfall
- b) Temperature
- c) Humidity,
- d) Day length,
- e) Soil conditions,
- f) Transportation,
- g) Availability of labour, and
- h) Marketing.

**ACTIVITY I**

- I) Go round your locality and identify the type of vegetables production popularly practiced.
- II) Looking at the economic situation of our country and the importance of vegetables in our lives, advise farmers on the type of vegetable production they should engage in.

**LEAF VEGETABLES (AMARANTH)**

**BOTANICAL NAME:** (*Amaranthus cantatus*)

**LOCAL NAMES:** Hausa (Alefo); Yoruba (efo)

It is also referred to as African Spinach. A well known leafy vegetable in Nigeria, it is found to grow in most ecological zones of our country. It grows best during the raining season but can be successfully grown under irrigation.

The seeds can be sown directly in drills on prepared beds, or seedlings may be raised in seed boxes or nursery beds and be transplanted. If seeds are sown direct, They should be sown thinly in drills 30cm apart. The seedlings should be gradually thinned out until there is one good plant in every 20cm in the row.

## ACTIVITY II

- 1) You should plant some leaf vegetables and study how they grow.
- 2) List all the leaf vegetables produced in your area in order of acceptability. Discuss why the vegetables are so accepted with your peer-help mate.

### FRUIT VEGETABLE TOMATO

BOTANICAL NAME: (*Lycopersicon esculentum*)

It is widely produced all over the world because it is rich in vitamins A, D and C.

Two main forms of tomatoes are cultivated, the dwarf and tall growing types. The tall types produce fruit over a longer period than the dwarf type.

#### Climatic and Soil conditions

Tomato does well on a wide variety of soil but the ideal soil should be well drained, slightly acidic, deep and with high organic matter and balanced mineral content. Well - drained sandy loams are suitable for the crop. Requires medium amounts of rainfall, but it is best produced under irrigation because of disease incidence and also the water can be controlled if irrigation is used.

#### Varieties

Varieties grown include:-

Ibadan local, Ife, Roma, Roma VF, Fire ball, VFN6425 and so on.

#### Cultural Practices

Seeds must be planted in seed boxes in nurseries or in seedbeds and then thin-out to about 5cm apart when the first true leaves appear, this is done to prevent overcrowding. Seedlings have to be provided with shade and given liquid manure. A week before transplanting the shade must be removed to harden the seedlings. Transplant when the seedlings are 2 to 3 weeks old. The spacing depends on the habits of the crop. That is whether the plants are determinate (short) or indeterminate (tall). For determinate types it is 60cm x 60cm and for the tall 60 x 90cm.

Weed control is by hand. Herbicides like **metribuzin** can be used for weed control.

#### Management

Each plant should be given a stake of about 1.2m long for support and be tied to it if necessary. This will prevent plants from sprawling on the growth, and reduce the destruction of fruits.

#### Harvesting

The best time to harvest is when the fruits have turned reddish yellow. Fruits for long distance travel should be harvested when they are yellow so that they will reach their destination in a fairly ripe stage.

#### Diseases:

The major diseases of Tomatoes are:-

- i) Early blight
  - a fungal disease caused by *Alternaria Solani*.
- ii) Septoria leaf spot
  - a fungal disease caused by *Septoria lycopersici*,
- iii) Root knot disease caused by nematodes.

#### Pests

The major pests of tomatoes are cricket, grasshoppers and beetles.

### OTHER KNOWN VEGETABLE CROPS

Other fruit vegetables are sweet pepper, Garden egg or egg plant, Okra, Cucumber, Pumpkin, and so on.

## SUMMARY

- The aim of this unit is to enable you to acquire some of the skills involved in vegetable production. It is important so that you will be able to apply the theory to a practical situation which is better judged by your success in growing vegetables.
- Vegetables are classified into four groups; leaf vegetables, fruit - producing vegetables, leguminous vegetables and root vegetables.
- There are 3 ways of vegetable production namely:
  - i) Back yard gardening;
  - ii) Intensive gardening for market; and
  - iv) Extensive vegetable farming.
- Vegetables are a source of vitamins. The problems of vegetable production include transportation, storage and adequate water supply.

## ASSIGNMENT

1. Make a list of all the vegetables you know and group them under leaf, fruit, leguminous and Root vegetables.
2. Define a vegetable and state any three vitamins found in vegetables.
3. Differentiate between Backyard gardening and Extensive vegetable farming.
4. List any five factors influencing vegetable production.

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## UNIT 9 STORAGE

### INTRODUCTION

Agriculture as we all know deals mostly with the production of food for man's use. Most of the food crops are produced during the raining season. This means that if some measures are not taken there will be food scarcity at a certain period of the year. To avoid this, measures are taken to see that there is enough food supply throughout the year. This is done through storage. Storing food crops in good condition makes it possible for us to have enough food all the year round. In this unit we shall see what storage means and also its aims.

### OBJECTIVES

By the end of this unit, you should be able to:

1. define storage;
2. list and explain some aims of storage
3. enumerate the methods of storing the above mentioned crops,
4. explain how each of these methods is carried on.

### WORD STUDY

Irrigated land	- an area of land where water is applied artificially for growing plants.
Farm produce	- something produced by farming.
Bumper harvest	- plenty of crops harvested as a result of good yield.
Barn	- This is a building used for storing produce by farmers.
Cribs	- These are raised platforms made of bamboo, wood that has been treated or steel materials.
Rhumbu	- This is a round-hut-like structure made of mud with thatched roof. Used by local farmers for crop storage.
Silo storage.	- This is a cylindrical structure made of either metal or concrete use for crop
Sillage	- Grasses cut and fermented for feeding of animals mostly during the dry season.
Gourds is soft.	- These are containers made from certain fruits. The exterior is dry while interior
Canning	- this is the act of putting something in a tin and sealing it to avoid air from entering inside.
Refrigerator	- Refrigerator is a machine that keeps food cool
Frozen	- state of iceing

### WHAT IS STORAGE

Storage may be defined as the process of keeping agricultural products safe in a form that is very close to its original form for future use or safe.

We all know that it is not easy to store food crops for a long time without incurring some losses in them. Most of the food crops get spoilt during this period. We are now lucky that technology has helped a lot in overcoming some of these problems of losses by providing us with ways to store and preserve our abundant food crops after harvest. This helps food not to get spoilt during the period of harvest and also during transportation and distribution.

Some foods keep for quite a long time if the correct methods of storing them are used. These food crops



may include yam, grains such as maize and guinea corn, groundnuts and beans. There are some food that stays fresh only for a short period and then get rot such as fruits, vegetables, meat and fish. These types of food may require processing before they are stored.

## ACTIVITY I

- State some crops that perish fast and also those that take longer time before spoiling.

Storage has been found to be of good use to people and for long been in practise. This can be dated as far back as to the era of the early man who lived by collecting fruits from the bush and hunting animals. Whenever he could not eat up all the food he had collected or hunted, he stored it in a place where he thought it safe to be used later. That was his main reason for storing his food. Nowadays there are many reasons that lead to farmers storing their food crops and also cash crops.

### **Some of the aims of storage include:**

Storage makes it possible for us to have food throughout the year. When there is a bumper harvest, storage helps in preventing food from being wasted. That is, food will be properly kept in a condition that it will last and will still maintain a high percentage of its taste.

Through storage, the farmer's income is improved. During harvest, food is always very cheap but later in the year especially during the dry season, food is scared and expensive. A farmer who stores his food crops up to this time will definitely make much more money than selling it during the harvest period.

Seeds for next planting season can only be obtained through storage. That is storing seeds in good condition will enable farmers to have good and viable seeds to be planted during the planting season.

Storage has made it possible for industries to have enough raw materials throughout the year.

## ACTIVITY II

Why farmers store food crops in your locality?

## SUMMARY

In this unit you learnt that:

- Storage is an old practice to farmers as they produce food crops beyond their immediate need and have to store it for future use.
  - Other aims of storage may depend from farmer to farmer or community to community but the universal aims are those we have discussed.
1. Explain in your own words the term storage.
  2. Give 4 benefits derived by industries on storage
  3. Give 3 reasons why some food crops have to be imported into your country despite the fact that such food crops are also produced in your area.

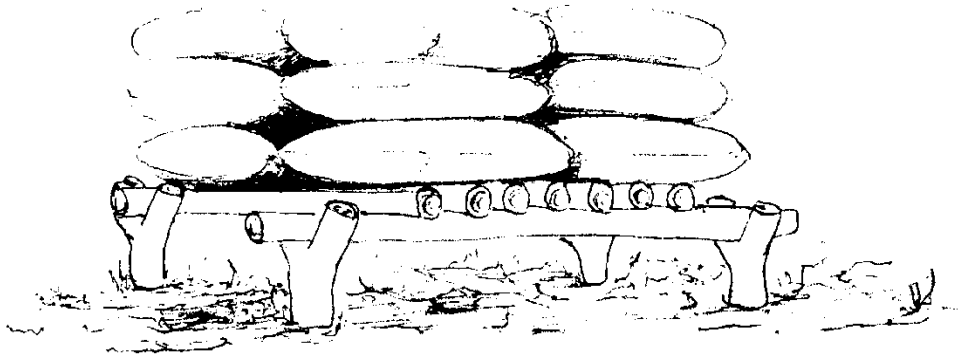
## METHODS OF STORAGE

### **I. Storing Food Crops in Sacks**

Crops such as millet, guinea corn, maize cowpea Cocoa seeds etc are dried before bagging them in sacks.

Dried grains can be stored in sacks, which are place on elevated platforms. The sacks are made in

such a way to ensure free movement of air to keep the grain cool and dry. These sacks are later kept under shelter to prevent rain from soaking the grain. Insects like weevils can easily attack the grains. Some farmers use insecticides to control insects while some burn a small smoky fire in the rooms. To control mice and rats, farmers use traps and poison baits.



Grains stored in sacks.

### ACTIVITY III

- a. Suggest reasons why maize grain has to be bagged and raised on platform before storage.
- b. Visit a store house and note the type of sacks used and condition of the environment of the store house.

### 2. Storing in Gourds, Clay Pots and Drums

Grains meant for planting are usually stored in gourds or clay pots. The gourds are often hung by the fire place where the smoke keeps off insects. Elevated clay pots and air-tight metal drums are useful for the purpose of storing dry grains. The drums are usually treated with chemicals to prevent rust.

### 3. Storing Grain in Silo

Silo is used for storing large quantity of grains or silage. Before storing any product in a silo, air is normally removed. The wall of the silo is always painted white to prevent over heat while the top is protected with palm grounds so as to keep it cool. The grain can be removed easily through an opening located at the bottom.

### ACTIVITY II

1. Name two industries you know that store their grains in silo.
2. What are these grains meant for in such an industry?

### 4. Storing Grain in Rhumbu

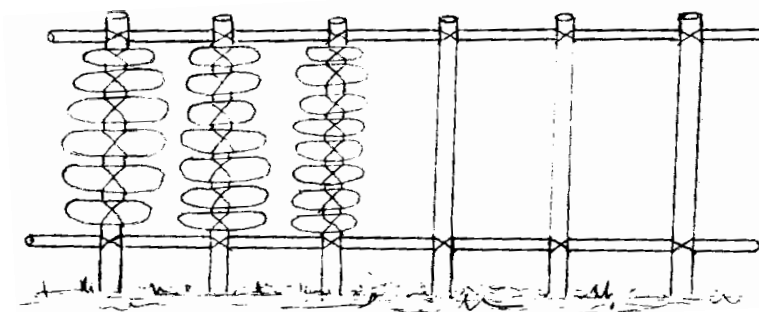
Rhumbu is made of mud walls. It is normally a round structure with a thatched roof. A small window just large enough to put or remove the grains. This type of storage system is very common in the northern parts of Nigeria.

## ACTIVITY IV

- Find out how the grains are stored in rhumbu.
- What types of grain crop is best stored in rhumbu?
- Why is it very common in the north.

### 5. Storing in Cribs

These are raised platforms which are often made of treated wood or steel materials. Bamboo can also be used in construction crib. The stands which support the platforms protected with rodent guards to prevent rodents from getting into it. Maize cobs are often stored in cribs.



Crib for Storing Maize Cobs

### 6. Storing Yams in Barns

Barns are buildings used for storing yam. Since yam contains a large quantity of water, it is exposed to the atmosphere so that it loses some of its water content. The roof is made of thatch. Barns should be rodent free. The yams are stacked in such a way that there is free flow of air to cool the barn. Yams are inspected regularly. During inspection any rotten yam are removed so that it does not contaminate other yams. The barns are often sprayed with insecticides in order to keep off insects. You can store yam in barn for a long period up to a year or more. Some of the moisture content of yam is lost during this period. And this leads to the concentration of nutrients in the endosperm therefore giving the yam a very good taste.

## ACTIVITY V

- Why are yams stored in barns?
- Give one strong reason why yams are tied singly on the racks.

## SUMMARY

In this unit you have learnt that:

- With proper storage methods, there will be limited losses of food crops
- Cereals are easy to store provided the principles of storage are followed.
- Sun drying plays a very important part in storage as many of these food crops need to be sun dried before storage.
- Insecticide sprayed during storage also helps to prevent pests and therefore prevent spoilage caused by these insects.

## ASSIGNMENT

- Give reasons why rotten yam should be removed from the barns.
- Why are grains stored in Silos?
- Describe storage of grain in Rhumbu.

## OTHER METHODS OF STORAGE

### 1. Storing by Canning

Produce like vegetables, fresh meat, fish eggs and fruit juice get spoilt very easily. They cannot be kept for more than a few days. To store such items they have to be canned. That is, the produce has to be put in tins and sealed through a special operation. This is not common with individual farmers and has to be sold to industries who have the equipment for canning operations.

Canned food should be stored in a cool and dry place. Although canned foods remain safe to eat as long as the seal is not broken, they should be used within a year of storage for best eating quality. Once the can is broken, the contents should be used immediately.

### 2. Refrigeration

Produce like fresh meat, fish, egg etc can be stored in refrigerators or deep freezers. The environment in the refrigerator is too cool for microorganisms to act on the stored items. This however needs constant supply of electricity to keep the refrigerator working.

### 3. Processing

Many perishable food items have to be processed before they are successfully stored. This changes the original form but most often retain the taste of the item. Such items are usually fruits eg mango juice, orange juice, pineapple juice etc. After processing, they are canned, put in plastic containers or bottled.

## ACTIVITY VI

- a. List 4 other food items that have to be processed before they are stored.
- b. Take note on some of the containers of such items mentioned above and see if the manufactured and expiration dates are indicated.
- c. **Storage in Dry Form**  
Food such as meat or fish can be kept for a long time when they are dried. Drying removed moisture to a level that micro organisms can not survive, thus prevent spoilage. Sun and oven are the major drying agence.

## ACTIVITY VII

- a. What is an oven?
- b. Mention 2 other methods in which meat can be stored.

## SUMMARY

In this unit you have learnt:

- Food with high water contents in them can be stored in refrigerator.
- They can also be canned before storage
- Some are bottled.
- Storing them also in cold rooms or refrigerators and freezers give a desirable result.

## ASSIGNMENT

- What is the best method of storing meat and why?

- What will you take note of before storing fish in an oven?
- How long do you think is ideal to store tomato in a refrigerator?

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## **UNIT 10      SUMMARY**

### **INTRODUCTION**

In unit (1-9) of this module you have studied the external features of a monocot and dicot plants, classification of crops. In this unit you will review what you have learnt in all the various units for emphasis and classification.

### **OBJECTIVES**

By the end of this unit you should be able to:

- Differentiate between a monocotyledon and dicotyledons plants.
- Describe how to produce legumes, roots and vegetable crops
- Identify perennial crops in Nigeria.

Crops plants can be classified based on their life cycle as annual, biennial and perennial crops.

### **ACTIVITY I**

- I. What is perennial crop?
- II. Give 2 examples of perennial crops you know?

Unit 6-9 discussed the Agricultural practices for the following groups of crops.

- a. Cereals
- b. Legumes
- c. Root crops and
- d. Vegetable crops

### **SUMMARY**

Crops are classified according to: length of their life cycle or ways in which such crops are used.

Monocots and Dicots belong to the class Angiosperm which are called flowering plants. Their differences are given in the text module 2.

Root crops form an integral component of the food production resources of Nigeria namely: Yam, Cassava, Cocoyam, Sweet potato and Irish potato.

Agriculture is important as it provide food, raw material for industries.

### **ASSIGNMENT**

- List 3 cereal crops produce in Nigeria.
- List 3 each of legumes and vegetable crops produce in your area.

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## **MODULE 3:            AGRICULTURAL IMPLEMENTS AND FARM MACHINES**

### **UNIT 3.1            SIMPLE FARM TOOLS**

#### **INTRODUCTION**

Looking at the history of agriculture, we learnt that our fore-fathers were wanderers, they gathered most of their foods and eat them raw, They throw away the surplus they could not eat one day they discovered that some seeds germinated, so that led to the planting of crops, They used sticks, bones, hands and even stones to scratch the ground and plant some seeds.

In Nigeria today we use different types of tools in planting different types of crops, we observed that tools are very necessary for farming operations. That if wrong tools are used, the farm work become very difficult, and farmers cannot achieve any meaningful results.

#### **OBJECTIVES**

By the end of this unit, you should be able to:

1.     define farm tools;
2.     list some simple farm tools;
3.     draw and label some simple farm tools;
4.     describe some simple farm tools;
5.     name the groups each farm tools belong;
6.     differentiate between some similar tools,

#### **WORD STUDY**

Implement	-	tools (simple)
Instrument	-	Equipment or material
Spout	-	long, projected pipes with opening attached at the body of a watering can
Rose	-	Very fine opening
Prong	-	teeth of farm tools e.g. hand fork and rake.

#### **SIMPLE FARM TOOLS**

Definition     -            Farm tools are the instruments used to make farm work easy and convenient.

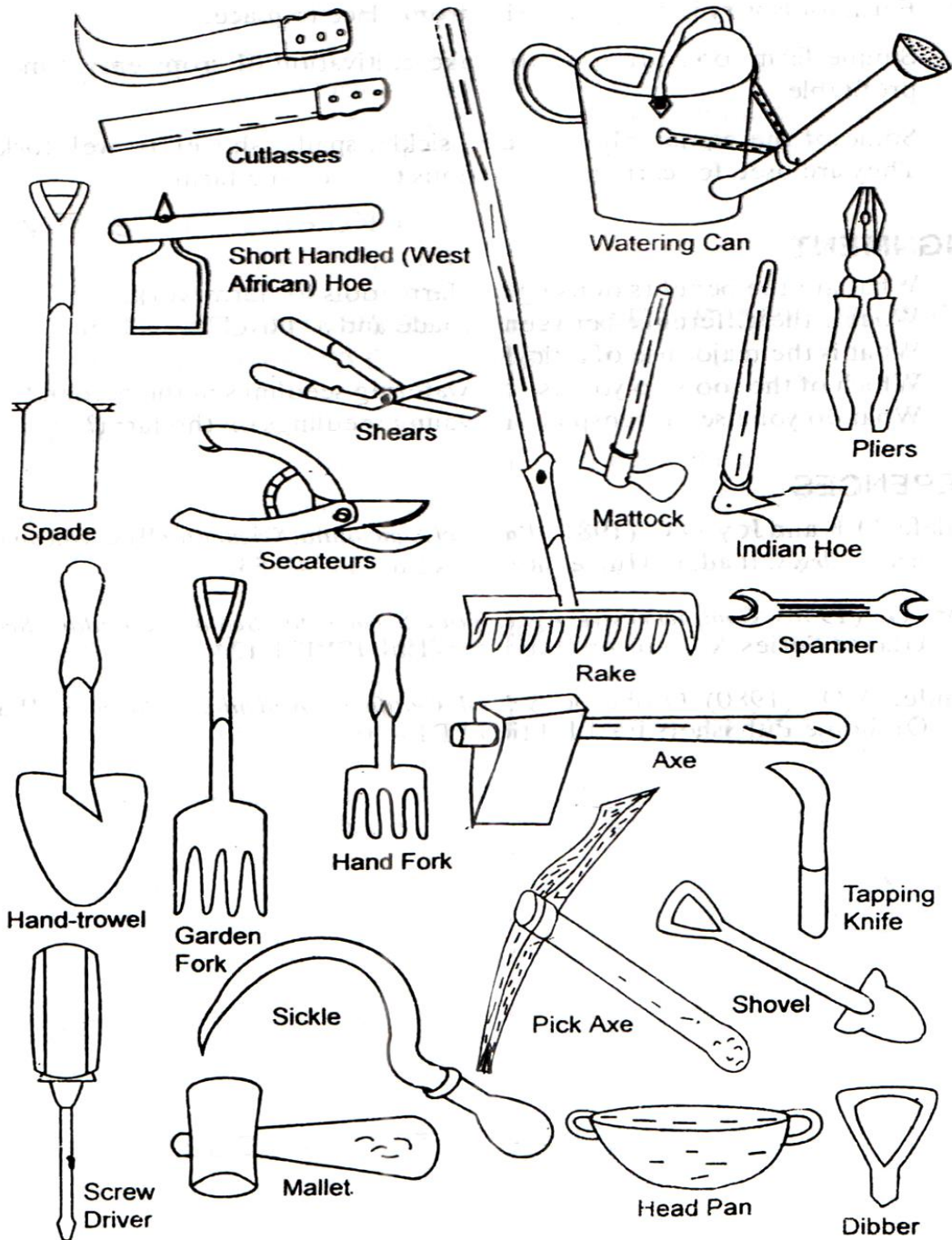
#### **COMMON SIMPLE FARM TOOLS AND THEIR USES**

Farm tools are grouped thus:

- a.     Land preparation tools. Examples are measuring tape, cutlass, hoe, garden line, rake, axe, and so on
- b.     Nursery and planting tools. Examples are seed box, and so on.
- c.     Watering devices. Examples are watering cans, bucket, sprinklers, and so on.
- d.     Pruning tools: Examples are secateurs, garden shears, pruning knife, and so on
- e.     Plant protection tools: Examples are knap-sack sprayer, duster and watering can
- f.     Harvesting tools: Examples are sickle. cutlass, hoe and harvesting hook.
- g.     Grading and packaging tools: Examples are scales. labels, baskets, hard box etc,



## SIMPLE FARM TOOLS



*Different Shapes of Cutlass or Matches*

### DESCRIPTION OF SIMPLE FARM TOOLS

These implements are used all over West Africa. The sizes and shapes are different so also the operations they are used for. They are made of wooden handle and metal blades which can be rectangular, oval or triangular. The part of the metal fixed to the wooden handle is forced through a small hole at the end of the wooden handle. Hoes are used to make ridges or mounds for weeding and harvesting of tubers.

## **CUTLASS OR MATCHET**

These are also very common in West Africa. They are made-up of different shapes and sizes. The cutlass consists of flat blade made of steel and short wooden handle. One edge of cutlass is normally sharp, while the other end is blunt. It is used for weeding and felling (cutting) trees.

## **AXE**

Axe has a heavy metal head with flattened and sharp blade. The metal head has an opening which is used to attach it to one end of the wooden or metal handle. An axe is used for felling or splitting trees.

## **SPADE AND SHOVEL**

Spade has a large rectangular flat blade which is attached to a long cylindrical hollow wooden handle. The shovel is similar to spade except that its blade is hollow. The spade and shovel are used to pack and dig soil.

## **THE TROWEL**

This is made of curved heart shaped metal blade with short wooden handle. The curved surface is called scoope. It is used to transplant seedlings.

## **PICK AXE**

This is also called digger. It is made of wooden handle and heavy metal blade. The metal head has hollow at the centre. One end of the metal head is flat while the other is pointed. It is used to dig soil.

**GO-TO-HELL:** This is a long wooden handle and narrow curved metal blade that is used to plug fruits from tall trees.

## **ACTIVITY I**

Describe the following farm tools:

1. Hand trowel
2. Cutlass

## **SICKLE**

Sickle is made of short wooden handle and curved metal blade that look like "question mark"(?) The inner curved blade is sharp while the outer part is blunt. It is used to harvest crops like rice, wheat, millet, guinea corn and grass.

## **SECATEURS**

These look like a small scissors. It has a short metal handle with a screw to join the two handles. It has a metal blade and a small iron between the two handles which are used to hold the two handles together. The secateurs is used for pruning.

## **SHEARS**

This looks like a big scissors. It has long metal handle and long metal blades. The two blades are joined together at the centre with a screw nail. Shears are used for pruning flowers.

## **RAKE**

This has long wooden handle and a head with metal prongs. The prongs can be five or more and are at right angles to the metal head. The metal head has an opening for the attachment of the long handle. A nail is used to hold the stick to the metal. The rake is used to gather weeds which were removed from the farm. It is also used to turn poultry, manure to allow free movement of air.

## **WATERING CAN**

Watering Can is a container made of metal with a spout on one side and a handle on the other side. The rose is made and fixed to the spout spray. The watering can is used to apply water in a fine spray to young crops or seeds in the nursery.

## **PRUNING SAW**

This is made of flexible metal with a hollow wooden handle. The blade may be serrated or not. One side of the pruning saw either serrated or not is sharper than the other. The saw blades can be of different sizes which can be fixed on the wooden head or handle with a screw for different operation. The pruning saw is used for cutting shrubs.

## **HAND FORK**

This looks like kitchen fork but it is bigger. It is made of short wooden handle and there are prongs. It is used to loosen the soil for easy penetration of crop roots.

## **SUMMARY**

- Farm tools are the implements used on the farm to make farm work easy and faster.
- Farm tools are grouped thus: Land preparation tools, nursery tools, watering devices, pruning tools, plant protection tools, harvesting tools etc.
- The examples of simple farm tools are - hoe, cutlass, spade, sickle, axe, pruning saw, garden form, etc.
- Hoe - Two types of hoe, long and short hoe. It is made of wooden handle and metal blade. The blade can be oval or rectangular in shape. It is very common to all West African farmers.
- Cutlass - it is made of short wooden handle and metal steel blade. It is made of different sizes and shapes depending on the operation it is used for.
- Rake - This is made of long wooden handle and a short metal prongs.
- Shovel and Spade - These are made of hollow triangular wooden head and metal blade. The difference between spade and shovel is that shovel has a hollow blade
- Hand Trowel - This is made of curved heart shaped metal and short wooden handle.
- Pick Axe - This is made of wooden handle and heavy metal head. The wooden handle is attached to the opening metal head for operation
- Sickle - This is made of long curved metal blade (like question mark) and short wooden handle.
- Watering Can - This is made of metal container with a spout. The rose is attached to the sprout for water to come out in form of spray.
- Pruning Saw - this is made of flexible metal with serrated or non-serrated edge, The handle is made of wooden with opening where the user can hold.

## ASSIGNMENT

1. List any ten tools used in your locality.
2. Take a trip to a nearby farm and see some Implements you find there,
3. Draw and label those implements you have seen,

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## UNIT 2      USES AND MAINTENANCE OF FARM TOOLS

### INTRODUCTION

In this unit, you will study the use and care of farm tools. Most of the simple farm tools used in Nigeria today are locally made by our craftsmen. As a result of this, subsistence agriculture is being widely practiced

### OBJECTIVES

At the end of this unit, you should be able to:

1. identify farm tools that are commonly used by farmers;
2. mention their uses and their maintenance;
3. acquire skills in handling farm tools.

### WORD STUDY

- Pruning        - Removal of unwanted branches of trees.  
Shrubs        - These are short trees mainly seen in low rainfall areas.  
Mown         - These are grasses cut with cutlass.

## USES AND MAINTENANCE OF FARM TOOLS

### 1. Uses of hoes

- i. They are used for making ridges, bed, mounds etc.
- ii. They are used for weeding and earthing ridges or mounds.
- iii. They are used for harvesting tubers, such as, yam, cocoyam, cassava, potato, etc.
- iv. They are used for uprooting small stumps of tough plants.
- v. They are used for sowing seeds.

#### Care of Hoes

- i. Wash and dry
- ii. Oil or grease the metal blades after use
- iii. Hang on a rack to avoid termite eating the wooden handle.
- iv. Sharpen the blunt metal blade.
- v. Replace the wooden handle when broken.

### 2. Uses of cutlasses

- i. They are used for clearing bushes and felling trees
- ii. They are used for harvesting yams, cassava, and so on.
- iii. They are used for digging shallow holes

#### Care of Cutlasses

1. Wash and Clean or dry under the sun
2. Oil or grease the IT1Ct2I blade
3. Sharpen the blunt blade.
4. Replace the wooden handle when broken

### 3. Uses of Sickle

- i. They are used for harvesting rice, wheat, guinea corn, and so on.

- ii. They are used in cutting weeds and forages for livestock.

#### **Maintenance of Sickle**

- i. Clean the metal blade
- ii. Grease or oil the metal blade
- iii. Sharpen the blunt blade.
- iv. Replace or weld the broken parts.
- v. Hang sickle on a rack when not in use.

#### **4. Use of Secateurs**

- i. They are use for pruning and cutting of dead and diseased stems and branches.

#### **Maintenance of secateurs**

- i. Clean the metal blades
- ii. Grease or oil the metal part to prevent rust
- iii. Sharpen the blunt blades
- iv. Tighten the knots that hold the blades

#### **5. Uses of garden shears**

- i. They are used for trimming hedges and shrubs
- ii. They are used to trim flowers

#### **Maintenance of garden shears**

Same as secateurs

#### **6. Uses of Rakes**

- i. They are used to collect mown grasses and farm rubbish.
- ii. They are used for leveling soil surfaces and breaking soils lumps into finer particles.
- iii. They are used to remove weeds and stones from the planting area.
- iv. They are used to rake seeds into prepared beds by raking a fine layer of soil over them.

#### **Maintenance of rake**

- i. Wash and dry under shade after use.
- ii. Hang on a rack to prevent the termite
- iii. Replace the wooden handle when broken
- iv. Straighten the bent prongs.

#### **GENERAL MAINTENANCE OF SIMPLE FARM TOOLS**

- vi. Wash and dry clean with rag
- vii. Oil or grease the metal blades after use
- viii. Hang on a rack to avoid termite eating the wooden handle.
- ix. Sharpen the blunt metal blade.
- x. Replace the wooden handle when broken.
- xi. Straighten the bent prongs.
- xii. Tighten the knots that hold the blades
- xiii. Hang on a rack to prevent the termite

## ACTIVITY I

1. Mention two uses of each of the following farm tools
  - a. Hoe
  - b. Cutlasses
  - c. Sickle
2. Mention three ways by which farm tools can be maintained.

## SUMMARY

You have learnt that farmers make use of farm tools in farm operations. Examples of some farm tools are:

Hoe	-	For weeding, harvesting, making ridges and planting seeds.
Care of hoe	-	Oil or grease the metal blade, sharpen the blunt blade.
Cutlass	-	For clearing, cutting bushes, and digging shallow holes.

### Maintenance of Cutlasses

Grease the metal blade, replace the broken handle and sharpen the metal blade.

Sickle: For harvesting rice and wheat.

Care of Sickle: Clean the metal part. Oil or grease the metal blade. Replace the wooden handle.

Rake: For breaking soil lumps for gathering farm rubbish and mown grasses.

Care of rake: Straighten the bent prongs. Wash and dry under shade. Hang on a rack.

## ASSIGNMENT

1. Why are farm tools important to farmers?
2. Explain any two uses of
  - a. Garden fork
  - b. Watering can
3. Discuss the general care of simple farm tools.
4. Find out the maintenance of others not mentioned here.

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## UNIT 3 SIMPLE FISHING TOOLS, USES AND MAINTENANCE

### INTRODUCTION

Fishing is one of the most important occupation of most Nigerians especially those living in the riverian areas. To undertake this occupation effectively the fishermen need some fishing tools to be able to go into the rivers, lakes, seas to harvest the fish.

### OBJECTIVES

By the end of this unit, you should be able to:-

1. name different fishing tools in your area.
2. draw and label some fishing tools common in your area.
3. describe some fishing tools.
4. Mention some fishing tools and describe how they are used and maintained.
5. take care for fishing tools.

### WORD STUDY

Hook	- to fasten or catch with
Net	- cord or twine knoted into mesh.
Spear	- sharp pointed metal weapon
Cast	- to throw

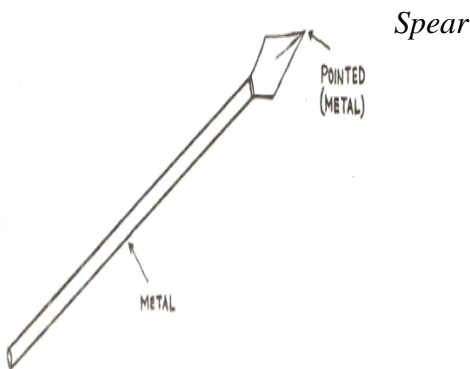
### ACTIVITY I

Mention some fishing tools used in your areas

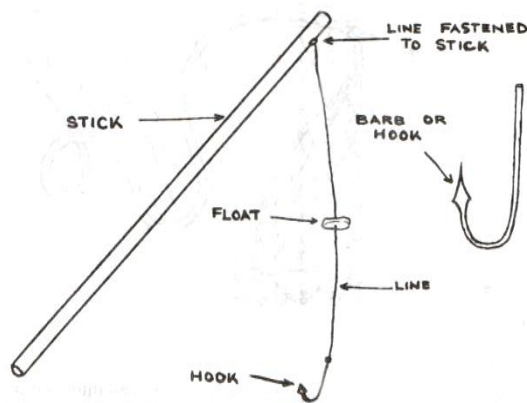
### SIMPLE FISHING TOOLS

Fishing tools are instruments used in harvesting fish. They are hook and line, basket, calabash, drag net, cast net, gillnet, purse seine, trawler boat (motorized bat) and so on.

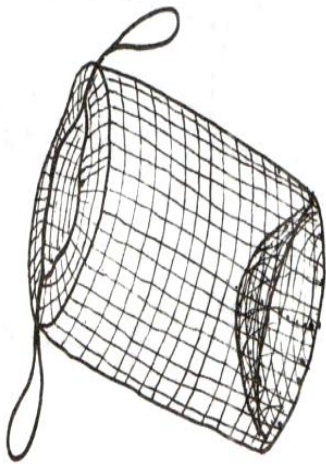
Drawing and labeling and description of simple fishing tools:



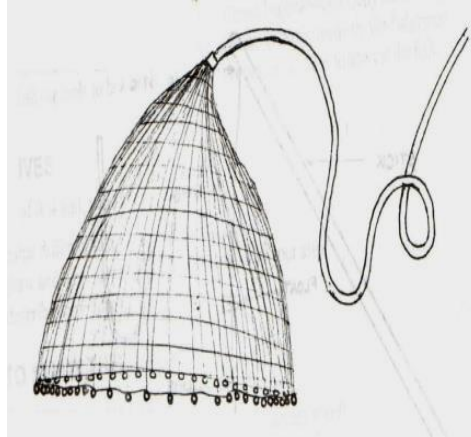
*Spear*



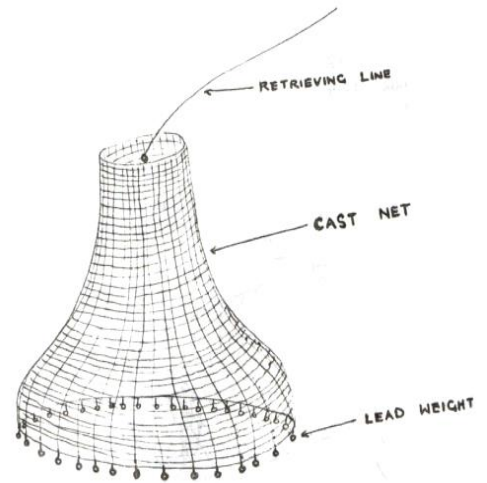
*Hook and line*



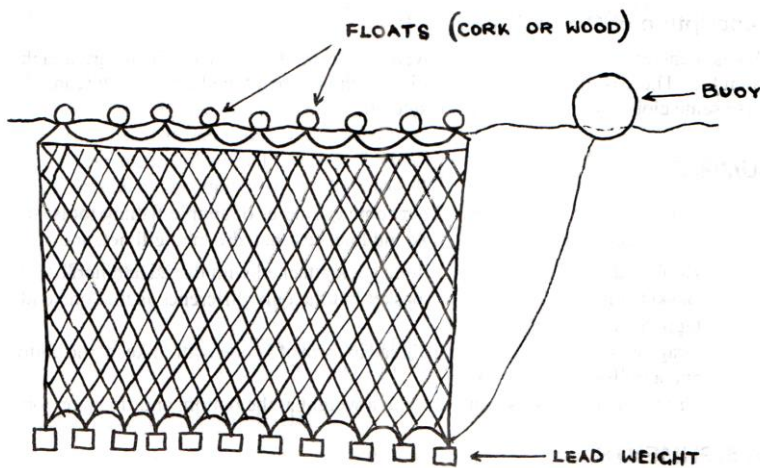
**Fishing basket**



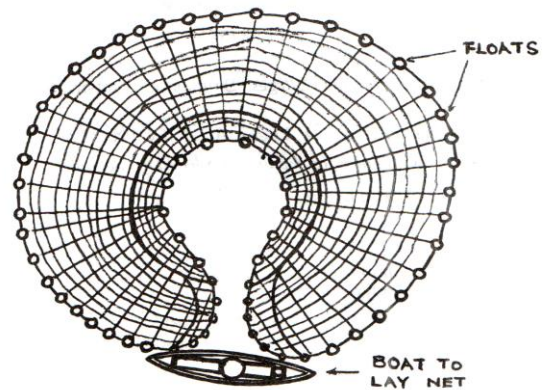
**Drag net**



**Cast net**



**Gill net**



*Purse seine*

**Description and uses of Spear**

This is made of heavy long pole (iron) with pointed end. The fisherman first observes the fish movement. He uses the sharp pointed edge and aim at a fish and then throws it to the fish.

**Description and uses of hook and line**

This is made of a strong string (line) which is attached to a metal hook at one end. The other end of the string is tied to a long stick (fishing rod). The long stick with line and hook are held by the fisherman. The stick with hook and linen with bait (earthworm) are thrown into the river or stream. A small piece of calabash may be tied on to the rope to act as a float and marker. Fish is attracted by the bait, and try to swallow it. It is then hooked.

### **Description and uses of fishing basket**

Fishing basket is similar to ordinary house hold basket but much deeper and tapers from the open end of the closed bottom. The basket is lowered into the water with the open end in front. Occasionally it is lifted up and inspected to see if any fish is caught. Also the basket can be left in the water over night with a bait. The basket is then inspected the following day to see if any fish is caught.

### **Description and uses of drag net**

It is a conically falling net. It is made of strong thread which is woven into a large net measuring about 15 metres by 20 metres. Heavy objects like piece of metal are attached to the edges of the net at regular intervals. The metal pieces allow the net to sink in the water when the net is thrown.

### **Description and uses cast net**

This looks like curtain with a weight at the bottom and a float on top. When the fisherman sees a fish, the net is thrown quickly and the metal pieces (sinkers) allow the edges of the net to sink thereby enclosing the fishes within the area where the net covers. By pulling the strong cord attached to the edges of the net, the edges come closer and form something like a sack in which the fishes are trapped.

### **Description and uses of Purse Seine**

This is made of strong thread. It is woven in a form of a circle. Floats are attached around it. There is opening in the middle which is joined together with a thread. The purse seine closes when there is fish inside

### **Description and uses of Trawl net**

The net is attached to one end of the boat and as the boat moves, the net sink at the bottom of the river with mouth opening in form of a bag. Fishes which enter the bag are trapped until the fishermen anchor the boat and drag the net.

## **ACTIVITY II**

Explain the following:

1. Hook and line
2. Gillnet

## **SUMMARY**

In this unit, you have learnt about some examples of simple fishing tools. Such as baskets, spear, calabash, hook and line, cast-net, Dragnet, gill net and so on.

**Hook and line:** This consists of long stick attached with thread and hook.

**Basket:** It looks like household basket but the only difference is that one tapered (small)

**Drag net:** This is made of strong thread in form of a cone with sinker at the bottom and a pulling cord on top.

**Gill net:** This looks like curtain with a weight at the bottom and floats on top. In this the net is submerged into the middle of the river or stream. The weight at the bottom holds the net down. Fishes that swim into the net are held there tight until the fishermen can raise the net and collect the fish.

## **ASSIGNMENTS**

1. Which of the fishing tool are commonly used by fishermen in your area?
2. Give two reasons why fishing tools are Important
- 3 Draw and describe basket used as a fishing tool.
4. You should visit a fisherman in your locality and take note of all the fishing tools he uses.

## **MAINTENANCE OF FISHING TOOLS**

### **Spear**

- i. Sharpen the pointed edge when blunt.
- ii. Keep the implement at a safe place to avoid injury.
- iii. Oil or grease the pointed edge to avoid rust.

### **Basket**

- i. Remove all the dirt collected In the water from the basket.
- ii. Dry the basket under the sun
- iii. Mend all the openings to avoid fish escape.

### **Cast-net**

- i. Replace the entire missing float to avoid fish escape.
- ii. Spread the net under the sun to avoid growth of mould.
- iii. Fold and store when not in use.
- iv. Mend all the openings with strong thread to avoid fish escape.

### **Drag net**

- i. Hang under the sun to avoid the grow of mucus.
- ii. Replace all the missing float and weight.
- iii. Mend all the opening to avoid fish escape.

### **Trawl net**

- i. They should be dried under the sun to avoid mucur growth.
- ii. Fold the net when not in use.
- iii. Mend all the openings when torn.
- iv. Replace when very old.

## **ACTIVITY I**

What are maintenance practices for the following?

- a. Spear
- b. Drag net

## **ACTIVITY II**

Describe in detail how basket is used in fishing?

## SUMMARY

In this unit you have learnt:

- How to use and care for simple fishing tools for maximum harvesting of fish.
- That fishing tools are the instruments used in harvesting fish.
- Use and care of: spear, basket, hook and line, cast net and Gill net

## ASSIGNMENT

1. Describe how the following fishing tools are used.
  - a. Hook and line
  - b. Cast net.
2. Give two reasons why you should study care of fishing tools.
3. How would you care for fishing basket?

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## UNIT 4 FARM POWER

### INTRODUCTION

Power is needed in farming operations. Farm power referred to the capacity for exerting or applying a mechanical force to increase the rate of doing farm job. Generally, power on the farm is required for pulling implements and for stationary jobs. Farm power is generally derived from a number of sources like wind, water, electricity and engines. Several farm operation like stumping, construction. Can be conveniently done with the help of mechanical force.

The major source of the power on the farm IS tractor which helps to draw the other farm implements. Also power can be derived from animals Farmer used his physical strength by walking to the farm, pushing and by using simple farm tools which release and improve his manual skill. All these sources of power had led to increase production of food to meet the demands of the increasing populations.

### OBJECTIVES

At the end of this unit, you should be able to:

1. Mention different sources of farm power:
2. Explain the sources of farm power:
3. State the advantage and disadvantages of each source.

### WORD STUDY

Power - Rate of doing work with respect to time.

Mechanized - To equipped with machines

Solar - Refers to the sun

### FARM POWER

#### Definition

Power is the rate of doing work or rate of expenditure of energy.

The sources of farm power are -

- |           |          |                          |                 |
|-----------|----------|--------------------------|-----------------|
| a. animal | b. man   | c. mechanical/engine     | d. water        |
| e. wind   | f. solar | g. electrical energy and | h. fuel energy. |

#### Human Power

Man power is the most important of all the power in the farm because it is the commonest. Man is also the controller or operator of other sources of power.

#### Advantage

Man operates and controls animal and even mechanical power.

#### Disadvantage

Human energy has limited capacity, so the production is low.

#### Work Animals

The out-put of animals like bull, donkey, horse and camel are more than that of man. In the Northern Nigeria, animals are used more often in the farm work to pull farm implements like plough, ridger and

cart. These implements are attached to the animals. As the animals move, man controls the animals and the implements.

### **Advantage**

The out-put is more than the man's output in terms of energy. More work per unit time can be achieved.

### **Disadvantages**

- i. Animals require a lot of food in order to work better.
- ii. They are costly to buy, maintain and care for.
- iii. Animal draught is difficult in tse-tse fly infested areas. They can contract trypanosomiasis disease.

### **Mechanical Power**

Mechanical power is got from an engine fuel or electricity driven-machine.

### **Advantages**

- i. It is possible to cultivate large hectares of land within a planting season.
- ii. It is more convenient to use in heavy operations than animals.
- iii. It can be used in any type of environment and soil.

### **Disadvantages**

- i. The purchase of farm machinery and operation are expensive.
- ii. It requires skilful and careful operator which is difficult to find,
- iii. Many tractors are laid up for a long time in West Africa because of lack of spare parts which are costly.

### **ACTIVITY I**

List five sources of farm power and state two advantages of man power in farm operation.

### **Wind Power**

Wind power is mainly used in wind mill to rotate the propeller of wind mill. The wind mill has two or more blades which rotate by force of wind. The blade or propeller now rotates the windmill shaft which later creates the electrical energy. The electrical energy can be used for different farm operations.

### **Advantage**

- i. The shaft can be connected to water pump for pumping water to farms.

### **Disadvantages**

- i. It is very expensive to construct.
- ii. The movement of wind is uncertain and unreliable.

### **Water Power**

Many sources of power are gotten from water flowing in rivers. For example, hydro-electric power is got from construction of a dam. Water is maintained at two different levels in the dam. At this level water possess kinetic and potential energies. When the flow of water is steady, water can be made to turn turbines or water wheels. As water from the dam come out of what is called penstocks, it forces the blades of the turbine to rotate. These are coupled to dynamos and electricity is generated.

### **Advantages**

- i. The electricity are transmitted to homes, offices and industries for use.
- ii. Electricity can be used as a source of power for processing machines.
- iii. Environmental pollution is eliminated.

## **Disadvantages**

- i. It is very expensive to produce.
- ii. it requires skillful and careful management and handling.

## **Fuel Energy**

Machines cannot work unless a sort of energy is applied. This energy is got either from coal, petrol, or diesel or kerosene. When these are burnt, the energy locked up in them are released as heat energy which can be used to work in the farm.

## **Electrical Energy**

It is used to operate electric motors which are used to operate many modern appliances like mixers, heaters and some power tools.

## **ACTIVITY II**

What are the two disadvantages of:

1. Water power
2. Wind power

## **Solar Energy**

Solar energy is also known as sun energy. All the radiation reaching the earth's atmosphere comes from the sun

### **Advantages**

- i. Solar energy is used for drying of agricultural products like corn, melon, groundnuts etc.
- ii. Solar energy can be converted to electrical energy.

## **SUMMARY**

The sources of farm power are - Man, animal, water, sun, fuel etc.

### **Man power**

Man uses his intelligence to control other sources of farm power. the only disadvantage is that man cannot do most of the hard work like stumping, construction.

### **Animal power**

Animals are made to pull other farm implements. Animals can work longer than man. The only disadvantage is that animals can refuse to work if not cared for.

### **Mechanical power**

it can come from the use of coal, fuel or kerosene. The advantages are that it can increase the hectareage of cultivated land. It can be used on any type of environment. Its disadvantage is that the machines are very expensive.

### **Wind power**

The power from the wind mill.

The power from the wind is used in drying of agricultural produce. The disadvantage of wind power is that it is sporadic (uncertain).

### **Water power**

This is used to generate electricity. The advantage is that the electricity are used at home, and industries.



### **Fuel power**

Machines cannot work unless some source of energy is supplied, this energy can be gotten from either fuel or coal or kerosene. The only disadvantage is that it is expensive.

### **Electrical energy**

The energy is used to operate electric motors like mixers, blenders, heaters and so on.

### **Solar energy**

This is the energy from the sun the advantage is that the solar energy is used by plants to make their food.

## **ASSIGNMENT**

1. What are the uses of power supply on the farm?
2. Mention common sources of farm power.
3. Discuss any two advantages and disadvantages of power supplied by wind and animal.

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## UNIT 5 FARM MACHINERY

### INTRODUCTION

Peasant farmers till today rely mostly on simple farm tools in their crop production operation. The use of hand tools in these operations is labour intensive, drudgery and slow pace. The introduction of Machinery has transformed agricultural production. Fatigue and backache are removed, efficiency and effectiveness of various farm operations are enhanced.

### OBJECTIVES

After careful study of this unit you should be able to

1. Enumerate and describe what farm Machinery are
2. Enumerate the advantages and disadvantages of Mechanized agricultural.
3. Recognize the different types of farm machinery
4. Enumerate the different types of machine use in crop production

### WORD STUDY

Farm Machinery:	Mechanically operated equipment used in farm operation
Mechanization:	Application of agricultural Machines to produce crops and animals. It is labour saving and reduce drudgery.
Peasant farming:	production for family consumption using hand tools (traditional implements)
Plough	An implement with one or more blades, that is used in turning .
Harrower	An implement for breaking large clods of soil
Shelling	removal of outer covering of nuts,
Pulsator	a devise in milking machine use to stimulate milk let down in dairy animals

Farm machinery is defined as mechanically operated devices that are used in agricultural production. Machines used in crop production include tractor, and tractor drawn implements such as disc plough, or Marldboard Plough used for primary tillage. While Disc harrow, spring tools, and spike tools harrow are used for secondary tillage operation. Others include planters, sprayers, and harvesting equipment. Machines used in agricultural production help in increasing productivity of the farmer. Farmers earn more income by selling the extra produce. With higher income farmers increased the total land area he cultivates. Mechanization is the application of farm machinery in agricultural production process this has made agriculture more attractive as labour is saved and drudgery removed.

### Advantages of using Machines

1. It is time saving, and thus, leads to increase production.
2. Expansion of cultivated area (hectare) is made possible with mechanization such that few people can feed a large population.
3. Drudgery and human suffering associated with the use of traditional tools has been eliminated, because farmers now manage labour rather than supplying it.
4. Farming become attractive and could influence young enterprising people into farming
5. More income to the farmer. This will help in raising standard of living of the farming family.
6. More work is done by using machine than manual labour.

- 7 More job opportunity is made possible in agriculture with the use of machinery. Drivers, Mechanics could be trained for efficiency labour.

### **ACTIVITY I**

What are the benefits of Mechanized farming?

The application of farm machinery in agricultural production is not without some difficulties. The following are disadvantages of mechanization:

1. Small farm size of the peasant farmer makes the adoption of machines very difficult.
2. High initial cost is beyond the means of many Nigerian farmers
3. Spare parts may not be easily available in the farmers' locality.
4. Spare parts are expensive.
5. Lack of Machine management skills among the owners is an impediment to mechanization
6. Difficulty in securing steady fuel supply in present day situation; renders many equipment useless
7. Heavy machinery was found to destroy soil structure thereby aggravating the problem of soil erosion.

### **ACTIVITY II**

- i. How can the problem of mechanization be solved in your locality?
- ii. Visit a local farmer in community and observe the types of machines he uses.

### **SUMMARY**

In this unit you learnt that:

- Farm machinery are mechanically operated equipment that are used on the farm to carry out different farm operations.
- The use of machines in the production process is referred to as mechanization. Increased productivity and income; time saving and efficiency are the major advantages while high initial cost, lack of technical know how are the major constraint while fuel scarcity is threatening the use of machines.

### **ASSIGNMENT**

1. List five advantages of the use of machines.
2. What is farm machinery?
3. How can the problem of adopting the use of machinery be minimized?

### **TYPES OF FARM MACHINERY**

There are various types of farm machinery they include

#### **A. TRACTOR**

A tractor is a vehicle specially designed for agricultural work. It is fitted with deep threaded types and large back wheels which enable it to move over rough surfaces:

A tractor is useful in pushing, pulling and lifting implements. Its engine capacity varies with type. Tractor uses diesel or petrol fuel.

There are four types of tractors

- i. **Two wheeled tractors:** - This type of tractor is steered by a walking operator. As the name implies it has two wheels, it is used in gardens.
- ii. **General Purpose tractor:-** It is the most common type of tractor in use on our farms.
- iii. **Large tractors:-** This is a heavy machine with an engine capacity of up to 373 kw it can pull up to 12 furrows
- iv. **Crawler.(Track laying tractor:)** It is a very heavy machine usually referred to as a bulldozer. It is used in clearing vegetation, stumps trees and so on. It travels on tracks rather than on tyres.

## **B. SHELLERS**

These are farm machines that are used in shelling pods or grains (rice maize) etc

## **C. DRYERS**

Dryers are machines use for drying or curing agricultural products. Crops harvested with high moisture content get spoiled easily in storage. Drying could be achieved by applying heat artificially to remove moisture from the material. Air accelerates drying by supplying heat for vaporization.

## **D. INCUBATORS**

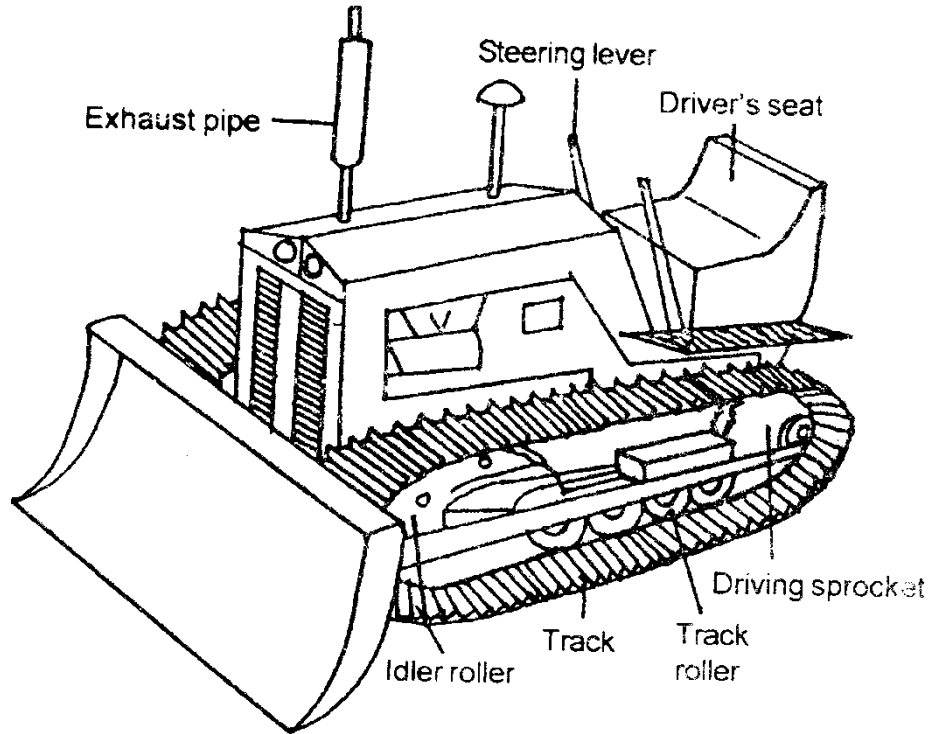
Incubators is a specially designed machine for hatching eggs. They are of varying sizes and make. Success in hatching eggs depends on the fertility of the egg and skill of the attendant. Internal temperature of the Incubators is maintained at 37.5-39 0c and a Relative humidity of 60%. Three types of incubators are in use

- (a) Hot air Incubators,
- (b) Hot water Incubators,
- (c) Electric Incubators.

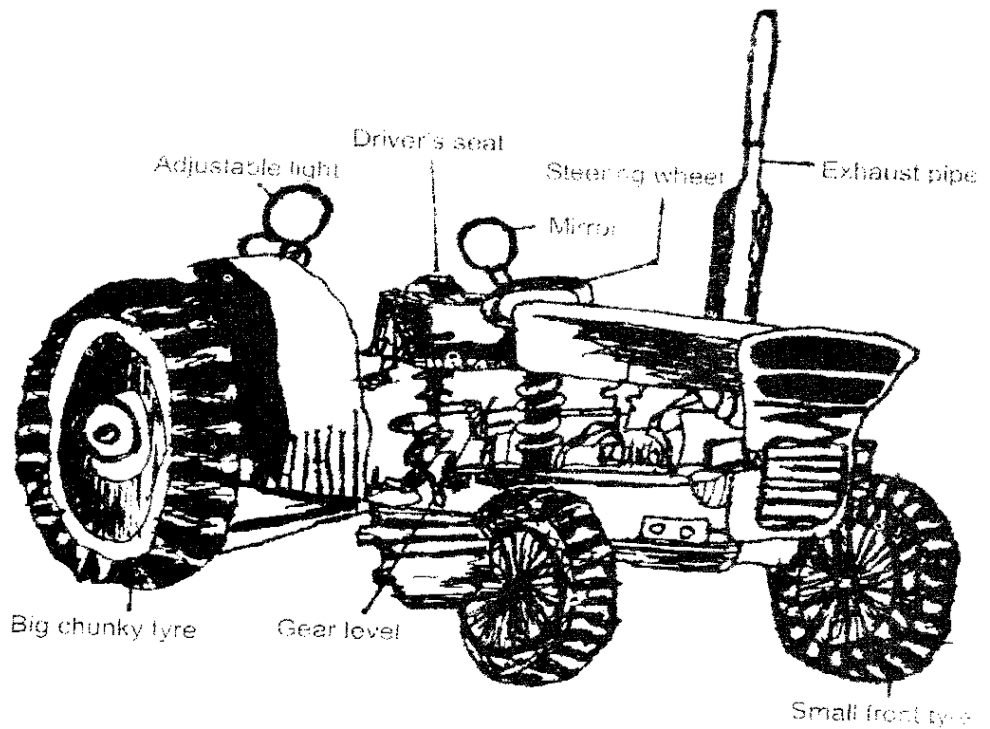
**E. MILKING MACHINE** - This is equipment used in extracting fresh milk of dairy animals. Milk is held in the recording Jar, until milking is completed. This eliminates risks of contamination.

PICTURE OF SOME FARM MACHINERIES

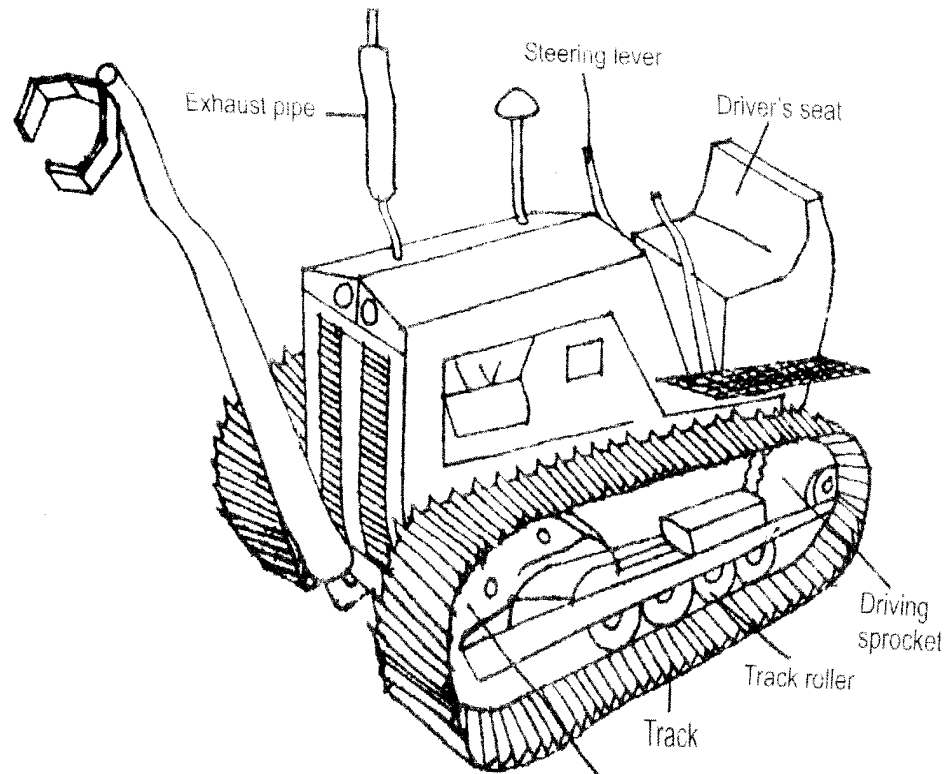
TRACK LAYING TRACTOR



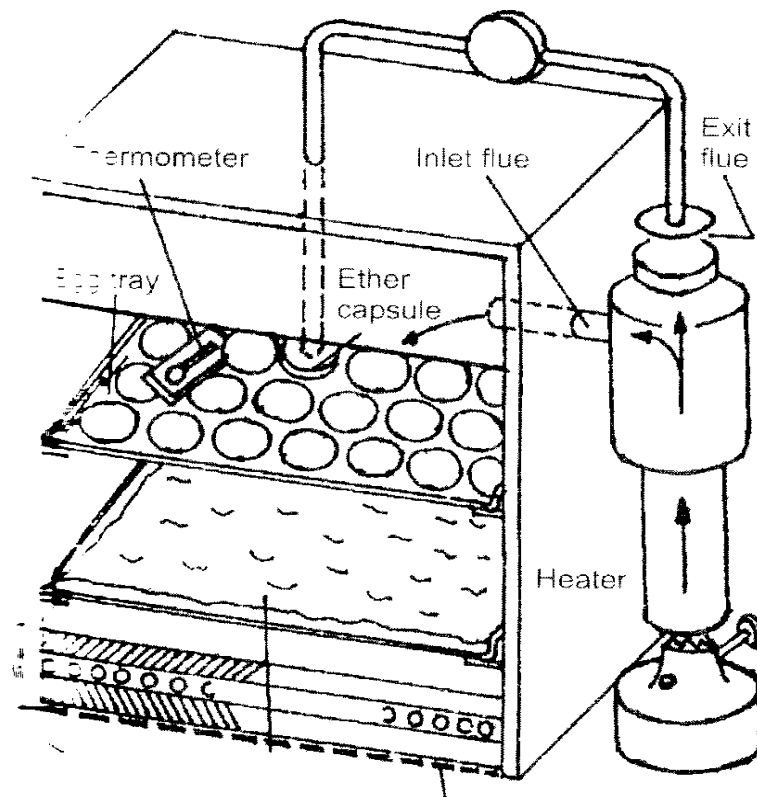
TRACTOR

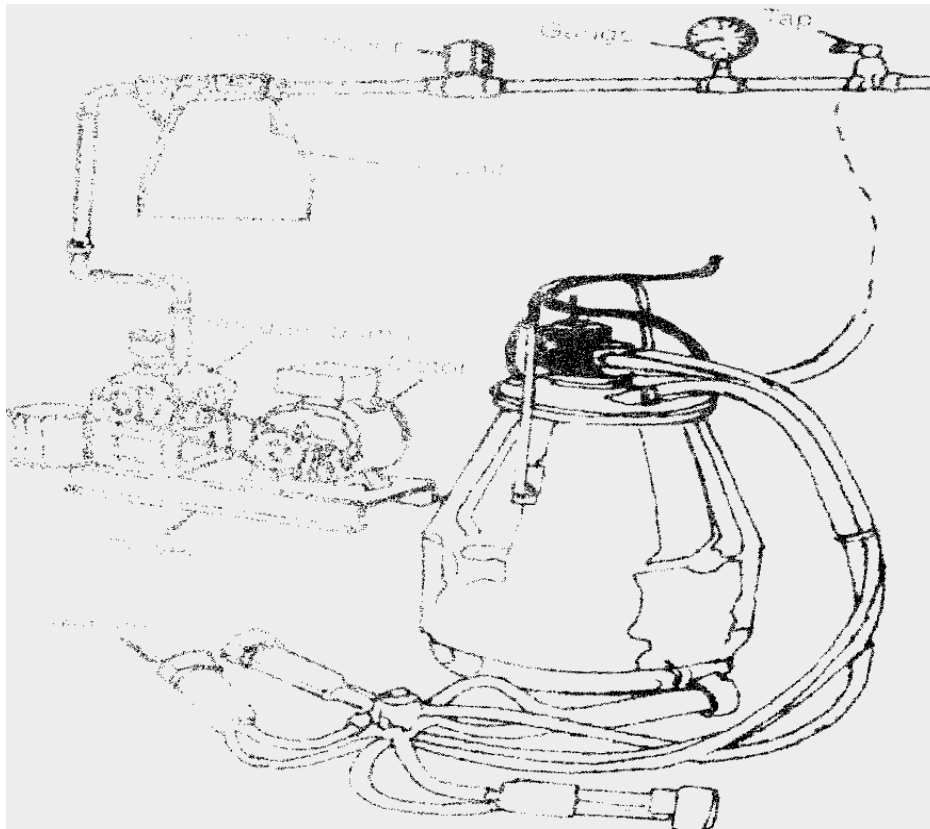


## SHELLERS



## INCUBATORS





**MILKING MACHINE**

### ACTIVITY I

1. List the different form of machinery used on farm
2. Visit a nearby big farm and record the types of machinery they use

**Intermediate machinery:** are animal drawn implements motor powered machinery and implements which are tractor trowled equipments. On attachment they may be pulled or attached to the power-take-off-shaft (PTO). The P.T.O. supplied the power necessary to turn the implement. Various types of intermediate machinery include

**Animal drawn implement:** This is an Implement that is usually drawn by work bulls driven by the farmer.

**Drillers/ Planters:** These are for placing seeds into seed bed/ridges. They are of three types:

- i. **Seed Broadcasters:** as the name implies seeds are broad cast/scattered over the seed bed and covered.
- ii. **Drillers- Drillers** dropped seeds and buried them in rows. Spacing between stands is not strict.
- ii. **Precision Planters-** This type of machine has many units and each unit plant a row at definite intervals. Distance between and within row is maintained,

**Fertilizer distributor/Manure spreaders**

These machines are used in applying fertilizer and spreading manure to the soil.

**Sprayers:** These are equipment used for spraying chemicals to control weeds and insect pests in crop fields. Sprayers are grouped into two based on system delivery and volumetric capacity.

- (1) (a) System delivery - This is based on delivery of chemicals to crop sprayers which are also be of two tyres
  - (i) Knapsack sprayers
  - (ii) pneumatic sprayers
- (2) Volumetric capacity:- This is based on their capacity to hold a given quantity of the spray chemical. They could be
  - (a) Knapsack sprayer capable of holding 10-20 liters
  - (b) Mist blowers- Hand or engine operated and capable of holding over 30 liters use to spray cocoa pests
  - (c) Boom - usually tractor mounted. Holds 100 - 2,000 liters and have many nozzles.

**Harvesters:** As the name suggests these are machines that are used in harvesting various crops. There are different type of harvesting machines. They include

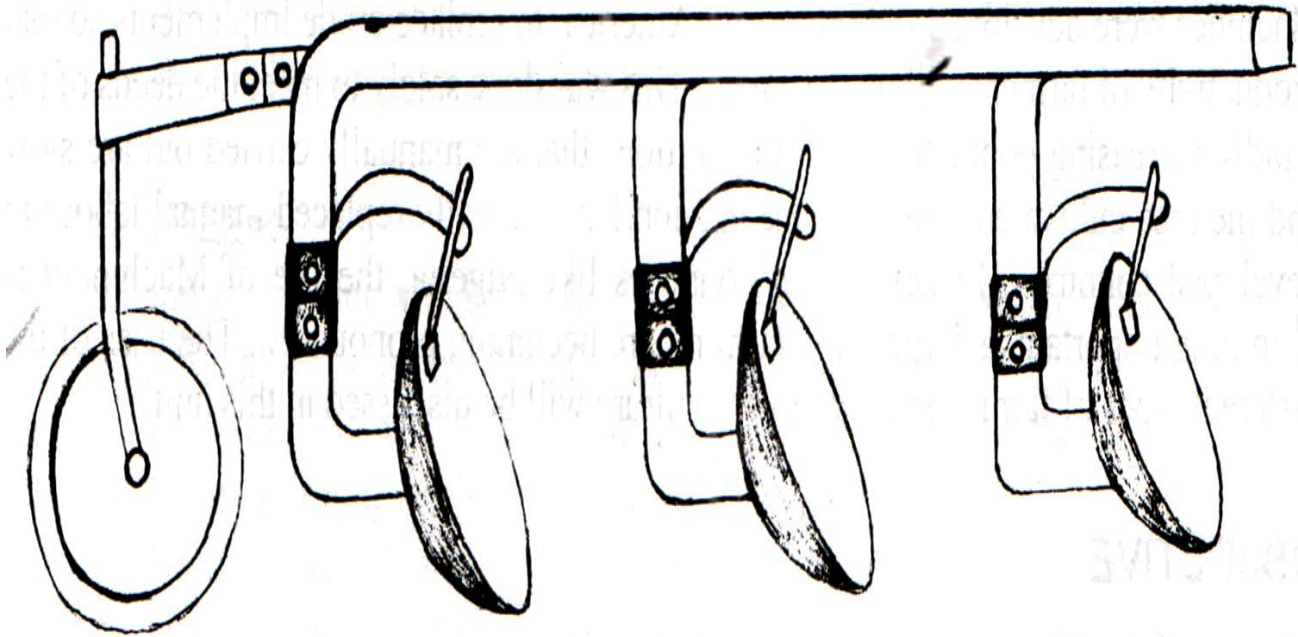
- a. Mowers- Used in cutting grass to make hay
- b. Balers - They collect, compact and compress the already cut grasses into bales
- c. Forage harvester - This type of machine is used for cutting the fresh herbage for direct feeding and or silage making.
- d. Combine harvester- These are large machines for harvesting crops e.g maize, rice, wheat, and so on, when the crop has attained maturity.
- e. Rootcrop harvester- This type of machine is used for harvesting crops like cassava, Irish potatoes, sugarbert, and so on.

Mould board plough - used for loosening the surface layer of the soil, this has the advantage of ensuing air, water penetration into the soil.

**Disc plough:-** Use to partially turn the soil and the process loosen the hard surface layer of the soil, it at the same time turn under the vegetation and crop residue.



**Harrows** - This may be disc harrow or spike tooth harrow. Harrows are used for breaking the large soil clods left on the surface by ploughs. Harrows help in pulverising the soil and provide smooth soil surface.



## **DISC PLOUGH**

### **ACTIVITY 11**

1. Visit a large farm in your locality or an Agro-service centre and list the type of tractor coupled implements found in the farm.

### **SUMMARY**

The use of machines has improved the productivity of many farmers. Less time and energy were spent in carrying out farm operations. Machinery require for crop production ranges from tractor, tractor trowled implements: such as primary tillage machines (Disc plany Mould board Plough) to planters, sprayers, and harvesting machines.

### **ASSIGNMENT**

1. List the different types of farm machinery used on the farm.
2. Mention five tractor coupled implements
3. Enumerate the different types of machinery that are used in crop production.

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## UNIT 6      USES OF FARM MACHINERY

### INTRODUCTION

Machines were developed in Europe and America to replace crude Implements so that productivity of farmers will be improved. This was done solely to meet the needs of the rapidly increasing population. Farm operations that are manually carried out are slow and the area cultivated small. Mechanization has gradually replaced manual labour in developed countries. In developing countries like Nigeria, the use of Machinery is becoming important as large scale farming are becoming pronounced. The uses of the different types of farm machinery in agriculture will be discussed in this unit.

### OBJECTIVE

After careful study of this unit you should be able to

1. List the uses of at least four farm machineries
2. Compare the uses of some machines e.g. harvester and sheller.
3. Describe the use of Bales. Disc and Mouldboard Plough 7

### WORD STUDY

Sheller            a processing machine operated mechanically

Incubator        a process leading to hatching of chick from egg.

Pulsation        a device fitted to milking machine that stimulates milk let down from the udder of dairy animal.

### USES OF FARM MACHINERY

Machines application to farm operation, otherwise referred to as mechanization makes farm life and farming enjoyable. The farmer is assured of better amenities and reduced fatigue. His productivity and income increase. The use of the different machines in agriculture is explained individually as follows.

1.      **TRACTOR:** Tractor is the most important machine in the farm. It is used in carrying out the following
  - a. It pushes, pull and or lift other farm machines. This may be made possible through hydraulic mechanism and or by attaching the machines to the three part linkage of the tractor e. g. ridger or harrow.
  - b. It is used in ploughing the land. This could be either primary tillage where the land is loosed to a depth of 15-45cm by using disk plough.
  - c. It is used in carrying out secondary tillage operation where the soil is pulverized to a fine tilth. This can be achieved by the use of Disc harrows or spring tooth harrow.
  - d. It could be used in transporting fertilizer and Manure.
  - e. Harvested crops and even workers are sometimes transported from the farm to the house by using tractor.

2.      **BULLDOZER**

A bulldozer is a tractor with broad steel blade in front. It is driven by chain. Bulldozer is useful in the following farm operations:

- a. Removal of unwanted trees, stumps and in some cases rocks
- b. Used in shifting earth in large quantity for landfills.
- c. Used for bush clearing, falling of trees in newly found land.
- d. Used for road construction.

### **3. SHELLER**

A Sheller is a processing machine that is operated mechanically. Manually operated shellers are available locally.

Uses of shellers.

- a. It is used for separating grains from chaff or rocks
- b. It is used to remove hard covering of nuts
- c. Shellers may combine with thresher in rice milling
- d. Used in the removal of tusks or ear of maize
- e. May be used in shelling grains.

### **4. DRYER**

Dryer is a machine that supplies heat to remove water from the material exposed for drying.

- a. A dryer is used to facilitate processing of produce
- b. Dryer facilitate storage of crops that could be unsuitable for storage
- c. Dryer is used for drying meat, fish and for airing tobacco

### **5. MILKING MACHINE**

Milking machine is equipment used in extracting milk from dairy animals.

- a. Milking machine eases the problem of manually milking a large herd of dairy animals.
- b. It prevents contamination of fresh milk as obtained in manual milking.  
But this is made possible only when the pipes and tubes are washed properly immediately after use.

### **6. INCUBATOR**

An Incubator is a machine that is used in artificial hatching of fertilized eggs. It is used for hatching large number of eggs.

### **ACTIVITY I**

- 1. Compare the uses of sheller and harvester
- 2. Discuss the uses of incubator and milking machine with your friends. In your opinion which is more useful

### **MOULD BOARD PLOUGH AND DISC PLOUGH**

The mould board plough tear and inverts furrow slice. The mould board receives the furrow slice and turns it, it is crushed and pulverized, While the share provides the cutting edge. On the other hand the Disc plough is equipped with a concave disc that cuts the furrow slice while rotating. The slice rises up in the cavity of the Disc where it is broken and thrown sideways. Disc and mould board plough may be trailed or mounted.

The uses of these two implements includes,

- a. Loosening the surface layer of the soil.
- b. It ensures free movement of water and air in the soil
- c. It improves soil drainage by breaking the impervious layer that have restricted infiltration.
- d. Complete turning of the soil.
- e. Disc plough is used in areas that are not suitable for the use mould board plough e.g. areas that have many stumps.

### **DISK HARROW AND SPIKE TOOTH HARROW, SPRING TOOTH HARROW**

Disc harrow consists of concave disc of varying sizes. It may be arranged straight or at an angle, in two or more sets. It is used to break hard and large soil clods. It smoothens the soil surface for planting. The spike tooth harrow pulverizes and level the soil after it has been ploughed. The spring tooth is used for light cultivation to loosen a previously ploughed soil.

### **RIDGER**

Ridgers as the name implies are used for making new ridges on ploughed land.

They may be used for splitting old edges in a previously ploughed land perhaps due to weed emergence.

Ridger may be used in remoulding ridges.

### **DRILLERS/PLANTERS**

There are power operated machines that are used for placing seeds into the soil (beds or ridges). They are of three types. These are

- a. broad casters,
- b. drill planters and( c) precision planters. Their uses include:
  - i. Drillers and precision planters to sow seeds on rows.
  - ii. Drill plant does not maintain regular intervals between stands while precision planters maintain regular intervened between and within rows.
  - iii. Allows strict control in seeding rate and spacing to some extent
  - iv. Speed up the work of planting large area of land
  - v. Fertilizer and seeds could be planted same time.

### **FERTILIZER/MANURE SPREADERS**

These are tractor driven machine and they are used:

- i. in applying fertilizer uniformly
- ii. to ensure speedy work

### **SPRAYERS**

Sprayers are equipment that are used:

- i. in spraying chemical to control various types of crop pests and diseases.
- ii. to spread chemicals, to kill weeds in crop fields.
- iii. to spray powdered chemicals blown as a fine dust to control cocoa pests (e.g. the case of boom)

### **HARVESTER**

Harvesters are various implements developed to facilitate the process of harvesting crops. Most crop harvesters are operated by hydraulic mechanism. They are used in the following ways

- i. to cut the standing crop.
- ii. to thresh the grains of crops harvested
- iii. to separate the grains from chaff
- iv. in baling harvested grass

## ACTIVITY II

Identify the most common farm machinery used in your locality and suggest reason.

## SUMMARY

In this unit you learnt that:

- The use of farm machinery has removed the difficulty encountered in carrying out farm operations manually.
- Almost every operation in the farm is now mechanized. This has reduced bad agricultural practices eg bush-burning. More crops are cultivated with ease. The uses of the individual machines is highlighted

## ASSIGNMENT

1. List 3 uses each of the following
  - a. sprayers
  - b. Incubator
  - c. Dryer
  - d. Bulldozer
  - e. Tractor.

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## UNIT 7      MAINTENANCE OF FARM MACHINERY

### INTRODUCTION

Despite the success recorded in the use of farm machinery for carrying out various farm operations and the fact that this machinery can withstand heavy stress, strain and rough usage length of usage of machinery depends to a large extent on the type of care given to ensure durability. Failure to maintain farm machinery could lead to complete breakdown, major servicing should be done by experts. In this unit we shall learn simple and routine maintenance of farm machinery.

### OBJECTIVES

After careful study of this unit, you should be able to:

1. discuss why it is necessary to take care of farm machinery
2. mention the steps taken to prevent rusting in farm machinery.

### WORD STUDY

Sharpening	Making cutting edge of metal sharp so as to cut easily.
Blunt	A metal without sharp edge
Nuts	A small piece of metal with a hole through the centre, used for holding of Machine together
Bolt:	with a head at one end and a thread at the other end. use with nut for holding things together
Lubrication	To put oil or grease to remove friction in machine parts
Maintenance	Action necessary to extend working life of a machine.

Machines are made of metals and therefore subject to wear and tear and rusting over time due to usage, exposure to the element of weather, air and moisture.

Rusting makes metal weak, and so causes breakage. The following are some ways that could be followed to ensure continuity of usage

- A. **preventive measure**: these are steps takes to prevent and protect the machine from breaking down.
  - i. prevention of rusting: which can be achieved by painting the surface of metal that is exposed to moisture and air. Greasing and oiling steel surfaces after use also proved valuable in preventing rusting.
  - ii. prevent over heating by avoiding grease and dirt accumulation by periodically changing engine oil and servicing at regular interval. Or when a recommend distance was covered.
  - iii. Lubrication is done to reduce friction by applying grease between rubbing surfaces of machines.
  - iv. Daily examination for loose nuts and so as to ensure safety.
  - v. Fertilizer materials are corrosive in moist environment, therefore care should be taken to wash containers used in spreading fertilizer.
- B. **Corrective Measures**: These are steps taken to ensure that the Machine is brought back to its proper working condition.
  - i. Broken and worn out parts should be replaced as soon as they were noticed.



- ii. Levers chains and belts on working machine should be carefully adjusted and if spoilt, changed on time.
- iii. Periodically changed the battery electrolyte, Gearbox oil, and engine oil. This is to ensure proper working condition.
- iv. Cleaning and draining the fuel system and radiator to ensure that the machine is not stressed and problems detected should be corrected immediately.
- v. Tightening of nuts and bolts- is very essential to avoid accidents. Due to constant movement and vibration some nuts become loose. At time the nuts can become loose due to wear on the part of the nut or bolt. The affected nut and bolt should be checked and replaced immediately.

## **ACTIVITY I**

Organize yourselves in a group and visit a nearby farm service centre. And/or you invite an extension officer who specialized on farm machines to deliver a talk on how to maintain farm machines.

## **CARE OF MACHINERY BEFORE STORAGE**

Before a farm implement/Machine is stored, the following steps should be taken to extend its working life.

**Tractor:** Before a tractor is put into the store

- i. Clean all dirt periodically to prevent its accumulation.
- ii. Replace all missing parts and those that showed signs of wear and tear.
- iii. Loose nuts and bolts must be properly tightened to ensure that the tractor is in a proper working condition before it is kept away.
- iv. The engine oil should be drained and replaced with new, so also the gear oil. Fill the tank with diesel fuel.
- v. cover the exhaust pipe so as to prevent dirt and moisture from entering the tractor engine.
- vi. Jack the tractor on stones or Log of wood and prevent excessive pressure on the tyres.

**Ploughs:** The implement used in ploughing the field, Mould-Board and Disk plough should be checked

- i. regular checking for wear and benels. This must be corrected immediately by proper alignment
- ii. Clean soil and dirt's daily
- iii. Treat with anti rust chemicals ego paint and greasing oil before storage

## **Harrow**

Care of the harrow is very essential to ensure longer period of usage.

- i. Ensure that proper hatching of the equipment on the tractor before work starts.
- ii. Ensure that the hydraulic links are working properly to avoid stains on the tractor.
- iii. Apply anti rust chemicals before storage.
- iv. Dirt's and soil should be removed immediately after work.

## **Milking machine**

1. Clean parts most especially the pipes after uses. This is done to ensure that quality of the milk is maintained and prevention of contamination.
2. Sterilize the machine after every usage
3. Start milking only when milk let down has been stimulated (and the milk has started running).
4. Use automatic washing system to circulates the washing solution.

### **Sprayer**

- i. Wash sprayer after every day's work. You ensure that tank and nozzles are thoroughly washed before storage.
- ii. Hoses should not be exposed to sunlight during storage.
- iii. Grease the moving parts most especially the pneumatic pump.
- iv. Check nozzles to be clear of sediments
- v. Concentrated chemicals should not be poured into sprayer tank.

### **Incubator**

- i. Wash and disinfect incubator after every incubation, before starting another.

### **Driller/Planter**

- i. Clean the units daily and remove large seeds that could block seed chambers
- ii. Keep the unit dry and lubricate all parts that rub each other
- iii. Replace worn out and broken parts,

### **Fertilizer/Manure spreaders**

- i. Lubricate all moving parts before filling with fertilizer material.
- ii. A. void rain wetting the hopper which is a metal, to prevent corrosion.
- iii. Dismantle the machine and remove traces of fertilizer at close of the season.
- iv. Cracked or worn out parts should be replaced
- v. Apply antirust chemicals to all parts before the machine is put into the store.

### **Harvester**

- i. Clean the cutting and thrusting mechanism periodically and at the end of the season.
- ii. Check and adjust the tightness of the chains
- iii. Check wear of shares and replace immediately
- iv. Treat chain with antr-rust chemicals so as to prevent rusting.
- v. Replace worn and missing parts before storage.

## **ACTIVITY II**

Describe how you will take care of an animal drawn plough (mould board plough)

## **SUMMARY**

In this unit you learnt that:

- Life span (useful life) of farm machine could be improved by taken good care of them during and after use. The following are the procedures to ensure proper maintenance. Lubrication of moving parts, Tightening of loose nuts and bolts, Blunt implements should be sharpened, cleaning and replacing worn out parts or those observed missing. Antirust chemicals must be used to paint metal surfaces that are able to rusting.

## **ASSIGNMENT**

1. Give two reasons why you maintain farm machines.
2. How do you prevent rusting?
3. Mention two preventive measures to ensure working condition of a farm machine
4. Why do you tighten bolts and nuts?

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## UNIT 8 FARM STRUCTURES, TYPES AND USES

### INTRODUCTION

In every farm there are certain structures which are designed to serve specific purposes. These structures vary from primitive agriculture to modern agriculture. Usually the more the number of structures, the more advanced the farm. While a farm under shifting cultivation may have just a farmstead for rest or refuge at times of harsh weather, modern farms may have in addition to farmstead storage sheds, notable roads, dams, fish pond, and so on. This unit discusses some of these farm structures and their uses.

### OBJECTIVES

By the end of this unit, you will be able to;

1. Classify farm structures
2. List some common farm structures and state their uses.

### WORD STUDY

Farm structure: These are simple and temporary buildings.

### Classification of Farm Structures

Farm structures are classified according to their uses. These include:

**a. Production structures:**

These structures are used for production as the name suggests. They can be structures for rearing animals. Examples are battery cages and range shelters for rearing poultry, fish ponds for rearing fishes, rabbit hutches for rearing rabbits, and grazing paddocks for rearing sheep, goats and cattle. Production structures also include those for tending crops under controlled conditions such as potting sheds for citrus nurseries and market gardening.

**b. Farm shelters:**

These are buildings simple enough to be termed structures. A number of them can be scattered over a large farm to provide shelter for rest or refuges for workers at times of bad weather. The farm shelters also serve as temporary storage points for farm inputs or gathering points for harvest before they are taken to their proper destination. Farmstead is an example of farm shelters.

**c. Processing sheds:**

These are structures designed to accommodate processing machines such as rice mill, oil palm press, grinding machines and so on.

**d. Storage Structures:**

These are used for storing farm produce before they are marketed or used as input in the following season's farming operations. Examples of storage structures are silos, cribs, rhombus and barns. Silos, rhombus, and cribs are used for storing grains while barns can be used to store either grains or tubers.

Some farm structures may combine the functions of processing and storage. For example the grain silo is essentially a storage structure, but usually associated with it is a modification by which hot air is blown into the grain to dry it.

## **ACTIVITY I**

1. Pay visit to a number of farms.
2. List out the structures observed on the farms.
3. Classify these structures and state their uses.

## **SUMMARY**

Farm structures are simple and temporary buildings on the farm that are designed to serve specific purposes. They are classified according to their uses. Examples of such classes are production structures for production, farm shelters for rest or refuge, processing sheds for housing processing equipments and storage structures for storing farm produce.

## **ASSIGNMENT**

1. What is a farm structure?

## **REFERENCES**

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## **UNIT 9 FARM BUILDING, TYPES AND USES**

### **INTRODUCTION**

In the last unit of this module, you read about farm structures and their uses. Apart from structures, there are buildings on the farm which are designed to serve certain purposes. The distinction between farm structures and farm buildings is not clear cut. The only difference is that buildings are more elaborate and more permanent than structures. A building also usually serves more than one specific purpose unlike the farm structure.

### **OBJECTIVES**

At the end of this unit you will be able to:

1. Classify farm buildings
2. State the uses of farm buildings

### **WORD STUDY**

Farm Building: an elaborate and permanent structure designed to serve usually more than one purpose on the farm

Agro-Chemicals: chemical substances used for agricultural production

### **FARM BUILDING**

A farm building is more elaborate and more permanent structure designed to serve usually more than one purpose on the farm. Just like farm structure, farm buildings are classified according to their uses. The major classes of farm buildings are:

1. Living houses
2. production houses
3. storage houses, and
4. Farm office.

### **LIVING HOUSES**

These are buildings that provide accommodation to the farmer, his family and farm workers. It is desirable that the farmer and his workers should live on the farm. This minimizes the time spent in moving from home to farm. Also living in the farm ensures that crops and farm animals are more efficiently looked after.

### **PRODUCTION HOUSES**

These are buildings used for running farm production projects. Examples are poultry houses, poultry hatcheries, and pens for sheep, goats and cattle or pigs.

### **STORAGE HOUSES**

There are buildings designed for storage of agricultural tools and input items like feeds and agro-chemicals, such as, fertilizers, herbicides and pesticides. They are also used to store farm produce. Farm stores can be specially equipped to provide cold storage for farm produce like meat and eggs awaiting evacuation and marketing.

## **FARM OFFICE**

This is an important building in large farms especially commercial farms. The farm office is used by the farmers and his managerial staff to plan and coordinate all the strategies of the farm business. The farm office is usually located at the centre of the farm and it houses all farm records including dates of farming operations, amounts of inputs and outputs etc. The farmer's link with the outside world is based in the farm office.

## **ACTIVITY I**

1. Pay a visit to a commercial farm in your locality.
2. List all buildings on the farm
3. Group these buildings according to their uses.

## **SUMMARY**

Farm buildings are not quite different from farm structures, except that they are more elaborate and more permanent. They are also designed to serve more than one purpose. Farm buildings are classified according to their uses, for instance living houses for accommodation, production houses for production, storage houses for storing farm inputs and produce, and farm office for keeping records.

## **ASSIGNMENT**

1. List four classes of farm buildings and explain their uses.
2. Give reasons why living houses are necessary on the farm.
3. Differentiate between farm structures and farm buildings.

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## UNIT 10 SUMMARY

### INTRODUCTION

The ideas taught in this module are based on those in units (1-9); Agricultural implements and farm machines. You have learnt that simple farm tools are the simple farm implement used by the farmer. The tools include cutlass, spade, hoe, rake, sickle, watering can knife etc. This unit will help you to understand some concept more clearly on Agricultural implements and farm machines.

### OBJECTIVES

By the end of this unit you should be able to:

- List and draw some simple farm tools
- Mention some fishing tools and describe how they are used and maintained
- Mention and explain source of farm power
- Enumerate and describe what farm machinery are:
- State types of farm structure and building.

### Simple Farm Tools

Simple farm tools are the hand tools use by the small scale farmers in carrying out farm operation. Such tools include cutlass, spade, hoe, rake, sickle watering can, knife etc.

The tools are locally produced by our blacksmiths and are produced cheaply. The tools evolved over several generations of usage. The output obtained by using them is low.

Fishing is one of the most important occupation of most Nigerians especially those living the riverian areas of Nigerian. Fishermen uses simple fishing tools to harvest fish from rivers and lakes.

Farm power ; The source of farm power includes; man animal, water, sun, fuel, wind etc

### ACTIVITY I

- List five sources of farm power.
- Mention some fishing tools in your area.
- Describe hand trowel and cutlass as farm tool.

### Farm Machinery

Farm machinery is defined as mechanically operated devices that are used in Agricultural production. Units (6-9) describe farm machinery types, uses and maintenance. While unit 9 is all about types of farm structures and uses. Read the units again for more understanding.



## SUMMARY

Farm tools are the implements used on the farm to make farm work easy and faster. They are grouped thus: Land preparation tools, nursery tools, watering device, pruning tools, plant protection tools and harvesting tools.

Some fishing tools are baskets, spear, calabash, hook and line, Cast-net, dragnet, gill net etc.

Farm power is derived from a number of sources like wind water, electricity, man, engines

Farm machineries are mechanically operated devices that are used in Agricultural production. They include tractor, plough planters, sprayers, and harvesters. They produce a higher output than simple farm tools.

## ASSIGNMENT

List five advantages of farm machines

What is farm machinery?

What are the uses of power supply on the farm?

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## **MODULE 4: SOIL**

### **UNIT 1 DEFINITION AND PHYSICAL COMPOSITION OF SOIL**

#### **INTRODUCTION**

In this unit, you will be studying about soil and what soil is composed of. Soil is defined differently by different people depending on the use it can be put into. To the builders, the soil is a place where houses can be built. To miners, soil is a place where minerals can be extracted, but to a farmer however, soil is the loose surface of the earth that supports plant growth. It provides food and support to the growing crop.

#### **OBJECTIVES**

By the end of this unit, you should be able to:

1. define soil
2. list the components of soil
3. explain briefly the different components of soil.

#### **WORD STUDY**

Weathering: Action of weather elements on rocks and soil surface.

#### **DEFINITION OF SOIL**

Soil is the loose surface of the earth which supports plant growth. It is the medium use for growing of crops.

#### **COMPOSITION OF SOIL**

The soil is made up of particles of various sizes, organic matters, air, water, living organism and mineral matter.

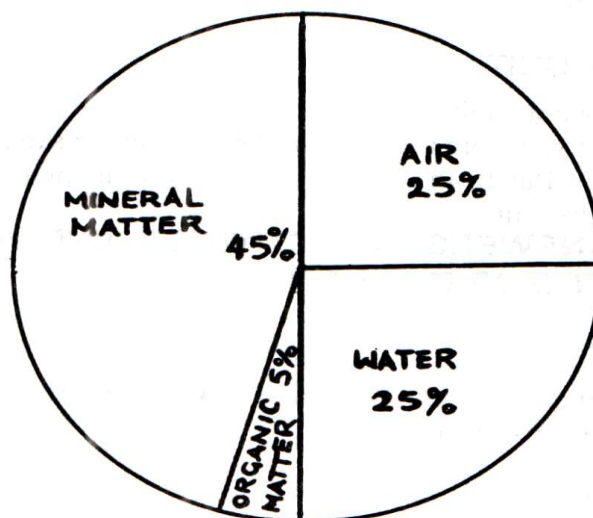
- Mineral matter:** It is the part of the soil which constitutes the largest portion of the soil originating from the rock called parent materials. After the rocks have been broken down through the agents of weathering, they form smaller particles such as gravel, sand, silt and clay which are regarded as different types of soils minerals. The mineral matter makes up about 45% volume of the entire soil.
- Organic matter:** It consists of decayed plants and animals which are source of food to plants. The organic matter makes up about 5% volume of the soil.
- Air:** Air is present in the spaces between soil particles. The presence of air can be demonstrated by pouring some soil sample into glass jar and then water is added into it, bubbles of air will be seen on the surface of the water which shows that water has taken the space created by air.

#### **ACTIVITY I**

- Demonstrate how you can determine the presence of air in a soil sample.
- Soil water:** This is the soil solution. Water helps to dissolve food materials for growing plants

- iii. **Living organisms:** These bring about the breaking down of organic matter and they are found in the soil. They also help in the mixing of the top soil. Examples of living organisms are earthworms, centipedes, termites, crickets, millipedes, bacteria, and so on.

The composition of soil can be represented diagrammatically as follows.



*Composition of Soil*

Water and air exist in equal volume in a good soil.

## ACTIVITY II

1. Mention four components of soil showing the percentages in which they exist in the soil.

## SUMMARY

In this unit, you learnt that soil is the medium in which plants grow.

- Soil is composed of mineral matter, water, organic matter, air and living organisms and these components exist in certain percentages in the soil.

## ASSIGNMENT

1. Give two reasons for considering soil an important factor to a peasant farmer.
2. State the functions of any two of the soil components to the growth of the plant.

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## UNIT 2 MAJOR TYPES OF SOIL

### INTRODUCTION

You have learnt that soil is made up of components such as mineral matter, air, water, organic matter and living organism. You also learnt that the mineral matter constitutes the largest portion of the soil which originated from the parent material as a result of the breaking down of rocks and after a long period of time formed the different types of soils used in growing our crops today.

In this unit you will be learning about the different soil types.

### OBJECTIVES

By the end of this unit, you should be able to:

1. name the major types of soils
2. state the characteristics of
  - i. sand
  - ii. silt
  - iii. clay
  - iv. loam
3. Differentiate between sandy soil and clay soil.
4. Identify the major types of soils
5. List some crops that can do well on loamy soil
6. Give reasons why loamy soil is the most suitable for crop production.

### WORD STUDY

Aerated	-	the amount of air present in the soil and its movement.
Percolation	-	the movement of water in the soil.
Water-logging	-	excess water present in a soil.

### MAJOR TYPES OF SOILS

The major types of soil are: sand, silt, clay and loam.

Characteristics of sand

- It is loosely packed and has large particles.
- It is coarse, gritty-or rough when felt in the hand.
- It has large pore spaces, therefore it is well aerated.
- The rate of water percolation is high as a result of the large pure space
- It cannot form shape or ribbon when moistened
- The colour is grey or brownish
- It has low water retention which means it cannot retain water
- It is light to work

Characteristics of clay

- It contains small fine powdery compact particles.
- It is smooth
- It has tiny pore spaces hence not well aerated.
- The rate of water percolation is low
- It has high water retention capacity as a result of tiny pore spaces

- It is heavy to work when moistened
- And it can also be stricky and slippery.
- It is easy to make shapes when moulded.

#### Characteristics of loamy soil

- It contains organic matter
- It has moderate sized pore spaces
- The rate of water percolation is moderate.
- It is not as coarse as sand and not as smooth as clay
- It is dark brown or black in colour.
- It is important to note that loamy soil is the best soil for crop production because it combines all the good physical qualities of sand with the good chemical qualities of clay.

#### Characteristics of silt

- Silt feels smooth and soft like in the case of clay
- The movement of air and water is also lowed down like in clay.

### ACTIVITY I

1. Name the common types of soil in any garden around you.
2. Give two similarities between silt and clay.

#### Difference between sand and clay

Sandy Soil	Clay Soil
1. This soil has large particles called grains	It has very small particles
2. It feels rough when felt.	It feels smooth when felt
3. It cannot be molded into shapes	It can easily be molded into shapes
4. The grains do not stick together when moistened.	The particles stick together when moistened
5. It has little nutrient or plant food.	It has a lot of nutrients
6. It cannot hold much water, when water is poured onto it.	It can hold a lot of water, when water is poured into it
7. It is a light soil to work	It is a heavy soil to work

#### Identification of different type of soil:

Description	Soil type
1. When shapes or ribbon forms very readily and can easily bend into a ring.	It is clay soil only.
2. When it is hard to form shape or ribbon and breaks quite readily.	It is loam
3. When ribbon does not form readily but soil can be moulded and feels gritty to touch.	It is sandy loam.
4. When ribbon does not form and soil can easily be moulded and feels very smooth.	It is sandy loam
5. When it is gritty to touch and does not stick together at all.	It is sand

### **Crops that do well on loamy soil**

Some crops that can thrive well on loamy soil are: maize, rice, cassava, yams, tomatoes, okra, millet and pepper.

Loamy soil is the most suitable for crop production for the following reasons.

It has moderate capacity for absorbing and holding water.

Contains organic matter which is a source of plant nutrients.

It is well aerated for root respiration and development.

It does not easily lose its nutrients through leaching.

### **ACTIVITY II**

1. Show by careful observation, on how you can identify clay soil in any garden or farm.

### **SUMMARY**

In this unit you have learnt that:-

- The major types of soil are clay, silt, sand and clay.
- That each of them has some characteristics on which they can be identified. some of these characteristics can be based on the
  - i. water holding capacity or water retention.
  - ii. Amount of nutrient as plant food.
  - iii. Pore space (air space) and aeration
  - iv. Particle sizes etc.
- You have also learnt that out of all the types of soil mentioned in the unit, loamy soil is the most suitable for crop production.

### **ASSIGNMENT**

1. Name two crops that do well on clay soil
2. What do you understand by weathering?
3. How can a farmer make sandy or silty soils fertile for plant use?
4. What are the common characteristics of sandy soil?

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## **UNIT 3 FERTILITY MANAGEMENT (BY ROTATIONAL CROPPING, INTERPLANTING, INTERCROPPING, BUSH FALLOW AND COVER CROP)**

### **INTRODUCTION**

You have learnt a few characteristics of the major types of soil. A soil is fertile if crops grow well in it, but fertility drops after the land has been used for two or three years. This is because crops remove large quantities of plant food from the soil. Cultivation also disturbs some of the important physical characteristics of soil.

The plant food is made up of nitrogen, phosphorus, potassium, magnesium, calcium, sodium, sulphur (all those are called major nutrients) and zinc, iron, manganese, copper, collectively called minor nutrients or trace elements. The major nutrients are those required by the plants in large quantities and the minor nutrients are those needed in small quantities for good growth and development of the crops. However this unit will be teaching you the fertility management by rotational cropping.

### **OBJECTIVES**

By the end of this unit, you should be able to

1. define soil fertility
2. define crop rotation
3. explain the principles of crop rotation
4. state the advantages of crop rotation
5. plan a four - course crop rotation
6. explain inter planting and inter-cropping as used in rotational cropping.
7. define bush fallow and cover crops;
8. state the advantages and disadvantages of bush fallow:
9. list some examples of crops that can be used as cover crops,
10. state the advantages and disadvantages of cover crops.

### **WORD STUDY**

Successive years:	-	Subsequent or following year
Leaching:	-	Is the washing away of plant nutrients deep down the soil where the roots of growing crops cannot make use of them
Erosion:	-	Is the washing away of the top soil by water or wind,

### **SOIL FERTILITY**

Soil fertility is the ability of the soil to supply the growing plants with enough air, water and nutrients.

### **CROP ROTATION**

Crop rotation is the growing of different types of crops in a definite order on the same piece of land in successive years.

### **PRINCIPLES OF CROP ROTATION**

Different types of crops require different types of nutrient elements in the soil. When a crop is planted on a piece of land the nutrients not required in large quantities can accumulate for the crops following it which may require them. Some crops may have deep rooted systems and can feed on the nutrients deep

down in the soil, leaving those at the surface layer for crops with shallow root systems. Leguminous crops which are alternated with other crops in the rotation will fix nitrogen into the soil. In the cropping system, the rotation must be arranged in a way that one crop is receiving some benefits from the previous crop and at the same time preparing the way for the crop following.

In arranging the crops in rotation care should be taken that plants with different mineral requirements follows each other in a definite order. On this note, therefore, the principles of crop rotation can be stated as follows:

- i. The farm must be divided to suit the rotation which depends on the number of crops to be planted.
- ii. The crops should be arranged in such a way that an increase in the yield of one results in an increase in the yield of the next crop. For example, a good legume crop will increase the nitrogen content of the soil with the results that, if the next crop is maize, which requires nitrogen, it will do well.
- iii. Crops that require high nutrient should come first in a rotation.
- iv. Deep rooted crops should follow shallow rooted crops. This enables the deep feeder crops to use some of the nutrient materials that leached into deeper layers of the soil (sub soil).
- v. It is necessary to consider the pests and diseases that attack the crops in the rotation. As far as possible; the crops that are attacked by the same pest or diseases should not follow each other.
- vi. Crops that are closely related must not follow each other in a rotation.

### ADVANTAGES OF CROP ROTATION

- a. It facilitates the control of weeds, pests and diseases
- b. It makes for effective utilization of plant food.
- c. Under a good system of rotation, the fertility of the soil is maintained
- d. Labour is used much more effectively
- e. The soil is put into maximum use without necessarily destroying it.

### ACTIVITY I

1. Define soil fertility
2. State 4 principles of crop rotation.

### PLAN OF A FOUR-COURSE CROP ROTATION

Divide your land according to the number of crops or according to the number of years. In this case, you are dividing the land into four crops A, B, C, D, to be planted on the four plots of land respectively for the season.

Yr	1 <sup>st</sup> Plot	2 <sup>nd</sup> Plot	3 <sup>rd</sup> Plot	4 <sup>th</sup> Plot
Yr 1	Yam melon i.p.w	Maize i.p.w groundnut	Cassava	Cowpea
Yr 2	Maize i.p.w groundnut	Cassava	Cowpea	Yam i.p.w melon
Yr 3	Cassava	Cowpea	Yam, i.p.w melon	Maize
Yr 4	Cowpea	Yam, i.p.w melon	Maize	Cassava

In the plan of crop rotation above, the abbreviation - i.p.w means inter planted with, that is yam that is a deep feeder is planted with melon which is a shallow feeder. In the plan, you will observe that in the second year, maize goes on to the first plot, cassava on the second plot, yam on the third plot, During the third season cowpea goes on the first plot, yam moves to the second plot maize moves to the third plot, The rotation continues until it is completed and the system starts all over again

### **INTERPLANTING**

It is the growing of a major crop in between planting another major crop on the same piece of kind. That is the crop planted last or later remains on the plot after the first crop has been harvested. Cassava and maize can be grown in this way; maize is planted first, followed by cassava. Maize is harvested first, while cassava continues to grow on the piece of land.

### **INTERCROPPING**

It is the planting of quick growing and quick maturing crops between slow growing and slow maturing crops. Melon can be intercropped with yam, that is, yam is planted before melon on the same land or plot but melon matures first and is harvested before yam.

## **FERTILITY MANAGEMENT II (BY USING FALLOWS AND COVER CROPS)**

### **FALLOWING OR BUSH FALLOW**

This is where a piece of land which has been put under cultivation for some years is left to rest (without use) for a few years. The aim is for the lost nutrients to be replaced back to the soil.

The length of fallow period depends on population and how much land is available to the farmer.

### **COVER CROPS**

Cover crops are fast growing crops grown to protect the surface of the soil against erosion, impact of the rain and leaching. Examples of crops that can be used as cover crops are pueraria, mucuna, cowpea, centrosema, calapogonium etc.

#### **Advantages of bush fallowing:**

- i. It helps in regaining soil fertility.
- ii. It makes available plant nutrient requirements to the next , crop to be grown the land and hence increase the Yield.
- iii. It requires no technical knowledge.

#### **Disadvantages of bush fallow:**

- i. It .involves growing crops on a piece of land until the fertility is completely used up.
- ii. In the presence of short fallow period, land becomes less fertile and low crop yield.
- iii. Soil erosion is encouraged where the fallow period is relatively short.

### **ACTIVITY III**

1. Look around your locality, and search for some crops that can be used as cover crops.

### **Advantages of Cover crops:**

- i. They reduce the loss of nutrients through soil erosion and leaching.
- ii. They reduce the rate of evaporation of water from soil.
- iii. Being leguminous crops, they can add nitrogen to the soil.
- iv. Since they are fast growing crops, they help to overshadow and control weeds,

### **Disadvantages of cover crops:**

- i. Cover crops compete of space, nutrients and water with the planted crop.

### **SUMMARY**

You have so far, learnt that rotational cropping is one of the aspects of fertility management. This has also been broken down into.

- defining rotational cropping (crop rotation)
- principles of crop rotation
- advantages of crop rotation
- plan of a rotation,

You have also learnt that another aspect of fertility management is by using fallows and planting cover crops in order to maintain and improve on the nutrient level of the soil which will be beneficial to the farmer and the society at large. Fallow period is the period when a piece of land is left to rest after it has been cultivated for years, Cover crops are fast growing crops, grown to protect the surface of soils against erosion and leaching.

### **ASSIGNMENT I**

1. Design one simple crop rotation for your area and explain how your rotation conforms with the principles you have studied so far.
2. Briefly explain the following:
  - i. crop rotation
  - ii. interplanting
  - iii. intercropping
3. State 3 advantages of crop rotation.

### **ASSIGNMENT II**

1. Give 4 examples of cover crops.
2. Why is it that a piece of land must be protected with cover crops all the time?
3. Explain what you understand by fallowing
4. State 3 advantages of bush fallowing.

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## UNIT 4      ORGANIC MANURE AND INORGANIC MANURE

### INTRODUCTION

You have been dealing with fertility management in the last two units: Fertility management by rotational cropping and by using fallows and cover crops. All these measure are used by the farmer to improve the soil for better yield in crop production. In this unit, you will be studying organic manure which is also an aspect of fertility management.

### OBJECTIVES

By the end of the unit, you should be able to:

- i. define organic manure
- ii. name the types or groups of organic manure
- iii. explain and describe the different types of manure
- iv. state the advantages and disadvantages of each of them.
- v. describe the various types of inorganic manure.
- vi. say the functions of the manures.
- vii. tell what happens when a particular fertilizer or manure element is lacking or insufficient.

### WORD STUDY

Straw:	-	the remains of the plant after harvesting the useful parts.
Litter:	-	the beddings made for farm animals to lie on
Dropping and dungs:	-	names use for animal excreta.
Pen:	-	a place where animals are kept.
Tillage:	-	the loosening or turning the top soil for seed bed preparation
Decay:	-	rotting
Chopped:	-	cut into small pieces
Roughage:	-	the matured grass used as animal feed.
Nodules:	-	small swelling found on the root of leguminous plants where micro organisms live to fix nitrogen to the soil.
Fertilizer:	-	it is any material, organic or inorganic which are added to soils to achieve desired plant growth.
Fertilizer carrier:	-	a material that contains at least one plant nutrient element e.g. urea is a nitrogen carrier, potassium chloride (KCl) is a potassium carrier.
Straight or sing fertilizer:		a fertilizer that carries one nutrient of nitrogen, phosphorus or potassium.
Compound fertilizer:	-	a fertilizer that carries two or more of the three plant nutrient elements, nitrogen, phosphorus and potassium.
Complete fertilizer:	-	contains the three plant nutrients, nitrogen, phosphorus and potassium.
Deficiency symptoms:		appearance of plants or signs produced on plants when a particular plant nutrient is either lacking or insufficient in supply.

## **ORGANIC MANURE**

Organic manure is made from green plants, straw and animal faeces or waste.

Organic manure are grouped into

- i. Farm Yard Manure (FYM)
- ii. Green Manure
- iii. Compost Manure.

## **FARM YARD MANURE (FYM)**

It is a mixture of livestock droppings with plant materials used as bedding or litter. This is the best and complete manure provided it is properly handled. In some cases, the litter and the droppings are properly mixed together by the animals and attendants before it can be used on the farm. If the droppings are removed daily from the animal pen, they can be collected in heaps and covered with grass materials. The composition of farm yard manure depends on a number of factors

1. The type of animals whose droppings or excreta is being used.
2. The age of the animals.
3. The type of feed the animal eats.
4. The handling of the manure before use.

Cattle dung is poor. Goat and sheep manures are the richest followed by pig's and then horse's. Animals that feed on concentrates are likely to produce richer dungs than those that feed on roughages.

Farm-yard manure is best applied before tillage so that it is incorporated in the soil and should be applied when the soil is moist or wet.

## **ADVANTAGES OF FARM YARD MANURE**

1. It is considerably cheap and easy to produce.
2. It has a fairly lasting effect on the soil.
3. It binds sandy soil and loosens clay soil, that is, it improves the physical conditions of both sandy and clayey soil.
4. It contains all the substances required by the plants.

## **DISADVANTAGES**

1. It is bulky
2. It is difficult to apply

## **GREEN MANURE**

Green manure crops are those crops which are grown to be ploughed into the soil as manure to improve the soil.

They are usually quick growing grasses, legumes or a grass-legume mixture. Cover crops are those plants that are grown to protect the soil from erosion and leaching. Leguminous crops like cowpea, mucuna, pueraria are commonly used.

## **ADVANTAGES OF GREEN MANURE**

1. It increases the humus content of the soil and thus improves the physical condition of the soil.
2. Green manure crops reduce the loss of nutrients through soil erosion and leaching.
3. They reduce the rate of evaporation of water from soil surfaces.
4. When legumes are used nitrogen is added to the soil.

## **DISADVANTAGES OF GREEN MANURE**

1. Production of green manure is time consuming and labour intensive.

## **SOME QUALITIES OF GREEN MANURE CROPS**

1. The growth should be rapid. The crops are usually ploughed in at their succulent stage.
2. The seeds should be able to germinate without chemical treatment.
3. The crops should be able to produce their seeds easily.
4. They do not require much fertilizer.
5. When the crops are legumes, they should be able to produce enough nodules for fixing nitrogen.
6. They should be free from insect pests and diseases.
7. The green manure crops may be used as food for human beings or feed for animals.

## **ACTIVITY I**

A farmer grows crops on two different farms A and B. The soil on Farm A is mixed with organic manure while the soil on farm B lacks organic manure. What will be the performance of crops grown on these farms? Give reasons for your answer.

## **COMPOST**

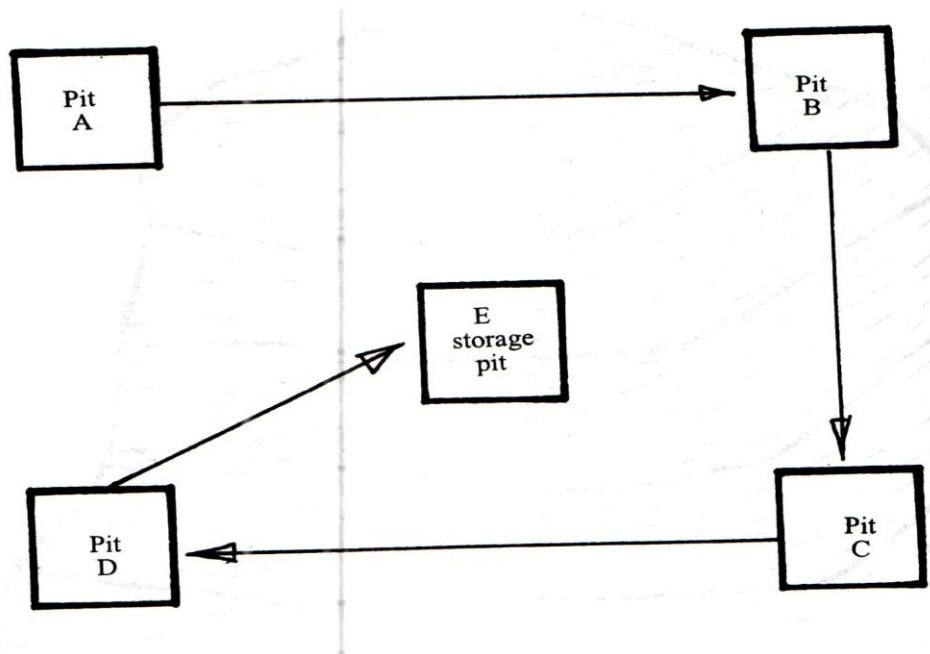
Compost consists of remains of plant and animal materials stored in pits or heaps to decay and form manure.

The value of compost manure depends on the preparation, handling and the materials from which it is made. Leaves from soil that is deficient in nutrients will be deficient. It can be prepared in heaps or in pits. In recent times, preparation in heaps has become more popular in this country. This is because preparation in heaps is best suited for the wet climate while the pit system is best in dry climate.

## **PIT COMPOST**

Here four pits are dug using the same method of building compost as described for heaps. The compost is normally turned layer by layer from the first pit into the second pit after two weeks and this is continued until the compost finally gets to the fourth pit where complete decomposition is expected to take place. However the last two pits should be kept away from rain and too much sun rays. There is a fifth pit in which the compost is transferred into as storage pit.





*Pit Compost*

Compost may be applied directly to the ridges or vegetable beds

### USES OF ORGANIC MANURE

1. They supply plant nutrients to the soil.
2. They help to improve soil structure.
4. They help to retain moisture in the soil and check its loss through evaporation.

### ACTIVITY II

Prepare compost manure using the guidelines provided in the unit.

### ASSIGNMENT

1. What is Farm Yard Manure?
2. Mention some micro-organisms that will help decomposition of compost materials.
3. What is the importance of micro organisms in the soil?
4. What are the advantages of green manure?

### INORGANIC MANURE

#### **Inorganic fertilizers or manure**

These are synthetic or artificially prepared fertilizers chemically. Fertilizer could be formulated as single or straight; compound or complete. There are about sixteen (16) of such fertilizer elements which supply nutrients essential for plant growth. Plant nutrients may be divided into two groups macro nutrients and micro or minor nutrients. The macro nutrients are required in larger quantities by plants while the micro nutrients are needed in much less quantity. Find listed below the macro or major and micro or minor nutrients and their corresponding chemical symbols.

Macro Nutrients	Chemical Symbol	Micro Nutrients	Chemical
1. Nitrogen	N	1. Manganese	Mn
2. Phosphorus	P	2. Zinc	Zn
3. Potassium	K	3. Iron	Fe
4. Calcium	Ca	4. Molybdenum	Mo
5. Sulphur	S	5. Boron	B
6. Magnesium	Mg	6. Copper	Cu
		7. Chlorine	Cl

The remaining three plant nutrients, carbon (C), Hydrogen (H) and oxygen (O) are naturally occurring in gaseous form.

### ACTIVITY III

1. What is inorganic manure or fertilizer?
2. How many groups of fertilizers do we have?
3. Can you list the inorganic fertilizers?

The macro nutrients are further divided into two classes called primary and secondary plant nutrients. They are as follows:

#### PRIMARY PLANT NUTRIENTS

Nitrogen (N)                      Phosphorus (P)                      Potassium (K)

#### SECONDARY PLANT NUTRIENTS

Calcium (Ca)                      Magnesium (Mg)                      Sulphur (S)

The primary nutrient N, P, and K are considered more important and influence the availability and functions of other plant nutrients. This explains why they are popular and are being emphasized.

### FUNCTIONS OF PLANT NUTRIENTS

Functions of the primary plant nutrients such as nitrogen phosphorus and potassium will be discussed. As mentioned earlier, these plant nutrients are considered more important and influence the function and availability of the other plant nutrients

#### Nitrogen

Nitrogen gives plant the green colour. It is required for healthy growth of plants.

It increases the size of fruits, grains and seeds of crops. Large quantity of nitrogen in the soil could be harmful to crops.

#### Phosphorus

Phosphorus assists plants to produce flowers and fruit

- It helps plants to mature.

- It helps fruits to ripen.
- It enables plants to resist certain diseases

### **Potassium**

Potassium is the third most important plant nutrient.

- It helps in root development.
- It helps in tuber development in crops such as yam, cassava, potato etc. just like phosphorus, large quantity of potassium is not harmful to crops.

## **DEFICIENCY SYMPTOMS OF PLANT NUTRIENTS**

When any of the plant nutrients, particularly the primary nutrients, are lacking or insufficient in the soil, they produce some signs called symptoms. The symptoms produced by a particular nutrient vary from nutrient to another.

### **Nitrogen**

When nitrogen is either lacking or insufficient in supply, plants will not grow well.

Leaves of plants will begin to lose their normal green colour and eventually may turn yellow.

### **Phosphorus**

Plants suffering from lack of phosphorus will produce red to purple colour along the edges of leaves.

Lower leaves are usually affected first.

### **Potassium**

Leaves of plants affected by lack of potassium will look dry especially along the tips and edges of lower leaves. The leaves may begin to curl. It can lead to poor yield or death of the plant.

## **WHY ARE LOWER LEAVES AFFECTED FIRST?**

Regardless of the particular nutrient, lower leaves are usually affected first when nutrients are lacking or insufficient. This is so, because lower leaves are older and have less nutrient concentration than the young ones.

## **WHAT TO DO WHEN DEFICIENCY SYMPTOMS APPEAR**

When deficiency symptoms appear, apply the required fertilizer to the affected plants through the soil. The type of fertilizer to be applied will be determined by the deficiency symptoms.

## **ACTIVITY IV**

1. What are primary and secondary plant nutrients?
2. How are they different from each other?
3. What is deficiency symptom?
4. What should you do when you observe deficiency symptoms on plants?

## **SUMMARY**

In this unit, you have learnt that:

- Organic manure is one aspect of fertility management and it is made from plants and animal residue or materials.

- There are three classes of organic manures that farmer can use to bring back soil fertility. These are compost, farm yard manure and green manures.
- Inorganic fertilizers or manures are those plant nutrients which are artificially manufactured by chemical means. Examples are urea and single superphosphate fertilizers.
- There are about sixteen plant nutrients which are essential for proper plant growth. Some of these are phosphorus, nitrogen and potassium.
- Phosphorus helps in flower and fruit formation.
- Nitrogen is responsible for green colour of plants.
- Potassium is needed by plant for normal cell function.

### **ASSIGNMENT**

1. How is inorganic manure differs from organic manure?
2. List the sixteen plant nutrients.
3. Which plant nutrients are primary and secondary?
4. State two functions of the primary plant nutrients.

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## UNIT 5 NUTRIENT LOSSES AND FERTILIZER APPLICATION

### INTRODUCTION

You may recall the properties of soils as discussed in the preceding units 1 and 2. You learnt the characteristics of different soils. Nutrient loss is one of such problems associated with certain soils character. Nutrient loss could occur naturally such as through microbial actions in the soil or artificially by man's activities through manipulation of the environment. By whatever means, nutrient loss has adverse effect on the ability of the soil to support plant growth. Like any other living organism, the plant requires food to survive. The food required by plant is nutrient. Therefore loss of nutrient will be detrimental to the growth and performance of the plant.

### OBJECTIVES

By the end of this unit you should be able to:

1. List the causes of loss of nutrients.
2. Tell how to minimize nutrient loss.
3. List the various ways of applying fertilizers:
4. say the best way to apply fertilizer to different crops:
5. tell the time of fertilizer application.

### WORD STUDY

Volatile:	- A plant nutrient that exists as gas or that can escape in form of gas and or vapour.
Humus:	- Product of decomposed organic matter such as plant remains or wastes. Humus is usually dark in colour.
Root Zone:	- Environment around the root.
Sub-soil:	- Inner layer of soil usually from 30 cm or more deep into the soil.
Lime:	- Materials such as carbonates, oxide, calcium used to neutralize soil acidity.
Leaching;	- Movement of plant nutrients downward in the soil by soil moisture.
Split applications:	- To apply fertilizer two or more time to minimize loss.
Vegetable crops:	- Crops produced for their leaves or fruits e.g. celosia. Amaranthus, okra, tomato,
Grain or cereal crops –	Grass family crops eg maize, rice and wheat.

### NUTRIENT LOSSES

It is important to know that fertilizers have to be dissolved by soil water before they can be used by plants. Some fertilizers such as urea and sulphate of ammonia, which are sources of nitrogen, dissolve more quickly in soil water and become rapidly available to plants. Others such as phosphates and lime are slow to dissolve.

Dissolved fertilizers are carried away by water. When water moves into the sub-soil, fertilizers are transported along or leached away. On the other hand, when water is retained by soil such as clay or loam, fertilizers remain around the root zone of plants. It is understandable that the destination and effectiveness of fertilizers depend on the ability of soil to retain water and fertilizer.

Apart from leaching, nutrient loss could occur when crops are harvested. During harvest, soil is exposed to direct sun shine that over heated the soil to make some nutrients to escapt. Nutrient losses are greater when the entire crop is harvested either for human consumption or as animal feeds. Nutrients lost through crop harvest are replaced when farmers reapply fertilizers.

### **Volatilization:-**

Records has shown that loss of nutrient could also occur when certain fertilizers are reduced or altered from their usual to other forms such as gas or vapour. For instance, certain soil organisms could convert urea fertilizers to ammonia, and as such could be lost as gas. Also, organisms converts ammonia ( $\text{NH}_3$ ) to nitrate  $\text{NO}_3$  which is very vulnerable to leaching. Further nitrate reduce to nitrite  $\text{NO}_2$  gas which escapes back to the atmosphere.

### **HOW TO REDUCE NUTRIENT LOSS**

**Humus** - Humus is a product of decomposed organic matter. Humus helps stabilize the soil by enhancing water retention and thus nutrient supply to the soil.

**Liming** - Liming helps to replace lost nutrients such as calcium and magnesium and provides favourable environment for microbial activity.

**Fertilizer Application** - Apply more fertilizer to replace lost ones. Such fertilizer should be applied to the soil in splits to minimize loss.

### **ACTIVITY I**

1. Revise the nitrogen cycle which have been discussed in unit 3 or 4 to know why certain nutrients are lost and the soil organisms responsible for such actions.
2. Inspect refuse dumps on soil surface to observe decomposition process which lead to humus formation.
3. Put humus in pot and ordinary soil in another pot. Plant maize or vegetable or beans and observe the difference in growth pattern.

### **FERTILIZER APPLICATION**

Fertilizers are applied to crops to enhance growth and yield increase in crops. Certain crops need more fertilizer than the others. For instance improved varieties of crops may require more fertilizer than the local varieties due to the growth and yield habit of the variety. Also, cereal or grain crops such as maize, millet or wheat need more fertilizers than legume crops such as groundnut, cowpeas (beans) because the legume crops could manufacture their own needed fertilizers. Fertilizers applied in excess or inadequate of the need of the crop could lead to poor yield. Fertilizers are applied to crops by various methods such as Band, Ring or Broadcast methods of fertilizer application. Fertilizer could also be dissolved in water and sprayed on crops. This method is called foliar application.

### **BAND METHOD OF FERTILIZER APPLICATION**

Band method involves putting fertilizer in holes dug around the crops or along rows of crop. This method encourages good growth of transplanted seedlings. For young plants, fertilizers is applied 15 – 15cm away from the plants. Band application of fertilizer is efficient for small size farms and is labour intensive for bigger size farms. This method of fertilizer application is good for grain or vegetable crops:

### **RING METHOD OF FERTILIZER APPLICATION**

In using the ring method, fertilizers are applied round the plant at a distance of 15 – 15cm or more from the base of the plant depending on the age and type of plant. This method of fertilizer application is effective also in the production of vegetable crops such as amaranthus, celosia, tomato, okra, egusi, melon, onion and grain or cereal crops such as maize, sorghum, millet, and wheat.

## BROADCAST METHOD

Broadcast method means to apply fertilizer uniformly over the soil surface. The fertilizer applied in this form is not usually incorporated into the soil. By this method fertilizers could be applied in large quantities with minimum damage to seedlings or plants. This method saves labour and time. Fertilizer application in big farms or plantations is usually done by broadcast method.

## FOLIAR APPLICATION METHOD

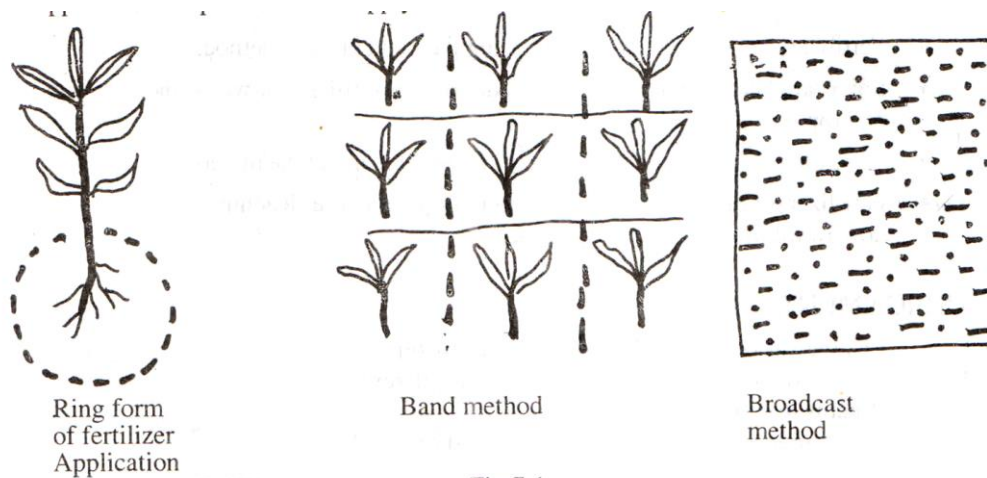
Using foliar method, fertilizers are dissolved in water and sprayed on the foliage (leaves) of plants. However, it is not possible to apply all the necessary plant nutrients through this method. This is because higher concentration of some fertilizers causes burn to leaves. To minimize damage of foliage through foliar, light fertilizer solution be applied either early in the morning or late in the evening. Foliar application of fertilizers done in the evening gives the plant enough time to recover from the shock overnight.

## ACTIVITY I

1. By what method could fertilizes be applied?
2. Should fertilizers be allowed to touch the plant?

## TIME OF FERTILIZER APPLICATION

Whatever method of fertilizer application a farmer decides to use, the time of application is important. Time of fertilizer application consider the age of the plant and moisture contact of the soil. Fertilizers applied during heavy rain will tend to leach while lack of moisture causes caking. This is mostly common in sandy soils; in areas of excessive rainfall fertilizers should be applied in splits to avoid leaching.



*Find listed below certain crops and time and method of fertilizer application.*

Find listed below certain crops and time and method of fertilizer application.

<b>CROPS</b>	<b>METHOD OF FERTILIZER APPLICATION</b>	<b>TIME OF FERTILIZER APPLICATION</b>
Leaf vegetables	Band	2 weeks after planting
Carrot, onion	Band	3 and 7 weeks after planting
Tomato	Band or Ring	2 weeks after planting and at fruit set
Okro	Band	2 weeks after planting
Egusi melon	Band or Ring	3 and 8 weeks after planting
Pineapple	Band	1,4 and 7 weeks after planting
Maize	Band	3 and 8 weeks after planting
Orange, Lemon	Ring	2 and 5 months after planting
Tangelo, grape, lime	Ring	April & July yearly for 3 years.
Mango	Ring	Beginning of each rain session.

### **ACTIVITY II**

1. What happens when fertilizers are applied during heavy rainfall?
2. Demonstrate fertilizer application on transplanted tomato seedlings using the ring or band method.
3. Put some fertilizers on the soil surface, add water and observe what happens.

### **SUMMARY**

- In this unit you have learnt that the various ways by which nutrients could be lost in the soil are leaching, crop removal and microbial activities and erosion.
- Fertilizer application and liming are some of the ways to reduce nutrient loss in the soil.
- The methods of applying fertilizers are broadcast. Band, ring and foliar methods.
- Fertilizers are commonly applied using the band or ring methods.
- Foliar application method involves dissolving fertilizer in water and spraying it directly to crops.
- Time of fertilizer application is very important.
- Fertilizer applied during heavy rainfall can cause leaching which is the downward movement of the fertilizer beyond the rooting zone of crops.

### **ASSIGNMENT I**

1. Explain briefly how soil erosion contributes to nutrient loss.
2. During decomposition process, certain soil organisms convert some nutrients into wasteful forms. True or False?
3. By what process do nutrients move into sub soil?
4. Give two ways by which nutrient loss could be reduced.

### **ASSIGNMENT II**

1. List the various methods of applying fertilizer.
2. Name four crops and their methods of fertilizer application.



3. What is leaching?
4. How can leaching problem be minimized or avoided?

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## UNIT 6 SOIL AND WATER CONSERVATION

### INTRODUCTION

Water is found in abundance in our planet. It is found in seas, oceans, lakes, rivers and streams. Water is also found in the ground, plants and animal, and of course in the air as vapour.

One important function a soil should perform is to be able to store water during period of rainfall for crop to use at a later time of need. A soil that cannot perform this function will be of limited use in terms of crop production unless irrigation facility is provided. Understanding of the various forms in which soil water exists and its movement in the soil is important. This unit is presented to create awareness in the student that a problem exist with soil water management. For the convenience of the student and this exercise, soil and water conservation will be discussed under forms of soil water, soil erosion and its control; and water conservation practices.

### OBJECTIVES

By the end of the unit you should be able to:

1. Tell the various forms in which soil water exist.
2. State why soil water is lost.
3. List various ways by which water loss could be reduced and thus conserve it meaningfully.

### WORD STUDY

Irrigation:	artificial supply of water to the soil for the benefit of plants.
Terraces:	a raised level of soil or land designed to prevent movement of water as erosion.
Strip Cropping:	To plant across the prevailing direction of the wind. The whole idea is to check soil erosion.
Wilting:	plant suffering from lack or insufficient supply of water.

### SOIL WATER

To enable us understand soil water, first let us look at the various forms in which water exist in the soil.

#### 1. GRAVITATIONAL WATER

Gravitational water is often called free water because it is not usually available to the plant. When it rains or you apply water to the soil, the water moves rapidly through the soil. The water is usually pulled down by force of gravity which has the tendency to pull down any substance. Gravitational water fill-up all the pore spaces around the root zone.

#### 2. CAPILLARY WATER:

Capillary water is usually the available water for plants. This is true because it stays around soil particles from where plants can extract it. The water needed by plants for growth and transpiration is from the capillary water.

#### 3. HYGROSCOPIC WATER

This is another form of soil water that is not available to the plant. Hygroscopic water stays around soil particles as vapour. The knowledge from previous units indicates that substances that exist as vapour can evaporate and escap into the atmosphere. This kind of water is no exception in this case.

## **SOIL EROSION**

In addition water loss also happen through soil erosion. Soil erosion occurs when 'man disturbs the vegetative cover of the soil by clearing, burning, over grazing by animals and other farming activities as well as establishment of settlements for factories, markets, roads and housing. The mechanism of soil erosion is brought about by detachment of soil particles followed by transportation of soils by water or wind.

Therefore, soil erosion is either water or wind erosion.

### **A. WATER EROSION**

Water erosion occurs when water flows over the soil surface carrying with it loose soils. There are basic forms of water erosion.

#### **1. Sheet Erosion**

This involves the movement as well as transportation of soil particles uniformly over a wide area of of soil surface by water.

#### **2. Rill Erosion**

Rill erosion results into formation of small channels through which water flows away.

#### **3. Gully Erosion**

It is often referred to as an advanced stage of rill erosion; because gully erosion is the formation of deep channels through which water flows and soil particles carried away.

#### **4. Stream Bank Erosion**

This kind of erosion happens along edges of rivers or streams. Edges of rivers or streams cave in due to flowing water.

### **B. WIND EROSION**

Wind erosion is the movement of soil particles in suspension by wind. Wind erosion happens in dry, bare, loose soils and in areas where the rain fall is low. It is most common in arid and semi- arid regions where there is sparse or no vegetation at all. Just like water erosion, wind erosion is brought about by detachment and transportation mechanism. Transportation of soil particles by wind takes place in two ways.

#### **1. Siltation**

Soil particles blown off the ground as such particles bounce on the ground.

#### **2. Surface Creep**

Soil particles that are too large to be blown by wind, roll or slide along the soil surface by action of wind.

## **EROSION CONTROL PRACTICES**

Be it wind or water erosion, the following measures or practices control or prevent soil erosion.

1. Planting cover crops over bare soils.
2. Plant trees to act as wind breaks.
3. Construct terraces or benches across water ways or slopes.
4. Use diversion ditches to remove water
5. Adopt minimum tillage practice or no-tillage practice in erosion prone areas.
6. Apply mulch or organic matter to the soil,
7. Do strip cropping by planting into compartments.

## ACTIVITY I

1. Read the unit carefully and try to understand the terms under word study.
2. Plant maize or beans in two separate pots or containers.
3. After seedling emergence and at reasonable growth stage, continue to water one of the pots and leave the other without watering.
4. Observe the difference in growth pattern of the crops thereafter.

## OTHER FORMS OF SOIL WATER LOSS

Soil water or moisture is also known to be lost through evaporation from the soil surface or through transpiration on the surfaces of leaves. Continuous downward movement of soil water, called percolation, also causes water loss. Soil water conservation could be summarized as follows:

TYPE OF SOIL MOISTURE LOSS	CONTROL MEASURES
1. Water run-off (erosion)	Construct terraces, strip or ridge across the water way. Apply mulching to avoid splashing effect of rainfall.
2. Evaporation	Arrange plants properly to cover the soil.
3. Transpiration	Remove weeds regularly from among crops.
4. Percolation	Add organic matter to the soil to increase soil moisture holding capacity.

## ACTIVITY II

1. Observe what happens when rain drops from the roof of your house to the bare soil.
2. Visit a slope of land after rains to observe flowing water and the resulting effect.
3. On bare soils, observe what happens when rain falls or wind blows.

## SUMMARY

In this unit you have learnt that

- There are three basic forms of soil water capillary, gravitational and hygroscopic of this only capillary water is available to the plant.
- Soil water could be lost through erosion
- Erosion control practices include planting cover crops, planting trees as wind breaks, construction of terraces and practicing strip cropping.

## ASSIGNMENT

1. Name some causes of soil erosion.
2. Name four ways by which erosion could be controlled or prevented.
3. Describe what is referred to as "available water".
4. Sheet erosion is the formation of channels through which water flows discuss.

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## UNIT 7      PROCESSES AND FACTORS OF SOIL FORMATION

### INTRODUCTION

The process of soil formation is called weathering. Weathering is defined as the disintegration or breakdown of rocks into tiny pieces to form soil. In other words, weathering can be defined as the breakdown of rock masses (rock minerals) into simpler forms through the agents of physical, chemical and biological processes.

### OBJECTIVES:

By the end of unit you should be able to:

- a. Mention the major factors of soil formation;
- b. Explain five of these factors of soil formation;
- c. Explain the term weathering
- d. Mention three (3) processes of soil formation.

### WORD STUDY

Formation – to build

1. **Physical process:** Agents of physical weathering are temperature, ice, wind, water and pressure.
  - (i) **Temperature:** The alternating heating and cooling of the rocks produce pressure within the rocks and cause them to break down into pieces.
  - (ii) **Wind:** As a result of the grinding of rock surfaces by solid materials carried by wind, water and moving ice (glacier), rocks break down to form soil.
  - (iii) **Ice:** The conversion of water inside cracks in rocks into ice results in increase in volume. This increase in volumes results in more pressure being exerted on the rock walls which eventually break into smaller pieces.
  - (iv) **Water:** Running water carries some fragments of rocks along its course and these rub against the surface of rocks in the river bed, thus breaking off small pieces of rocks.
2. **Chemical Process:** Agents of chemical weathering include solution, carbonation, hydration, hydrolysis and oxidation.
  - (i) **Solution:** This occurs when water dissolves soluble minerals present in the rock.
  - (ii) **Carbonation:** Atmospheric carbon dioxide mixes with rain water to form weak carbonic acid. This acid dissolves rocks, resulting in their breakdown.
  - (iii) **Hydration:** This is the attachment of water with rock minerals. This results in chemical alteration of the minerals, e.g., the conversion of iron II rocks to hydrated rocks. Hematite rock is also changed to limonite.
  - (iv) **Hydrolysis:** This is the reaction of water with rock minerals to weaken the rock. For example olivine rock is changed to serpentine.
  - (i) **Oxidation:** This is the reaction of rocks minerals with oxygen from the atmosphere. This reaction eventually weakens and breaks down the rock to form soil.
3. **Biological process:** This involves the activities of plants and animals in the breaking down of rocks to form soil.

- (i) It is caused by the action of animals like earthworms, termites and other soil organisms.
- (ii) Movements of these organisms cause small fragments of rocks to disintegrate.
- (iii) Earthworms and termites burrow into the rocks and break off fragments of rocks.
- (iv) The roots of growing plants penetrate rocks, exerting pressures which split some rocks.
- (iv) The activities of man during farm operations such as ploughing and harrowing also break down rocks into tiny pieces.

Soil formation is greatly controlled by five major factors which are:

- (i) climate (ii) parent materials (iii) topography (iv) biotic (living organisms) and (v) time.

**1. Climate:** Elements of climate such as rainfall, temperature, wind and pressure are all very important in soil formation.

**(i) Temperature:** The alternating heating and cooling of rocks result in the continual expansion and contraction which eventually result in cracks in the rocks and its consequent breakdown into small pieces to form the soil.

Temperature affects the rate of chemical weathering of rocks.

**(ii) Rainfall:** The action of running water from rainfall causes the gradual wearing away of rocks during erosion to form soil. Rainfall provides water for hydrolysis. Also, rain drops may break down some parent rocks to form soil.

Rainfall enhances vegetative growth of plants whose roots cause further breakdown of rocks, while the rain water transports rock particles after disintegration.

**(iii) Wind:** High-wind velocity in deserts carries with it other tiny rocks which collide with one another or other rocks, resulting in the breaking of rocks into tiny pieces to form soil. Wind also removes weathered materials, thereby, exposing parent materials to further breakdown.

**(iv) Pressure:** High pressure on a hanging rock may cause such rock to fall down and break into tiny pieces, resulting in the formation of soil.

**2. Parent material:** Parent materials constitute the major materials from which soil is formed. They are igneous, sedimentary and metamorphic rocks.

Parent materials determine the chemical composition of the soil that is formed. It also contains different minerals which account for differences in the fertility of the soil formed. Parent materials determine the physical characteristics of the soil. Hardness of parent material affects the rate of soil formation.

**3. Topography:** The shape of the ground in relation to the underlying rock of the earth's surface is known as topography. Topography affects the rate of run-off and erosion. Steep slopes encourage erosion and increase the rate of soil formation. Soil-formation is faster in valley than on slopes. Steepness of the slope affects the rate of abrasion of rocks; hence, soil is formed.

**4. Biotic Factors (Living Organisms):** The activities of living organisms help to speed up the process of soil formation.

- (i) Termite, earthworm, rodent mix the mineral and organic matter together, and this results in the formation of soil.
- (ii) They also allow water and air into the soil which eventually react with rocks to cause

- breakage.
- (iii) The activities of man during tillage and other farm operations indirectly help to break rocks into tiny pieces to form soil.
  - (iv) The activities of micro-organisms which promote decomposition of organic materials aid soil-formation.
  - (v) The roots of plants penetrate rocks and break them into tiny pieces to form soil.
  - (vi) They influence the organic matter content of the soil.
  - (vii) Organisms produce carbondioxide which forms carbonic acid with water and enhances the weathering of rocks.
  - (viii) Microbes also improve soil aeration and water percolation. This enhances chemical and physical weathering.
  - (ix) Microbes help in the decomposition of organic matter in the soil.
  - (x) Decay of fallen leaves of trees results in the formation of humus, and this is rich in plants food.

**Soil Time:** Time also plays an important role in soil-formation. It takes a long time for mature soil to be formed.

- (vi) It takes a long time for small pieces of rock to disintegrate into grains of soil.
- (vii) It also takes a long time for plants to decay and become part of the soil.
- (viii) It also takes time for rainfall to leach chlorides, sulphates and carbonates from the soil.
- (ix) It takes a short time in the formation of immature soil.

## ACTIVITY I

Discuss five factors of soil formation.

## ASSIGNMENT

**Enumerate** some of the role of the following in soil formation:

- i. Parent material
- ii. Soil time
- iii. Living things

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## UNIT 8 SOIL COMPONENTS

### INTRODUCTION

There are five main components of the soil namely:

1. Inorganic matter (minerals)
2. Organic matter
3. Soil water
4. Soil air
5. Living organisms

Mineral or inorganic matter, water and air are collectively referred to as physical component of the soil while living organisms are referred to biological components of the soil.

### OBJECTIVES

In this unit you are expected to

- a. Mention the five components of the soil
- b. Discuss briefly each of these main components of the soil

### WORD STUDY

Soil	- the uppermost layer of the earth's crust which provides support and nutrients for plant growth.
Organic water	- Remains of dead plants and animals.
Inorganic matter	- Small rock fragment of the soil.
Soil air	- gases present in the soil.
Soil water	- water in the soil.
Living things	- Refers to both plants and animal

**1. MINERAL OF INORGANIC MATTER:** The mineral matter represents small rock fragments of the soil. It forms the bulk of about 45% of total volume of the soil. It consists of gravel, stones, sand, silt and clay.

- (i) It forms the solid part of the soil and provides support for plants.
- (ii) Mineral matter is a store of plant nutrients such as nitrogen, calcium, magnesium, iron, etc.
- (iii) It represents the home or habitat of all soil living organisms.
- (iv) It holds water and air for both plants' and animals' activities.
- (v) Mineral matter has moderating effects on soil temperature.
- (x) It also affects soil porosity.

**2. ORGANIC MATTER:** The organic matter represents the remains of the decomposition of plants and animals. It is about 5% of the total volume of the soil. Leaves, roots of plants, the residue of crops, animal dung etc, when deposited on the soil, decay to form a dark colour on the upper part of the soil known as organic matter or humus

- (i) It is very rich in plant nutrients.
- (ii) It is the habitat of many soil microorganisms.
- (iii) It also prevents soil erosion and evaporation of soil water.
- (v) It allows for good drainage and holds water in the soil for plant use.
- (vi) It improves the structure of the soil by binding the particles of coarse-texture.

**3. SOIL WATER:** Soil water refers to the water in the soil which is usually obtained either from rain or irrigation. Water represents 25 % (percent) of the total volume of the soil. It is usually found in the soil within the pore spaces. When water is too much in a soil (covering the soil surface), the soil is said to be waterlogged. A waterlogged soil can, however, be improved by drainage to make such soil more productive. On the other hand, a situation where there is lack of water in the soil for a very long time to the extent that plants cannot absorb water even when supplied again, results in a condition called permanent wilting point. The plant at this stage can die.

There are four major types of soil water. These are:

- I. **Hygroscopic water:** This water is tightly held by the soil particles such that it is never available to the plant.
- II. **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.
- III. **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 easily available to plants.
- IV. **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.

**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.

Soil air, especially oxygen, is necessary for the growth and development of plants

**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).

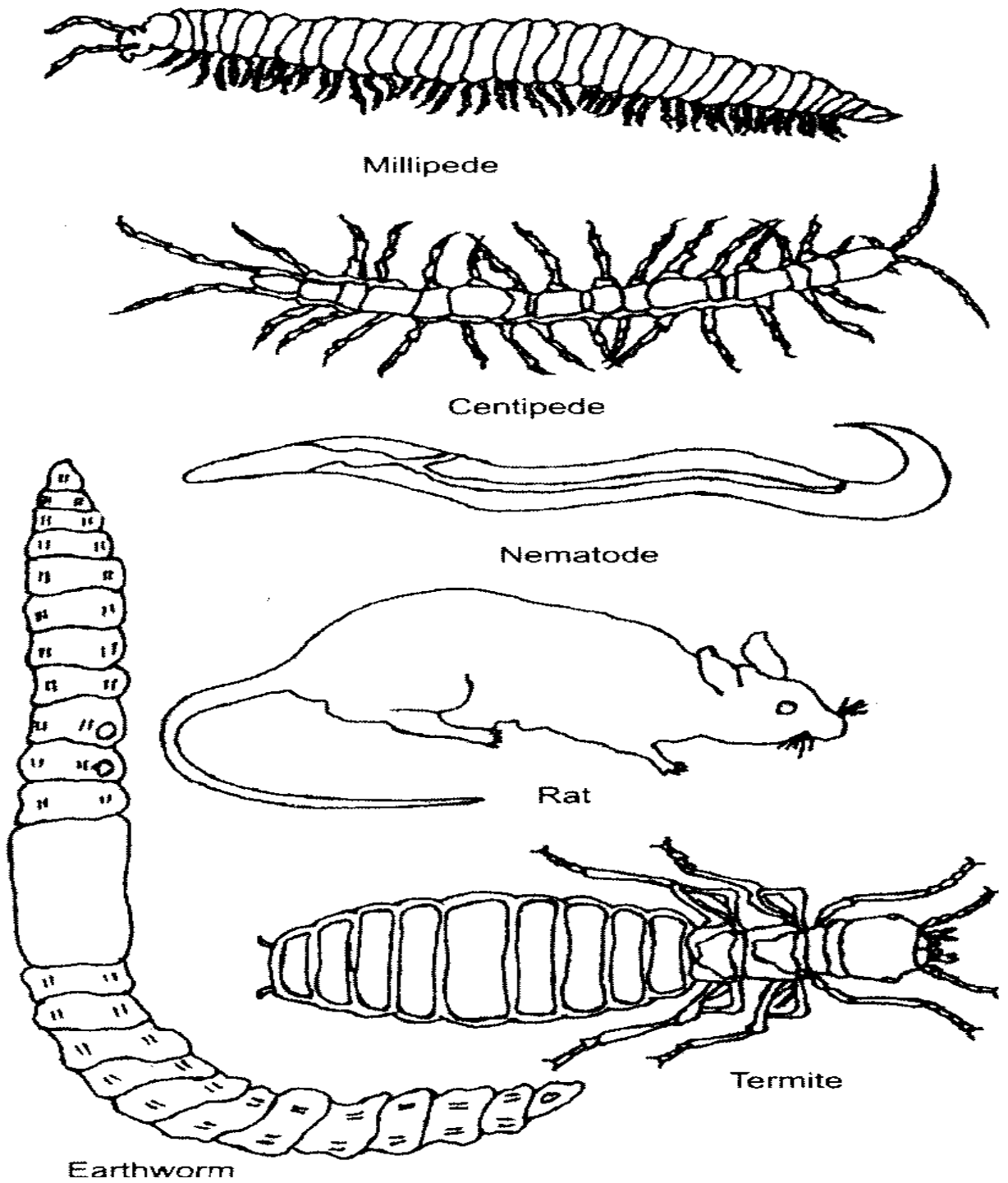


Fig. 4.12 Living organisms in the soil

### ACTIVITY I

Mention 5 components of the soil.

## **ASSIGNMENT**

Explain the following soil components:

1. Soil air
2. Soil living organisms

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## UNIT 9 SOIL PROFILE, TEXTURE AND STRUCTURE

### INTRODUCTION

The soil is characterised with properties such as soil profile, texture, structure, temperature, colour, porosity, water holding/retaining capacity and soil pH. For the purpose of this unit you will learn about soil profile.

### OBJECTIVE

By the end of this unit you will be able to:

- Define soil profile
- Show, using diagram, the different layers of the soil.
- Define soil texture
- State the names and sizes of soil particles

**Definition:** Soil profile is defined as the vertical section of the soil, showing series of horizontal layers of different types of soil. These horizontal layers are called horizons.

A soil profile in an area of the humid tropics such as the forest zones may have about four different horizons. (fig. 8.8) The first thing noticed in a soil profile is soil colour. The horizons show different colours, e.g., the top soil may be dark, followed by brown below.

### Horizons of Soil Profile

The four major horizons of soil profile are:

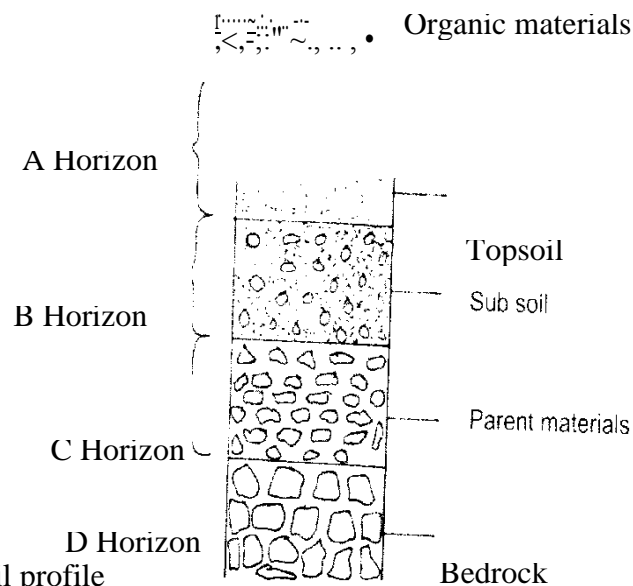


Fig 4.13 Soil profile

(1). The A - Horizon, also called the top soil, represents the surface layer of the soil profile. This horizon contains more organic matter than other horizons. The A horizon, is the most weathered and leached of all the soil horizons. Most of the food crops, especially shallow rooted derive their nutrients from it, e.g., vegetables, legumes, etc.

(2) B - Horizon: The B - horizon, also called the sub-soil, is the next horizon immediately after the top soil. It is rich in minerals that are leached down by percolating water. The B-horizon is suitable for the cultivation of deep-rooted crops like cocoa, rubber, orange, oil palm, etc.

(3) C- Horizon: The C - horizon, also called parent materials, represents the type of material from which top-soil and sub-soil are made.

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

(4) D - Horizon: The D - horizon is the bedrock. It represents the unweathered rock materials. This horizon is found at the bottom of the profile and they are usually of large particles.

### **Importance of Soil Profile**

(1) Level of soil fertility: Soil profile determines the level of soil fertility. A thick top soil represents high level of soil fertility.

(2) To know the type of crop to grow: It helps the farmers to know the type of crop to grow. For example, shallow-rooted crops like cowpea, groundnut, etc. are grown in the top soil, while deep-rooted crops are grown where the sub-soil is thick.

(3) Penetration of roots: A loosely-packed sub-soil allows easy penetration of roots of crops.

(4) Level of drainage and aeration: A loosely packed sub-soil also allows for easy drainage and aeration.

(5) Easy percolation: A loosely-packed subsoil also ensures easy percolation of water, thereby preventing the occurrence of erosion.

### **SOIL TEXTURE**

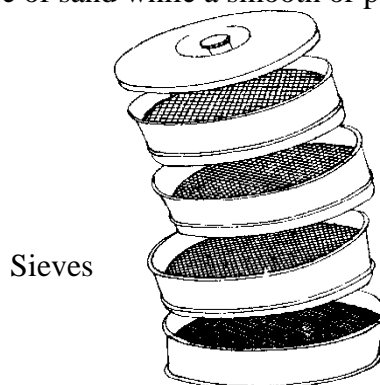
**Definition:** Soil texture refers to the relative proportion (sizes) of the various particles that made a soil. In other words, it refers to the degree of fineness or coarseness of the various soil particles.

The particles that make up a soil sample include gravel, sand, silt and clay. Sand, silt 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.

Soil texture can be determined by various methods. These methods include:

1. By feeling: Take a little sample of soil and rub them between the fore-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/fractions present in a sample of dried soil can be separated by putting the sample into a series of various measured mesh diameters and shaking vigorously. One starts 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.

A sample of soil is placed inside a glass jar and large volume of water is added and the mixture is vigorously shaken and allowed to settle. At the end, large particles like coarse sand and gravel settle at the bottom, while the organic materials float on top of water.

## SOIL STRUCTURE

**Definition:** Soil structure refers to the ways in which the different particles of the soil are packed or arranged. It also refers to the shape and arrangement of primary particles to form compound particles.

Soil structure has a direct effect on crop yield. If the soil structure is good, soil, air and water are balanced thus, erosion and leaching will be reduced. The structure of the soil can be preserved in the following ways.

- (i) Planting cover crops.
- (ii) Mulching.
- (iii) Application of manure (green manure and lime).
- (iv) Avoidance of over-grazing and erosion.
- (v) Avoidance of clean clearing with machines.

## TYPES OF SOIL STRUCTURE

The different types of soil structure include:

- (1) **Single-grained structure:** In this structure, the primary particles exist in single form and are not cemented together. It is found in sandy soil.
- (2) **Crumb structure:** There exist large gravels or stones 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 plates or leaflets on top of each other. It is commonly found in the sub-soil.

(4) **Spheroidal structure:** This is also referred to as granular structure. The particles are cemented together in a circular form with lots of air spaces. It is commonly found in top soil.

5) **Prismatic structure:** This could be columnar or prismatic. They are just like a structure with air spaces. It is found in sub-soil

(6) **Mock-like structure:** The aggregates are like blocks whose edges are irregular and may be either sharp or rounded. It is commonly found in the sub-soil.

## **IMPORTANCE OF SOIL STRUCTURE**

(1) It determines the level of fertility of the soil.

(ii) A good soil structure supports aeration. (iii) It also prevents erosion and water logging.

(iv) A good soil structure promotes the activities of soil micro-organisms.

(v) A good soil structure has a good water retaining capacity.

(vi) It also supports the growth of crops.

## **ACTIVITY I**

1) State the various methods of determining soil texture.

2) In a tubular form, state the four soil particles and their sizes.

## **ASSIGNMENT**

With diagram inclusive, explain sedimentation as a method of determining soil texture.

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## UNIT 10 SUMMARY

### INTRODUCTION

In this unit, you will review all that you have studied in the earlier units of this module that is units (1-9). The purpose of this unit is to enable you clearly understand some concepts and practices you did not yet understand.

### OBJECTIVES

By the end of this unit you should be able to:

- Define soil
- Define soil fertile
- List the components of soil
- State the characteristics of sand, silt clay and loam.
- Plan a four – course crop rotation.
- List the causes of nutrient loss in the soil.

### Soil

Soil is the medium for plant growth and it contains living matter, air, water, and mineral matters. The composition of the soil; include mineral particles resulting from rocks, organic matter, air and water. The mineral matter and organic matter constitute the solid part of the soil. While air and water are present in pore space. Soil texture is the term which describe the amount of sand, silt and clay which made up the soil. Intermediate mixture of sand, silt and clay give rise to loam, which is the 4<sup>th</sup> type of soil.

Sandy soil has 70% or more of sand content.

Silty soil has 80% silt composition

Clay soil has 40% or more of clay

Read units 1 and 2 again and answer the questions that follows-

### ACTIVITY I

- Give two similarities between silt and clay.
- Mention four components of soil showing the percentages in which they exist in the soil.

### Fertility Management as Principle of Crops Rotation

Different types of crops require different types of nutrient elements in the soil. When a crop is planted on a piece land, the nutrients are not required in large quantities can accumulated for crops following it which may require them.

In unit 3, you were introduced to different fertility management; fertility management by crop rotation, by using fallow and cover crops, Check unit 3 again for more understanding of the concepts.

### **Nutrient losses and fertilizer application**

In units 4 and 5 you studied organic and inorganic manure, nutrient losses and fertilizer application. Go through them for proper understanding.

Units 6 – 9, discussed soil and water conservation processes of and factors of soil formation, soil components, soil profile, texture and structures. Go through them once again.

### **SUMMARY**

Rotational cropping implies that crops would be alternated such that soil fertility is maintained similar crops in terms of nutrients demand should not be allowed to succeed each other in the rotation.

Fallow is the act of allowing a cultivated piece of land to revert to bush, resting period to enable the soil regain its lost nutrients.

Organic manure – materials, plant, animal that decompose constitute organic manure or fertilizer.

Inorganic fertilizer are the plant nutrients which are artificially prepared by chemical means.

Several ways of fertilizer application includes: Broadcast, Band, Ring and Foliar application.

Nutrient losses are brought by:

- i. Leaching
- ii. Crop removal
- iii. Soil erosion
- iv. Microbial activity

### **ASSIGNMENT**

- State three (3) basic types of soil water
- State four (4) various ways of soil erosion

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## **MODULE 5: METHODS OF TEACHING AGRICULTURAL SCIENCE**

### **UNIT 1 AIMS AND OBJECTIVES OF TEACHING AGRICULTURAL SCIENCE IN THE PRIMARY SCHOOL**

#### **INTRODUCTION**

You would recall that primary school is the basic in acquiring knowledge and skills of farming in an organized manner. Children from various homes are motivated and encouraged to practice farming in the most acceptable ways.

You also noticed that some parents do not grant their children opportunity of learning how to cultivate crops and also to keep animals and birds, especially parents in the urban areas who are purely white collar jobbers' or business men.

To these categories of children, you must pay special attention in order to instill interest in them. Specifically, children are taught agriculture in primary school in order to be aware, acquire knowledge for further studies in agriculture and be able to sustain their interest in farming.

In this unit, two main issues will be discussed. They are; aims and objectives of teaching agricultural science to pupil in primary school.

#### **OBJECTIVES**

By the end of this unit, you should be able to

1. List aims of teaching agricultural science in primary school.
2. List objectives of teaching agricultural science in primary school.

#### **WORD STUDY**

Iteratively	- step by step so as not to skip any section of the unit.
Cognitive	- Use of brain to understanding and learning.
Affective	- Emotion and interest towards a particular object, subject and person.
Psycho-motor	- Physical practice with hand, eye, leg and brain to acquire skills.
Principles	- refer to constant relationship between two or more concepts.
Concepts	- means mental or reasoning construct.
Inculcate	- to build into their brain for the purpose of remembering,

#### **AIMS OF TEACHING AGRICULTURAL SCIENCE IN PRIMARY SCHOOL**

You know that primary school provide children with the basic opportunities to have practical investigation of any object, event and subject in their environment

You may also recall that before you undertake any kind of project or course of study, you may have considered what you will achieve at the end of such project or course of study. 'Aim' as used in this unit refers to long-term achievement as compared to immediate achievement at the end of 45 minute classroom activities. Therefore, children are taught some broad reasons why they should study agriculture science at the primary school level.

Suffice to assert that specific objectives are carved out of general aims.

The following are some aims of teaching agricultural science at the primary school level.

1. To build a rational and consistent opinion about agriculture.

2. To gain effective understanding of concepts and principle of agriculture.
3. To develop some skills in practicing agriculture
4. To cultivate the interest in order to take to farming as a means of livelihood.
5. To develop firm attitude about agriculture for further studies.
6. To prepare pupils for occupations in agriculture
7. To expose pupils to opportunities in the field of agriculture.

In a nutshell, the study of agricultural science in primary schools should inculcate into the pupils scientific attitude, spirit of enquiry and skills in solving agriculture problems that will help them earn a living in the society.

### **ACTIVITY I**

Answer these questions

1. Define the word 'aims' of agriculture science in primary school.
2. Outline five aims of teaching agricultural science in primary school.

### **OBJECTIVES OF TEACHING AGRICULTURAL SCIENCE IN PRIMARY SCHOOLS**

An objective is a practical guide. It is an intentional out come after a classroom teaching as well as teaching on the farm for periods of 45 minutes and 90 minutes respectively.

Before you go for a particular lesson, you already know what your pupils should acquire at the end of the lesson. Objectives are derived from broad aims.

You may wish to assess the pupils cognitively, effectively and psycho-productively. These three domains will assist you to take final decisions in determining the levels of performance of your pupils in that lesson.

You may also wish to observe some desirable changes in behaviour of your pupils towards agriculture during the process of teaching. These changes could be as a result of their ability to think critically with their brain, ability to appreciate agriculture due to its usefulness and ability of fully put into practice the acquired skills and knowledge.

On the other hand, these objectives could be grouped under three domains; - cognitive affective and psych-productive. As an experienced and trained teacher, you have to watch carefully for the manifestation of all these variables of these three domans in the performance of your pupils during the course of teaching in the classroom.

The following are some of the variables under each of the domin that you expect your pupils to.

### **COGNITIVE OBJECTIVE**

This refers to the ability of children to use their brain in solving problems in agriculture and other subject. It is stated in an action form, which means the pupils will physically show that such objectives have been attained.

The following are the practical ways cognitive objectives are stated under various levels.

1. By the end of the lesson on any topic in agriculture, you would expect your pupils to cognitively define, describe, identify, label, list, name, outline, select and state what was taught. All these fall within a core-variable called **information**.
2. Similarly by the end of the lesson, on any topic in agriculture, you would expect your pupils to cognitively convert, depend, distinguish, estimate, explain. extend, generalize, give examples,

infer, paraphrase, predict, re-write and summarize what was taught. All these fall with a core variable called **comprehension**.

3. In the same vein, by the end of the lesson on any topic in agriculture, you would expect your pupils to compute, demonstrate, discover, manipulate, modify, operate, predict, prepare, produce, relate, show, solve and use what was taught. All these fall within a core variable called **application**.
4. Also by the end of the lesson on any topic in agriculture, you would expect your pupils to cognitively breakdown, illustrate, infer, outline, point out, relate, select, separate and sub-divide what was taught. All these fall within a core variable called **Analysis**.
5. By the end of the lesson on any topic in agriculture, you would expect your pupils to categorize, combine, compile, compose, create, devise, design, explain, generate, modify, organize, plan, rearrange, construct, relate, revise, re-write and take what was taught. All these fall within a core variable called **synthesis**.
6. By the end of the lesson on any topic in agriculture, you would expect your pupils to appraise, compare, contrast, criticize, describe, discriminate, explain, justify, interpret, relate, summarize and support what was taught. All these fall within a core variable called **evaluation**.

### **AFFECTIVE OBJECTIVE**

These refer to the pupils' feelings and emotions about agriculture.

1. By the end of the lesson on any topic in agriculture, you would expect your pupils to appreciate, pay attention, accept, get, hold and direct what was taught. All these fall within a core variable called **receiving**.
2. By the end of the lesson on any topic in agriculture, you would expect your pupils to participate, react, and attend to what was taught. All these fall within a core variable called **responding**.
3. By the end of the lesson on any topic in agriculture, you would expect your pupils to believe, internalize, value, appreciate what was taught. All these fall within a core variable called **valuing**.

### **PSYCHO-MOTOR OBJECTIVE**

This concerns combination of various types of physical abilities. It involves the use of hands, legs, eyes, nose and brain in practicing activities.

1. By the end of the lesson on any topic in agriculture, you would expect your pupils to physically distinguish, recognize, compare, taste, smell, see, hear and touch what was taught. All these fall within a core variable called **perceptual abilities**.
2. By the end of the lesson on any topic in agriculture, you would expect your pupils to endure, and practice what was taught. All these fall within a core variable called physical **abilities**.

### **ACTIVITY II**

1. List the expected outcome under cognitive objective.
2. List the expected outcome under affective objective
3. List the expected outcome under psycho-motor objective
4. Find out the meaning of the following in your dictionary analysis, synthesis, information, comprehension, receiving, responding, valuing, perceptual abilities, physical abilities etc.

## SUMMARY

- In this unit, we have looked at issues of aims of teaching agriculture science in primary school. We looked first at the introduction of aims and its usefulness. We also looked at the specific aims which include: to build a rational and constant opinion about agriculture, to gain effective understanding of concepts and principles of agriculture, to cultivate the interest in order to take to farming as a means of livelihood and to develop firm attitude about agriculture for further studies.
- In the second part of the unit, we also looked at the objective of teaching agricultural science in plain any school. We examined various core variables and the immediate expected outcome under the three domains which include: cognitive, affective, and psycho- motor.

## ASSIGNMENT

1. Define the terms 'aims' and 'objective' of agricultural science in primary school.
2. What are the core variables of specific objectives of teaching agricultural science in primary school?
3. Outline four expected outcome from cognitive and affective after a lesson on agricultural science.
4. As an agricultural science teacher how will you motivate your pupils to practice agriculture?

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## **UNIT 2      TECHNIQUES OF TEACHING AGRICULTURAL SCIENCE IN THE PRIMARY SCHOOL**

### **INTRODUCTION**

You may recall that various techniques of teaching agricultural science exist in primary schools. These techniques vary from teacher to teacher in terms of applicability. However, the most important issue is that children are expected to benefit from the interactions at the end of the lesson.

Interactions differ based on the level of involvement of pupils and teachers. Interaction in this context is that series of activities, tasks and procedures that you will use to create a lesson that challenges and stimulates your pupils.

In the classroom, you should ensure that each interaction must provide the pupils a reason for being there, a direction to go, a way of getting there and a change in their behaviour that is relatively permanent.

In the primary school, teachers adopt the simplest methods of teaching agricultural science to pupils. They want to ensure that such methods could inculcate interest in the pupils. Besides, at that level, pupils could not be exposed to abstract instructional materials and learning experiences.

In this unit, emphasis will be focused on expository approach, discovery/inquiry approach, problem solving approach, 3 - Dimensional riddles, concept map and small group discussion.

### **OBJECTIVES**

By the end of this unit, you should be able to explain.

- (1) expository approach:
- (2) discovery/inquiry approach:
- (3) problem solving approach:
- (4) pictorial Riddles:
- (5) concept map:
- (6) small group discussion; and
- (7) 3 - dimensional riddle.

### **WORD STUDY**

**Interactions**                      is the series of activities, tasks and procedure that you will use to create a lesson that challenges and stimulate your pupil.

**Expository:**                      This is an approach of telling stories to pupils and also asking them to take down notes without asking questions. In this approach, the teacher does the talking alone while the pupils listen.

**Discovery inquiry:**            is the process whereby pupils find out things about an existing problem themselves with little or no assistance from the teacher.

**Problem solving:**              is the type of training given to the pupils to be able to discover answers to problems themselves.

**Pictorial Riddle:**                refers to the presentation of pictures and stimulating questions in the course or teaching.

**Concept map:**                    is used to present meaningful relationship between related concepts.

**Group discussion:**              is a process whereby pupils are taught in a group instead of individual.



3 - Dimensional Riddle: refers to those objects in their real nature with three dimensions – height, breath and width. The combination of this object with questions lead to what is called 3 - dimensional riddles

## **EXPOSITORY APPROACH TO THE TEACHING OF AGRICULTURAL SCIENCE IN PRIMARY SCHOOL**

Expository approach is an aged used method of teaching rudimentary science and primary science before the 6-3-3-4 educational system in Nigeria. It involves verbal presentation of ideas, concepts and principle. You are responsible for much of the activities in form of talking while the pupils listen.

To be able to use this method effectively you must have clear and good command of language and ability to write clearly and boldly or the chalk-board.

As a trained teacher, you need some fundamental guidelines for effective usage of the expository approach in teaching agricultural science in primary school.

1. Expository approach should not merely consist of verbal presentation of facts. You should endeavour to involve the pupils as much as possible by asking questions which lead to critical thinking.
2. There should be continuous interaction between the teacher and pupils so that the pupils should not get tired on time. In this case, pupils could be allowed to ask questions.
3. Expository approach should be used to develop concepts and should be directed to principles and facts. You should minimize the use of this approach because, facts are easily forgotten when they are presented verbally.
4. Expository approach should not be used alone. When it is used to introduce a lesson, another method should be used to develop the lesson.

### **ACTIVITY I**

1. Explain Expository approach
2. List four (4) fundamental guidelines for effective usage of expository approach to the teaching of agricultural science in primary school.

## **DISCOVERY INQUIRY APPROACH**

In the early experience of children, they learn both to do and to know better by doing things. Through practice children become more skillful. For example, in the school garden, pupils could be asked to carry out ring method of fertilizer application or yam staking Pupils will acquire skills of doing these activities through active participation and learning-by doing. You could ask pupils to find out solutions to problems on their own with little or no guide.

On the other hand, guided inquiry could be used to find out answers to problems or to generate problems from the answers provided. This means guided inquiry consists of an instructional mode which can be from simple to complex or from complex to simple.

As a trained teacher, you need the following guidelines for effective teaching of agricultural science using discovery approach.

1. Discovery approach can be used when science lessons including agricultural science are moderately structured so that the teacher can give some kind of guidance if need be.
2. Discover approach is used when pre-activity discussion precedes actual discovery lesson. This is important because, it will help the pupils to understand the expected outcome of their activities.

3. Post-activity discussion should be part of the discovery lesson so that questions based on pupil's activities can be discussed by the whole class.
4. Discovery approach cannot be used effectively with large class, when the approach is to be used, pupils should be split into smaller groups for effective supervision.
5. The guided inquiry aspect of discovery approach should be consistently used along with other approaches of science-teaching because it IS applicable to all levels of pupils unlike unguarded inquired inquiry which puts hard burden on pupils.

### **ACTIVITY II**

1. Explain discovery/inquiry approach.
2. List five (5) fundamental guidelines of discovery/inquiry approach to the teaching of agricultural science in primary school.

### **PROBLEM SOLVING APPROACH**

Problem-solving approach is a process whereby facts, concepts and units of information do not themselves constitute the content to be taught but are the vehicles by which positive values and ideas are developed.

You could recall that problem solving approach usually leads to the development of skills for agricultural productivity. Through these methods, pupils can solve their problems of everyday living efficiently and effectively.

For the problem - solving approach to be successful, you must see clearly the goal to be achieved. Similarly, you should ensure that stimulating environment in which pupils will be motivated to ask questions and to search for answers under the guidance of the teacher be created. Pupils must be confronted with problems and have them search for the answers.

You could stimulate pupils into finding out answers to problems through story-telling, displaying of picture-related to agriculture and role playing. Through role - playing and co-operative discussion pupils could come together-to solve their problems. For example, during practical lesson on the school farm, pupils could identify common problems and have it solved jointly. For instance, prevention of outbreak of certain diseases and pests.

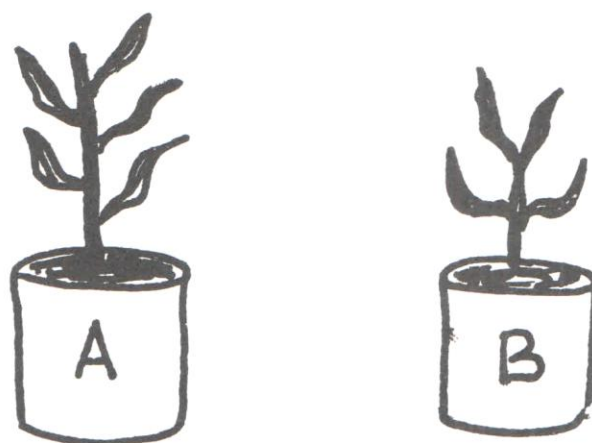
### **ACTIVITY III**

1. Explain problem-solving approach.
2. List why it is important to use problem-solving approach to teach agricultural science in primary school.

### **PICTORIAL RIDDLE**

Pictorial riddle is one of the simplest methods of teaching agricultural science in primary school. You present varieties of agricultural pictures and posters to pupils in the classroom. Along with these pictures and posters, you also present questions related to the pictures.

For example, if you want to teach the effect of nutrient elements on plant growth, you could present two potted plants - one treated with nutrient elements and the other without treatment. Obviously there will be differences in their growth and development. After presenting the potted plants, then you can ask questions related to the effect of nutrients on the growth of plant.



Diagrams of groundnut seedlings of the same age.

### QUESTIONS accompanying the pictures-

- What observations can you make regarding the two seedlings?
- What could be responsible for the poor growth observed in seedling B?
- What can be done to correct the growth of seedling?
- What would happen if no remedial actions are taken?

### ACTIVITY IV

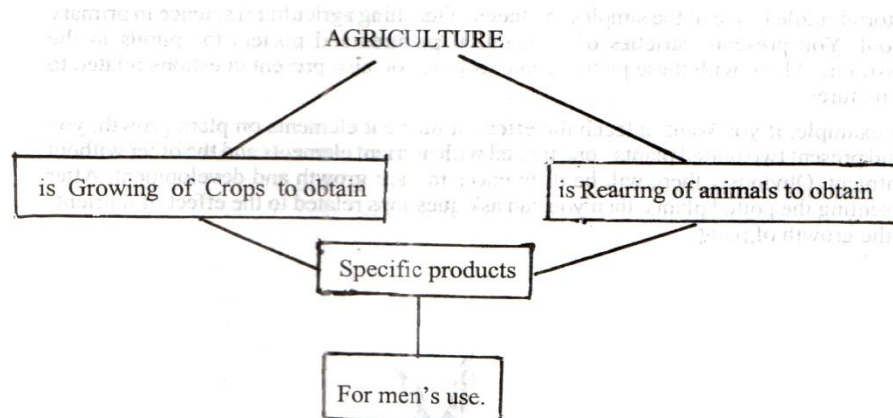
- Explain Pictorial Riddle
- Give an example of pictorial riddle in agricultural science.

### CONCEPT MAPPING

The concept map is used to present meaningful relationships between related concepts in the form of propositions. Propositions are two or more concept labels 'linked by words like a chain. Therefore, a concept map would be two or more concepts connected by a linking word to form a chain of meaningful words.

If you want to teach the definition of agriculture, it could be done through mapping.

For example: Meaning or Agriculture



Source: Olaitan, S.O. and Ali A. (1999)

It is a map that provides a kind or visual road map showing some of the path ways you may take to connect meanings of concepts in a chain form.

### **ACTIVITY V**

1. Explain concept map.
2. Give 2 importance of concept map in the teaching of agricultural science in primary school.

### **THE 3 - DIMENSIONAL RIDDLES**

The 3 - dimensional riddles are those objects in their real nature with three dimensions - the height, breath and width. The combination of this object with questions leads to what is called 3 - dimensional riddle. Example include: real objects like hoe, cutlass, shaved, tractor, plant, seeds, hen, goat, cow etc.

All these objects have length, breath and width qualifying when to be grouped as 3 - dimensional riddles. You will present each of the objects with series of questions based on the objective of the lesson.

You will have to allow pupils bring into the classroom or school farm these objects to acquire the real knowledge and skills and the technical know - how of using them. Both the teacher and students show their unique roles in the teaching -learning process that involves the use of 3 - dimensional riddle. For example: Sowing Soyabean:

### **TEACHER'S ACTIVITIES**

You take the pupils out from the classroom to the school farm where you show how Soya bean seeds are planted on ridges.

You provide viable seeds, working tools etc.

Pupils handle the seeds, put the seeds into the soil, maintain the planting depth of 2.5cm, maintain a planting distance of 5cm, plant when the temperature is about 29°C and plant when the soil is moist.

Questions that complement these activities include:

- (1) How are good and healthy seeds selected?
- (2) How will you dig hole before planting?
- (3) How will you bury the seeds?
- (4) What type of soil will you like to bury the seeds?
- (5) How do you determine the required temperature?

Solutions to these problems are solved by the pupils with little or no assistance from the teachers. The teacher only presents instructional materials, observes and supervises the lesson.

### **ACTIVITY VI**

- (1) Explain the term 3 - dimensional riddles
- (2) Why is 3 - dimensional riddle used in the teaching of agricultural science in primary school?

### **SUMMARY**

- Teaching is a systematized activity in the classroom that eventually results to changes in behaviors of pupils. These changes in behaviour are relatively permanent and desirable. It is a known fact that teachers adopt various techniques of teaching agricultural science in primary school.
- These techniques include expository, discovery/inquiry approach, pictorial riddle, concept map, problem-solving and 3-dimensional riddle. All these techniques especially, the discovery/inquiry.

Pictorial riddle, concept map, problem-solving and 3 - dimensional riddle are practically oriented. These methods assist pupils to acquire basic skills and knowledge in practicing agriculture. Besides, these methods inculcate interest in the pupils in order to undertake agriculture in higher classes and future occupation.

### **ASSIGNMENT**

1. Outline two (2) viable approach required, for effective teaching of agricultural science in primary school.
2. Why is expository approach not a viable method of teaching agricultural science in primary school?

### **REFERENCE**

- Agbulu, O.N. (1993) Effectiveness of Expository and Discovery Approaches to Teaching Practical Agriculture in Junior Secondary Schools in Benue State. Ankpa Journal of teacher Education. Makurdi: Osmond Publishers Ltd.
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## UNIT 3 SCHEME AND PLANS OF WORK PREPARATION

### INTRODUCTION

Scheme and plans of work are the beginning of effective teaching and learning in the classroom. As a trained teacher, you are expected to prepare in detail all that is to be covered in a particular course.

Scheme and plans of work are the starting points for carrying out teaching and learning activities including pupil's activities which usually lead to the achievement of the objectives of a Course of instruction.

In scheme of work, the whole course is divided into small workable sections which include related topics. The scheme of work normally takes four, five or six weeks to teach. It could also extend to twelve or thirteen weeks depending on situations.

A comprehensive scheme of work consists of entry behaviour of pupils, objectives to be attained, content of the subject matter or topic, methods and activities employed by teachers in the classroom, materials and instructional aids needed and evaluation techniques to ascertain whether the broad and specific objectives of the scheme are achieved.

In this Unit, emphasis will be focused on the preparation of scheme of work on agriculture science in primary School.

### OBJECTIVES

By the end of this Unit, you should be able to:

1. Outline some essential features of scheme of work.
2. Prepare comprehensive scheme of work for agriculture science in primary school.

### WORD STUDY

Instructional	Refer to teaching equipment, materials such as chalk,
Materials/aids	chalkboard drawing board, table, film slide, hoe, cutlass, rake and so on.
Entry behaviour	Refers to previous knowledge and characteristics of the pupils. These characteristic include age level, maturity level, attention span, and ability to recall past learning activities.
Learning Experience	Refer to prepared subject matter including activities and questions presented within the given 45 minutes and 90 minutes of teaching in the class room and on the school farm respectively.
Apparently	Means something that is sure of happening
Anticipate	Ability to think ahead of time of what should happen.
Execute	Ability to put plan into action
Canvasses	Means looking for informative or going about for information and materials to make preparation of scheme of work possible.
Improvise	To make instructional material with local materials that are available for the purpose of teaching
Attention Span	Ability to listen and to understand full teaching in the classroom and on the school farm.
Maturity level	Refers to the age of pupils that will make them listen very well and learn effectively.
Previous Knowledge	Means what the pupil has learnt before coming to that school or class.

Intended Objective Means what you have already planned to achieve at the end of the course or lessons.

## **PREPARATION OF SCHEME OF WORK**

The following steps are systematically followed to prepare comprehensive scheme of work.

### **NAME OF SUBJECT: AGRICULTURAL SCIENCE**

#### **ENTRY BEHAVIOUR:**

You should endeavour to know the ability and characteristics of your pupils before starting the preparation of scheme of work. This will help effective usage of scheme of work. Besides, it will prevent pupils characteristics from affecting teacher's decision concerning the selection of objectives. Specifically, to be aware as entry behavior of your pupils are; age level, Maturity level, attention span and previous related back ground knowledge.

#### **UNIT OBJECTIVE**

As a trained teacher, the first question that should arise in your mind is how you can achieve your intended objective. Apparently, effective teaching is based upon well defined objectives of the Unit plan which should be formulated at the beginning of the course.

Remember, that Unit plan is usually four to thirteen weeks depending on situation on ground. Because of this duration, Unit objectives are stated in general and specific forms. The specific objective contributes to the achievement of the general objectives and also form part of daily lesson plan.

#### **CONTENT**

The content refers to the entire body of the course, specifically, the learning experiences taught to pupils. As an experienced teacher, you require less content for a particular lesson while, a beginning teacher needs to think ahead in greater details of the content to be taught.

Materials that you used for adequate preparation of content for the teaching include text books, Journal, magazine etc. You should also canvass for information that will provide facts and principles.

#### **METHODS AND ACTIVITIES**

Methods of teaching vary from teachers to teachers. The procedure of teaching pupils out rightly determines the quality of pupils produced. It is through carefully planned and skillfully executed procedures that full learning content in its broadest sense is achieved.

Activities in this context refer to demonstration by teachers experiment by pupils, classroom discussion of problems, viewing of films by pupils, mutual activity in the form of problem - solving, role-playing and field trip to places of interest.

#### **MATERIALS NEEDED**

These refer to instructional materials that enhance effective teaching and learning in the classroom.

These include; reading materials like books, journals, magazines. Others include; laboratory apparatus, slides, charts, maps, models and Living materials, chemicals and other relevant materials. You could also improvise in the absence of desirable instructional materials.

## **EVALUATION**

You should try to assess your pupils from time to time either as the teaching progresses or at the end of the lesson and course. Your assessment should be based on the context of the course. If this idea is remembered during the planning stage, then there is a greater likelihood that evaluation will be related to the objectives.

## **SCHEME OF WORK ON AGRICULTURAL SCIENCE (Duration: ELEVEN WEEKS)**

### **ENTRY BEHAVIOUR**

Primary 3 Pupils of average intelligence. Pupils have some previous knowledge on home science, Nature Study and Primary science with element of agricultural science.

### **OBJECTIVES**

#### **GENERAL:**

- To develop Understanding of history of agriculture
- To develop knowledge and understanding of agricultural principles and concept.
- To develop skills in handling crop/animal production.
- To develop skills in handling agricultural equipment.
- To develop interest in pupils towards agriculture.



Topic	Objectives	Contents	Pupils' Activities	Teachers' Activities	Evaluation/ Assignment
WK 1 INTRODUCTION TO AGRICULTURE	<p>Pupils should understand the</p> <ul style="list-style-type: none"> <li>- History of agriculture, meaning and importance of agriculture and</li> <li>- identify simple farm tools</li> </ul>	<p>Pupils should understand:</p> <ul style="list-style-type: none"> <li>- The meaning and importance of agriculture factors influencing agriculture.</li> <li>- Simple farm tools</li> <li>- Land tenure and land usage</li> <li>- Agricultural Systems</li> </ul>	<p>Pupils should clear, stimp and ridge their farm plots</p>	<p>Teachers should make available farm implements, and planting materials.</p>	<p>Draw some simple farm tools</p>
WK 2 SOIL	<p>Pupils should identify:</p> <ul style="list-style-type: none"> <li>- identify various types of soils</li> <li>- understand the characteristics of soil.</li> <li>- understand soil formation.</li> <li>- understand and know the type of nutrients in the soil</li> </ul>	<ul style="list-style-type: none"> <li>- origin &amp; formation of soils</li> <li>- common soil characteristics</li> <li>- soil fertility &amp; plant nutrients</li> </ul> <p>Soil conservation Soil management</p>	<p>Pupils should:</p> <ul style="list-style-type: none"> <li>- dig soil to identify various layers.</li> <li>- prepare farm yard manure and compost manure.</li> </ul>	<p>Teachers should provide instruments for identifying layers of soil.</p>	<p>Prepare compost manure</p>

Topic	Objectives	Contents	Pupils' Activities	Teachers' Activities	Evaluation/ Assignment
WK 3 CROP SCIENCE	<p>Pupils ' should</p> <ul style="list-style-type: none"> <li>- identify various types of available permanent, forage, vegetable and fruit crops.</li> <li>- understand various diseases of crops.</li> <li>- understand how these diseases are prevented</li> </ul>	<ul style="list-style-type: none"> <li>- Types and definition of crops</li> <li>- available crops</li> <li>- permanent crops</li> <li>- forage crops</li> <li>- vegetable crops</li> <li>- fruit crops.</li> </ul>	<p>Pupils should display various samples of available permanent, forage, vegetable and fruit crops in the agricultural laboratory.</p>	<p>Teachers should provide samples of arable, permanent, forage, vegetable and fruit crops in the laboratory.</p>	<p>Give three examples of some available, permanent, forage, vegetable and fruit crops.</p>
WK 4 WEEDS	<p>Pupils should indentify:</p> <ul style="list-style-type: none"> <li>- identify various types of weeds.</li> <li>- know how weeds are dispersed.</li> <li>- understand how weeds are controlled.</li> </ul>	<ul style="list-style-type: none"> <li>- Types of weeds</li> <li>- methods of weed dispersal</li> <li>- weed control <ul style="list-style-type: none"> <li>- cultural weed control</li> <li>- chemical weed control</li> <li>- biological weed control</li> <li>- mechanical weed control</li> </ul> </li> </ul>	<p>Pupils should collect various types of weeds and prepare weed album</p>	<p>Teachers should provide practical samples of these weeds.</p>	<p>Name some common weeds in your environment.</p>

Topic	Objectives	Contents	Pupils' Activities	Teachers' Activities	Evaluation/ Assignment
WK 5 DISEASE & PEST OF CROPS	Pupils should understand the - types of diseases and pests. - identify disease crops - remedial measures of controlling these diseases and pests	Diseases of Crops. Fungus Soil – borne Water – borne Wind – borne Bacterial Viruses Parasites Cultural and direct methods of disease control. - Pest of crops Insect pests Birds Rodents Monkeys.	Pupils should: - identify diseased plants - devise methods of controlling pests.	Teachers should provide practical samples of these pests.	What is the effect of diseases and pests on your crops?
WK 6 MAIZE, SORGHUM, RICE	Pupils should understand: - How maize, sorghum and rice are cultivated. - And know the climatic requirements.	- Climatic and soil requirements - varieties grown of cultivation - yields - storage	Pupils should plant maize, sorghum and rice in the school farm.	Teachers should provide planting materials and necessary guidance.	Identify varieties of maize, sorghum and rice.

Topic	Objectives	Contents	Pupils' Activities	Teachers' Activities	Evaluation/ Assignment
WK 7 YAM, CASSAVA	<p>Pupils should: understand how yam and cassava are cultivated.</p> <ul style="list-style-type: none"> <li>- identify various types of yam and cassava.</li> </ul>	<ul style="list-style-type: none"> <li>- Climatic and soil requirements</li> <li>- varieties grown</li> <li>- methods of cultivation</li> <li>- yields</li> <li>- storage</li> </ul>	Pupils should plant yam and cassava in the school farm.	Teachers should provide planting materials and necessary guidance.	Identify varieties of yam, sorghum and cassava.
WK 8 COWPEA, GROUNDNUT	<p>Pupils should: understand how cowpea and groundnut are cultivated.</p> <ul style="list-style-type: none"> <li>- identify varieties types of yam and cassava.</li> </ul>	<ul style="list-style-type: none"> <li>- Climatic and soil requirements</li> <li>- varieties grown</li> <li>- methods of cultivation</li> <li>- yields</li> <li>- storage</li> </ul>	Pupils should plant cowpea and groundnut in the school farm.	Teachers should provide planting materials and necessary guidance.	Identify varieties of cowpea and groundnut.

Topic	Objectives	Contents	Pupils' Activities	Teachers' Activities	Evaluation/ Assignment
WK 9 COCOA, OIL PALM, RUBBER, KOLA, CITRUS FRUITS	Pupils should: - Identify cocoa seed, palm fruits, rubber seeds, latex, kolanut and citrus fruits. - understand how they are cultivated.	- Climatic and soil requirements - varieties grown of cultivation - yields - storage - diseases	Pupils should display seeds of these crops in the laboratory	Teachers should provide the seeds and chemicals for preservation.	Write the uses of these crops to mankind.
WK 10 FORAGE AND PASTURE CROPS IMPROVEMENTS	Pupils should: - know the available forage and pastures in Nigeria.	- Climatic and soil requirements - varieties grown and pasture management	Pupils should identify pasture and forage crops.	Teachers should provide samples of forage and pastures	Name some pastures and forages available in your locality.
WK 11 ANIMAL SCIENCE CATTLE, POULTRY ANIMAL NUTRITION ANIMAL IMPROVEMENT AND REPRODUCTION	Pupils should: - understand and know the various types of farm animals. - know the healthy ones and diseased animals.	-Traditional and modern systems of husbandry. - Breeds of farm animals - Uses of animals to man. - Animal nutrition. - Animal management - Control of Pests and diseases. - Reproduction and improvement.	Pupils should keep farm animals.	Teachers should provide quality breeds of animals.	Discuss how farm animals could be properly cared for.

## **ACTIVITY I**

1. List all the steps involved in the preparation of scheme of work for agricultural science.

## **SUMMARY**

In this unit, we have

- discuss the scheme and plan of work preparation.
- mentioned some essential ingredients that would form the guide for the preparation.
- learnt that work plan could be two column style and three column style
- seen a sample of scheme of work for pupils in Primary 3.

## **ASSIGNMENTS**

1. Define the term scheme of work.
2. As a teacher how will you cover the entire scheme of work before examination?

## **REFERENCES**

- Adegbola, A., Are, L.A, Ashaye, T.I., Komolafe, M.F. (1978). Agricultural Science for West African Schools and Colleges, Ibadan: Oxford University Press.
- Olaitan, S.O. and Anthony, A. (1997). The making of a Curriculum. Theory, Process, Products and Evaluation. Onitsha: Cape Publishers International Ltd.
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## **UNIT 4      PREPARATION OF LESSON PLANS FOR THE TEACHING OF AGRICULTURAL SCIENCE IN PRIMARY SCHOOL.**

### **INTRODUCTION**

Preparation of lesson is the teacher's last task for preparing for class instruction. You may recall that scheme of work talks about 14th weeks. In the case of lesson plan, it takes a single day period. In this unit emphasis will be placed on stages of preparing lesson plan.

### **OBJECTIVES**

By the end of this unit, you should be able to:

1. Outline the essential ingredients of a lesson plan.
2. Prepare adequate and workable lesson plan on any topic in agricultural science.

### **WORD STUDY**

Subsistence farmers:	Farmers who grow only for their needs and their families.
Cash crop:	Are those crops planted for sale.
Formative evaluation:	refers to mid-way questions presented to pupils at the course of teaching,
Summative evaluation:	refers to the final questions presented to the pupils at the end of the lesson or the terminal examinations.
Industries	are places where raw materials got from agriculture are put into final form for usage,
Animal Husbandry	Refers to method of keeping animals. This method involves feeding the animal, providing water for the animal, providing shelter etc.
Drifted	means movement from one place to another.
Learning experiences	means the actual teaching or alteration that goes on in the classroom between the teacher and the pupils at the course of institution,

### **LESSON PLAN**

Lesson plans are part of Unit plans. A number of lessons may be planned to complete one unit. If a subject is taught three times a week, a unit of 4 week duration in the subject will consist of about 12 lessons.

Lesson plan is the weapon of any trained teacher for effective teaching. You have to prepare the lesson in a simple manner. In preparing the lesson, you should consider the pupils' maturation, readiness and aptitude capabilities.

In making the daily lesson, you should ask yourself three basic questions (1) why? (2) What? and (3) How? A lesson plan starts with the why or the objectives of the particular lesson, the what does with the learning experiences of the topics and how deals with the methodology or the procedure for passing information.

Lesson plan contains some essential ingredients found in the Unit plan, however, the ingredients of lesson plan are more detailed and specific in nature than the unit plan. In addition to the essential ingredients found in unit, a lesson plan must contain the following:

Name of subject, topic of the lesson, class for which the lesson is planned, instructional objectives, subject contact, instructional materials, teaching/learning activities and evaluation.

An Example of A Lesson Plan Is Given Below

## **LESSON PLAN ON AGRICULTURAL TOPIC.**

### **STEP 1:**

NAME OF SUBJECT:                    AGRICULTURAL SCIENCE

TOPIC OF THE LESSON:            MEANING AND IMPORTANCE OF AGRICULTURE

CLASS:                                3

TIME:                                45 minutes

### **INSTRUCTIONAL OBJECTIVES**

By the end of the lesson the pupils should be able to:

- 1)     Define agriculture
- ii)    Give 5 uses of agriculture to man.

### **STEP 2:**

#### **MEANING AND IMPORTANCE OF AGRICULTURE**

Agriculture is the preparation of plant and animal products for man's use. The crops which the farmer grows (either arable or tree crops) can be used by the farmers in different ways.

If the farmer grows only enough for his own needs and the needs of his family, he is said to be a subsistence farmer. A farmer who grows more than he needs will sell the crop he does not need. The crops he sells, such as maize will be used for food, others, such as cotton and rubber will be used by the industries.

You could now recall from the definition that the most important aspect of agriculture is the provision of food and animals for human feeding. This aspect is very important, because without food there will be no life on earth and other activities of existence would have been disturbed.

Another importance of agriculture is the provision of raw materials, plants and animals for the industry. Examples of these plants and animals include: Groundnut, Soya beans, orange, rubber latex, cocoa seeds, tea, hides and skins.

All these plants and animals products are used in the industries such as: textile mill in Kaduna, Kano and Zaria; timber in Sapele and Jebba, oil and soap factories in Aba; beef factories in Kano and cattle hides factories in Kano.

Again, agriculture provides money to farmers and employment for graduates. Agriculture provides foreign exchange i.e. money got from the other countries. All these are importance of agriculture to man.

### **STEP 3:**

#### **INSTRUCTIONAL MATERIALS**

Teachers should provide all the necessary teaching equipment, material and notes to the pupils.

### **STEP 4:**

#### **EVALUATION**

#### **ASSIGNMENT**

1.     Name some useful agricultural industries in Nigeria.
2.     Define the term agriculture.



## **ACTIVITY I**

1. List some benefits of agriculture to mankind.
2. List the procedures of preparing lesson note.

## **SUMMARY**

- Agricultural science is part of primary science that has existed in primary school. So to fully understand the subject agricultural science, you need to know something about primary science and natural science.
- Agricultural science taught to pupils in primary school helps them to know the basic systems of farming, above all, it equips the pupils with saleable skills and interest in farming.
- Agriculture also provide food for man, it provides raw materials for the industries and money for man.

## **ASSIGNMENT**

1. Define the term lesson plan.
2. Prepare a lesson note on any topic in agriculture.
3. List the importance of agriculture.

## **REFERENCE**

- Adegbola, A. Are L.A. Ashaye, T.I., Komolafe, M.F. (1979). Agricultural Science for West African School and Colleges. Ibadan: Oxford University Press.
- Ohuche, R.O. and Anthony. A. (1989). Development of primary school teacher education in Nigerian. Onisha : Summer publisher Ltd.
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## UNIT 5 CLASSROOM FIELD/PRACTICAL AND LABORATORY MANAGEMENT I

### INTRODUCTION:

Agricultural Science is practically - oriented which means pupils are expected to be involved in the doing processes such as ridging, hoeing, clearing etc. Agriculture is taught both in the classroom and on the farm. The principles, concepts and theories are taught in the classroom, while the practicals are demonstrated on the school farm,

You may recall that the very nature of agricultural science requires that pupils be trained on the skills needed to perform on the job. Since there are performance skills, many of the objectives in agricultural science fall within performance objectives.

The achievement of these objectives require the three domains to work together. These three domains include: cognitive (knowledge), effective (attitude and value) and psycho motor (skills). For example, to achieve the overall objective of using tractor to make ridges, you need to drive the tractor to run smoothly and gently (knowledge); value a smooth running tractor (attitude) and demonstrate how to fix plugs (skills).

Classroom management in agricultural science requires adequate time-tabling, presentation of teaching materials to enhance adequate understanding of principles and theories and arrangement of seats for pupils to effectively participate in the learning process.

Pupils require better training in order to escape some hazards during field practicals. In like manner, pupils require expert advise to maintain farm machineries and equipment in the farm laboratory.

### OBJECTIVES

By the end of this unit, you should be able to explain:

- a. Classroom Management
- b. Field/Practical Management
- c. Laboratory Management

### WORD STUDY

**TRACTORIZATION:** Is the using of tractors to make ridges on the farm.

**FORMATIVE STAGE:** Means mid-way questions thrown to pupils while the teaching is still on-going

**STUMP:** Refers to remains of large tree on the ground. The remains of trees that have already been cut off

**THEORIES:** Means sets of properly argued ideas intended to explain facts or events.

**PRINCIPLES:** Refer to a constant relationship between two or more concepts.

**CONCEPTS:** Refer to mental experience or reasoning.

**PRACTICLLY ORIENTED:** Refers to doing the work physically.

**HAZARD:** Means things that will cause difficulty, weakness and obstacle.

**FARM MACHINARIES:** Refer to heavy machines like tractors, ridges, pay loaders used on the farm.

## **CLASSROOM MANAGEMENT**

Effective teaching of agricultural science requires adequate management of the classroom. Management in this situation refers to adequate time-tabling, presentation of pictorials charts and agricultural posters to enhance adequate understanding of the theories in the classroom.

Ideally, you require single period of 45 minutes to complete your lesson. So the first step towards adequate management of your class is to prepare your lesson in a manner that it could be completed within the given time. This will prevent conflict of your lesson with other teachers.

Secondly, you ensure that pupils are not piled up on one seat. This will make it easy for pupils to move freely about in terms of practical lesson. More importantly, you will find it very easy to attend to individual pupils especially during self-study and classroom practicals.

Thirdly, you should guarantee adequate availability of teaching materials such as text books, chemicals, litmus paper, soil samples, samples of crops and animals to be taught and farm tools like hoe, rake, watering can, cutlass and host of others.

You should ensure that each pupil has each of the materials to be used in teaching a particular lesson. This will enhance effective participation of pupils. If you allow pupils to move from one seat to the other in search of materials to be used, then you cannot effectively manage the class.

Fourthly, you should ensure that all pupils participate in answering your questions during the formative stage of teaching. This is another way of keeping them at alert and preventing them from making noise.

In a nutshell theories and principles learnt in the classroom are transformed into realities on the school farm. Therefore, adequate understanding of these theories and principles are predicative of effective performance/demonstration of skills on the school farm.

### **ACTIVITY I**

1. Show how you can effectively manage your class room.

## **FIELD/PRACTICAL MANAGEMENT**

Field Practical lessons and classroom activities go together. At the beginning of the term, you first and foremost teach your pupils introductory lessons. Subsequently, you introduce them to classroom practicals. This classroom practicals will help them to know the real practice on the farm, for example, if you want your pupils to understand how yam is cultivated. The first thing you should do is to introduce in the class varieties of yam, maturation period, climatic requirement, diseases, etc. The next step is to teach them how land is cleared, stumps removed, heaps made, yam seeds/tubers planted on heaps, fertilizers applied etc. All these stages will be learnt in the classroom and practically demonstrated on the farm.

Management of field/practical lessons requires professional knowledge and skills. You need to understand the type of practical's to be carried out, the duration and the equipment required. This is important because, on the farm, you are expected to spend only 90 minutes and within these minutes you are also expected to attend to your pupils individually.

For you to effectively manage your practical lessons, you must understand your pupils are respect the time allocated to that period,

### **ACTIVITY II**

1. List how practical lessons are effectively managed.
2. List how pupils are taught on the farm.

## **LABORATORY MANAGEMENT**

Laboratory Management in agricultural science could refer to both land laboratory and equipment laboratory. Land laboratory in agriculture include: some ornamental gardens that is where flowers and other plants that could beautify the premises are planted.

Usually, pupils are asked to oversee these flowers by watering them, trimming, weeding and scaring away goats and other harmful insects from destroying them.

In the equipment laboratory, equipment like hoes, cutlass, rake, heed pan, digger, shovel, spade, hand fork etc are kept. After use, the equipment are maintained.

For example after using a hoe, you can remove the blade and rob palm oil and place on the shelf. It is adviceable to keep all farm tools and implements in the store to prevent them from sun and rain.

### **ACTIVITY III**

1. Go to the farm store and identify go-to-hell; shovel and hand fork.
2. Demonstrate before your teacher how you can preserve your hoe.

### **SUMMARY**

- Effective teaching and learning of agricultural science requires the combination of classroom and school farm activities. The knowledge and skills of these activities will help the pupils to achieve the intended objective of farming.
- In the classroom, teachers manage their classes by good time Management, provision of teaching materials and allowing pupils to mix together.
- On the farm, the teacher involves all the pupils on separate plot with individual guide.
- In the equipment laboratory, the teacher informs pupils about how to be careful with the equipment.
- In a nut shell, effective management of classroom and field activities depend on the teacher's level of knowledge.

### **ASSIGNMENT**

1. List some ways pupils could be involved in maintaining the farm tools.
2. What is the importance of laboratory management?

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## UNIT 6 CLASSROOM, FIELD AND LABORATORY MANAGEMENT 11

### INTRODUCTION:

In this unit, you will be introduced to the classroom field and Laboratory environment. Agriculture, as a science discipline entails both theory and practicals. The theory is thought and learnt in the classroom while the practical is demonstrated in the field and laboratory. These facilities (Classroom, Field and laboratory) are very important in the teaching of Agricultural science. Hence there is need to sustain and manage these facilities properly.

### OBJECTIVES

By the end of this unit, you should be able to:

1. define a classroom and Laboratory;
2. list the Importance of field Practical;
3. tell the functions of some Laboratory facilities; and
4. say how to manage in classroom and the Laboratory,

### WORD STUDY

Convenience	Suiting somebody's needs or plans.
Inflammable	that can easily catch fire or burn
Vigilant	Looking out for possible danger.

### THE CLASSROOM, FIELD AND LABORATORY ENVIRONMENT

Classroom is a room designated for teaching the pupils. It contains usually a desk and chair for the teacher, chairs or stools and lockers for the pupils and blackboards for teaching. Teaching and learning of theories and methodologies take place in the classroom,

In terms of management, the teacher appoints a class monitor, whose responsibilities include among other, arranging for the sweeping of the classroom, cleaning the environment making sure that pupils, are quiet and taking assignment to and from the teacher to the class.

Field is an open large expanse of land used for practical demonstration of theories and principles. School farms are good examples of field practicals. Agriculture as a science requires that student be properly taught the practical application of theories.

The Laboratory can be defined as a room or building used for scientific Research, experiment and test. For convenience, it is usually called "Lab". There are basically two types of laboratory. The first is, Language laboratory and the second type is science laboratory. The Language laboratory is a room containing special equipment to help student learn languages. Such equipment include, radio, tape recorder, television sets and video machines etc. We will concern ourselves with the science laboratory alone, this is because agriculture is a science subject. Subjects like Biology, Chemistry and Physics also use science laboratory.

In a science laboratory, the following facilities are used extensively. They include, water container, chemicals (Reagents), specimen, cutlass, head pan, wheel barrow, Hoe, pesticides, sprayers, incubator, feeding can, cages, basic drugs, first aid kit, light, Bunsen burner, pipette, beakers, barometer, titration equipment, litmus paper, centrifuge, lab coat, boots, microscope, crucible, generator, refrigerator, filter paper, meter rule, thermometer, wall posters, tables and racks etc.

It is possible to have more facilities in a laboratory than the ones we've listed here. It is again possible to have laboratory whose facilities are not as many as the ones listed here.

There is always a person, whose duty is to look after the laboratory. Such a person is called the "laboratory attendant". He usually wears a white laboratory coat. It is a rule that you should not eat in the laboratory. If you must eat at all, it has to be after the lab session and you must have your hands properly washed with soap. This rule is to prevent chemical poisoning.

During the lab session, all windows must be opened for proper ventilation. This will prevent gas poisoning or accident like fire outbreak. No smoking is allowed in the laboratory. The teacher gives appropriate instruction in the lab from time to time.

### ACTIVITY I

1. What are the functions of the class room and Laboratory?
2. List any four Laboratory facilities.
3. Mention two things you must not do in the laboratory.

### THE USES OF SOME LABORATORY FACILITIES

We will discuss the uses of a few laboratory facilities. They include:

**Reagents** - These are substances used to cause a chemical reaction, especially in order to detect the presence of another substance.

**Specimen:** It is sometimes called a sample. It is a thing or part of a thing taken as an example of its group or class e.g. urine, blood etc to be tested for medical purposes.

**Litmus paper** - This is a paper to detect basic and acidic media. The blue litmus paper changes to red in an acidic medium, while the red litmus paper changes to blue in a basic medium.

**Incubator** - This is an equipment designed to keep eggs warm until they are hatched.

**Refrigerator** - This is an equipment that makes food, Drugs and its contents cold in order to keep it fresh or preserved. Some of them are cupboard shaped and some are as big as room specially designed and called cold room.

**Thermometer** - This is an instrument used in measuring temperature. It uses mercury encased in a glass and graduated scales. It is usually read in degree centigrade celcius or fereinheight,

**Microscope** - This is an instrument for making very small objects appear larger, especially for scientific study. Organisms too small to be seen with the naked eye can be seen with the aid of microscope.

**First-Aid Kit** - This is a cupboard containing basic drugs used in the treatment of an injured person before the doctor is invited for treatment. It is very important in treatment of accident in the Laboratory.

### ACTIVITY II

Answer the following Question.

1. What are the functions of the following laboratory equipment?
  - a) Refrigerator
  - b) Thermometer
  - c) First-Aid kit
  - d) Incubator
2. A student had a very serious cut on his hand in the laboratory. From which equipment should we get the drug to treat him?

## **MANAGEMENT OF LABORATORY**

Laboratory management entails the control and making of decisions pertaining to the laboratory. If the decisions and control of the laboratory is good we say "Good laboratory management" Otherwise, we say "bad laboratory management"

It is often desired to have a good laboratory management. For us to have good Laboratory management the laboratory attendant must keep the laboratory very clean at all times - sweeping the floors, cleaning and washing the windows and removing dust from the equipments. By doing so, the equipments are protected against damages or malfunction. In any lab session, all the windows must be opened for proper ventilation. This is to prevent any form of accident. The lab attendant must take stock of items and equipment regularly. This is to ensure that no chemical runs out and that no equipment is removed without his knowledge. If stocks are not taken, Instruments such as microscope etc will be stolen unnoticed and the lab will be grounded.

The Laboratory attendant must be provided with an office where other important instruments can be kept in safety. The attendant must be very vigilant to prevent theft. No smoking should be allowed in the laboratory. This is because so many inflammable substances are contained in the lab e.g. Gas.

No eating in the laboratory too. This is to guide against accident that are likely to come in terms of poisoning. Equipments/Instruments in the laboratory or routinely checked to see that they are functioning. This safeguards life, equipments and instruments are operated with the assistance of the laboratory attendant. Students in the laboratory must put on, at least a protective cloth e.g. lab coat. This to prevent accident .For a good laboratory management, all these must be strictly followed.

## **SUMMARY**

In this unit, you have learnt that:

- Classroom is a room where teaching and learning take place.
- The fields and laboratory are places where practical training takes place.
- Instruments and chemicals are used in the Laboratory.
- Smoking and eating in the laboratory are prohibited.
- Good decision and control of laboratory facilities are desired.

## **ASSIGNMENT**

List any five Laboratory facilities and state their functions.

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## UNIT 7      AVOIDANCE AND TREATMENT OF ACCIDENTS ON THE FIELD AND IN THE LABORATORY

### INTRODUCTION

In this unit, you will learn about accidents, their causes, treatment and how to avoid them in the field and laboratory.

In the course of practical, accidents can occur. When they do we can treat them. However, it is better to avoid accidents on the farm and laboratory.

### OBJECTIVES

By the end of this unit, you should be able to;

- (1) know what accident means.
- (2) Know that they can be caused in the laboratory and field.
- (3) Know accident treatment.
- (4) Know how to avoid them.

### WORD STUDY

Unpleasant:	Causing bad feeling
Unexpected:	Causing Surprise
Emergency:	Sudden serious events or situation requiring immediate action.
Severity:	Seriousness

### ACCIDENTS IN THE FIELD AND LABORATORY

Accident is an unpleasant event that happens unexpectedly and causes damages, injury and death in extreme case. It is not planned in advance. It occurs in the field and Laboratory. Accidents don't just happen they are caused. There are many causes of accident in the field and Laboratory. Some of the causes include.

1. **Known dangers** e.g. you are warned that concentrated acid is dangerous. If you're not careful in handling it, it pours on you causing several bums. In the field, tillage equipment like tractor, if not carefully driven can cause accident.
2. **Carelessness:** You have probably been instructed to heat up a substance and the instruction is that the heat should be applied only for five minutes and you applied heat for about ten or twenty minutes, you will get an unexpected result. Explosion or fire out break may ensue. Even when you are expected to put off all electric or gas appliances and you fail to do so out of carelessness, accident may result.
3. **Non-adherence to Instructions:** When you fail to adhere to instructions in the laboratory, accident may occur. e.g. No eating in the lab. No Smoking of cigarette in the laboratory. These habits can cause accident.

### ACTIVITY I

1. How are accident caused?

### TREATMENT OF ACCIDENT IN THE FIELD LABORATORY

We have stated earlier that accidents are sudden occurrences that are not planned ahead. This also means that its treatment cannot be planned ahead. However, when accidents occur in the field and Laboratory,



we say it is an "emergency" case. The first attempt at treating the victim is first-aid. Recall the presence of first aid kit in the Laboratory.

The essence of first - aid kit is to prepare the victim and rush him to the nearest hospital for full medical attention.

Depending on the severity of the accident, any delay in taking the victim to hospital may worsen the situation and may result in death. First - aid attention ranges from pouring of water on the victim in order to lower the body temperature to applying bandage or tying up of cuts, to prevent excessive blood loss between the scene of the accident and the hospital

## **ACTIVITY II**

1. A student had a deep cut in a lab session and he is bleeding seriously. How do you treat the case?

## **AVOIDANCE OF ACCIDENTS IN THE FIELD AND LABORATORIES**

Like the popular saying "prevention is better than cure", the best way to avoid accident is prevention. Prevention implies that we take appropriate precautions. If an acid is labeled "poison", we should be very careful in handling it. If any specimen is tagged "Don't touch" you should not touch it.

Another preventive measure in avoiding accidents in the field and Laboratory is to adhere to all safety instructions e.g switch off all electrical appliances after every lab session. Ensure that all Gas taps are properly locked. Put on your protective coat to prevent acid or poisonous substance from touching your skin.

Obey all instructions. Do not smoke in the laboratory. Do not eat in the laboratory. Open all the windows, wash your hands with soap after every lab session.

Once we stick to all these preventive measures, we are likely to avoid most type of accidents.

## **ACTIVITY III**

1. What is the best method of avoiding Accidents in the field and laboratory?
2. Name two safety measures that should be followed in the lab?

## **SUMMARY**

In this unit you have learnt that:

- Accident is an unpleasant event that happens unexpectedly and caused Damages, injury and death.
- Accidents don't just happen, they are caused.
- The causes include amongst others, carelessness and when we underestimate known danger.
- Accidents can be avoided if we stick to safety and precautionary measures.

## **ASSIGNMENT**

1. What precautionary measure will you take when in the lab?
2. Name two sources of common accidents in the laboratory.

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## **UNIT 8 SPECIAL PROBLEMS OF AGRICULTURE IN SCHOOLS**

### **INTRODUCTION**

In this unit, you will learn about problems facing agriculture in our schools. Agriculture as a science subject is very important to the Nigerian economy as 70 - 80% of Nigerians live in rural areas and depends on agriculture. Not only Nigeria, but most developing countries depend on agriculture to provide employment, foreign exchange, food and raw materials for the industry. It is the importance of agriculture to the Nigerian economy that prompted the government to introduce Agricultural Science in primary and secondary schools curriculum

### **OBJECTIVES**

By the end of this unit, you should be able to:

1. say the importance of agriculture in school
2. list the problems facing agriculture in a school

### **WORD STUDY**

Central: Most important

Desire: A strong wish to have or do something

Constraint: A thing that limits or restricts something

Militate: to have a great force or influence to prevent something

### **AGRICULTURE IN THE NIGERIAN ECONOMY**

Agriculture occupies a central position in the Nigerian Economy. It is expected to increase food production in order to cater for the increasing population, support the rural population in productive work, produce export crops in order to earn foreign currency and provide finance for the development of industry. It is because of this important position of agriculture in the Nigerian economy that government decided that Agriculture should be taught in Nigerian schools at all levels.

### **ACTIVITY I**

1. Explain why agriculture should be taught in Nigerian schools.

### **SPECIAL PROBLEMS OF AGRICULTURE IN SCHOOLS:**

It is the desire of government to teach agriculture in schools at all levels in Nigeria. However, the teaching of agriculture is constrained by certain problems. These problems include:

- i) Inadequate land - Agriculture as a science discipline entails practical work. These practicals come in form of school farms where trials are carried out. The land for conducting these practicals is lacking and where it is available, the pressure on land further constrains it. So many schools with agricultural programmes do not have demonstration farms.
- ii) Another problem facing agriculture in schools is inadequate finance. For a school to set up a school farm and laboratory and maintain the same, it requires a substantial amount of money. We have stated earlier that a school farm is necessary for the conduct of practical activity. Money to procure inputs such as fertilizers, agro chemicals and improved varieties is usually very high.
- iii) Poor staffing is another special problem militating against agriculture in schools. Trained agricultural science teachers are limited in number. The very few ones around prefer to work in other sectors of the economy. The very few, willing to teach will want to remain within the

township. So any school located in the rural areas will likely not have teachers in agricultural science. The poor staffing problem has forced teachers in subjects like commerce, biology, economics etc. to teach agricultural science in schools that do not have qualified agricultural science teachers.

- iv) Equipment and scientific inputs required in setting up laboratory in schools are expensive. Most schools cannot afford to put these items in place. This makes agricultural science as a subject in a school expensive.

## **ACTIVITY II**

1. List and explain any two problems facing agricultural science in a school?

## **SUMMARY**

In this unit, you have learnt that:

- Agriculture is very important in the Nigerian economy, hence, the need to teach it in schools
- The problems facing Agriculture include inadequate land, finance, poor staffing and inadequate equipment.

## **ASSIGNMENT**

1. Why should Agriculture be taught in schools?
2. How does inadequate land affect the teaching of agriculture in schools?

## **REFERENCES:**

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## UNIT 9 QUALITIES OF A GOOD AGRICULTURAL SCIENCE TEACHER

### INTRODUCTION

In this unit, we have focus on the qualities of a good agricultural science teacher.

### OBJECTIVES

By the end of this unit, you should be able to:

1. Identify and know a good agricultural science teacher

### WORD STUDY

Profession:	occupation
Unquestionable:	good quality
Infinite:	boundless
Inertia:	inactivity

### THE QUALITY OF A GOOD AGRICULTURAL SCIENCE TEACHER

A person considering teaching agricultural science as a profession should:

- i) have the minimum qualification or should have the will-power to attain it
- ii) be of unquestionable character so that the student will strive to emulate him
- iii) have an attitude of friendliness towards farmers and other workers of agriculture
- iv) have an understanding of the working conditions in non-farm occupations requiring the knowledge of Agriculture
- v) understand the abilities needed by the person you teach
- vi) competent, physically strong and in good health
- vii) have leadership skills
- viii) have infinite tact in meeting trying situations
- ix) have unlimited patience in over in overcoming community inertia
- x) be pleasant and have a saving sense of humour when nothing else will meet the situation
- xi) have a large vision of the work to be done
- xii) have the commitments to do the work
- xiii) have confidence in his/her ability to do the work and exude same
- xiv) have the professional ethics
- xv) be emotionally stable

These, amongst others, are the desired qualities of a good agricultural science teacher.

### ACTIVITY I

1. List any five desirable qualities of a good agricultural science teacher?

### SUMMARY:

In this unit, you have learnt that:

- A good teacher in agricultural science should have the basic qualification, good character, be friendly, physically strong and possesses leadership qualities.

**ASSIGNMENT:**

1. What happens when a teacher in agricultural science does not have the basic qualification?

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## **UNIT 10 SUMMARY**

### **INTRODUCTION**

In this unit, you will review all that you have studied in the earlier units of this module that is units 1-9 for emphasis and clarification.

### **OBJECTIVES**

By the end of this unit you should be able to:

- List aims of teaching Agricultural Science in Primary Schools
- Outline essential features of scheme of work
- Prepare adequate and workable lesson plan on any topic in Agricultural Science.
- Explain field/practical management
- List the problems facing Agriculture in Schools.

### **Aims and objectives of teaching Agricultural Science in Primary Schools**

In unit 1 of this module 5, aims and objectives of Agricultural Science in Primary schools was taught. Aims refers to long term achievement while objectives is an intentional outcome after a classroom teaching as well as teaching on the farm for a long period of 45mins and 90 minutes respectively. Specific objectives are carried out from aims. Go through it again for more understanding.

### **ACTIVITY I**

- Outline five aims of teaching Agricultural Science in Primary Schools.

### **Teaching Techniques of Agricultural Science in Primary Schools**

The techniques used in teaching agricultural Science in Primary Schools includes: expository approach; discovery/inquiry approach; problem solving approach; pictorial riddles; concept map; small group discussion and 3 – dimensional riddle. Check unit 2 for clarification.

Unit 3 and 4 discussed scheme of work and lesson plan. Go over them again.

Unit 5, 6 and 7 discussed classroom field/practical and laboratory management. The laboratory is defined as a room or building used for scientific research, experiment and test. The field is an open land used for practical demonstration of theories and principles. School farms are good examples of field practical.

### **ACTIVITY II**

- List any four laboratory facilities
- Mention two things you must not do in the laboratory.

### **Problems of Agriculture in schools and good Agricultural Science Teacher**

Unit 8 and 9 discussed problems of Agriculture and qualities of a good Agricultural Science teacher.

The problems of Agriculture in Schools include:

- Inadequate land
- Inadequate finance
- Poor staffing
- Inadequate laboratory equipments and facilities. Check the unit for proper understanding.

## **SUMMARY**

- Early exposure of children to agriculture at the level of Primary School helps to: build a balance and rational opinion about agriculture. Develop practicals; develop interest in agriculture and sustain such interest.
- Scheme and plan of work are pre-requisites to effective teaching and learning in the classroom.
- Classroom is central for any teaching exercise. It should be quiet for learning, clean and tidy.
- Agriculture is a science discipline where practical activities are involved which are carried out in the field or laboratory.
- A good Agricultural science teacher should be trained, qualified, highly visionary, good rapport with pupils and farmers.

## **ASSIGNMENT**

- List any five desirable quantities of a good agricultural science teacher.
- What are the best methods of avoiding accidents in the field and laboratory?

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## **MODULE 6: FARMING AND CROPPING SYSTEMS AND ANIMAL PRODUCTION**

### **UNIT 1 FARMING AND CROPPING SYSTEM**

#### **INTRODUCTION**

The term farming system is used to describe the combination of livestock keeping and crop production activities. Broadly speaking, three types of farming systems are recognized namely: mixed farming, arable farming, and pastoral farming.

#### **OBJECTIVES**

At the end of this unit, you should be able to:

- Mention some of the farming system in agriculture
- Define some of the farming system mentioned in this unit.

#### **FARMING SYSTEM**

**Mixed farming** is a system in which both the cultivation of crops and rearing of livestock are practiced together. This system promotes efficient utilization of resources. For instance, crops are feed to the livestock which in turn produces high quality animal protein for man. At the same time animal droppings and urine are used to enrich the soils for crop production. This system is advantageous because it assures the farmer of regular income throughout the year in addition to efficient use of the by-products of both plants and animals. Its major disadvantage is in the area of skilled labour required.

**Arable farming** is another type of farming system in which crops are grown for food, fibre and drugs. In Nigeria some common crops grown for food are yam, rice, cassava, maize, sorghum and cowpea. Cotton is the most common fibre crop followed by kenaf while tobacco and pawpaw are grown for drugs.

#### **Pastoral Farming**

The third type of farming system is pastoral farming in which raising of livestock is practiced. This can be done through ley farming, nomadic herding and ranching. Farming is a system of combining pasture production with crop production in alternation.

**Nomadic herding** is a non-settled farming system in which animals are allowed to graze widely, while ranching is a settled form of livestock rearing.

#### **CROPPING SYSTEMS**

Cropping systems can be defined as the various methods of cultivating different crops during any planting season. The crops can be grown singly (mono cropping) or mixed (mixed cropping), continuously on a piece of land (continuous cropping) or rotated (crop rotation), bush following and shifting cultivation.

**Mono cropping** is the practice of growing only one type of crop on a piece of land at a time. This has a serious disadvantage of total loss of income in case of crop failure. The advantage of this system is the



ease of mechanization. Mono culture differs from mono cropping in that in mono culture the same crop is grown on the same piece of land year after year. The disadvantages of mono culture include diminishing yield as a result of depleting soil fertility and general soil degradation as well as the buildup of pest and diseases.

**Mixed cropping** is the cultivation of more than one type of crop on a piece of land at the same time. For example yam, maize and okro can be grown together at the same time. Its advantages include effective utilization of soil nutrients, control of pests and diseases, and insurance against total loss of income in case of failure of one or two crops.

**Crop rotation** is a system of cropping in which a piece of land is put under cultivation every year in such a way that the crops grown follow a definite order or cycle. This cycle is planned in a manner that soil productivity is maintained. Crop rotation is based on the principle that different crops require different nutrients from different soil zones because of different rooting systems. Some examples are given in unit 1. This system is advantageous because it can be practiced where land is scarce or population density is high as it is the case in most parts of Nigeria today.

**Shifting cultivation and bush fallowing** are primitive systems of cropping because they are entirely dependent on nature for soil fertility restoration. Their major disadvantage is that they cannot be practiced with current increasing pressure on the land.

### **ACTIVITY I**

1. Differentiate between mono cropping and mono culture.

### **ASSIGNMENT**

Give reasons for the changing trend from shifting cultivation and bush fallowing to crop rotation and continuous cropping.

### **SUMMARY**

Three types of farming systems are discussed in this module namely mixed farming, arable farming and pastoral farming. These systems have their advantages and disadvantages. Under cropping systems, six types are also discussed namely mono cropping, mixed cropping, continuous cropping, crop rotation, shifting cultivation and bush fallowing.

## UNIT 2      TYPES OF FARMING SYSTEM

### INTRODUCTION

The differences in the types of farming systems in Nigeria are not a luxury but part of his everyday life. The types of farming system vary in line with the culture of the people, topography of the area, vegetation, season of the year and the forces of market demand and supply. All the activities and farm plans centre on the materials and form instruments that are available locally. It is thus not unusual to see those that inhabit the forest vegetation zone or savanna zone base their farming system on the forest or grassland scenery - root crop and keeping of goats, and grain crop farming and cattle raising respectively. Attempts will be made in this unit to describe and discuss the basic types of farming systems practiced by Nigerian farmers.

### OBJECTIVES

At the end of this unit, you should be able to:

1. describe the different types of farming system in Nigeria?
2. identify and explain the various components of farming as it relates to mixed farming:
3. relate this type of system with the locality and daily life of Nigerians.
4. Identify arable farming system in your locality.
5. Describe the different types of arable farming system practiced.
6. Identify and explain the various activities in each system.
7. Recognize the various components in each system.
8. Relate each system with the locality and the role it plays in the daily life of the community.
9. Identify pastoral farming in your area.
10. Describe the differences between pastoral farming and other farming systems.
11. Identify and explain the various activities associated with pastoral farming.
12. Recognize the components that make up the system.

### WORD STUDY

Topography-	the features of a place, especially the position of its rivers, mountain, mall, building, and so on.
Nutrient-	a substance that helps a living thing to grow (plant feed) eg manure.
Crop residues-	part of crop left on the field after the valuable parts have been harvested.
Supplement-	something given to balance the deficiency observed in another.
Root tubers-	are tubers formed from adventitious roots.
Stem tubers-	are tubers formed by stolons which grow out from the lowest auxiliary bud e.g. Yam tuber.
Annual crop-	Crop that survives for only one season.
Biennial crop-	crop which requires two seasons of growth to reach majority.
Textile-	any cloth or woven material
Tender-	easy to bite through (especially of food) (succulent).
Pathogens-	organisms that cause disease.
Resistance-	power to endure something without damage.
Ranch-	large farm where. cattle sheep and goat are bred and fed.
Ruminant-	animals with 4 compartment (or compound) stomach and chew cod.

- Roughage- feed stuffs that are low in protein and high in fibre content.  
Pasture- area of land reserved for grazing livestock.  
Husbandry- care and management of crop, land or animals bred for food.

## **MIXED FARMING**

To fully discuss farming system, it is important to know what farming system is all about. Farming system is the various methods used by different groups of people to produce crops and livestock to supply human needs. Many factors have influenced the choice of anyone method. These factors include the land tenure system the climatic and topographical conditions. Others include social and the economic role of farming in the community and the superstition, religious beliefs and custom. These can influence the system that can be adopted by people of specific locality.

In discussing types of farming system with reference to mixed farming, we must attempt to know the meaning of it. It is a system in which both the cultivation of crops and the raising of livestock is practiced. That means that both crop cultivation and livestock raising are carried out on the same farm. In this system, the farmer supplies his livestock, such as cattle, pigs, sheep, poultry, cattle and goats with crops he produces from his farm. The animal in turn converts these plants products to high quality animal protein which is needed by man. The farmer then sells these animals products such as milk, eggs and meat. By this method, the farmer is assured of a regular flow of income throughout the year. By this method, the farmer does not suffer from changes in market prices. This is because, when the prices of crop products decline in the market, he converts such crops to animal feeds. The faeces and urine of these animals are used by the farmer as fertilizers. This is because, the faeces are rich in plant nutrients, and leads to the production 'of more crops. The money that the farmer would have used in buying inorganic fertilizer is saved as a result.

In areas where cattle rearing is predominant, like some parts of Nigeria, arable crop plots are used as feeding point after the crop has been harvested. The goats, sheep and cattle feed on the crop residues (green portions and the dried portions). They in turn leave their dung on the field to enrich the soil for the following season's crop(s). In this system, animals are given feed supplements since the crop residues are deficient in some important nutrients such as crude protein. This will enhance performance in terms of growth and production.

Mixed farming calls for a good knowledge and skill of both the land and livestock management. This leads to high total production. As a result, adverse effects of the failure of any single farm enterprise will be highly reduced.

## **ACTIVITY I**

Answer the following question.

1. find out the farming system most practiced in your locality
2. why is it being in practice

## **SUMMARY**

- Farming system adopted in any locality is dependent on some factors

- It involves both raising of animals and cultivation of crops.
- Several benefits are obtained from this system.
- A good knowledge and skill of both land and livestock management are important for its success.

## **ASSIGNMENTS**

1. List 3 advantages of mixed farming.
2. How can you practice mixed farming in your locality?

## **ii. ARABLE FARMING**

To adequately discuss the types of arable farming, it is important to define arable farming. Arable farming is a system of farming in which food, fibre and drug crops are cultivated.

From the above description, our discussion on arable farming will centre along the following readings:

- Crops used to supply food
- Crops used for the production of fibre
- Crops used for the production of drugs.

Crops that supply food for human needs include the following: root tuber crops – cassava, potato (sweet) etc; stem – tuber crops – yam, water yam, etc. cereal grain crop – maize, Guinea corn, Rice, wheat, millet, etc, legume crops – groundnuts, cowpea, soyabeans, sword beans, pigeon pea, etc.

The arable food crops are mostly annual crops, that is, they complete their life cycle within one season. They are planted at the beginning of the season, grow, mature and are harvested, e.g. yam and guinea corn. Some of these crops can be grown two times in a year, e.g. early maize and late maize. Some are even grown in two years. These are referred to as biennial crops (i.e. they require two seasons of growth to reach maturity e.g. many unimproved varieties of cassava fall into this category. It is however important to mention that many improved varieties of cassava are annuals. These crops are given in rotation with each other and with other crops. Some others are even perennials e.g. kola, cocoa, rubber and so on.

## **ACTIVITY I**

1. Make a list of arable food crops in your locality and separate them into
  - a) Annual crops
  - b) Biennial crops
  - c) Perennial crops

## **FIBRE CROPS**

Arable fibre crops are crops that are cultivated for the production of materials for use in the textile industries. They include such crops as; cotton, kenaf, jute, sisal and so on. Cotton is used for the production of cotton yarn used in the textile industry for the manufacture of clothing materials. Kenaf plant produces fibre which is used in jute bag manufacturing industry. These fibre crops, like the arable food crops, can be grown in rotation with food crops like maize, cowpea, and so on. The cotton seeds are processed and salad oil is obtained from it. This is also used for the manufacture of margarine. The residue from this oil extraction, known as cotton – seed cake is used as a source of protein in livestock feeds.

## **ARABLE DRUG CROPS**

These are crops from which chemical substances (drugs) can be obtained. These include crops like tobacco, pawpaw, hemp, and so on. Tobacco leaves can be processed into cigarettes and snuf. When these substances are taken, they act like stimulants in the system. In some advanced countries like Europe, nicotine can be extracted from tobacco leaf and stem. This is used in the manufacture of drugs and insecticides. Some chemicals like papain can be extracted from the white latex-like juice of the green pawpaw. This used to make the meat tender. Meat can also be tenderized by cooking it wrapped in pawpaw leaves. Pawpaw is used as digestive tonics and in the manufacture of shrink -resistance industry.

## **ACTIVITY II**

1. Using an oral interview method, carry out a census of smokers and people who snuf in your locality. Find out the reaction they experience in their system when they take the stuff.
2. Cook two pieces of meat in different pots with one wrapped in a pawpaw leaf. After cooking, taste the pieces of meat and write out your observation. What does your observation tell you about pawpaw leaves?

## **SUMMARY**

- Arable farming was defined and the different types outlined and discussed.
- Arable food crop farming produces food for human need.
- Arable fibre crop farming produces fibre for the textile and other related manufacturing industries.
- Arable drug crop farming produces substances that are used in the manufacture of some of useful chemicals and drugs.

## **ASSIGNMENT**

Answer the following questions

1. Differentiate between the following terms and give examples.
  - a) Annual crop,
  - b) Biennial crop
  - c) Perennial crop.
2. Which class of crop in our discussion produces nicotine and what can it be used for?
3. List 3 fibre crops in your locality and state clearly the role such crops have played in the life of the community.

## **iii. PASTORAL FARMING**

### **TYPES OF FARMING SYSTEM III**

For better understanding, pastoral farming can be defined as the system in which the raising of livestock is practised. It is a settled form of livestock farming, where the major or perhaps the sole source of farm income is the keeping of livestock. It is practised on extensive farms (ranches) in areas of low rainfall and rough terrain.

For effective understanding of the system, use shall discuss along the following topics:

1. Ley farming
2. Nomadic herding
3. Ranching

## **LEY FARMING**

Ley farming is the system of combining pasture cultivation with crop cultivation in alternation. This system is practiced where the pasture has high nutritional quality and structure that make it fit into the crop rotation. In this system, the right type of animal breeds has to be kept. For a successful operation of this system, the farmer must have the technical knowledge in both land and livestock management. After an arable crop e.g. cereal is harvested, the field is put under pasture and grazed for one or two seasons. After this, it is then ploughed up. The planted pasture is usually a mixture of grasses and legumes with different grazing characters. For good results from this system, there must be provision for fencing the field and supply of watering point for the livestock.

### **ACTIVITY I**

Do the following activities:

1. Visit a livestock farmer in your locality and ask him his source of feed for his animals.
2. Ask also whether he practices ley farming.

## **NORMADIC HERDING**

Another system that relates to pastoral farming is nomadic herding. The nomad moves from one locality to another to take advantage of occasional rains and the herbage that spring up as a result of such rains. The nomad in the arid region usually live at-a subsistence level and his animal provide him with food, clothing and shelter. There is always in this kind of situation, the tendency to overgraze the sparse vegetation. This consequently leads to exposure of the surface to soil erosion.

### **ACTIVITY II**

Answer the following questions

1. Why does a nomadic herder move from place to place?
2. What are consequences of overgrazing?

## **RANCHING**

This is another system that relates to pastoral farming. In this system, the land is used all the time. As a result, its fertility is highly depleted. Provisions are made to improve and maintain animal breeds. This normally involves commercial operations on a large scale where one operator may control herd feeding on a large area and sells his products to a large commercial market.

### **ACTIVITY III**

Answer the following questions.

1. What are the major differences between nomadic herding and Ranching?
2. Which of these systems is more prominent in Nigeria?

## **SUMMARY**

- Pastoral farming is the practice of raising livestock by pasture cultivation.
- It is a settled form of livestock farming where farm income comes mainly from livestock
- Closely related to pastoral farming is ley farming which is the cultivations of pasture in rotation with food crops.
- Ley farming is however expensive and demands a lot of skill in land and livestock management.

- Nomadic herding also related to pastoral farming but primitive practice.
- Ranching which is based on the management and maintenance of improved animals breeds is highlighted with advantages and disadvantages.

### **ASSIGNMENT**

1. List the characteristics of a Pastoral farming system.
2. Distinguish between ley farming and ranching?
3. Which of these systems will you recommend to people In your locality and why?

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## UNIT 3      TYPES OF CROPPING SYSTEM

### INTRODUCTION

Attempts will be made in this unit to describe and discuss the basic components of cropping system as they relate to monocropping and mixed cropping.

### OBJECTIVES

By the end of this unit, you should be able to:

1. Identify and explain monocropping and mixed cropping as practiced in Nigeria.
2. Recognize the basic components of the different system.
3. Relate each system with the locality in which is practiced
4. Discuss the reasons why shifting cultivation is practiced;
5. Compare the advantage and disadvantages of the two systems;
6. Explain the changing trend from these systems to the more intensive systems.

### WORD STUDY

Sequence-	set of events taking place in a particular order.
Mechanization-	use of farm machinery in farm operations.
Subsistence-	standard of existence that only provides the basic necessities.
Trample-	to march under foot.

## MONOCROPPING AND MIXED CROPPING

### TYPES OF CROPPING SYSTEM

- Monocropping
- Monoculture
- Multiple or mixed cropping.

### Monocropping

This is the practice of growing a single crop e.g. maize, yam, usually over a large area of land. In this system it is exclusively one type of crop which is harvested before another one is planted on the same piece of land. It can be practiced by individuals or companies. It has the following merits and demerits.

### Demerits/Disadvantages

1. In a case of crop failure as a result of pest or disease invasion or bad weather conditions, the farmer is exposed to the risk of poor harvest.
2. The soil becomes exhausted faster.

### Merits/ Advantages

1. Farm operations can easily be mechanized in terms of use of machinery e.g. spraying, harvesting.



## **Monoculture**

This means the growing of the same crop on the same piece of land every year; this may apply to annual crops such as yam and maize. It has the following merits and demerits

### **Demerits/Disadvantages**

1. After some years, crop yield diminishes because the same nutrients will be continually removed from the same depth of soil by the plants.
2. This will lead to depletion and destruction of the soil structure resulting in weed invasion, and soil erosion.
3. It exposes the farmer to a great risk in case there is bad climatic condition or an invasion of pests and diseases.

### **Merits/Advantages**

1. It may encourage specialization in certain crops which could lead to better production in quality and quantity.
2. Farm operations could easily be mechanized.

## **ACTIVITY I**

1. In a cocoa-growing area, cocoa plants occupy the land year in year out for many years, What type of cropping is that?
2. If you plant 4 hectare of maize this year and another 4 hectares (using the same piece of land) of cowpea the following year, state the type of cropping system you have adopted or used.

## **Multiple Cropping or Mixed Cropping**

This is the cultivation of more than one type of crop on a piece of land at the same time, Yams and maize and okra can be grown in this way, cocoa and bananas, and yam, okra and peppers. Crops in mixture are usually crops that absorb their nutrients from different soil levels. Deep-rooted crop will be able to absorb nutrients which will be lost to shallow-rooted crops. Like monocropping, it has its advantages and disadvantages.

### **Advantages;**

1. This system make effective use of available nutrients.
2. Fibrous-rooted plants will be able to hold the soil units together thus preventing soil erosion.
3. If legumes are included in the mixture, it will raise the nitrogen status of the soil.
4. Insect pests and diseases cannot spread so quickly as they would have been in a single crop situation.

### **Disadvantages**

1. Young crops may be trampled upon during the harvest of older, crops.
2. Mechanization of farm operations, e.g. harvesting may not be possible.

## ACTIVITY II

Carry out the following activities

1. Attempt a maize harvest operation in a plot sown with maize, okra and cowpea and report your observation.
2. Assuming you are a rich man and can afford to use a harvester to harvest your crop. Use this machine to harvest rice from a plot containing rice and cowpea, and report your observation.

## II. CONTINUOUS CROPPING AND CROP ROTATION

Exhaustion-	to deplete, to devoid of energy or resources, nutrients etc.
Fallow-	period allowed for rest, e.g. soil allowed to rest to regain fertility.
Green manure -	are usually leguminous cover crops which are buried into the soil at the point of flowering.
Host-	Any plant or animal on which a disease pathogens subsist for survival.

### CONTINUOUS CROPPING

This is a cropping system practiced in densely populated areas where there is scarcity of land for agricultural activities. It involves the putting of a piece of land under cultivation year in and year out (ie every year). The crops planted may either be annual crops such as maize, yam, etc or biannual crops such as cassava or pineapple.

Continuous cropping can be well organized in a crops rotation system. Its demerit/disadvantage however is that it leads to soil depletion/exhaustion in fertility, destruction of soil structure, erosion and low productivity.

### CROP ROTATION

Crop rotation is a system of cropping in which the same piece of land is kept under cultivation every year in such a way that crops follow in a definite order or cycle. This cycle is planned in such a way that soil nutrients removed by crops are restored or maintained through the planting of another type of crop. Different crops have different rooting systems. Therefore nutrients from different soil levels. They also require different amounts of nutrients element, some crops add nutrients to the soil. e.g. legumes, while others consume.

On the basic of the rooting system of the crops, they are classified as.- shallow-rooted e.g. maize and grasses; and deep- rooted, e.g. groundnut plants. When deep-rooted plants are planted after shallow-rooted plants, the soil in the different layers has time to recover before the planting of the next crop.

The actions of the roots of different crop in the soil vary. While some cause expansion in the soil to improve the soil air and water contents, e.g. yam, others, e.g maize, grasses, tend to hold the soil particles together to prevent soil erosion Thus. it IS good that surface feeders like maize should succeed root crop such as cassava in rotation.

One family of plants may be a susceptible host to certain pathogens. If such plants are grown continuously on the same soil without any resting period in – between, the disease pathogens may increase in population. If this happens other susceptible plants will be attached.

### **ADVANTAGES**

1. This system sustains the soil nutrients
2. It involve maximum use of the available land
3. It diversify crop production

### **DISADVANTAGE**

1. Crop rotation can only be practiced by advanced farmer
2. Large area is required when employing crop rotation

### **ACTIVITY III**

1. In your backyard, do the following activity;
  - Plant the plot with yam + maize
  - After harvest, plant the same plot with cow pea or soyabeans and write up a report on what type of cropping you practice?

### **ASSIGNMENT I**

1. Clearly distinguish between monocropping and monoculture.
2. What are the advantages and disadvantages of monoculture?
3. List possible crops that can be cultivated in mixture considering their rooting system.

### **ASSIGNMENT II**

Answer the following questions

1. How does continuous cropping differ from crop rotation?
2. Under what condition is continuous cropping practiced? Explain why,

### **III SHIFTING CULTIVATION AND BUSH FALLOWING**

Soil fertility: the status of a soil with respect to the amount and availability to plants of elements necessary for plant growth.

Leaching: the penetration of soluble soil nutrients beyond the plant rooting zone.

Subsistence: food production just for family consumption.

### **SHIFTING CULTIVATION**

Shifting cultivation as the name implies involves periodic shifts to a new piece of land after the fertility of the old piece of land has been depleted. In this system, farmer abandoned the land whenever he noticed decrease in yield to a new piece of virgin land.

The practice of shifting in the West African sub region is an obvious response of the farmer to the climate and soil conditions of the area. The farmer has learnt from experience that heavy rainfall encourages soil

erosion and leaching of soil nutrients such that there is a steady decline in crop yield 2-4 years after a virgin land is cultivated. Moreover, the nature of the soil is so fragile that it is easily degraded by the unfavorable weather conditions. This is particularly true of the rainforest soils. The soils seem to be stable under the forest vegetation, absorbing all the rainfall without surface water accumulation. But as soon as the land is cleared of its vegetation, erosion sets in and the surface soil is removed exposing the compacted surface soils which are not very good for crop production. The third condition that encourages progressive crop decline is the buildup of pests and diseases because of the hot and humid environment these conditions combine to cause decline in yield with time.

Consequently, the farmer abandons the piece of land after about 4-7 years of use' for, a new piece of land. This "shifting" is made possible only when there is abundance land, low population density and communal ownership of land. It is important to note also that this shifting is encouraged by the rapid regeneration of the natural vegetation thereby restoring soil fertility in short time.

There are two factors responsible for the practice of shifting cultivation. These are the push and pull factors.

The push factors include:

1. Declining soil fertility as a result of erosion and leaching as well as continuous crop uptake of nutrients without replacement.
2. Build up of pests and diseases, and
3. Declining yield.

The pull factors include:

1. Abundance of land;
2. Low population density;
3. Communal ownership of land
4. Quick regeneration of natural vegetation.

### **Advantages of shifting cultivation**

1. It is low capital intensive. Soil fertility is restored by nature. There is no application of inorganic fertilizers and no pest control measures.
2. Labour requirement is family based. Skill labour is not needed.

### **Disadvantages**

1. Shifting cultivation does not improve agriculture beyond subsistence level.
2. The land is impoverished because of continuous nutrient uptake by crops without addition.
3. It encourages erosion.
4. It encourages loss of organic matter through burning.
5. This system cannot be practiced where land is scarce or where the population density is high. This is the major reason why shifting cultivation and bush fall owing are giving way to continuous cropping.
6. It is labour intensive.

## **BUSH FALLOWING**

This is a system of farming whereby a farmer after cultivating a piece of land for a number of years abandons it for another piece of land, but with the intention of coming back after some years. The principle behind this system is basically the same with that of shifting cultivation to restore soil fertility through regeneration of natural vegetation. During the fallow period soil fertility is restored through the accumulation of plant and animal remains. Like shifting cultivation, bush fallow is also associated with low population density and surplus land. The only difference is that shifting cultivation involves total abandoning of the site while the farmer has the intention of using the land after it regained its fertility in bush fallow.

### **Advantages of Bush Fallowing**

1. Soil regains the lost nutrient without necessarily applying inorganic fertilizers.
2. It helps to check spread of diseases

### **DISADVANTAGES**

1. It cannot be practiced where land is scarce
2. It cannot be practiced where population density is high.

### **ACTIVITY IV**

1. Find out from your locality which cropping system is being practiced
2. Give reason for your findings.

### **ASSIGNMENT III**

1. Define shifting cultivation?
2. What conditions favour the practice of shifting cultivation?
3. What are the disadvantages of shifting cultivation and bush following?
4. Explain why these cropping systems are not widely practiced as before.

### **SUMMARY**

In this unit you have learnt that:

- Monocropping and Monoculture are more commercial oriented and practiced on a large scale.
- Multiple or mixed cropping is more of sub-sistence level.
- Each of these systems has advantages and disadvantages that are related to everyday life style of the community.
- Continuous cropping exhausts the land because the land is use year in and year out.
- This practice is readily seen in the urban areas where there is land scarcity,
- For a sustainable yield, crop rotation is essentially practiced,
- Crop rotation ensures the safety of the land in terms of prevention of soil erosion, decrease of pathogens population in the soil and improvement in soil air and water content and structure.
- Shifting cultivation and bush following are both primitive systems of cropping, completely dependent on natural vegetation for soil fertility. Both of them cannot be practiced in areas of land scarcity and high population density.

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## UNIT 4      LIVESTOCK PRODUCTION I: CATTLE

### INTRODUCTION

In this unit we shall shift our discussion to the animal aspect of agriculture. In this unit we will focus on cattle production. Meanwhile, recall that cattle are important domestic animals of tremendous economic value. It is one of the major animal protein source in form of milk and meat. Milk and meat also contain minerals such as calcium, iron and phosphorous and vitamins.

### OBJECTIVES

By the end of this unit, you should be able to:

- 1) Describe types of cattle breeds found in Nigeria.
- 2) Classify cattle on their uses.
- 3) Identify factor affecting cattle production.

### WORD STUDY

Bull:	Uncastrated male cow of any age
Heifer:	Female cow which has not produced a calf.
Calf:	A cattle less than one year of age.
Steer:	Castrated male cow
Stocker calf:	Calf of weaning age sold for fattening.
Yearling:	Cattle aged between 1-2 years.
Vealers:	Calves less than three months old sold for immediate slaughter.

### BREEDS OF CATTLE

The breeds of cattle found in Nigeria are divided into 3 main groups; they are

- A. Humped or Zebu cattle
- B. Humpless cattle.
- C. Cross breeds between zebu and humpless.

Let us now discuss each of the breeds in detail using specific examples.

#### (A) Zebu or Humped Cattle:

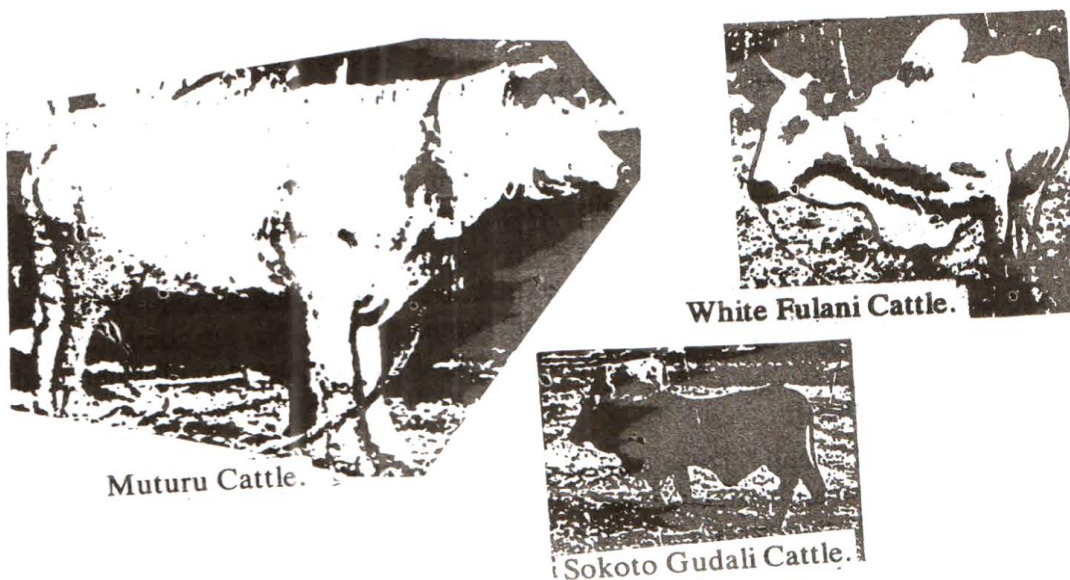
These animals have large or small hump with conspicuous horns. Examples of common Zebus in Nigeria are discussed below

- I. Sokoto Gudali:** As you can see by the name, these animals are found in Sokoto area. They have well developed hump, with a fleshy and compact body. They are comparatively docile and are easily trained for farm work. They are also good for milk and beef production.
- II. White Fulani:** Also called Bunaji." These usually white or grey in colour with or without black spots. They have small head, 'large hump with a compact fleshy body. They are most suitable for milk production.
- III. The Red Bororo:** These are long hyre-hurned Zebu found in the north-eastern, part of Nigeria with lean narrow body. They have a relatively slow growing rate. May weight not more than 400 - 420kg at maturity.

## **(B) THE HUMPLESS CATTLE**

This breed of cattle do not possess hump and are found in various parts of West Africa. Examples are:

- I. The N'DAMA:** This is a small, humpless, well built animal with a straight top line and short fint hump. The skin is pigmented, the colour varying from black to light brown. They are usually poor milkers but can be used for draught purpose. They are essentially beef cattle. An important characteristic of N'dama is that they are tolerant to trypanosomiasis, and hence are found in wet regions of Nigeria.
- II. The MUTURU:** These are short-humed, humpless cattle with dark colour or sometimes pure black. Muturu possesses small head, with dwarf structure They are very resistant to trypanosomiasis.
- III. FRESIAN:** This is a dairy type of animal, although not of Africa origin. It was introduced to West Africa and used to cross - breed with the native breads. They are very tolerant to trypanosomiasis but they have the problem of heat.
- IV. THE CROSSES BETWEEN HUMPED AND HUMPLESS:** This group of animal is exemplified by the "Borgu" otherwise called "Keteku". They have different colours ranging from white to red with specks of any colour. They are smaller than white Fulani and are good for beef production.



*Types of Nigerian Cattle*

## **TYPES OF CATTLE ACCORDING TO THEIR USE**

### **(i) Beef cattle:**

These animals have good compact body and produce good carcasses for beef. Ndama is a good example of a beef cattle. Their mammary gland is not prominently developed.



**(ii) Dairy Cattle:**

These are good milk producers with prominently developed mammary gland. Examples are white Fulani and Fresian cow.

**(iii) Dual purpose Cattle:**

Are used for both dairy and beef A good example is Sokoto gudali

**(iv) The draught cattle:**

These are cattle that are used to produce power for farm operation, such as, ploughing, ridging, planting, pulling of cart and so on. They have well developed muscles and long legs.

**ACTIVITY I**

1. List the type of cattle breed found in Nigeria.
2. Take a visit **to the nearest cattle** market and try to identify the features of the breed you find there.
3. What are dairy and dual-purpose cattle used for?

**PRODUCTION SYSTEMS**

There are various production systems in use today

**1. INTENSIVE SYSTEM**

In this type of system, movement of the animal is restricted. Animals are kept confined in pens and feeds provided. The system capital intensive and is found mainly on research stations and government or experimental farms. However, this system is very good for dairy cows.

**2. SEMI INTENSIVE SYSTEM**

This is sometimes called 'ranching'. In this case the animal is allowed to graze on a piece of land which is not used for crop production. The land is fragmented into sections and animals graze on one section of the pasture before moving to another to enable the grazed area to regrow. Pens are usually built on such ranch. This system is also used mostly in government and experimental farms in Nigeria.

**3. EXTENSIVE SYSTEM**

Here the animals move from one grazing land to another depending on the availability of pasture. This is the most popular system of cattle production in Nigeria.

The system involves driving the animal into the field to graze each morning. They are allowed to graze far and wide. While in the evening the animals are driven to their temporary house. This is repeated daily until the pasture is exhausted, then moves to another region in search of pasture and water. This is **nomadism**. The long search for pasture and water caused the animal to lose weight and reduce their resistance to infection.

**FEEDING OF CATTLE**

This depends on factors, such as types of cattle, production capacity, stage of development, and so on. Cattle are Ruminants and can therefore be fed on roughages.

For dairy cattle, balance nutrients are of paramount importance. Apart from grazing in pasture, concentrates are also provided to increase quantity of milk production.

For beef cattle, adequate supply of water and feeds are needed throughout the year. They should be allowed to graze on pasture during wet season while silage and hay are supplied to them during dry season. Supplement feeds are also added.

## ACTIVITY II

1. Name the most popular system of cattle production in Nigeria. What does it entail?
2. Which system of cattle production is employed by government and experimental stations? Why?

## CATTLE DISEASES

Diseases occur in cattle as a result of:

1. Pathogen infections by viruses, bacteria and fungi. Some of the diseases include:
  - a) **Rinder Pest:** It is a viral disease. Highly fatal and contagious. It can wipe out a whole herd within a short period. Prevention is by vaccination.
  - b) **Bovine Pleuro - Pneumonia**  
It is caused by bacteria and spread by poor handling of animals.
  - c) **Trypanosomiasis:**  
Caused by a protozoa called trypanosomes. It causes the "sleeping sickness" in animals. Control measure is mainly by using resistant animals such as N'dama and Muturu.
2. Nutritional deficiency:  
This is controlled by providing "salt lick" and concentrats.
3. Wound or cannibalism:  
Some birds are carnivorous because they feed on tickd and hides of cattle, thus causing wounds through which pathogens enter the animal and cause diseases.

## CATTLE REARING

This is the process of bringing up the young calves until they are weaned. Following birth (parturition) the calf should be fed with the colostrum (first milk) produced from the udders during the first four days. Colostrum contains and supplies the calf with proteins, minerals and vitamins and makes the animals resistant to infectious diseases. As much as possible the calf should be allowed to suck milk until it is weaned. Weaning of calf is done at about 6-9 months old.

Calves may also be brought up by **pailfeeding** especially in dairy herds. Here, the calf is taught to feed from a pail (bucket) containing feeding stuff which takes the place of chef milk alone. Pail feeding has the advantage of ensuring proper ration for the calf. However, before pail feeding starts the calf is allowed to suck colostrums for few days.

Before two months old, dehorning (removal of horn) is done for the calf. This reduces the risk of wounding one another when kept in large flocks.

Dehorning is done using a hot iron to burn out the horn bud. If dehorning is to be done after emergence of horn in young stock, then it has to be sawn off and the wound treated with iodine tincture to prevent infection.

## FACTORS AFFECTING CATTLE PRODUCTION

There are factors which favour cattle production, while others hinder cattle production.

Factors which favour cattle production included:

- i. One man can control up to two hundred heads of cattle.
- ii. Beef cattle can utilize roughage such as maize, millet, and guinea corn stalks and grass.
- iii. Unproductive land can always be used for grazing.
- iv. Housing and equipment for cattle are not very expensive when compared with those of other livestock.

Factors that hinder production of cattle include:

- i. Lack of water and forage all year round in areas favoured by cattle production.
- ii. It requires heavy initial capital
- iii. Presence of diseases which retard growth and development, e.g. Trypanosomiasis.
- iv. Use of traditional system of production which does not favour large scale production. For example nomadism.
- v. Lack of improved breeds as our local breeds have low output.
- vi. Lack of financial credit facilities for farmers.
- vii. Cattle production requires time, as building up a herd required the herd to reach reproduction stage.

## WAYS OF IMPROVING CATTLE PRODUCTION

1. Scientific method of production should be embraced by cattle producers instead of the traditional methods.
2. Planting of pastures should be encouraged so as to make feed available all year round.
3. Adequate supply of water from dams, bore holes and so on should be embarked upon as this would greatly reduce nomadic movement.
4. Deadly diseases of cattle should be properly controlled or totally eradicated.
5. cross-breeding should be encouraged especially of the resistant and or more productive ones with the local breeds

## PRODUCTION SYSTEMS

The following systems are found identifiable with sheep production:

1. **EXTENSIVE SYSTEM:** This is also called "free range". It entails the animal roaming about to fend for itself This is the most popular system, but does not allow for provision of adequate feeds quantitatively and qualitatively. The animals are prone to disease and theft.
2. **INTENSIVE SYSTEM:** This involves provision of all the needs of the animal at its housing. It is sparsely practiced by farmers.
3. **SEMI-INTENSIVE:** Here, the animals are allowed to graze during the day, and housed at night. They are provided with supplements to Increase their return.
4. **HERDING:** By this system the animals are grouped in large numbers and are fed freshly cut grass. During dry season, the animals are allowed to graze under supervision, but housed at night. This system is found in sahelian Zone.

5. **TETHERING:** Here, the animals are tied with long ropes to allow a degree of movement such act would not cause damage to farms. It is mostly practised during farming season to prevent animal going into the farms.
6. **NOMADIC SYSTEM:** This is practiced mostly by the Fulanis. The sheep are allowed to graze together with cattle and also move from place to place in search of pasture and water.

## **SUMMARY**

In this unit you have learnt

1. Breeds and types of cattle common in Nigeria
2. Types of production systems used in Nigeria.
3. Sources of diseases in cattle production and their controls.
4. Factors that favours and hinders cattle production in Nigeria.

## **ASSIGNMENT**

1. List ways by which cattle can become diseased. How would you control such diseases?
2. What factors favour cattle production in Nigeria?

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## UNIT 5      LIVESTOCK PRODUCTION II: SHEEP

### INTRODUCTION

In this unit, you will study sheep production.

Like cattle, sheep is also an important source of protein in Nigeria. They also play a very important role in religious and social festivities. Sheep skins are used for religious purpose as well as raw material for local shoe industries.

### OBJECTIVE

By the end of this study, you should be able to:

1. Identify distinct breeds of sheep in Nigeria,
2. Describe production system of sheep,
3. Describe feeding and management sheep.

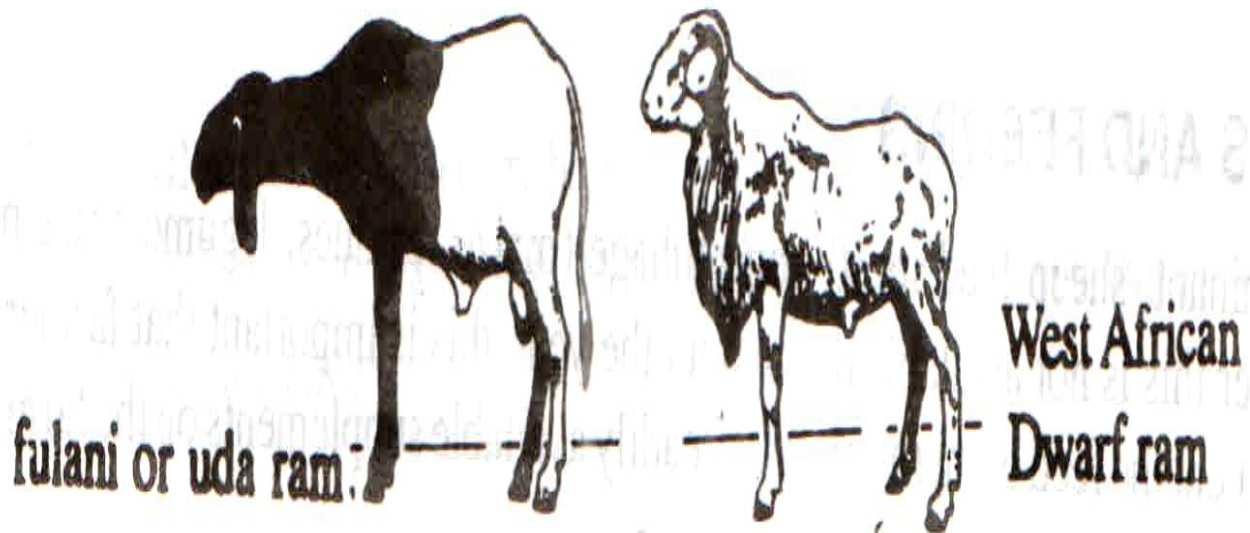
### WORD STUDY

Shearing:	Young lamb
Ewe:	Female sheep
Gestation:	Length of pregnancy
Ram:	Male sheep

### BREEDS OF SHEEP

There are four distinct breeds of sheep in Nigeria. They are:

1. **UDA:** These are Long-legged sheep (70-80cm at weaning), they are found in Sahelo-Sudan vegetation zone. They are largely hairy animal with brown or black fore-quarters and white hind-quarters. Males have heavy laterally spiral horns while females have no horns, at maturity the animal can weight up to 60kg.
2. **BALAMI:** This is one of the most prominent breed in Nigeria, They have big, white, hairy body with slight dull facial depression. The tails are long and thin while the ears are large and dropping. The male has heavy horns while the females have no horns, they are found prominently in Borno, Yobe and other North eastern parts of Nigeria.
3. **YAKASA:** These breeds are more numerous than all other breeds and well distributed In Nigeria. They are found in all the savanah zone (Sahel Sudan and Guinea). They have white body with black patches around the eyes, muzzle and ear. The male (ram) are horned. They are the most important breed numerically.
4. **West African Dwarf Sheep:** These are found mostly in the forest zone as they are tolerant to trypanosomiasis. They are extremely hardy, with short legs. They occur in various colours, with short ears carried horizontally. Only the males have horns.



*Types of Nigerian Sheep*

### **ACTIVITY I**

1. List the types of breeds of sheep you have come across in this unit and the zones where they are found.
1. What is the major differences in external features of a ram and an ewe?
2. Name the traditional systems used in sheep production.

### **ESTABLISHING A HERD**

Establishing a sheep herd is determined by the following factors.

1. Selection of breeds: The appropriate breed is selected for the purpose of keeping the sheep: either for wool or meat.
2. Size of heard: The herd size varies according to the available resources such as capital and area of grazing land.
3. Uniformity: it is necessary that the ewe flock should be uniform in size, body conformity and quality. This is to enhance the market value.

### **FEEDS AND FEEDING**

As ruminant, sheep feed mostly on roughage (maize residues, legume-grass mixture). However this is not available throughout the year, it is important that farmers should supplement feed of these animals.

Readily available supplements on the farm include:

- Cotton seed
- Cotton seed cake
- Palm kernel cake

Rice bran

Yam peels

Cassava peels

Water is also very important aspect of sheep feeding for proper body functioning. In addition it is important to provide the animals with minerals such as commercial salt or local potash (Kanwa).

### **BREEDING IN SHEEP**

In Nigeria, sheep have no definite mating season and therefore breed throughout the year. A properly reared **shearling** matured at the age of nine months. It is advisable to delay breeding until such a time when the animal can withstand pregnancy stress (at about 12 month).

The average **gestation** period in sheep is about five months. During gestation the ewe should be given supplements, especially during the last two months of pregnancy which constitute a critical period of nutrition. In the traditional production system, the animal fend for themselves, leading to indiscriminate mating. As such owners have no idea when their animals are pregnant, consequently no supplement is given to the pregnant ewe. This may lead to abortion or production of weak lamb.

### **LAMBING**

The ewe that is about to give birth shows decrease food intake. As labour advances the animal groans and tries to lay on her side.

A good mother will lick clean the offspring soon after birth, failing to do so, the lamb should be clean with a clean rag of straw. A strong lamb will be on his feet not more than half an hour after birth, otherwise it should be helped on his feet. The lamb should suckle the mother for at least three days to obtain colostrum. This can continue for three to four weeks before the lamb will be able to eat grass. The lamb can be weaned at about four months old.

### **DISEASE AND PEST OF SHEEP**

The following are common diseases and pests found in sheep:

- (A) **Foot rot:** This is a bacterial infection causing rottenness of tissue beneath the hoof. The infected animal becomes lame. This disease is treated by:
  - i. removal of infected tissue with clean sharp knife.
  - ii. clean infected part with 10% formalin.
- (B) **Helminthiasis:** Helminth is an endogenic parasitic worm. It makes the animal become lean. It is controlled by deworming the animal and good grazing management.
- (C) Other disease and pest condition can be minimized by taking appropriate measure. To maintain sound health of the animal in the flock, the following preventive measure can be taken:
  - i. Quarantine all newly purchased animals
  - ii. Maintain high level of sanitation.
  - iii. Dip or spray animal regularly and also deworm frequently.
  - iv. Avoid grazing early in the morning when the grass is till wet.
  - v. Avoid over crowding and separate sick animals from the healthy ones.

## **FEED FATTENING**

This is common small scale tradition practice by livestock farmers. It involves fattening between 1-3 rams. The animals are kept at home and are provided with cereal bran and legume hay which may not be given to the rest of the animals. The aim is to feed the animals specially so that between 90-110 days, the animal are big enough for market. This however is targeted towards religious festival periods like Sallah when the demand is higher and better prices can be obtained.

## **ACTIVITY II**

1. Name one disease and one pest common to sheep described in this unit. How are they controlled?
2. At what period of gestation is nutrition of ewe become critical?

## **SUMMARY**

In this unit, you have learnt that:

- There are four major sheep breed in Nigeria namely Uda, Balami, Yankasa and West African Dwarf sheep.
- Of this breed Yankasa is numerically the most common; while the West African dwarf is the hardiest.
- type of management in sheep keeping is determined by selection of breed, size of flocks and the capital available.

## **ASSIGNMENT**

1. Explain why sheep production may be low in villages.
2. Describe feedlot fattening of sheep.

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## **UNIT 6      PROBLEMS OF LIVESTOCK PRODUCTION IN WEST AFRICA**

### **INTRODUCTION**

In this unit, we shall focus a general attention on the problems of livestock production in West Africa. You can still remember the importance of sheep to man and its contributions to the development of the society. In unit 6, we are going to look at the problems of livestock production and possible solutions to such problems.

### **OBJECTIVES**

By the end of your study of this unit, you should be able to:

1. explain the meaning of livestock production;
2. name the common types of animals reared by man;
3. identify and list the problems of livestock production in West Africa and
4. suggest solutions to such problems.

### **WORD STUDY**

Subsistence farming: growing of crops or rearing of animals for domestic uses.

Commercial farming: growing of crops, or rearing of animals for profit making.

Vaccination: Protection of livestock against disease by using vaccines.

Cross-breeding: matting of two difference breeds to produce a hybrid.

### **WHAT IS LIVESTOCK PRODUCTION?**

Livestock production can simply be defined as the branch of agriculture which deals with the rearing of animals for the use of man and industry. Examples of such animals are cattle, sheep and goats, swine, poultry, rabbits and so on. There are two types of animal farming namely, subsistence and commercial farming. While the subsistence farmer rears animal for his family use, the commercial farmer produces enough for the market.

### **ACTIVITY I**

- a. What is livestock production?
- b. Name any three types of livestock known to you.
- c. Explain the two type of animal farming in West Africa.

### **PROBLEMS AND SOLUTIONS OF LIVESTOCK PRODUCTION**

The expected level of livestock production in West Africa is yet to be attained. This is because of the following problems-

1. Climatic problem.
2. Financial problem.
3. Pest and disease problem.
4. Use of improved breads.
5. Problems of high cost of feeds.
6. Land tenure problem.
7. Shortage of well-trained personnel.
8. Cost of technology,

1. **CLIMATIC PROBLEM:** this has to do with the average weather condition of a place observed over some period of time, say up to 35 years. The elements of climate are rainfall, temperature, sunshine and humidity. A good knowledge of the climate of a place will help you in choosing or selecting the breed of animals that can do well in such climate. Climate has effect on the performance of animals.
2. **FINANCIAL PROBLEM:** Most farmers in West Africa are poor and cannot raise enough money for commercial production. Farmers can form co-operative societies to raise money for farming from the Banks or government.
3. **PESTS AND DISEASE:** These are the enemies of livestock in West Africa. Farmers should be encouraged to keep resistant breed of animals, maintain proper hygiene, and also vaccinate the animals against common disease in their areas.
4. **USE OF IMPROVED BREEDS:** Our local breeds are not so productive as the improved breeds, Efforts should be made to improve our local breeds through cross-breeding.
5. **HIGH COST OF FEEDS:** The farmers should be encouraged to produce their own feeds, while the government can encourage feed processing and preservation especially during the time when feed is plenty.
6. **LAND TENURE PROBLEM:** The government should provide more lands for forage and pasture production. This will minimize the livestock and crops farmers' conflicts.
7. **SHORTAGE OF WELL-TRAINED PERSONNELS:** More qualified manpower should be trained by Agric colleges, Institutes, and universities of Agriculture.
8. **LOW-TECHNOLOGY:** Application of high technology in livestock production will both save time and increase production, Government should help farmers to produce these saving devices locally or subsidize its cost to farmers.

## ACTIVITY II

1. List any five problems of livestock production in West Africa.
2. Identify any three problems of livestock and suggest possible solutions to them

## SUMMARY

- Keeping or rearing of livestock is an important occupation in West Africa. Therefore, the problems of livestock should be identified and solutions for them made.

## ASSIGNMENT

1. Advise a local farmer on how to solve any two problems of livestock production in your community.
2. Make a list of the types of poultry birds you know.

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## UNIT 7 POULTRY PRODUCTION

### INTRODUCTION

In this unit we shall be studying poultry production. You will recall that poultry is among the common livestock reared by farmers in West Africa. We are going to study the origin of poultry, breeds and types of poultry, branches of poultry production and management of poultry, and the importance of poultry to man.

### OBJECTIVES

By the end of your study, you should be able to:

1. Name the common types of poultry.
2. Discuss the ancestors of the domesticated chicken,
3. List the major branches of poultry production.
4. List the major uses of poultry to man; and
5. Draw and label the important parts of a chicken.
6. Explain clearly the meaning of feeds and feeding to a local farmer;
7. Name the importance of feeding in poultry farming,

### WORD STUDY

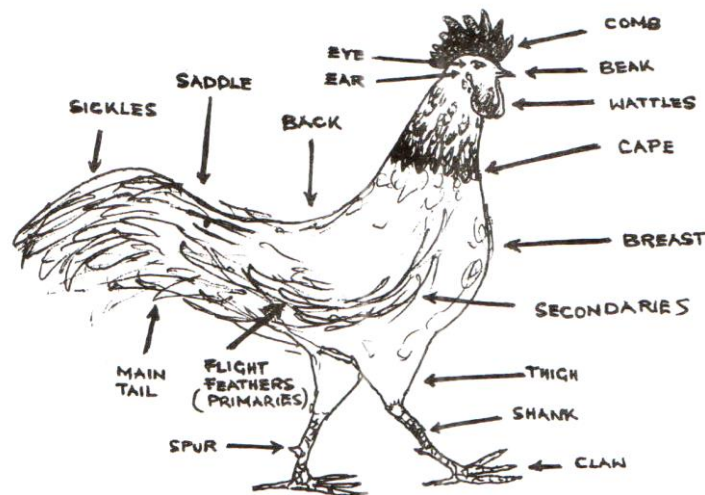
Barred:	an intermixture of black colour with white markings or spots.
Breeding:	the production of young animals by mating females and male animals at the age of maturity
Indiscriminate:	not regulated or patterned.
Mortality:	Death or no more in existent.
Pasture Land:	A piece of land with grasses and legumes for feeding animals.
Predators:	An animal that kills and eats other animals. Examples are snake, rats and cats.
Scavenger:	An animal that search through waste for food.
Species:	A group of animal within a genius.
Concentrates:	A feeding material having up to 18% crude protein, highly digestible and with low fiber content.
Crop:	A pouch in the stomach of birds.
Diagnosis:	Identification of disease from symptoms.
Elimination:	Removal of waste.
Feather Pecking:	The act of pulling or eating the feathers of chicken by another chicken
Gizzard:	Part of a birds stomach having stones in then for digestion.
Hatchability:	The percentage of eggs set that hatch.

**Breeds of Poultry:** There are mainly two breeds of poultry known to man, namely the exotic (foreign breeds) and the local breeds. Breeds of poultry are further classified into egg type, meat type and dual purpose type. This classification is based upon the product they give to man. Examples of these breeds are: the Rhode Island Red, the Plymouth Rock, the white leghorns, the Hampshire Harco browns, Thornbers, Bascock, Australorp and so on.

**The Rhode Island Red:** this is an American breed of poultry developed in Rhode Island. The birds are brown colour with yellow legs. They can be described as dual purpose breed; for they can lay good number of eggs upto 200 in one year, and yield enough meat. The average weight for the cock is 3.9kg, and the hen is 2.7kg.

**The Plymouth Rock:** This breed is heavier than the Rhode Island Red, and is an origin of Britain. They are strong birds which are good egg producers, even though they are mainly kept for meat production. The colour of the feather is either white or barred. The cock weighs 4.3kg while the hen weighs 3.4kg.

**The Mediterranean breed:** Examples are the white and the brown leghoms. They are generally of small body size, the cock weighing upto 2.7kg, while the hen weight upto 2kg. They are mainly used for egg production. The white leghom can lay between 170 - 240 eggs in a year under good management.



*Parts of a Chicken*

**MANAGEMENT OF POULTRY:** There are mainly two systems of managing poultry namely the traditional system or the modern system of keeping poultry.

### **MODERN SYSTEM OF POULTRY MANAGEMENT**

This is the practiced in commercial private farms, or government farms. This system increased production of eggs and meat. The following are the characteristics of this system of poultry management:

- i. improved breeds, which are more productive than local breeds are used.
- ii. proper feeding of birds is ensured, using concentrates and feed additives.
- iii. proper housing is provided for the birds,
- iv. proper record of breeds, breeding and other operations are kept,
- v. mortality rate in such farms is low if proper hygiene, medication and vaccination of birds are practised.

Generally, birds are either reared under extensive system, semi- intensive or intensive system of management.

**EXTENSIVE SYSTEM:** Here the birds are allowed to rum around the premises of the Iarm, with little or no housing and feeding provided. It is also called the 'free range system'.

**SEMI-INTENSIVE SYSTEM:** The birds are allowed to run around a range land or pasture land, while housing is provided depending on the weather condition. Examples are the mobile chicken houses, the fold units housing, and so on.

**INTENSIVE SYSTEM:** Under this system of management, birds are kept inside the house for most of their normal life span; their needs for water, food and medication are also provided for in their houses. Examples are the deep litter and the **battery cage** houses.

- Good management of poultry should ensure that birds are:
- of good breed and suitable to a given environment;
- there should be proper housing for the birds;
- the birds should be well -fed with balanced diets;
- pests and diseases should be controlled or prevented via good hygiene, vaccination and use of drugs; and also
- keeping of farm records.

### **IMPORTANCE OF POULTRY TO MAN**

Poultry has been used in different places for:

- i. provision of animal protein to man. in form of eggs and meat,
- ii. Source of income, the returns in poultry business is fast within 6 - 12 months,
- iii. poultry is used for experimental and study purposes in the schools and research institutes,
- iv. for social and religious purposes example for sports like cock-fighting for sacrifices and for ceremonial purposes.

Poultry production can be carried out where land is inadequate or in short supply; also poultry can survive in places where cattle cannot, because the common cattle pests and diseases are not transmissible to poultry. Poultry manure provides nutrients for our crops.

### **ACTIVITY I**

1. Name any two breeds of poultry know to you, classifying according to the purpose of keeping them.
2. list the four parents of the domestic fowl.
3. what are the three major branches of poultry production you know,
4. identify any two ways of raising poultry and discuss their characteristics,
5. list any three importance of poultry to man; and
6. with a well labelled diagram show the important parts of a poultry bird.

### **POULTRY FEEDS AND FEEDING: HEALTH AND MANAGEMENT**

#### **FEEDS AND FEEDING**

Poultry belongs to the class of livestock which are described as monogastric. That is, animals with simple stomach. Unlike most other classes of livestock it doesn't have teeth in its mouth, hence the food must be in a form to allow proper digestion in the crop and the gizzard.

A feed can be defined as any material which can be of organic origin, or artificially manufactured use to support life. Example of feed stuffs are grasses and legumes, blood, bone and fish meals, meat scraps, root crops, cakes of legume crops, water, and so on.

**FEEDING:** This is the act and science of providing or giving food to animals. In feeding animals consideration is given to the following:

The health of the animal,

The age of the animal,

## **SOURCES OF POULTRY FEEDS**

1. **ENERGY FEEDS:** Energy feeds supply the energy required by poultry to keep its body warm, carry out functions and activities, and for production. Examples of energy providers are maize, wheat, rice, millet, barley, oats, cassava, sweet potato, and so on. The energy content of a feed determines its intake. The higher the energy content of a feed the smaller the amount of such feed taken or consumed by animals. Carbohydrates and fats are the energy providers.
2. **PROTEIN FEEDS:** These are body-building feeds, which are required for egg and meat production. Examples of protein feeds are fish meal, blood meal, Soya-bean meal, groundnut cake, cotton seed cake and palm kernel cake. Grains, such as, maize and guinea corn may also be used as a source of protein to animals, however, their protein content is low; ranging between 8 - 12% crude protein.
3. **MINERAL ELEMENTS:** These are inorganic elements required for the normal functioning of the animal body. They are divided into two, namely: macro and micro elements. Macro elements include Sodium, Magnesium, Calcium, Potassium, Nitrogen, and so on. While the micro mineral elements include manganese, copper, chlorine, sulphur, iodine, and so on. Sources of minerals to poultry include, limestone grit, oyster shell, common salt, fish meal, bone meal, and so on.
4. **VITAMINS:-** These are organic nutrients required for good growth, and prevention of diseases, particularly leg weakness. Vitamins are also important for the laying of good eggs and for hatchability. The requirement of vitamins is in small quantity, but they are very important for the well-being of birds. Examples of vitamins are vitamins A, B complex; vitamins C, D, E, and so on. Sources of vitamins are: high quality green feeds, cod liver oil, sunshine, sea foods and sea weeds. Vitamin supplements can also be used to meet the vitamin needs of poultry.
5. **WATER:** Water is required for most of the body functions and reactions. For poultry, clean water should be provided from rivers, ponds, wells, bore - holes and so on.

## **EQUIPMENT FOR FEEDING POULTRY**

The two major equipment required for feeding the poultry are the Feeders or the Fed hoppers, and the Drinkers.

**FEEDERS:** Depending on the farmers preference these may be made of wood, plastic or metal. Feeders may be on the floor of the house, or they may be suspended from the roof of the house.

Good Feeders should have the following qualities:

They should provide enough space for the birds to feed comfortably,

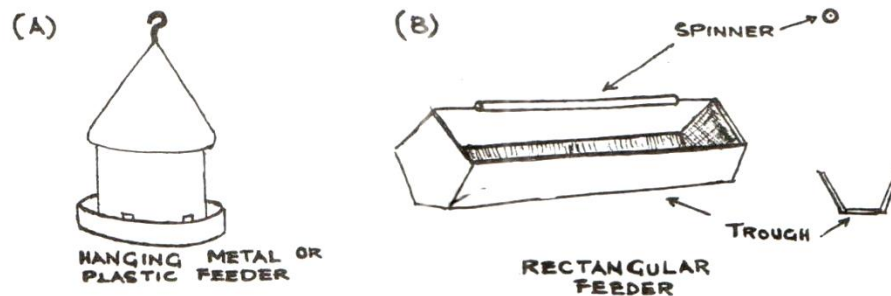
Also good Feeders save cost for the farmer by avoiding feed wastage. Each bird should be allowed a feeding space of between 5 - 15 cm.

In the brooder, after the first day of introducing the chicks, they should be provided with feeds on a paper print or any flat surface.

**TABLE: 6.7.1 SPACE ALLOWANCE FOR FEEDING POULTRY, ACCORDING TO THE TYPE OF FEEDER.**

<u>Age (in weeks)</u>	<u>Space (in cm)</u>	
	<u>Rectangular dish</u>	<u>Round dish</u>
0-16	4	1.5
6 - 18	8	3
18 (and above)	10	4

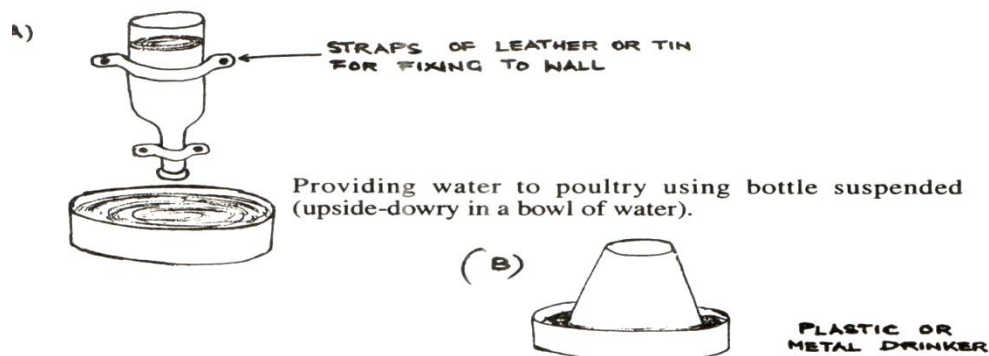
Source: Ekeren Van N. et al (Small Scale Poultry Production in the Tropics) 1990.



*Types of Poultry Feeders*

In the rectangular feeding trough the sides of the trough has lip to guide against feed wastage. Also the spinner ensures that no bird will perch on the feeder and contaminate the feed with its faeces or excreta.

**DRINKERS:** Water can be provided to birds manually or automatically. Drinkers can be in form of hanging plastic containers, or with a bottle suspended in a bowl of water. Ensure that water is available always; also such water should be clean.



*Types of Poultry Drinkers*



**TABLE 6.7.2 SPACE ALLOWANCE FOR DRINKERS:**

<u>Age (in weeks)</u>	<u>Space (in cm)</u>
0-6	1
6 - 18	2
18 (and above)	3

Source: Eekeren Van N. et al (Small Scale Poultry Production in the Tropics) 1990 p 17

**WATER INTAKE OF CHICKEN**

The water intake of chicken depends on the temperature and the humidity. Increase in temperature will cause an increase in feed intake and this will lead to increase in water intake.

**TABLE 6.7.3 NECESSARY NUTRIENTS IN CHICKEN -FEED:**

	<b>LAYERS</b>	<b>BROILERS</b>
Metabolizable energy	11.7MJ (2800 Kcalkg)	13.4 MJ
Crude protein	16 - 17%	21 - 24%
Lysine	0.7%	0.9 - 1.0%
Digestible Lysine	0.56%	0.7%
Methionine and cystine	0.65%	0.65%
Calcium	3.5%	1.0 - 1.1%
Phosphorus	0.5%	0.5%

Source: Eekeren Van N. et al (1990) - Small Scale Poultry Production in the Tropics p 27.

**TABLE 6.7.4 EXAMPLES OF POULTRY RATION IN NIGERIA:**

<b>Ingredient</b>	<b>Parts of Weight</b>		<b>Layer</b>
	<b>Chick (0-8 weeks)</b>	<b>Grower (9-18 weeks)</b>	
Ground yellow maize	60	70	55
Fish meal	9	4	6
Vegetable (dried style meal)	-	2	4
Groundnut cake	25	16	20
Rice bran	3	4	5
Oyster shell	1.5	2	7
Bone flour/limestone	1	1.5	2.5
Common salt	0.5	0.5	0.5

Source: Komolafe M.F, et al (1980) - Agricultural Science for West African Schools and Colleges (2nd Edition) p 183.

**FACTORS INFLUENCING CHOICE OF RAW MATERIALS FOR MIXING FEEDS**

Raw materials for mixing feeds for livestock depend on the following factors:

- Availability of the raw materials,
- The nutrients (energy, protein, minerals etc) contained in the material,
- the quality of the material,
- the kind of feed you want to mix.

## FEED INTAKE OF BIRDS

This depends on the temperature of the house or environment, the level of egg production, the size of the bird, daily requirement or intake of by hybrids birds given well - balanced ration is about 110g per bird.

Farmers may buy already made feeds namely, **dry mash, pellets and crumbs, concentrates and balances**, etc, for feeding their birds; or mix their own feeds.

## HEALTH AND MANAGEMENT

Health can be defined as the soundness of the body. It is a condition whereby the body organs and systems are performing their functions normally.

Good management including good breeding, housing feeding, disease control, and so on, is the best way to maintain healthy birds.

## DISEASES OF POULTRY

Disease can be defined as the departure from the normal functioning of the body (organs and systems). It is a state of lack of ease (uneasiness) in an animal as a result of disorderliness in the system, caused by an enemy in the body.

There are three main agents or causes of disease in poultry, namely:

**Infections: introduction of pathogens in the body of animals.**

**Deficiency** of certain kind of nutrients, and other abnormalities, such as, **feather pecking and cannibalism.**

Examples of common poultry diseases are: New castle disease, infectious bronchitis, fowl pox, fowl typhoid, coccidiosis, cholera, and so on.

**TABLE 6.7.5 SOME INFECTIONS OF POULTRY**

NAME	CAUSE	SYMPTONS	PREVENTI ON	TREATME NT
1. New castle Disease	Virus	Respiratory troubles, nervous signs, green diarrhea, egg drop	Vaccination	None
2. Infections bronchitis	Virus Virus	Respiratory troubles, egg production drops, misshapen eggs	Vaccination	None
3. Fowl pox	Virus	Lessions on comb, wattle and face, yellow membranes in mouth cavity.	Vaccination	None
4. Fowl Typhoid	Bacterium Salmonella	Mortality	Sanitation Monitoring	Sulfa drugs Antibiotics
5. Coccidiosis	Protozoa (Elimeria)	Diarrhea	Sanitation, dry, litter, coccidiostats	Sulfas
6. Chronic	Mycoplasma	Respiratory	Sanitation,	Antibiotics

respiratory disease (CRD)	a	Signs	monitoring, use of MG free flocks	
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Source: Eekeren Van. N (1990) *Small Scale Poultry Production in the Tropics P. 47*

### ACTIVITY I

1. What do you understand by the terms feeds and feeding?
2. List any four feeding stuffs you knew,
3. List any two importance of feeding a chicken,
4. Define health as used in poultry farming,
5. Mention any two infectious diseases of poultry known to you, giving causal agents and cure.

### SUMMARY

- Poultry production is a branch of livestock production which emphasizes the breeding, housing, feeding and general management of birds. Man can benefit from poultry and its by products if this species are properly kept by him.
- In this unit you have studied the different kinds of feed stuffs useful in poultry farming. Also management practices necessary for maintaining health of poultry such as feeding and good housing were discussed. You are to apply the knowledge gained in this study for survival in your community.

### ASSIGNMENT

1. Why do you think poultry production should be encouraged?
2. Advise a local farmer on the important principles of feeding the poultry.

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## UNIT 8      POULTRY BREEDING AND HATCHERY MANAGEMENT

### INTRODUCTION

In this unit, you are going to study poultry breeding and hatchery management. Breeding is the act of producing or raising young ones. It is the process by which living things maintain existence or survival on earth. In poultry as in other livestock breeding involves careful selection of good animals breeds) and the actual breeding of the selected animals.

### OBJECTIVES

By the end of this unit, you should be able to:

1. explain the meaning of breeding.
2. discuss the importance of local breeds in breeding,
3. describe the ways of improving the local chickens,
4. list the qualities of a good egg for hatching,
5. explain the basis of sexing chicks in a given farm, and,
6. list the characteristics of a good broody hen or chicken.

### WORD STUDY

Coop:            A cage or pen for poultry or fowls.

Culling:        The act of removing diseased or unproductive birds from a block.

Fumigate:      The application of fumes or smokes of a chemical for the purpose of disinfecting a house or an object.

Hatchability:   The percentage of eggs set that hatch into live chicks.

Heritability:   Characters or traits that can be transferred from parents to their offspring in breeding.

Huddle:        Curning of dustering together of birds in a brooder because of cold.

Setting:        The act of putting eggs for hatching in the incubator or under a broody hen.

Stubby:        A short and broad object.

### ANIMAL (BREED) SELECTION

There are three main ways of selecting animals for breeding

#### i.      PEDIGREE SELECTION

Under this method animals for breeding are selected based on the performance of their parents or ancestors.

#### ii.     FAMILY SELECTION

Animals are selected based on the performance of a group of related individuals. There are two types of family selection, namely progeny testing and sib testing. Under the former, future breeders are selected on the basis of the performance of their offspring; whereas in the latter, breeders are rated on the basis of the performance of their brothers or sisters.

#### iii.    INDIVIDUAL OR MASS SELECTION

This is useful in improving characteristics which have high heritability. Here selection of animal is done based on their individual appearance or performance.

### BREEDING SYSTEMS

After selecting the animals for breeding the next thing to do is to mate the animals. There are two main methods of breeding animals namely.

## 1. **INBREEDING**

This is the mating of related individuals such as full brothers and sisters sire and daughter, dam and son (close breeding); or the mating of more distantly related individuals such as half mothers and sisters or cousins (Line breeding).

## 2. **OUT-BREEDING**

This is the mating of individuals that are non-related. It is useful in tackling the negative effects of inbreeding. This method of breeding encourages the transfer of good characters from different animals, producing offspring's having the good qualities of the parents (hybrids).

Artificial insemination, the process of using semen from a male animal to fertilize the eggs or ova of a female animal can also be done in poultry.

## **BREEDING OF CHICKEN**

If you want to breed your own chicks it is advisable to use the local breeds of poultry available your area; except where good management practices is guaranteed.

## **ADVANTAGES OF THE LOCAL BREEDS**

The local breed has the following advantages over the exotic breeds for breeding. except where good management is guaranteed.

1. Local breeds are cheaper.
2. They are better adapted to local conditions than the hybrids.
3. They suffer less from local diseases than the more fragile hybrids, and
4. They scavenge for survival on local garbage and kitchen leftovers.

## **HOW TO IMPROVE THE LOCAL CHICKENS**

The local chickens can be improved by any of the following ways:

- i. Replacing the local cocks with cocks of more productive breeds.
- ii. Culling the unproductive birds or chickens.
- iii. By improving the conditions of the poultry farm through good management.

## **EXAMPLES OF GOOD BREEDS OF POULTRY**

Apart from their appearance, birds for breeding are selected according to their breed characteristics or performance. All poultry belong to one of the following types, according to what they produce:

1. High egg producing fowls:  
Examples are the **mediterranean** breeds namely, the **white** and **brown leghorns**, the Ancona and the minoscon. Others include the **Harcobrowns**, the Thosnbers, the Hy-lines, Bab Cock etc.
2. The meat producing types namely the orpinton, the codnish and the Jersey Block giant etc.
3. The dual purpose types: examples, the **Rhode Island Red (R.I.R)** the New-Hampshire and the Australorp

## **PUBERTY OR AGE OF SEXUAL MATURITY**

Birds for breeding should be healthy, of good body weight and should be matured. For the cock, maximum sexual maturity or vigour is attained at 7 to 8 months of age. This ability declines after two years of age.

**TABLE 6.8.1 GUIDE FOR SELECTING LAYERS (PULLETS)**

<b>TRAIT</b>	<b>PRODUCTIVE CHICKEN</b>	<b>UNPRODUCTIVE CHICKEN</b>
1. General Condition	Lively	Dull
2. Weight	Good	Usually fairly light.
3. Wattle and combs	Soft, bright-red	Pale and sought
4. Eyes	Lively	Dull, yellow rims
5. Pigment (Yellow breeds)	Disappears	Stays longer
6. Cloaca	Large, soft, moist	Shriveled, dry
7. Distance between Breast-bone And lay bones	Large ( $\pm$ 8cm)	Small ( $\pm$ 4cm)
8. Skin	Soft, loose thick	Fat under the skin

*Source: Eekeren Van. N. (1990) Small Scale Poultry Production in the Tropics (Agrodok 4) p41.*

### **HATCHERY MANAGEMENT**

Birds are primarily kept for egg and meat production. It is from the fertilized eggs that the population and the existence of poultry is maintained. It is therefore necessary that 80% of the total population to be layers. Age and breed type are the two major factors that influence egg production in poultry. Generally a bird will lay more eggs in the first year than in the subsequent years. Egg production can fall by about 10-12% with every year of age. Therefore, it may not be useful to keep laying chickens for more than two laying seasons, except for sentimental reasons. The local chicken can lay about 50 eggs in one year, while the exotic breeds can lay between 250-270 eggs in a year. Onset of egg production is shown by the reddening up of the comb and wattles. Also this can be confirmed by feeling the two pelvic bones of the chicken. Birds in lay have their pelvic bones well apart, a space about 2 or 3 fingers wide. In addition, the skin around their vent is very moist, soft, and pliable (see table 1).

### **HATCHING OF EGGS**

Eggs are either for the table (consumption) or for use in producing chicks. Eggs for producing chicks are fertilized by allowing the cock to run with the layers (Hen) before they start laying. Eggs for hatching should be of good size, should have good shell texture, should be clean, not broken or cracked, and should be free of infectious organisms.

The hatchery is the place where eggs for hatching are kept.

### **CHOOSING THE EGGS TO HATCH**

1. Such eggs must be fertilized. An average- of one cock is needed for every ten hens. The cock should be introduced to the hens 2 weeks before the laying period.
2. Use undamaged and clean eggs, which are of moderate size or medium size.
3. Collect the eggs regularly, for example three times a day. Let the eggs cool down as quickly as possible after collection.
4. Write the date of collecting the egg, and ensure that the temperature is normal.

Temperature of 20°C is good for eggs to be stored for 1-3 days. The temperature should fall to 15°C if the eggs are to be kept for up to one week.

## **METHODS OF HATCHING EGG**

There are two methods of hatching eggs namely: the natural method using the hen, or artificially using the incubator.

## **NATURAL INCUBATION OF EGGS**

This is done using the broody hen. It may be difficult to find a broody hen as breeders no longer lay much emphasis on this trait. However, as a rule, the light Mediterranean breeds, for example the leghorns, tend to be non-broody or unreliable; whereas the heavy breeds example or **Pington** and **Sussex** are often excellent brooders.

## **CHARACTERISTICS OF BROODY HEN**

1. They make a characteristic broody sound;
2. They have a wrinkled comb;
3. They do not like to leave their nest;
4. They collect as many eggs as possible in their nests.

## **ARTIFICIAL INCUBATION**

An alternative to a broody/hen, is the incubator. This is when the chicks are wanted at specific times, and this is the only way to hatch them. The general principle of brooding applies to all poultry except pigeons, which feed and warm their young.

The task of hatching the eggs and brooding the chicks can be done better and faster using the hatchery or artificial incubators. Artificial incubation of eggs was practiced in Egypt long before the time of Aristotle. Incubators and Brooders supply warmth to the young chicks.

## **SOURCES OF FUEL/HEAT IN THE BROODER**

Heat in the brooder can be transferred via.

### **1. CONVENTION**

Through hot air

### **2. CONDUCTION**

Using hot water pipes or

### **3. RADIATION**

Using heated slat or heat lamps.

In addition, proper insulation of building will reduce the loss of heating.

## **TYPES OF INCUBATORS**

There are different types of incubators, ranging from the small portable types, to the large-scale incubators which can hatch thousands of eggs. Incubators can be of kerosene type, fuel or gas type, and electricity incubators. Whatever type of incubator being used, the following conditions should be maintained in the incubator:

## **GOOD CONDITIONS IN THE INCUBATOR**

1. Be sure the incubator is in good working condition before introducing the eggs. Inspect the incubator, clean it, and test it before introducing the eggs.
2. Fumigate the incubator with formalin
3. Maintain clean liners in the incubator. The eggs should remain clean throughout the period of incubation.
4. Keep the litter in the nest clean, remove any dirty litter when discovered. Also clean dirty eggs for incubation with wire wool or sandpaper. **Do not wash it**, as this tends to push any dirt into the pores of the egg.
5. Regulate the temperature in the incubator, this should be about 38°C use a single heat source.
6. The relative humidity of the air must be quite high, about 55-60%. This should be increased to about 75% after the 18<sup>th</sup> day of incubation. You can achieve this by putting bowls of water filled to the brim in the incubator.
7. Ensure proper circulation of air, and proper ventilation.
8. Turn the eggs regularly, at least seven times a day. To turn an egg, you must rotate it 90 along its longest axis. Some incubators have automatic device for doing this. Turning of egg should stop at the 18<sup>th</sup> day of incubation.
9. Test for fertility after 7 days, and test for dead embryos on the 14<sup>th</sup> days. Dead germs can be seen to have no movement, and should be removed.
10. As with the broody hen, avoid the temptation to take a look once the developing chicks begin to emerge. Rather the window of the incubation room should be covered to prevent the early hatched chicks from crowling out.
11. Follow the recommendations and instructions of the manufacturers of the machine strictly.
12. After incubation and hatching, the incubator should be cleaned and fumigated immediately for use again (if need be).

## **SEXING OF CHICKS**

This can be done from the 4-10 weeks of age. Light breeds, can be sexed at an earlier age than the heavy breeds. The **cockerels** have larger and redder combs than the **pullets**. In light breeds, the **tails** of the males appear before those of the females. The **feathers** on the backs of the heavy-breed males do not grow as quickly as those of the females; and often their backs appear stubby due to the slowly growing feathers.

Sexing in hybrid chickens can be done at day old using their.

- Down colour or
- By the length of their sedimentary wing feathers. This is known as auto-sexing.

## **INCUBATION PERIODS OF DIFFERENT POULTRY**

This is the period taken for the hatching eggs to become chicks. This varies amongst species. However, generally the larger the egg, the longer it takes to incubate (Feltwell. 1980).



**TABLE 6.8.2 INCUBATION PERIODS OF DIFFERENT POULTRY**

<b>SPECIES</b>	<b>INCUBATION PERIOD</b>
1. Chicken	21 days
2. Guinea-fowl	26 – 28 days
3. Turkeys	28 days
4. Ducks	30 days
5. Geese	30 – 35 days.

**REARING AND BROODING**

Brooding of chicks after hatching can be done using the Electric brooders, the oil-heated brooder, the infra-red or eclectic lamp brooders, or Hay brooders.

Successful rearing or brooding entails:

1. Giving the birds the best possible start in life.
2. Preparing the brooder some days before the arrival of the chicks. Everything needed should be ready and in good working order.
3. Heat the brooder a day before arrival of the chicks.
4. Set the food hoppers, water troughs etc. in their proper place.
5. Scrub all equipment with hot water and washing soda.
6. Supplying artificial heat until the birds are between 6-8 weeks old. Note that excessive heating is bad.
7. Also ensure proper spacing in the brooder.

**TABLE 6.8.3 HEATING GUIDELINES IN THE BROODER**

<b>AGE (WEEKS)</b>	<b>REQUIRED AMBIENT TEMPERATURE (°C)</b>
1. 0 – 1	35 – 32
2. 1 – 2	32 – 29
3. 2 – 3	29 – 26
4. 3 – 4	26 – 23
5. 4 – 5	23 – 20

After 2 weeks, chicks can be allowed to go outside. There may be no need for extra heating after 4 weeks, except at night. The temperature of the brooder can be known by the behavior of the chicks. The huddle together when the temperature is too cold, and stay away from the heat source when too hot. They will use all the available space in the brooder when the temperature is normal or proper.

**SPACING OF CHICKS IN THE BROODER**

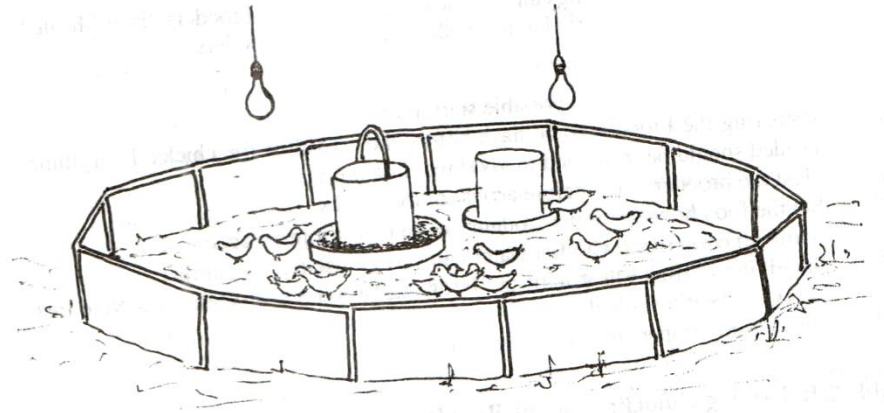
1. 100 chicks can be given a space of 4.65m for up to 4 weeks of age.
2. The spacing can increase to 9.3m up to 8 weeks of age. Avoid overcrowding of the chicks and possible death(s) in the brooder by rounding off the corners of the brooder with some wire netting in triangular form or using bags of hay.

Provide wood shavings to the chicks for the 8 weeks brooding period. A 100 chicks may need about 100kg of wood shavings.

### **REARING OF CHICKS:**

Chicks are generally removed from the brooder by the time they are about 6 weeks old after this age they may be reared in any place at room temperature eg:

1. In wire cages,
2. In deep litter houses,
3. In boxes and cages or
4. Extensively in range land, pastures etc.



*A Modern Chick Brooder.*

### **ACTIVITY I**

- i. What is the principle behind animal selection?
- ii. Name any two breeding systems known to you.
- iii. When will you recommend the local breeds for breeding?
- iv. Mention any two ways of improving the local breeds of chicken.
- v. List any three qualities of a good egg for hatching.
- vi. What are the basis of sexing chicks in a farm?
- vii. List any two qualities of a good broody hen.

### **SUMMARY**

- Living things ensure their existence via the process of breeding. This involves the improvement of the characteristics of animal via proper selection and mating. This in poultry is achieved by selecting and mating parents of proven abilities and those having the desired traits. Fertile eggs should be set for the hen or in the incubator for hatching. Good hatchery and brooder management is important for the production of good chicks and chicken.

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## UNIT 9 FISH AND FISHING METHODS

### INTRODUCTION

Fishes constitute one of the most important groups of animals to man and are used in a wide variety of ways in man's daily life. An important use of fish to man is food. Fish proteins therefore present a cheaper source of animal protein for human consumption. In Nigeria, fish constitutes about 40% of animal protein consumption and this proportion increases in the coastal areas.

### OBJECTIVES

By the end of this unit, you should be able to:

1. Describe the various uses of fishes in the daily life of man;
2. Describe the uses of some body parts of fish;
3. Identify the different fishing methods, gears and crafts;
4. Describe the operating mechanisms of these gears;
5. Choose the gears suitable for different kinds of fish;
6. Explain the disadvantages of some of the fishing methods.

### WORD STUDY

Per capita:	Per person
Coral reefs:	Cement – like structures built in shallow marine waters by coral animals and Provides habitat for many fishes
Artisanal fishery:	Fishing with traditional open canoe, paddle and simple tools such as nets, hooks, pots, etc.
Fugitive:	not fixed, coming and going, not in existence for long, not easily accessible.
Abrasion:	Scraping or rubbing, to wear by rubbing.
Benthic:	Associated with sea bottom.
Stuperfy:	make dull.

### Primary Use of Fish (Food)

A primary importance of fish to man is food. The present total world fish production is about 100 million metric tons. A large proportion of this is used directly for human consumption. In many developing tropical countries where people cannot afford livestock meat, fish protein has provided a cheaper alternative. Fish is also used in the production of fish meal to feed livestock, poultry, etc.

### Use of Fish in Sports

In many countries certain water bodies are designed for sport fishing where people practice and compete to catch fish. Fish so caught are returned to the water, Sport fishing is a form of recreation and relaxation. In Nigeria, you might have heard of the Argungu Fishing Festival, Kebbi State which is an annual event and a tourist attraction. During the festivals, fishermen compete to catch the biggest fish. This is an example of sport fishing. Fishes are also used for interior decoration of homes and public buildings. Colourful ornamental fishes usually obtained from the coral reefs. There is a huge international trade on ornamental fishes which supports the aquarium industry. In countries with coral reefs, tourism industry has developed as people come from different parts of the world to dive and explore the coral reefs with its huge diversity of highly colourful fishes. This is a source of tourism dollars for some East African countries such as Kenya and Tanzania.

## ACTIVITY I

1. List the main uses of fish you have learnt so far.
2. Give an example of sport fishing in Nigeria.

### Medicinal use of Fish

The oil extracted from some fishes have medicinal value an example of this is the cod liver oil which is rich in Vitamins. Some fishes that feed on the larvae of aquatic insects may be used in the biological control of some human pests in limited water bodies. For instance, such fishes may be introduced to feed on mosquitoes. This indicates the public health significance of some fishes. Furthermore, some plant-eating fishes such as grass carps and some tilapia may be used to control aquatic vegetation.

### Use of Fish for Research Purposes

Fishes provide an almost unlimited opportunity for scientific research. The study of fish has led to a greater understanding of the physical structure of ocean waters (e.g. current movements) and its influence in establishing the communities of living organisms. Thus fishes have contributed to the scientific development of human societies. With over 25,000 species of fish known (more than one half of all vertebrate species known), fishes constitute a warehouse of biodiversity. In all the activities described above. Human skills and labour are needed. Thus fishes and the activities associated with them, provide employment opportunities to millions of people around the world. In Nigeria, the artisanal fishing sector alone is reputed to engage over 1 million full-time fishers and over 900.000 part-time fishers. Thus fishers make significant input to the economy of many countries.

### Other Uses of Fish

Different parts of fish are also used for various purposes. For instance, the skin of some cartilaginous fish provides useful leather and polishing materials. The scales of some fishes are processed into a substance such that when coated on the inside of glass beads results in artificial pearls. Isinglass. a shiny powder use as an absorbent in the wine

## ACTIVITY II

1. Give an example of the medicinal value of fish
2. Discribe how fish can be used to maintain research purposes.

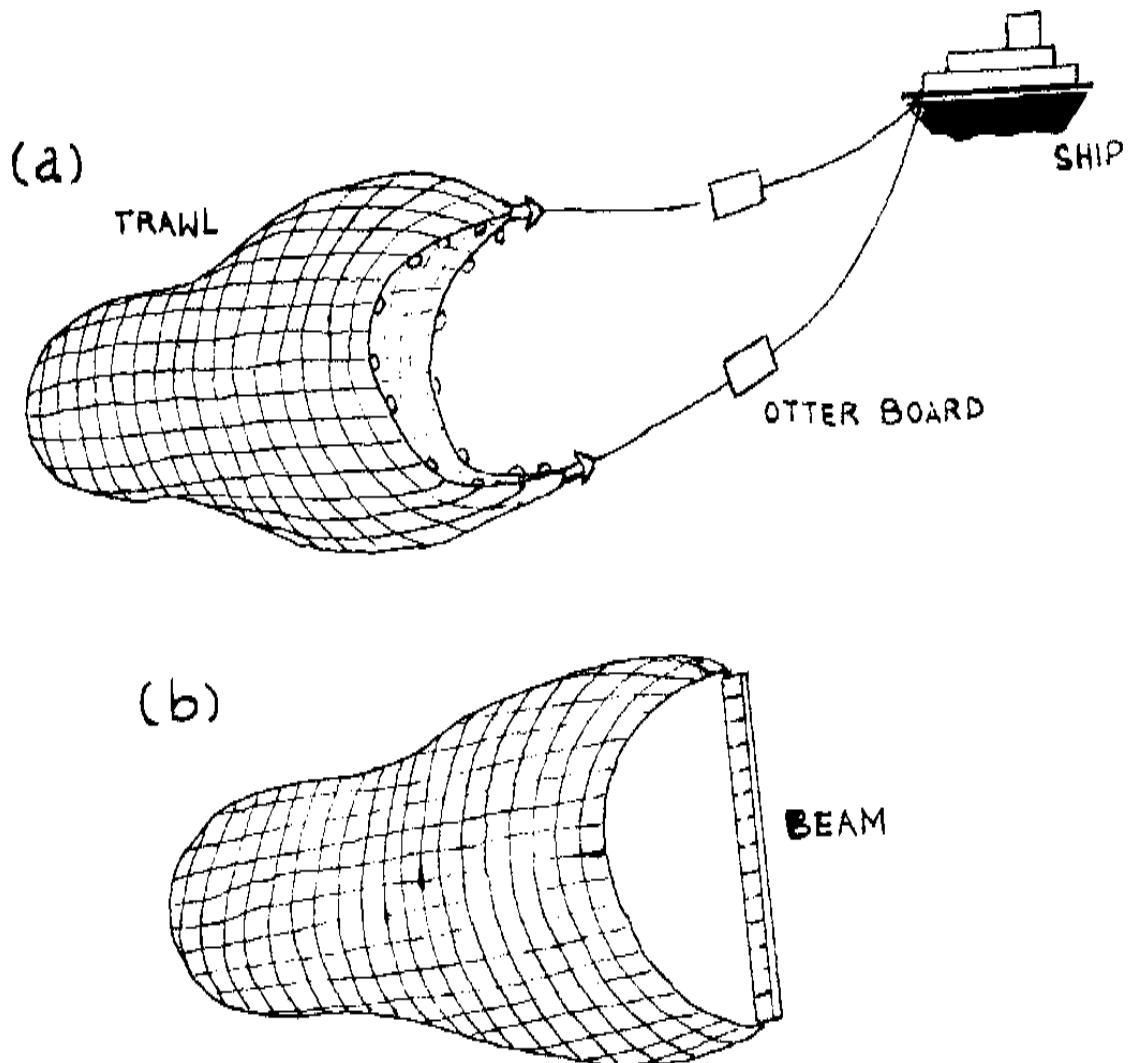
## FISHING METHODS

### INDUSTRIAL FISHING METHODS

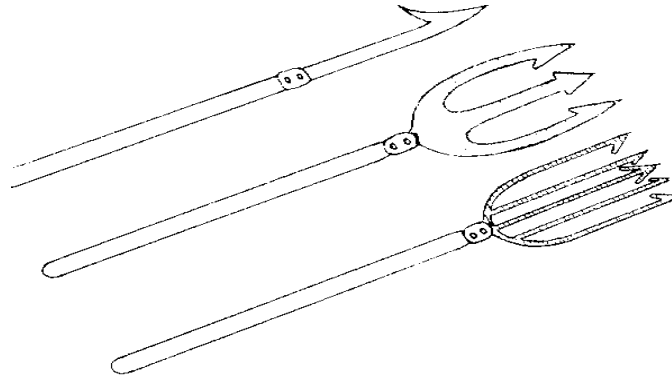
Fishing methods vary from the simplest type of fishing without gear, to the very highly sophisticated industrial purse seining where sonar, radar and other modem fish-detecting devices are employed. Among the industrial fisheries, the diversity of fishing gear is quite low. The most common industrial fishing method is the use of **trawl net** (a conical bag net) attached to the ship and dragged along the

bottom at a specified speed. Fish at or near the bottom are caught by the trawl. This is known as **bottom trawling**.

There are modifications of this gear for mid-water and surface trawling. The mouth of the trawl may be kept open by attaching other boards to the wings of net (**otter trawl**) or by attaching a horizontal beam across the mouth of the trawl (**beam trawl**). A disadvantage of trawling is that it is a non-selective gear and catches anything on its path. Secondly, the mechanical abrasion of its movement modifies the sea bottom and damages benthic organisms.



Another industrial fishing gear is the **long line** may be up 120km long with hooks attached at 5 to 10m intervals and dragged along by a ship. After a period the line is drawn into the ship and the fish caught are removed. The **purse seine** is quite a modern and an efficient gear. It is an encircling net.



Wounding gear: Single and multipointed spear. (Moses, 1983)

### ACTIVITY I

Give an example of sport fishing in Nigeria

### ASSIGNMENT

1. What is the contribution of fish to protein consumption in Nigeria?

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## UNIT 10 SUMMARY

### INTRODUCTION

This unit is a summary of all the previous nine units of this module. No new idea or concept is introduced here except to highlight major areas of each unit. The units consist of the following areas; farming system, cropping system, livestock production, poultry production and fishing.

### OBJECTIVES

By the end of this unit, you should be able to:

- Describe the different types of farming systems
- Explain the different types of cropping system.
- Discuss the problems of livestock production in West Africa.
- Explain the basic food nutrients required by livestock.
- Discuss Poultry production and management
- Explain the structure of a fish and different fishing methods.

### Farming System

The term farming is used to describe the combination of livestock keeping and crop production activities. Broadly speaking, three types of farming system are recognized namely as: mixed farming, arable farming, and pastoral farming.

Mixed farming is a system in which both the cultivation of crops and rearing of livestock are practiced together. This system promotes efficient utilization of resources.

Arable farming is another type of farming system in which crops are grown for food, fibre and drug. In Nigeria, some common crops grown for food are yam, rice, cassava, maize sorghum and cowpea. Cotton is the most common fibre crop while tobacco and paw-paw are grown for drugs.

The third type of farming system is pastoral farming in which raising of livestock is practiced. This can be done through ley farming, nomadic herding and ranching. Ley farming is a system of combining pasture production with crop production in alternation.

Nomadic herding is a non-settled farming system in which animals are allowed to graze widely, while ranching is a settled form of livestock rearing.

### ACTIVITY I

- Define farming system
- List the various types of farming systems.



## **Cropping Systems**

Cropping systems can be defined as the various methods of cultivating different. The crops can be grown singly (monocropping) or mixed (mixed cropping), continuously on a piece of land (continuous cropping) or rotated (crop rotation, bush fallowing and shifting cultivation). Check unit three, read through it for clarification.

## **Problems of Livestock production**

The expected increase in livestock production in West Africa is yet to be attained or achieved. This is because of some problems or barriers being faced by farmers namely:

1. Climatic problems
2. Diseases and pest problems
3. Inadequate finance and funding
4. Use of local (unimproved ) breeds
5. Land tenure problems
6. High cost of feeds
7. Lack of planning and availability of reliable data
8. Low technology.

## **ACTIVITY II**

- List any 5 problems of livestock production in Nigeria.

## **Poultry and Fishing**

Units 6, 7, 8 and 9 discussed poultry production management and fishing and fishing methods check the units for proper understand and clarification.

## **SUMMARY**

Three types of farming system discussed in this module namely as mixed farming, arable farming and pastoral farming. These systems have their advantages and disadvantages.

Under cropping system six type are also discussed namely monocropping, mixed cropping, continuous cropping, crop rotation, shifting cultivation and bush fallowing.

The major problems of livestock were discussed.

Fishing methods

Poultry and poultry management

Diseases sources in cattle, sheep and poultry were discussed.

## **ASSIGNMENT**

- What is the major different between nomadic herding and ranching?
- Which of these systems is more prominent in Nigeria?

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## **MODULE 7: PRACTICAL AGRICULTURE**

### **UNIT 1 RECORD KEEPING**

#### **INTRODUCTION**

Record keeping is reporting in writing of the various activities of an organization. It is very important in every economic venture and in farm management.

#### **IMPORTANCE OF FARM RECORDS**

It helps to determine the level of profit or loss made by the farmer.

It provides the necessary facts and figures for farm planning and budgeting. It helps the farmer to know his crop yields.

It gives details of what happens in the farm from the beginning to the end of the farm business.

With farm records the farmer can obtain loans from the bank more easily. Farm records are used to determine the value of the farm in case of winding up or death of the owner of the farm.

#### **ACTIVITY I**

Why is record keeping important in Agriculture?

#### **TYPES OF FARM RECORDS**

The farm records include:

- a) Sales records
- b) Purchase records
- c) Yield or production records
- d) Profit and loss records
- e) Farm diary records
- f) Farm inventory of tools and properties records.
- g) Labour records
- h) Annual valuation records
- i) Farm input utilization records:
- j) Income and expenditure or cash records.

#### **FEATURES OF THE VARIOUS FARM RECORDS**

**Sales Record** shows details of farm produce sold during the period with their selling prices. It is recorded on the right side of a trading account.

#### **Purchases Record**

Purchases record shows the details of the different items bought by the farmer during the period. Purchases include farm inputs with their prices and date of purchase. It is recorded on the left side of a trading account.

#### **Production Records**

These records show the yield and produce from crops, livestock, poultry or any other product of a farm.

### **Profit And Loss Records**

These are records that show the success or failure of the business. It is prepared once in a year.

There are two types of profit or loss, Gross and Net Profit or loss. Gross profit or loss is the total sales minus the cost of sales

Gross Profit (loss) = Total sales - costs of sales

Net Profit or loss is all the expenses and gross profit plus other income

Net profit (loss) = All expenses - Gross Profit + others.

Farm diary records are records of daily activities, events, losses, theft, rainfall, etc on the farm. It serves as a good reference book about the farm

### **Farm Inventory Records**

It records the list of all items, assets and liabilities of a farm. They include land and landed properties e.g. building and also include crops, livestock, loans, payments and interest on loan machinery and the state of each equipment and its value

### **Labour Records**

These are records that show the number and type of labour hired or employed and the pay for each. It helps in the making of the profit and loss account.

### **Annual Valuation Records**

These are the records of statement of the value of stocks at the beginning and end of the year based on market value or cost of production.

### **Farm Input Utilization Records**

These show the inputs acquired and used and the level of their application during the period.

### **Cash Records**

These records: show both income and expenditure of the farm side by side. Income (receipts/debit) details are recorded on the left side while expenditure (payments/credit) events are put on the right side.

### **ACTIVITY 11**

Examine the records kept in a poultry farm.

What do you observe are the features of the production records?

### **SUMMARY**

In this unit you learnt that:

- Record keeping is very important in farm business
- Farm record helps the farmer to know whether he is making profit or loss to take decision on his farm.
- It enables the farmer correct past mistakes and aid at profit making.
- Types of record kept in the farm include yield, cash, sales, purchase, input, annual labour, inventory and farm diary records.

## **ASSIGNMENT**

1. What is farm record? Name three types of farm records a farmer will keep in his farm.
2. What is the name of a record which contains the list of all items in the farm?
3. Give four importance of farm records to a farm
4. Name two principles that are associated with record keeping in the farm.

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- Anyanwu A.C. and Anyanwu B.O. (1995). Junior Secondary School Agriculture. Onitsha: Africana – FEP Publishers Ltd. PP 21-28
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## **UNIT 2      LAND PREPARATION FOR NURSERY BEDS**

### **INTRODUCTION**

Land preparation is very vital for both nursery bed and field crops. Land preparation is one of the steps in crop production. Some crops particularly the vegetables require planting in nursery beds before they are transferred to the garden. This practice is necessary in order to get healthy and vigorous seedlings for transplanting in the farm. Nursery beds are prepared at the recommended depth and distance or width to suit the crop to be planted.

### **OBJECTIVES**

By the end of this unit, you should be able to

- select site for nursery bed;
- clear the selected site
- Prepare a nursery bed
- adopt correct system to crop the nursery bed
- provide a shelter or shade for nursery seedling

### **WORD STUDY**

Nursery - An area normally protected from excessive wind, sun and water in which young plants are raised from seeds for subsequent transplanting.

Perennial - Plants which grow for more than two years and which survive for many years

Drainage - The removal of excess water from land which is to be used.

Cropping - The cultivation of land for raising crops.

### **Site Selection**

A good site for nursery beds should have readily available water supply, be free of nematodes, perennial weeds such as spear grass, nut grass and Bermuda grass.

### **Clearing Of the Site**

Before tilling the soil, the land should be cleared of all vegetation and rubbish and be properly raked to remove all stones, sticks and remains of previous crop. The woody materials should be burned while the leafy, soft or succulent materials can for compost making. All diseased or materials infested with pests should also be burned.

### **Land Preparation**

The land where nursery beds are to be established need to be dug and hoed in order to improve drainage and aeration. Tillage of the soil helps to control weed, by burying them to a depth where they cannot survive. When digging or hoeing the soil, care should be taken to avoid bringing the infertile subsoil to the surface.

### **Construction of Nursery Beds**

After this process the soil should be left for a day or two before raking the surface and finish the preparation of the beds by beating the soil with the spade blade or treading with the feet. The edge of the

nursery, bed should be slightly raised and may be consolidated by hoeing beaten with the back of a spade. The nursery beds are sometimes prepared in the form of a square or rectangular form. In the wet season the beds should be raised for drainage while in the dry season they should be sunk to conserve moisture.

**ACTIVITY I**

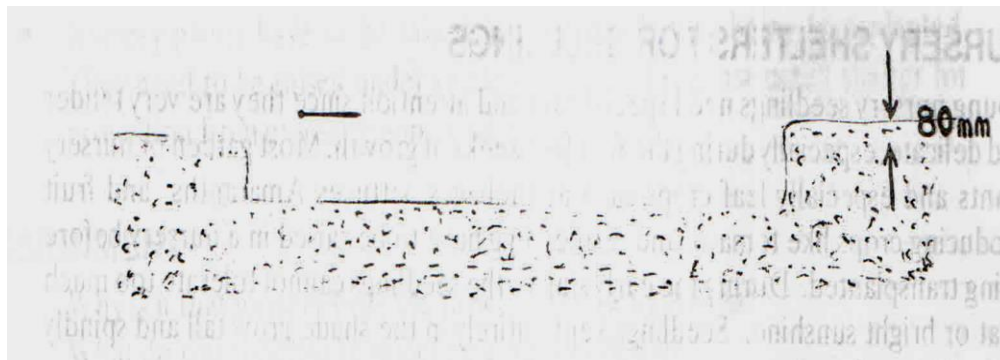
1. Take a look at an already prepared nursery bed.
2. What do you think is the reason for digging the soil surface

**SYSTEM OF CROPPING THE BEDS**

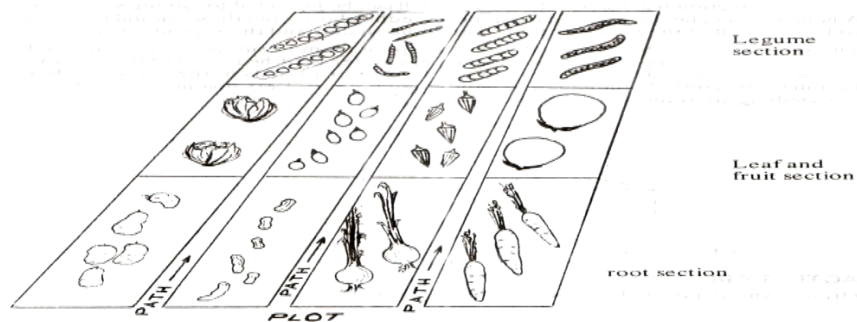
**Sowing of Seeds:** Seeds are sown in definite pattern in nursery beds to make management operation easier.



Cross-section of a raised bed



A cross section of a sunken Nursery bed



Three course rotation of vegetables

For the purpose of planning a rotation, garden crops are divided into three main groups. The main groups are legume, leaf and fruit and roots.

## **ACTIVITY II**

What are the reasons for rotating beds?

## **NURSERY SHELTERS FOR SEEDLINGS**

Young nursery seedlings need special care and attention since they are very tender and delicate, especially during the first few weeks of growth. Most garden or nursery plants and especially leaf crops such as cabbages, lettuces, Amaranths and fruit producing crops like tomato, and garden egg have to be raised in a nursery before being transplanted. During the early stages, the seedlings cannot tolerate too much heat or bright sunshine. Seedlings kept entirely in the shade grow tall and spindly, with thin weak stems.

Different methods can be adopted to protect seedlings from harsh weather conditions like excessive sun or rain. The different methods are.-

- (i). The seedlings are shaded using leave or straw mats or boxes.
- (ii) Another method is to erect or construct a shelter or shed where full protection from sun and heavy rainfall can be provided for young seedlings.

A bench or benches are needed to support seedling boxes and these should be 90cm wide with half of the bench or table within the shelter and the second outside.

The seed boxes can be taken out so as to expose them to sun in the morning and taken back inside the shelter as the sun gets hotter or if heavy rain falls. As the seedlings grow and develop, they are left for longer periods in the sun until they become sufficiently hardened to be exposed to full sun. Less shading is done when the seedling are transplanted to the farm.

## **ACTIVITY III**

Draw a typical nursery bed under a nursery shelter

## **SUMMARY**

In this unit you have learnt that:

- Vegetable crops are raised in nursery beds before transplanting.
- The nursery bed sites are first selected, cleared, dug or hoed. e The soil for beds is loosened mixed and added manure.
- Nursery beds are not planted with the same crop every season.
- Young nursery seedlings need to be given special care and attention during the first few weeks of growth.
- Nursery plants have to be raised in a nursery before being transplanted.

They need to be raised under shade or kept under constructed shelter for protection from excessive sun, wind and rainfall.



## **ASSIGNMENT**

1. Why is it that nursery beds are raised in the rainy season?
2. What do you consider in selecting a nursery bed site?
3. Give reason for rotating nursery crops?
4. Why is it that nursery beds must have fine tilt and flat surface?
5. Name four farm tools used in preparing a nursery bed.

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Extension Bulletin No. 13 "Nursery Practice for fruit trees in northern States of Nigeria". Horticultural Series No 2

## UNIT 3 CARE OF PLANT BEFORE AND AFTER TRANSPLANTING

### INTRODUCTION

Nursery seedlings and transplanted once need adequate care and management to enable them survive. In achieving this objective, the young plants need watering, mulching, weeding, pests and disease control so as to enable the overcome most of their problems. In this unit you are going to learn about care of plants before and after transplanting.

### OBJECTIVES

By the end of the unit, you should be able to:

- Undertake watering of the seedlings both in the nursery beds and in the farm at the appropriate time;
- determine what to use in mulching the young seedlings
- Carry out mulching of the seedlings;
- Undertake weeding of the seedlings when due; both in the nursery and in the farm;
- Correctly transplant young seedlings;
- explain these practices well and why they are being done.

### WORD STUDY

Absorption –The intake or drawing in of a liquid by a plant.

Erosion – Washing or wearing away of the earth surface by the action of water, wind or animals.

Pricking out – Planting out or transplanting young seedlings from the soil in which they have been sown, usually in a container such as box, beds.

### Watering

Watering nursery seedlings and transplanted plants is necessary. It is done twice a day; that is in the morning and in the evening time. This is because the growing seedlings need water to absorb and to dissolve the nutrients to be absorbed by the plants. They also need water to reduce the effect of heat in the soil. The water should be applied to the seedlings gently at the bottom and it should be done with care not to be applied on the leaves because it encourages disease infection and transpiration.

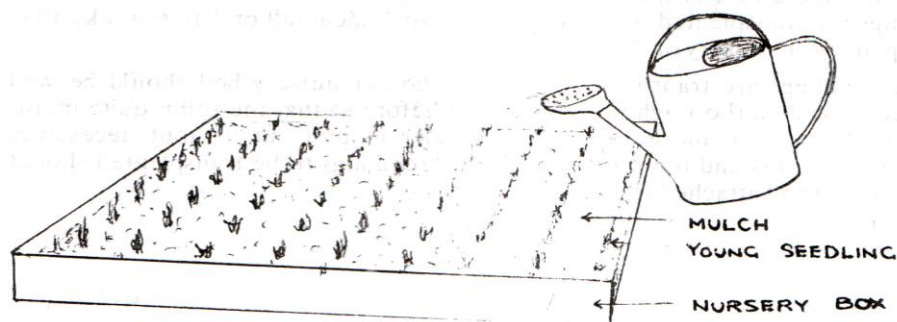


Fig. 7.3: Young Seedling being mulched and watered using watering can

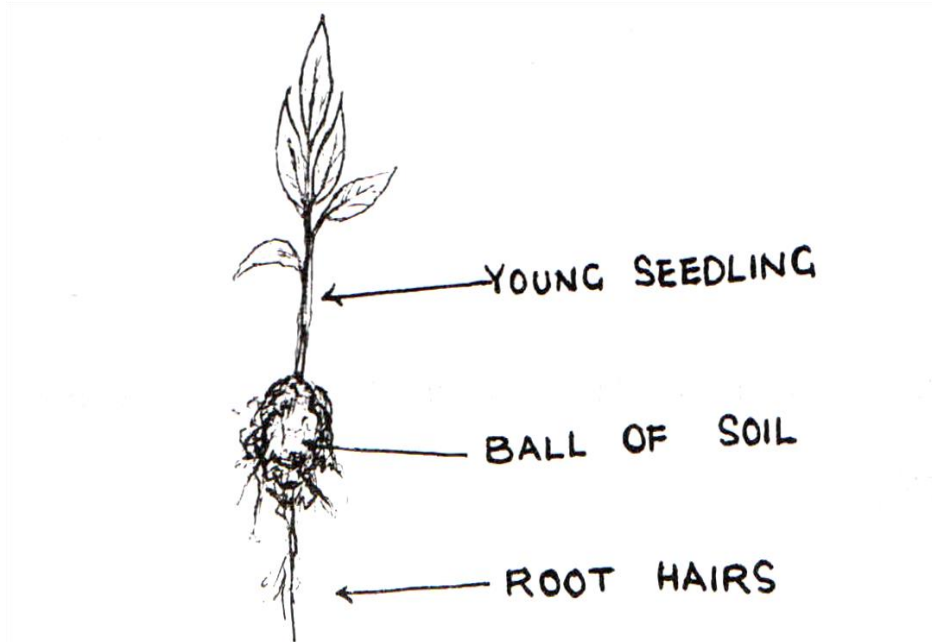
### Weeding

The seedlings growing in the nursery beds and in the field need to be routinely weeded by hand or with a small hoe. They can also be weeded using hand trowel. This weeding helps in reducing the effect of competition and over crowding among the growing plants.

## Transplanting

Seedlings should be transplanted when they are well established and developed. Seedlings are transplanted when they are 2.5 to 12.5cm tall or 4 to 6 weeks after being planted in nursery or 4 to 6 leaves are produced.

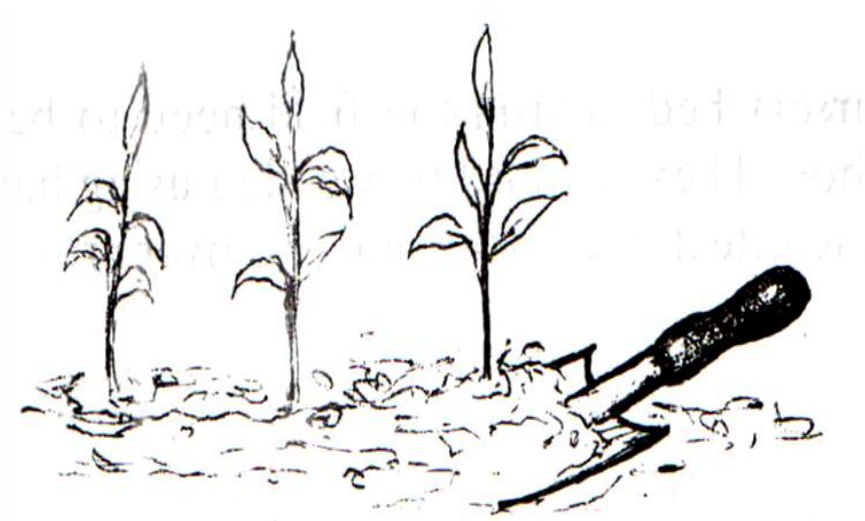
Before seedlings are transplanted, the seed box or nursery bed should be well watered or soaked thoroughly about 3 hours before so that the soil is quite moist. The seedlings when moistened become easier to pull out without necessarily affecting the roots and the tender stems. The seedlings to be transplanted should have a ball of soil attached to the roots.



Young Seedling with a ball of soil attached to the roots.

Before transplanting a seedling to the farm, the soil should have been tilled to produce a fine tilt and be flat surface. Transplanting should be done in cool weather or cool evening.

Pricking out should be done using a dibber or sharpened stick the size of a pencil to prick out small seedlings. Garden trowel is used for large seedling of trees or shrubs. Pricking out is done in rows or singly in polythene bags. Healthy and vigorous seedlings should be pricked out, all diseased and weak ones discarded at this stage. Before taking seedlings to the garden, seedlings are lifted with a trowel and are lifted one at a time. They should not be pulled by their soft stems. After lifting the seedlings, they are put in head pans or baskets and carried to the farm.



*A Young seedlings being lifted with a Trowel*

Transplanting is done only after the rains have become steady. It is possible to transplant seedlings into the farm during the dry season if a steady and reliable source of water supply is available.

The land for transplanting seedlings should be manured. However the quantity of manure applied is dependent on the fertility of the soil. The seedlings should be watered immediately after transplanting

### **ACTIVITY I**

What do you use in mulching seedlings in your locality?

### **SUMMARY**

In this unit you have learnt that:

- Vegetable crops are raised in nursery beds before transplanting.
- The nursery bed sites are first selected, cleared, dug or hoed. e The soil for beds is loosened mixed and added manure.
- Nursery beds are not planted with the same crop every season.
- Young nursery seedlings need to be given special care and attention during the first few weeks of growth.
- Nursery plants have to be raised in a nursery before being transplanted.

They need to be raised under shade or kept under constructed shelter for protection from excessive sun, wind and rainfall.

### **ASSIGNMENT**

1. What is mulching? List four mulch materials.
2. List four reasons why water is necessary in nursery.
3. When are seedlings best transplanted.
4. What is pricking out? What happens during pricking out?
5. Why do you water the nursery beds before lifting out?

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## UNIT 4 PLANT PRACTICE: WATERING, THINNING AND WEEDING

### INTRODUCTION

In this we will discuss some of the plant practice involve in farming. In Nigeria, these practices are commonly used.

### OBJECTIVES

At the end of this unit, you should be able to:

- define the term planting, thinning, broadcasting and drilling
- planting in sit, thinning, weeding and drilling and reasons for the practices
- give examples of crops that can be planted in situ
- carrying out the above practices appropriately.

### WORD STUDY

Planting in situ - Planting directly without transplanting

Maturity - Stage of development at which plants make no additional growth

Broadcasting - Scattering of seeds in a random manner over prepared land by hand or machine

Transplanting - Moving plants from one site to another e.g. from nursery beds to the field.

### Planting

The land for planting these crops is prepared in a similar manner to that prepared for transplanting. Seeds are sown in rows or by broadcasting. The advantages include easy weeding, hoeing, manuring and mulching. The crops have enough room to develop and have equal opportunity to compete for food, space, light, and water. However, some small seeds such as Acha are best broadcast. The land that is to be used for sowing the seeds should be watered or supplied with sufficient rainfall before the planting. Planting can be done by putting at the correct depth and rate. Seeds should be planted a few hours after the soil surface has been tilled. It is advisable to sow seeds in drills rather than broadcasting then. The drill method helps in making or carrying farm operations easier.

During rainy season, there will be need for mulching the beds after planting, but the soil surface should not be allowed to dry.

TABLE 5.1: Spacing distances for some vegetable crops

Vegetable	Spacing of rows (cm)	Spacing of crop in (cm)
Tomato	60	60
Egg plant	60	60
Okro	56	55
Sweet pepper	45	45
Cucumber	9	9
Radish	0	0
Amaranth	2	4
Beans	2	2

Source: UPE Teacher Education Material Production Project, University of Ibadan 1978.

## **ACTIVITY I**

What happens if small seeds are sown directly in the farm?

### **Thinning**

After germination the seedlings may be over crowded. This leads to poor growth and development. To prevent these problems, the weak and small seedlings are pulled out gently by the hand. This process is called thinning out. Thinning out allows more space, food, water and light for the development of the other seedlings.

## **ACTIVITY II**

What is the correct spacing distance for tomato? What happens to crops that are closely spaced?

### **Weeding**

Some plants are not wanted in the nursery or garden are called weeds. Examples of common weeds are: witch weeds, goat weed, spear grass, imperata grass, Cypros sp, carpet grass, etc. Weeds should be removed regularly and timely. They can be removed by pulling with hands or by using some simple farm tools like shovel, hand fork and small hoe. Weeds can also be killed by using chemicals.

## **ACTIVITY III**

Identify some of the unwanted plants found in your school farm.

## **SUMMARY**

In this unit you have learnt that:

Some crop seeds are sown directly into the garden.

Seeds are sown according to their recommended spacing distances

Overcrowded seedlings are pulled out gently by hand to allow more space, food and light

Unwanted plants are removed regularly and timely to avoid competition with the crops.

## **ASSIGNMENT**

What is planting? What is the best method for planting seeds in the farm?

Name five crops that require direct planting on the farm

Give the recommended planting distances for the following crops, beans, okro, radish and egg-plant.

Give two simple farm tools that you can use in removing unwanted plants in a school farm.

## **REFERENCES**

The UPE Teacher Education Project (1978). Agricultural Science: Teacher Education Material Production Project. (Pp. 201-203). Lagos: Macmillan (Nig) Publishers Ltd

## UNIT 5: IDENTIFICATION OF MATERIALS USED IN IRRIGATION

### INTRODUCTION

The crops which farmers grow must have water or they will die. Water, air, and soil are the most important elements together with sun-light for the growth of crop plants. Where rainfall falls short of the required minimum, the farmer adds more water by other means. Irrigation is mainly practiced in the Northern part of the country where rainfall is slight and unreliable. In this unit you will learn about the types of irrigation systems and the materials used in irrigation.

### OBJECTIVES

By the end of this unit you should be able to:

- define irrigation
- describe the 3 types of irrigation systems;
- mention the sources of irrigation water;
- describe the materials used in irrigation

### WORD STUDY

1. Artificial - made or produced as a copy of something natural or real.
2. Supplement - Something that is added on something else to improve or complete it.
3. Surface - The upper part of (soil).
4. Salination - Containing more of salt.

### IRRIGATION

Irrigation is the artificial application of water to the soil to supplement insufficient rainfall and to eliminate soil water handicap for crop production or agricultural purposes. The importance of any irrigation are stated below:

- a. It makes early planting possible
- b. It adds water to the soil in order to supply the moisture for plant growth.
- c. It softens soil for easy tillage operation.
- d. It promotes high yields of crops.
- e. It facilitates the survival of crops during drought
- f. It influences time of harvest
- g. It reduces salination in the soil

The sources of irrigation water are:

- |               |              |          |
|---------------|--------------|----------|
| 1. Rivers     | 2. Lakes     | 3. Ponds |
| 4. Dams       | 5. Boreholes | 6. Wells |
| 7. Reservoirs | 8. Springs   |          |

### ACTIVITY I

1. Define irrigation
2. Write any 5 importance of irrigation
3. Mention 6 sources of irrigation water.



## **Three Principal Methods or Types of Irrigation Systems**

There are three main types of irrigation systems. They are

1. Surface irrigation system  
Example:
  - (a) Flood water irrigation
  - (b) Shadoofs.
2. Sub-surface irrigation system
3. Overhead irrigation system.

### **Surface Irrigation System**

In surface irrigation system water from the river, dam or stream is applied on the surface of the soil of the whole area, where furrows or gaps are constructed between ridges to provide moisture to the crops planted along the ridges. Typical example of surface irrigation is flood water irrigation. The Fadamas of Northern Nigeria are flooded in the months of July to September. When the flood water subsides it leaves behind a wet soil enriched with silt. Sugar cane, Tobacco and rice can then be planted on the soil thus irrigated.

Shadoof is another type of surface irrigation system. It is used to supplement the water supplied by the seasonal floods. Dry season vegetables can be grown with this system. It involves the raising of water from a river or shallow well by means of a lever system.

Another form is Canal irrigation where floodwater is controlled and led through canals to the farms. Pumps are also installed to draw water from rivers and distribute it through canals to the farms. Examples of this form of surface irrigation can be seen in the River Basin Development Authority's irrigation schemes e.g. Rima River Valley in Sokoto State

### **Sub-Surface Irrigation**

This is the system in which water is applied below the soil surface to the farms by using perforated pipes which carry the water to the roots of crops through capillary action.

### **Overhead Irrigation**

In this system, water is supplied over head. The sprinkler methods is an example of this system. It involves the spraying of water by the help of pumping machines and spraying nozzles which spreads the water evenly distributed over the crops.

## **ACTIVITY II**

1. What are the 3 types of irrigation systems in Agriculture?
2. Define the 3 types of irrigation methods mentioned above?
3. Give 2 examples of any of the three methods of irrigation you have mentioned

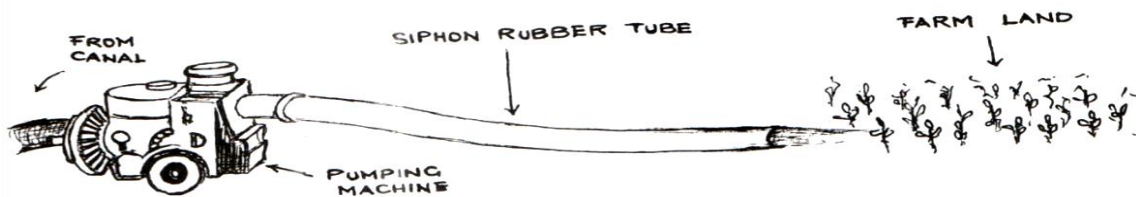


Fig. 6.1:

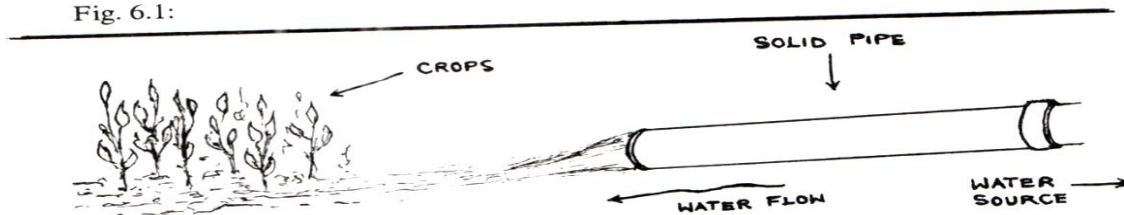


Fig. 6.2:

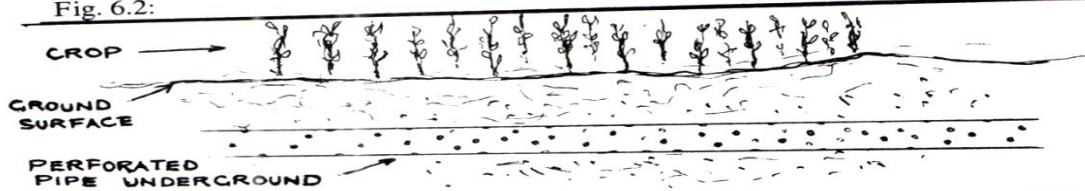


Fig. 6.3:



Fig. 6.4:

## SUMMARY

In this unit you have learnt that:

- Water needed by crops can be supplemented by irrigation in the absence of rain water.
- Irrigation has some advantages
- There are some methods of irrigation systems.
- Different kinds of equipment and materials are used in carrying out irrigation.

## ASSIGNMENT

1. Irrigation is mostly practiced in Northern Nigeria; why?
2. Mention the uses of watering can in irrigation activities.

## REFERENCES

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## **UNIT 6      PREPARATION OF COMPOST MANURE**

### **INTRODUCTION**

Food, in the form of plant and animal products is one of first necessities of life. Agriculture is the main source of food. Soil is a natural material formed from a variable mixture of broken and weathered minerals and decaying organic matter which cover the top most layer of the Earth surface where our food crops grow. Efficient conservation of water, soil and nutrients is very essential if Agriculture is to progress. The loss of Nutrients and water cannot be completely prevented but measures can be taken to control the excess losses. Compost manure is very important material to replenish plant nutrients in the soil. In this unit you will learn how to prepare and apply compost manure.

### **OBJECTIVES**

By the end of this unit you should be able to:

- Define compost manure
- Define composting
- List the sources of waste composting
- Try the two basic methods of compost preparation.

### **WORD STUDY**

Compost – rotting the plants and animals remains in heaps

Broadcasting

Pit

Heap

Manure – decomposed plant/animal residue.

### **WHAT IS COMPOST?**

Compost is organic manure resulting from integration of animals into crop productions system to make available to the farmer a free supply of fertilizer. The faeces, urine, and other metabolic waste products of domesticated animals can all be utilized effectively in the preparation of compost manure.

The importance of compost manure is that, it contains all the substances required by any crop. It is cheap to be produced on the farm. It has lasting effect on the soil. It binds light soil and opens compacted soil.

### **COMPOSTING**

Refers to the act of rotting the plants and animals remains in heaps before residues are applied to the soil for farming activities.

### **SOURCES OF WASTE FOR COMPOSTING**

1. F.Y.M i.e. dungs of cows, sheep, goats etc.
2. Crops residues such as straws and dry leaves.
3. House hold waste e.g. Food waste, and garbbages.
4. Industrial waste - though industrial wastes are not commonly used because they contain heavy metal pollutants.

## ACTIVITY I

1. Define compost manure
2. What are the sources of waste for composting?
3. Define what composting means.
4. Why is industrial waste not commonly used as a source of waste for compost preparation.

## METHODS OF COM POST PREPARATION

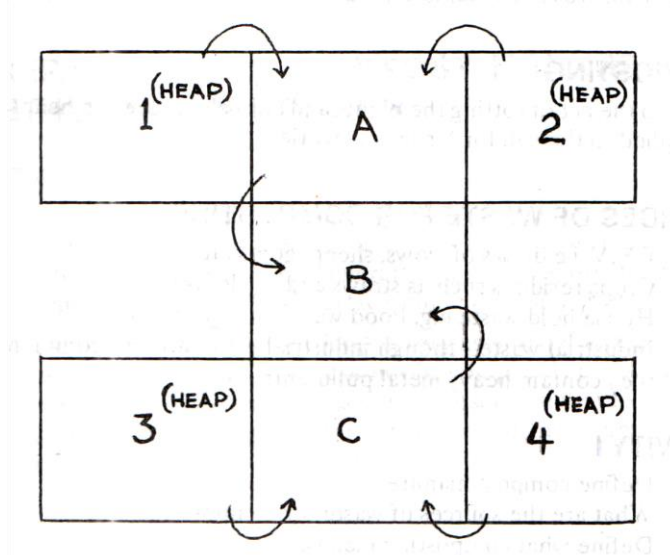
There are basically two (2) methods or procedures for compost preparation or making. These two methods are:

- The Heap or stack method
- The Pit method

The Heap or stack method.

The heap or stack method is commonly used in humid wet tropics, while the pit method is common in dry areas, or semi-arid area. The basic need is to bring about rapid and thorough decomposition of organic materials to increase the plant nutrients in the soil lost.

- First step is to get well drained plain ground.
- Fill the place with composting materials e.g. dungs, urine, straws, dry leaves, old compost. Four heaps are made.
- After you finish step one, water is sprayed to create moist environment.
- You then test the heaps for decomposition. You may test by using soil thermometer to know the temperature, or you can use stick for 10 minutes and if warm, decomposition is taking place.
- Turning the compost. This means supplying enough air so as to promote the process of decomposition. It also makes moist for chemical and biological activities.



*Method of Heaping and Turning Compost*

2. The pit method of compost preparation

The procedure is the same as the heap method, except that in this, pits are dug and the rotting materials kept inside.

## **EFFECTS OF COMPOST TO THE SOIL**

1. Serves as the source of plant nutrients.
2. It helps to improve soils structure and other physical properties.
3. It hosts and serves as food to living organisms in the soil
4. It controls the soil temperature
5. It absorbs moisture in the soil.
6. It is buffering mechanism of the soil.
7. It helps to prevent erosion especially water erosion.

## **METHODS OF COMPOST MANURE APPLICATION**

### **By broadcasting**

In this method the compost manure is scattered evenly in the surface of the soil before cultivation. The manure is, later worked in the soil with a hoe or plough before plants are planted.

### **By top dressing:**

This involves spreading of compost manure on the surface of the soil on which crops are already growing.

### **Ring Method of Compost Manure Application:**

The manure is applied around 15cm away from the plant. This made it easier for roots to absorb the manure nutrients quickly.

### **Band placement method:**

This involves applying the manure in bands or placing the manure beside the plant.

## **ACTIVITY II**

Discuss the different methods of compost application in the soil.

## **SUMMARY**

In this unit, you have learnt that:

- Organic manure can be used effectively in our farms.
- There are two main methods for compost manure preparation.
- There are advantages of applying compost manure.

## **ASSIGNMENT**

1. Differentiate between compost manure and composting.
2. Draw a well illustrated diagram to show how heap or stake of composting is done.

## **REFERENCE**

Akin Sunmi O. (1975). Certificate Agricultural Science Principal. Amany High School Nigeria 1975  
Lagos: Longman Group Ltd.

## UNIT 7 IDENTIFICATION OF INSECT PESTS AND THEIR DAMAGE TO CROPS

### INTRODUCTION

What is a crop pest?

A pest is any living organism that feeds on crop thereby limiting its optimal growth and yield whether in the field or in the store. What are the major classes of crop pests you have studied? Does your answer include mammals, birds, arachnids, molluscs and insects?

What is the economic importance of crop pests?

The economic importance of crop pests is this:- certain pests attack the aerial parts of the crop causing defoliation of the plants. This reduces the photosynthetic areas of the plant and hence leads to low yields. In a monocropping system, severe pest attack may lead to total crop failure loss of jobs and funds invested.

Insects are the most important pests of crops. Insects are six-legged invertebrates with an exoskeleton. Adult insects have three pairs of legs with the body divided into head, thorax and abdomen. The larvae have segmented worm-like body with a distinct head. There are different types of larva with different forms - some have no legs (maggots or apods) some have three pairs of legs (grubs or oligopods) while yet others have three pairs of true legs and four pairs of false legs (caterpillar or polyopods)

### OBJECTIVES

By the end of the unit, you should be able to:

1. classify insect pests according to their feeding habits;
2. list some examples from each class and the common crops they attack;
3. identify and describe the damage done to these crops.

### WORD STUDY

Mandibles	-	an organ performing the function of a jaw in the lower animal
Proboscis	-	mouth-parts of some insects
Apod	-	an animal without feet
Sap	-	vital juice that circulates in plants

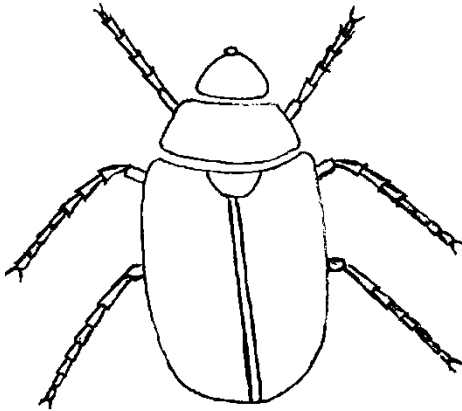
### BITING AND CHEWING INSECTS

In this group the organ around the mouth (mouth parts) are adapted for biting and chewing. They have pronounced **mandibles** used for chewing. The crops are damaged by these insects in the following ways:-

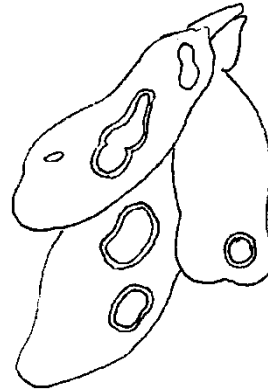
- i. by eating or removing leaf-tissue of growing crops. This hinders the growth of the plants by reducing the photosynthetic surface of the plants and consequently reduce yield e.g. grasshoppers, locusts, beetle, weevil adults, larvae of butterflies and moths.
- ii. some remove or cut off the apical stem and cause stunted growth e.g locust and crickets.
- iii. some feed on the pistil or stamen and reduce the chances of fertilization of the crops e.g. earwigs and thrips
- iv. some feed on roots and storage organs and through this may spread fungal and bacterial diseases e.g beetles. Weevils, termites.

## ACTIVITY

Catch samples of detected pests in farms or garden under study and preserve in formalin.



Yam Beetle



Yam showing

Fig. 6 1: (*Heterolegius melos* yam beetle damage).

## PIERCING AND SUCKING

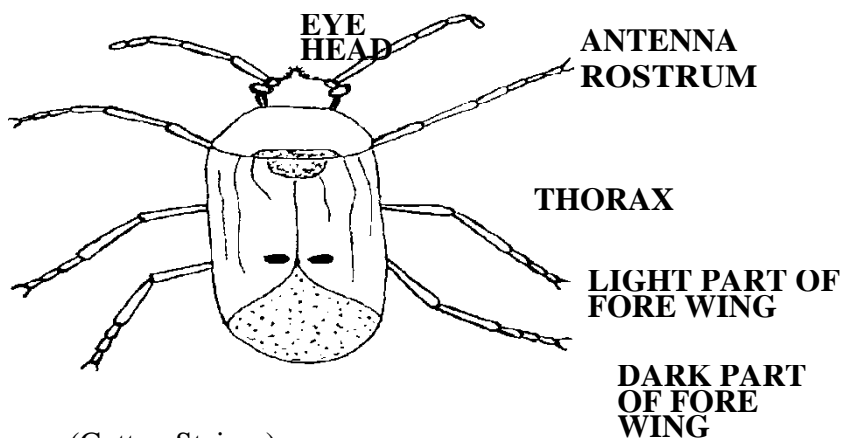
The mouth parts of this class of insects is called proboscis. These insects pierce through the outer tissues of the plants and then suck the nutritional saps within. While feeding, saliva is injected into the plant cells before the juices are sucked up. During this process, virus previously picked from an infected plant may be transmitted into a healthy plant. In this sense, these pests serve as vectors.

Some of the sap-sucking insects inject poison (toxins) into the plants after piercing through them. Such poison kills the parts of the plant where they are injected.

They cause mechanical damage by depriving the host crop of its own supply of nourishment.

Some sucking insects like the scale insects transmit fungus from one crop to another. The fungal spores stick onto the plant by means of the sticky sweet fluid secreted by the insect.

The most common example of this group are cotton stainer, aphids or aphids, white flies, scale insects, mealy bugs and capsids.



*Dysdercus* spp. (Cotton Stainer)

## **BORING INSECTS**

These eat out the juicy centres of stems and cause considerable damage to growing crops. Boring insects have mouth parts which are adapted to digging hole through plant material. A good example of boring insect is the cowpea weevil. It lays its eggs while the cowpea pods are young. These eggs are either deposited on the pod or pushed through into it. The larva hatches and eats a circular hole on one of the seeds. It later pupates in this hole. When the adult weevil emerges, it continues to feed and breed within the cowpea while the cowpea is in storage.

Other example are leaf borers, stem borers, root borers (wire worms, cockchafers larvae of beetles)

### **ACTIVITY II**

Draw and label any two of the underlisted

- I. a maize stem showing larva borer inside.
- II. a crop showing leaf borer attack
- III. a cocoa stem showing damage by capsids

### **PRINCIPLES OF PEST CONTROL**

The principle of insect pest control is to reduce the pests population to a very low level or eradicate completely so that the loss of crops and produce may be very minimal. For control to be effective, the various types of insects should be identified along with the nature of their damage and the like Iy time of attack.

The pests should be studied in relation to their ecology, the association of the insects with the crops and the crop environment.

### **SUMMARY**

In this unit you have learnt that:

- Insects and other animals find food readily in crops and their produce.
- By feeding, the pests disturb the growth-of the crops at various stages.
- Insect pests reduce crop yield and the quality of crops and their produce.
- The activities of the insect pest affect the farmer(s) by attracting poor sales and zero germination of seeds.
- To control insect pests, their population must be reduced to the lowest level to have minimal loss.

### **ASSIGNMENT**

- i. What is an insect pest?
- ii. Give **FIVE** reasons why insects are important pests of crops
- iii. List **THREE** example of each of the following classes of insects:- biting and chewing, piercing and sucking, boring and insects of stored produce. (As much as possible, avoid repetition)

### **REFERENCES**

- L.A. Are et al (1987) *Agricultural Science for Junior Secondary Schools*. Ibadan: University Press Limited.
- Oluyerni Akinsanmi (1975) *Certificate Agricultural Science*. Lagos: Longman Group Ltd.
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## **UNIT 8            DISEASE DEVELOPMENT AND EFFECTS ON CROPS**

### **INTRODUCTION**

You have learnt from units 1 and 2 that pathogens cause plant diseases. In this unit you will see how diseases develop and the effect of diseases on crops.

### **OBJECTIVES**

By the end of this unit, you should be able to:

1. describe the various stages in the development of diseases of crops;
2. identify the symptoms Of many crop diseases;
3. mention the effects of disease development on the crops
4. describe some simple animal pests;

### **WORD STUDY**

Events – Susceptible happening

Yielding readily to - being readily acted on by something.

### **DISEASE DEVELOPMENT**

Development Occurs in states of events, with one stage leading to another in some chain-like pattern, in order to preserve and sustain the object of development. Also, with disease development there are chains of events to preserve and sustain the diseases. The chain of events is called the disease cycle. The events of disease cycle goes from the events that go on within a growing season and from one growing season to the next and so on. The events involve changes in the plant which include the symptoms and changes in the pathogens.

### **ACTIVITY I**

1. What do you understand by infection?

From this study explain the term susceptible.

### **EFFECT OF DISEASE DEVELOPMENT ON THE CROP**

A disease can be defined as "any disturbance by plant pathogen which interferes with manufacture, translocation. or utilization of food, mineral nutrients, and water in such a way that the affected plant changes in appearance and/or yields less than a normal healthy plant of the same variety" A pathogen that penetrates a susceptible host invades the cells and tissues by killing or disturbing the host cells through substances produced by the pathogen. Such death and disturbance that make the infected plant, tissues or cells different from the normal healthy ones are called symptoms, Symptoms are often observed as changes in appearance. There are various plant diseases usually named according to their appearance. The symptoms of some diseases are - root rots, cankers, wilt, leaf spots scabs, blights, anthracnose s, rusts, smuts, mosaic, yellows, ring spots, etc.

Pathogens are often parasites of crop plants obtaining nutrients and water from their host. If continuous, it results in reducing vigour which discourages further crop development and multiplication. Some pathogens establish themselves in the hosts by invading the xylem and phloem vessels where they block the transportation of food, mineral, nutrients and water leading to wilting and finally death if not checked.

### **SUMMARY**

In this unit you have learnt that:

In the chains of events in the preservation and sustenance of disease is called disease cycle.

The events of a disease cycle are mainly inoculation, penetration, infection (invasion + growth) and reproduction of the survived in adversities.

The effects of disease development on the crop include:

- i) Pathogens kill or disturb the metabolism of host cells through substances produced by the pathogen which results in the development of symptoms
- ii) Pathogens consume the host's content and if it is continuous, there is loss of crop vigour and further growth and development would be slow if not stopped.
- iii) Pathogens block the transportation of food mineral nutrient and water through the conducting vessels leading to wilting and death of crop if not checked

### **ASSIGNMENT**

1. What do you understand by the term disease cycle?
2. What re the main events of the disease cycle?
3. What do you understand by the term symptom?
4. What are the effects of disease development on the crop"?

### **REFERENCES**

- Agrios, G .N. (1978) *Plant Pathology* 2nd edition New York: Academic Press Inc. San Francisco, London: 703p:
- Horsfall, J.G and Cowling E.B (eds) (1977). *Plant Disease* Vol. I. New York: Academic Press,: 465p.
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- Stakeman. E.C. and Harrar J.G. (1957). *Principles of Plant Pathology*. New York: The Ronald Press Co. 581p.
- Walker J.C. (1969) *Plant Pathology*: 3rd Edition. New York: McGraw-Hill Book Coy81

## UNIT 9

## SITTING A SCHOOL FARM

### INTRODUCTION

Have you ever seen a school farm? Do you ever consider why the school farm is sited where it is? In this unit you, will learn about some factors that influence the selection of a site for the school farm.

### OBJECTIVES

By the end of this unit, you will be able to:

1. Explain the factors that influence, the sitting of a school farm.
2. Identify a suitable site for your school farm.

### WORD STUDY

Susceptibility:	liable to, likely to be affected by something.
Waterlogging:	too much water in the soil to the exclusion of air.
Topography:	outline of the earth surface.

### SITTING A SCHOOL FARM

A school farm is a farm established and maintained by the school. A school farm is important for the following reasons:

- i. it helps to improve the understanding of farm practice and techniques and expose the students to some practical experience in the farming business.
- ii. it is a source of income to the school.
- iii. it helps to put theory into practice, and
- iv. it helps to solve individual farming problems through experiments.

These laudable objectives can only be achieved when the school farm is rightly sited. Wrong sitting may defeat the objectives of the school farm. In sitting a school farm therefore the following factors should be considered.

- 1) Distance: the site should be within a walking distance from the school so as to avoid time wastage and fatigue as a result of trekking long distances to and from the farm.
- 2) History of the land: In most cases, sites allocated to the school for farming are those that have been over-used and abandoned by the community. Such sites are barren and may pose serious soil management problems. In sitting a school farm therefore efforts should be made to identify sites that have not been heavily used.
- 3) Topography: Some sites have very uneven outline, hilly, stip sloping and very low-lying areas. Sloping ground should be avoided because of the difficulty in erosion control. Also the lowland valleys should be avoided because of susceptibility to water logging, especially during heavy rainfall.

The school farm should therefore be sited in areas that are more or less flat. Sometimes, however it necessary to include sloping ground and lowland valleys so as to demonstrate some agricultural techniques

- 4) Accessibility: The school farm could serve the purpose of ex tending new farming practice /techniques to the community at large. The site should therefore be accessible to members of the community.

- 5) Fencing: If the school is very close to the town there may be the risk of destruction by animals or even pilfering by the villagers. It is therefore important that the school farm is fenced to avoid these risks.
- 6) Source of water: school farm should be sited where water is available.  
The school farm will be rightly sited if the above factors are considered.

### **ACTIVITY I**

1. Make some visits to nearby schools or even backyard farms.
2. Assess sites around the school for a school farm in terms of
  - i. Distance
  - ii. Local relief - sloping, flat land, valley bottom, crest, and so on.
  - iii. Drainage
  - iv. Accessibility
3. Use the above terms to suggest a site for the school farm.

### **SUMMARY**

A school farm project is important because of its laudable objectives, some of which include generation of income, and exposure to practical experience in the agricultural business. These objectives may not be achieved unless the farm is rightly sited, some factors that should be considered in siting a school farm include distance, topography, history of the land, accessibility and fencing and availability of water.

### **ASSIGNMENT**

1. State the importance of a school farm.
2. Explain how topography influences siting a school farm
3. List factors that influence siting a school farm.

### **REFERENCES**

Olaitan, S.O and O.C Onazi (1983). *Agricultural Education in the Tropic. Methodology for Teaching Agriculture*. MacMillan Intermediate Agriculture series. Macmillan Publishers.

## UNIT 10 SUMMARY

### INTRODUCTION

This unit highlight certain key ideas, point or concepts so that you can have full grasps of all the units under this module. It is meant to refresh your mind about the module. It is meant to refresh your mind about the points already made known in units 1-9. These ideas are centered on record keeping, land preparation for nursery beds, care of plants before and after transplanting, materials used in irrigation activities, preparation of compost manure, methods of application, friendly and harmful garden insects and rudents.

#### Record keeping

In unit 1, you have learnt about record keeping. Record keeping is very important in farm business. Record keeping helps the farmer to know whether he is making profit or loss and that helps in making decision. It enables the farmer correct mistakes and aim at profit making. Records kept in the farm include yield record; others include labour inventory cost and income records etc.

#### Preparation of Nursery Beds

In the 2<sup>nd</sup> unit you have learnt of raising seeds in nursery beds before transplanting. The nursery site is first selected and cleared and the soil loosens, and manure added as required. The nursery plants have to be raised in nursery before being transplanted. They needed to be raised under shade for more protection against excess sun, wind and heavy rainfall.

Nursery seedlings need water and weeding, to reduce the effect of competition and overcrowding. Watering is done twice a done twice a day when necessary and weeding once a week. The transplanting is done in cool weather or evening and watered immediately. Thinning allows for more space and reduces competition amongst crops for food. It helps in exposing the plant leaves to sunlight, for photosynthesis. Lastly it gives room for expansion and growth.

### ACTIVITY I

- Give examples of farm records
- Nursery seedlings need to be raised under shade to protect them from \_\_\_\_.
- Why does a nursery seedling need water?

#### Irrigation

Irrigation is the application of water to the soil to supplement insufficient rainfall for crop production or agricultural purposes. Its importance are stated in unit 5 check its for more clarification.

#### Preparation of Compost Manure and Application

Composting is the act of rotting the plants and animal remains in heaps before residues are applied to the soil for farming activities.

Basically you learnt that there are 2 way of making compost manure:

- i. By heap or stack approach
- ii. By pit method

### **Harmful and friendly insects (Pests)**

Harmful insects in the garden attack the vegetables which in turn reduce market value. The problems caused by these insects include reduction of vegetable yield, reduction of the quality and market value of the commodity, it also affects health of consumers who eat the affected vegetables. These insects are controlled culturally or chemically.

Friendly insects feed on harmful insects which attack vegetables. They also help in pollination of flowers.

### **ACTIVITY II**

- What is irrigation?
- Define compost manure?
- What are the sources of waste for making compost?

### **SUMMARY**

Record keeping is important in farm business

It enables the farmer correct mistakes for profit making.

Some vegetable crops are raised in nursery before transplanting

Mulching conserve moisture.

Water needed by plant can be supplemented by irrigation in absence of rain.

Different kinds of equipments and methods are used to carry out irrigation.

There are harmful and friendly insect in the garden or farm.

### **ASSIGNMENT**

- Why is industrial waste not commonly used as source of compost materials?
- Why it is that nursery beds are raised in rainy season?

### **REFERENCES**

The UPE Teacher Education Project (1978). Agricultural Science: Teacher Education Material Production Project. (Pp. 201-203). Lagos: Macmillan (Nig) Publishers Ltd

## **MODULE 8: FORESTRY AND WILD LIFE MANAGEMENT**

### **UNIT 1 DEFINITION AND TYPES OF FOREST**

#### **INTRODUCTION**

Forest is a special ecosystem worth to study for good understanding. In this unit you will learn the appropriate meaning of forest and the types of forest that exist.

#### **OBJECTIVES**

By the end of this unit you should be able to:

1. Describe the component of forest;
2. Describe the structure of the tropical lowland rainforest;
3. Differentiate freshwater swamp from mangrove forest.

#### **WORD STUDY**

Canopy	-	the crown part of the tree containing the branches and leaves.
Ecosystem	-	consist of the plants, animals and environment and their interrelationships.
Bole	-	the trunk of a tree.

#### **THE FOREST**

Forest is a particular type of plant community where most of the constituent members are trees that are woody and grasses are virtually absent. A tree that may be described as a woody plant is usually not less than 6 metres in height and with only one supporting stem. Forest exhibit different character depending on the environment they are growing. In the temperate zone where growth conditions for plants are not as favourable as in the tropics you have temperate forest.

#### **TEMPERATE FOREST**

These are characterized among other thing by one or two species occupying a very large area of land. But in tropics where the growth conditions for plants are much better due to high temperature and soil moisture, plants can grow the year round. Nigeria is located in the tropic thereby having tropical forest. In Nigeria, the forest is made up of many tree species unlike the temperate forest where the species composition is limited to one or two species. In a tropical forest there is no one prevalent tree species unless in special ecosystem where due to local conditions only highly specialised tree species can thrive. A case in point is in the water logged ecosystem of the delta of Niger and highland of the Jos and Mambilla areas.

#### **TROPICAL FOREST**

Tropical forests are found between latitude 23° 30' N and 23° 30' S. Hence the climate and soil conditions are such that extensive growth can take place all year round. There is abundant water for soil moisture, sunlight and high temperature. These environmental and soil conditions make for production of high volume of plant biomass.

It is this high and relatively even temperature that has encouraged the growth of many species found in the tropical forest ecosystem. Majority of the species are evergreen; they do not completely drop their leaves all at once during certain times of the year. The proportion of the deciduous tree species increases as you move towards the drier margin of this zone.

The type of forest that grows in any environment is determined by environmental and edaphic factors as attitude and soil moisture among others.

### **SWAMP FOREST**

In Nigeria swamp forest developed as a result of the excessive high soil moisture or water logging. There are two types of this forest.

The first is the mangrove forest; which developed due to water logging by brackish or saline water. The other type found in fresh water logged area which gives rise to freshwater swamp. All these ecological zones have plant communities that have special feature adapted for survival and growth in these environments.

### **STRUCTURE OF FOREST**

Most of the forest cover in Nigeria occurs at low attitudes and on non waterlogged soils. These are referred to as lowland rainforest. The tropical rainforest as it occurs in Nigeria is very complex. It is only on very close and careful examination that its structure or organisation can be discerned or figured out.

The forest consists of horizontal layers of canopy, of the trees at different height levels. These layers are called strata. Usually forests in the lowland rain forest have three recognized tree strata. These are the upper or emergent stratum, the middle stratum and the lower stratum also called the understory.

The upper stratum is about 30 - 45 metres high and the crowns of the trees in this category are wide spreading. They do not touch each other i.e., they are not continuous. Next to this emergent stratum is the middle stratum which occupies height of 23 to 30 metres, their crowns are spherical or rounded in shape and are more or less continuous. The last tree layer is the understory which their crowns at between 9 and 23 metres. Their crowns are narrow in shape because they are densely packed and are more or less continuous. It is this layer that merges to the shrub layer below it. The shrub layer consists of young trees. They vary in their number occupying a unit area of land or density. Below the shrub layer is the herb layer which is patchy and made of mainly the seedling of the trees in the upper middle and lower strata. This layer only grows to about 1 metre in height other plants common in the tropical forest is the climbing plant. There are two types namely the herbaceous type which are generally small and grow in the lower parts with the dense shade of the forest canopy. The other groups is the lianes, these are woody and climb up to the full length e.g. the emergents. Their older stems are leafless and unbranched while the younger stem branch profusely and produce leaves and flowers. Also in the forest there is an intermix at all levels, of climber, liane creeper and epiphyte. Epiphytes are plants which grow upon other plants which they use only for mechanical support.

The component trees in the forest have tall, unbranched, cylindrical boles which taper only very slightly towards the crown. The barks of most of these trees and shrubs are very thin and are easily damaged by fire.



In other words, they are not fire - resistant like the savannah species.

Most of the larger trees often have buttress which are plan like protusion from their stems at their points of contact with the ground.

### ACTIVITY I

- a. Visit the forest nearest to you and observe the vertical stratification of the various canopy layers.
- b. Measure the heights of the tallest trees (2), the average height (2) and the short (2)
- c. Count the number of plant species a plot of 20 metres square hias.

### SUMMARY

In this unit you have learnt that:

- Forest is a type of plant community that are predominantly trees;
- Different types of forest include:-
  - Temperate forest
  - Tropical forest in Nigeria further subdivided into
    - mangrove forest
    - freshwater swamp forest
    - lowland rainforest.
- Low land rainforest is stratified vertically into
  - emergent stratum
  - middle stratum
  - understorey.
- Other plant types present are climber, both lianes and herbecous as well as epiphytes.

### ASSIGNMENT

1. List the different types of tropical and low land rain forest subdivision in Nigeria.
2.
  - a. What is a stratum in the tropical rainforest?
  - b. List the three strata in the tropical lowland forest.
    - a. What is the common feature in the mangrove forest?
    - b. How many types are there?

### REFERENCES:

Hopkins B. (1965). (2nd edition) *Forest and Savanna*, An Introduction to Tropical Terrestrial Ecology with special references to west Africa London: Heinemann Educational Books Ltd.

## UNIT 2 ECONOMIC IMPORTANCE OF FOREST

### INTRODUCTION

The economic importance of the wood based industries exceeds those of any other industrial sector. This is as a result of the high variety of manufacturing feasibility within the timber economy and the relatively large market for the different wood products. The economic importance of the forest to the wood based industries such as sawmill, paper products, manufacturers of furniture, as well as boat building, will be discussed in this unit. However, this is not to the exclusion of the forest produce for domestic and export markets and the employment generated by the forest industry

### OBJECTIVES

At the end of this unit you should be able to:

1. describe the main uses of wood;
2. list the different types of forest products;
3. enumerate the economic value of forest products.

### WORD STUDY

Fuel wood - wood obtained to serve as energy or to generate energy for many purposes e.g. for cooking.

Mushroom - Mushroom is an edible food from lower plants (fungi)

### ECONOMIC IMPORTANCE OF FOREST

For convenience of learning, the economic importance of the forest to the wood based industries such as sawmill, furniture, paper as well as boat building industry will be highlighted in this unit. Also employment opportunities offered by the forest industry and its produce for both domestic and export market will be discussed.

**SAWMILL:** The forest provides the woods which are sawn in the sawmill into different forms and sizes for different uses. The forest is the principal source of sawn timber to meet the needs of the consumers.

**FURNITURE:** - The forest provides the wood, sawn by the sawmill, for the furniture industry to produce various brands of furniture items such as chairs, tables, beds, cupboard and wardrobes. Furniture is a movable household item of different forms and sizes and meets varying needs.

**PAPER INDUSTRY:** - Forest provides the wood used by the paper industry.

For instance, forest wood is processed into pulp for the manufacture of paper products and news prints.

**BOAT BUILDING:** - Wood obtained from the forest from the principal raw material used by the boat industry and for the construction of jetties.

**DOMESTIC USES OF WOOD:** - Wood probably serves more of the domestic uses than the others. Wood is from tree which provides food directly or indirectly and in turn is eaten as leaves, nuts, seed, or roots.

Trees also provide the environment and medium for the production of mushroom.

Fuel wood is also a product of the forest. Fuel wood is a major source of household energy for cooking and other purposes in the rural areas.

Wood is equally an essential product required for house building, implements, and construction.

### **POWER AND TELECOMMUNICATION POLES**

Wooden poles are products of the forest and are used for electricity and telecommunications lines and as support system in many structures.

### **EXPORT VALUE OF WOOD**

Wood and some other form of wood products are exported to foreign countries to generate income, for example, mahogany and teak are few such forest woods exported abroad to meet various uses, principally for flooring of buildings due to the hardness of these woods.

### **ACTIVITY I**

1. Observe some household items in your environment and determine which ones are forest or wood products.
2. Visit a forest near you and identify some forest trees.

### **OTHER USES OF FOREST AND FOREST PRODUCTS**

**MEDICINAL USES:** - Forest provides medication to rural and urban populace. Parts of plants are used in various combinations to treat variety of ailments such as measles, hepatitis, ringworm and as snake repellent.

There are services derivable from the forest which cannot be estimated as well as some non- timber forest products which are important sources of income to the rural community. For instance, the forest improves the microclimate, reduces wind damage when used as wind breaks, protects soil against soil erosion and helps to restore soil fertility and productivity. Forest also creates water shade that sustains catchment areas of rivers.

The non - timber forest products augment the dietary needs of some people and thus save money on household feeding cost, e.g bushmeat.

**WILD LIFE HABITAT:** - Forest form habitat (living environment) for all forms of wildlife.

### **ACTIVITY II**

1. Examine some food, fruit, seed or nut you eat and determine if they are forest products.
2. Observe and identify any forest tree whose part is used to treat an ailment.

### **SUMMARY**

In this unit you have learnt that:

- The economic importance of the forest and forest products is in the area of:
  - sawmilling
  - manufacturing of furniture
  - boat building
  - producing paper products

- creating job opportunities
- domestic or local uses for food, home building, construction works.
- exportation of forest products
- medicinal uses
- improving the environment and microclimate.

### **ASSIGNMENT**

1. Name any two forest trees common in Nigeria
2. Name some principal uses of forest trees or wood.

### **REFERENCES:**

Hopkins B. (1965). (2nd edition) *Forest and Savanna, An Introduction to Tropical Terrestrial Ecology with special references to west Africa* London: Heinemann Educational Books Ltd.

## **UNIT 3      BASIC PRINCIPLES OF AGROFORESTRY**

### **INTRODUCTION**

Nigeria has a land mass of about 98.321 million hectares. 75% of this mass may be regarded as arable while 10% under one form or the other of forest reservation. The balance of 15% is assumed to be occupied by infrastructural development, building pastures etc. Productivity of land is steadily diminishing owing to a variety of reasons. Some of the causes are manmade while others are natural such as drought. Of the manmade causes, indiscriminate burning of the vegetation and uncontrolled exploitation of the resources base are very serious.

As the agriculturally productive land is diminishing the population is increasing in some areas at a geometric rate. This large population has to be fed.

This situation further aggravates the already precarious situation culminating in land scarcity and land hunger. The latter is already in existence in certain parts of Nigeria. The need to develop a land management system that will ensure sustainable production of food and wood becomes more imperative, such a system is Agro-forestry. This unit discusses the basic principle to be followed in the establishment and management of combination of trees and food crop system.

### **OBJECTIVES**

By the end of this unit, you should be able to;

1. Create awareness of the various production components of Agro- forestry;
2. Categorize the production systems.

### **WORD STUDY**

Pastoral – Having to do with animal husbandry  
Rotation – Period from planting to harvesting of forest trees.  
Fodder - Food for animals

### **MEANING OF AGROFORESTRY**

Agroforestry is nothing new to the Nigerian landscape as it is found in our traditional farming system all over the country. Agroforestry means so many things to so many people. All the classic definitions of Agroforestry have at least one thing in common which is that Agroforestry is that given by King and Chandler in 1978 and that of Combe and Budowski in 1979 who called it " a group of land management techniques implying the combination of forest trees with food crops or domestic animals or both and applies management techniques that are comfortable with the cultural practices of the local population and sound environmental conditions, or the combinations.

### **CATEGORIZATION OF AGROFORESTRY**

Agroforestry may be categorised on the basis of

- Expected output or products
- The functions performed by the component part;
- Or the distribution of the components parts both in time and space.

**a. Categorization by Expected Output or Product.**

By this approach, three systems call the recognised this covers the agricultural products combined with forestry crops thus:-

- I. agrosilviculture system
- II. simultaneous combination of forestry crops with agricultural and grazing i.e. Agrosilvopastoral system.
- III. combined forestry and grazing, i.e. silvopastoral system.

**ACTIVITY I**

1. Read the unit carefully and understand the technical terms used in the unit within the context.

**b. Categorization by major function:**

In this approach the major function of the forestry components are reflected. forestry generally performs three basic functions such as:

- protection function eg soil conservation
  - production function e.g. wood
  - service function e.g. weather amelioration
- a. In a silvoagricultural system with a production function, the following combinations are possible:
    - Agrisilviculture
    - Commercial trees combined with crops
    - Fruit trees combined with forest trees.
  - ii. When protection and service functions are emphasised you following systems possible:
    - live fence post / wind breaks
    - shade trees among crops
    - trees to conserve and improve soil climate and water.
    - trees grown around fish pond.

In a silvopastoral system with a production function emphasised, the possible combinations are:

- grazing in young forest
- fruit trees combined with grazing
- fodder tree production

With a protection and services functions are emphasised the possible combinations will be possible:-

- live fence post / wind breaks and grazing
- shade trees in pastures
- trees for soil conservation and improvement and grazing.

**c. Categorization of Agroforestry based on the distribution.**

In time and space of the component parts. In this approach the distribution of the component parts III time may Yield the following combinations.

I. When categorized with a time function, the combination with farm crops and or animals may either be temporary or permanent.

a. It is permanent when the combination is maintained during one or more rotations of the forestry component. This also includes the continuous harvest of the agricultural component grown in the combination.

b. It is regarded as temporary when the farm crops lasts less than one rotation of the forestry component.

II. In a spatial function, the distribution of the forest crop in the combination with the agricultural crops or animal can be regular or irregular

a. The regular distribution is when the forest components are grown plant by plant in association with the farm crops or grown in rather scattered pattern among them.

b. The irregular distribution is when the forest components are placed alongside or around the farm crops with which it is associated, particularly groups of trees in rows or strips such as in live fence posts. The type of distribution found in a particular system depends on the objectives of management and the environmental setting. So emphasis should be placed on what crop can grow in what site before any other input is considered.

### **ACTIVITY 11**

1. Visit a farmer's field in your area. Take note of the trees left standing on the farm
2. Visit the herdsman in your area. Take note of where he grazes his animals

### **SUMMARY**

In this unit you have learnt that:

- Agroforestry broadly is the growing of agricultural crops and forest crops on the same parcel of land at the same point in time and space.
- There are three basic types depending on the combination namely:
  - Agrosilvopastoral combines agricultural crops forest trees and grazing
  - Agrisilviculture combines farm crops and forest trees
  - Silvopastoral combining trees and grazing.
- Other categorizations are based on function as well as distribution in time and space.

### **ASSIGNMENT**

1. True or false agroforestry is a desirable system of production
2. List any two reasons to justify the practice of agroforestry.
3. List three basis of categorizing agroforestry.

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## **UNIT 4 IDENTIFICATION AND MAINTENANCE OF ECONOMIC FOREST TREES**

### **INTRODUCTION**

Nigeria is blessed with a rich flora. There is virtually a tree for every possible need in Nigeria. Many Nigerians know the products of useful trees but are unable to recognise the tree itself when they see it. Every Nigerian is being persuaded to plant a tree, at least every year and maintain. Many people want to plant a tree for particular purpose, but either they do not know the tree that satisfies the purpose they have in mind or they do not know how to maintain the tree after planting. After planting the trees, you will need to maintain them until they have established and are able to survive through subsequent years. This unit provides you methods of recognising and maintaining trees.

### **OBJECTIVES**

By the end of this unit you should be able to:

- recognise most common useful trees, using the standard tree identification
- keys;
- plant and maintain trees.

### **WORD STUDY**

Species - Orderly classification of plants and animals according to their presumed (family)

Orderly classification of plants and animals according to their presumed

natural relationship specific name of plant general name of some group of plants.

natural environment - the general look

a combination of tree crowns.

animals or plants that attack other plants or animals and are unwanted

### **IDENTIFICATION AND MAINTENANCE OF ECONOMIC FOREST TREES**

Economic forest trees are the trees of the forest that are useful. There are many economic trees in the Nigerian forest. Some are economic as valuable timber trees, others are economic as valuable fruits trees or soil improvement trees. Many Nigerians do not know the names of their economic forest trees. All the trees in Nigerian forest are described in the "Nigerian trees" which has been published in two volumes, by the federal Department of Forest Research, Ibadan (now Forestry Research Institute of Nigeria Ibadan). A key is also provided for identifying the trees. Although the standard economic classification of trees is based on reproductive features the key in naming Nigerian trees is based on non-reproductive features. This is because; it is not often possible to see the flowers and fruits of most mature and tall trees.

The sixteen characteristic provided for the keys are:

spines - spines are straight, thorns are curved

Latex i.e. an opaque and milky - while exudate.

other exudate - distinct from latex.

- simple leaves - not compound
- 1 - pinnate leaves with more than 5 leaflets
- opposite - simple or opposite leaflet in compound leaves
- leaves or leaflet widest above middle



- leaves or leaflet widest below middle
- Blade of leaf long - over 5 times as long as broad.
- Blade of leaf under 1 - 5 times as long as broad
- margin of leaf or leaflet entire
- Blade of some leaf or leaflet over 1 ft long.
- Blade of all leaves or leaflets under 1 inch long.

Some stalks of simple leaves or some stalks of leaflet in compound leaves, excluding the stalk of the terminal leaflet if present) over 2 inches long.

All stalks of simple leaves (or all stalks of leaflet excluding the terminal leaflets) under 0.5 inch long.

lowest main nerve or pair of nerve or pair of main nerves (or where several main nerves radiate from the base, then at least one of them) longer than the lateral nerves higher up the midrib

## **MAINTENANCE OF ECONOMIC FOREST TREES**

The maintenance of economic trees starts from seedling stages. You plant the seedling at a chosen spacing during the rains so that the young trees will survive and establish. If the rains stop after planting, you water the young trees. You keep the farm weed - free by weeding up to three times during the first two year; until the canopy of the trees close. At this stage weeds cannot be a problem for the trees.

To reduce the cost of weeding you may plant available food crops in mixture with your trees. This system of planting is called agroforestry. While you are weeding around your arable crops, you are also invariably weeding around your trees. You do this until you harvest your crops among your trees until the canopy of the trees close.

When there are pest problem, you treat the trees with pesticides

## **ACTIVITY I**

- Go to the bush with this unit
- Cut a branch with leaves
- Check all the listed (16 in all) character, ticking "1" or "0" for yes or no, respectively
- Go to the classroom. Read out the characteristics in the Nigerian trees to identify the plant
- Confirm your answers from a nearby herbarium
- Collect seedling and plant during the rains at spacing not closer than 2m x 2m, plant maize in between the rows.
- Water for six months, observe when the weeds grow to the height of the tree seedling before weeding. Check how many weedings you make before the maize matures and is harvested

## **SUMMARY**

In this unit you learnt that:

- Economic trees are identified, using the sixteen - character key, provided in the Nigerian trees Volume II, by R.W.J. keay, C.F.A. Onochie and D.P. stanfield
- character describes
- The sixteen characters have been enumerated and the use of the key applying character describes.
- It includes planting of the appropriate time during the rains, keeping the weeds away and also keeping pests away from plants.
- The key gives directly the name of tree that is so treated.

- The maintenance of a tree starts from the young stages.
- It includes planting of the appropriate time during the rains, keeping the weeds away and also keeping pests away from plants
- Planting trees in mixture with arable food crops - a system called agroforestry is a cheap way of establishing a tree plantation.

### **ASSIGNMENT**

1. Name 4 character use in tree identification
2. Give the name of the book that has the key for the Identification of trees in Nigeria.
3. How do you reduce weeding cost in tree maintenance?
4. How do you eliminate insect pests from a tree farm?

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## **UNIT 5 NIGERIAN VEGETATION**

### **INTRODUCTION**

Vegetation is defined as the sum total of plants covering an area. Vegetation could be natural, semi-natural or artificial. Natural vegetation- Natural vegetation is that vegetation in which no activity such as farming, burning, clearing or dwelling has taken place. It is rare to find this kind of vegetation now.

Artificial vegetation - is more or less man made plot of plants. Examples are plots of maize, millet, cowpea etc.

Semi-Natural vegetation - the most common vegetation is the semi- arid one which has been or being affected by man's activity, example savanna or forest which has been previously cultivated. The vegetation of a place is affected by the environment prevalent in the place, including animal population, climatic factors and soil factors. These factors are also in place in the Nigerian vegetation. Environmental factors affecting vegetation have allowed the Nigerian vegetation to be classified into two main vegetations. This unit will teach you about the types of vegetation that exist in different parts of Nigeria

### **OBJECTIVES**

By the end of this unit you should be able to:

1. describe the types of vegetation found in different places in Nigeria
2. explain the basis for the classification of the vegetation.

### **WORD STUDY**

Flora – This is a group of lower plants in the soil.

Landscape – forms of a region – Natural inland scenery

### **TYPES OF VEGETATION**

Two main vegetation formations dominate the Nigerian landscape namely, the forest and savanna. The vegetations are defined on the basis of species, composition and rainfall pattern of the place.

The savanna is further sub divided into Sahel, Sudan and guinea savanna while the forests are lowland, rain forest, fresh water swamp and mangrove forest. However, there are two other forms of vegetation, Jos plateau and montane region, which are distinct and have been classified based on their peculiarity.

### **ACTIVITY I**

Mangrove swamp is mainly found in the north east of Nigeria. True or False.

Rivers and Edo States are located in the Sahel savanna. True or False.

### **SAVANNA VEGETATION**

**SAHEL SAVANNA** – Sahel savanna is found in Northern Nigeria. It is very dry and the vegetation covers the north eastern border of the country. The vegetation in this place is influenced by the presence of Lake Chad and Komadugu – Yobe river. The vegetation is typically grasses which are also sparsely distributed. Yobe state is typically having the Sahel savanna vegetation.

**SUDAN SAVANNA** – This vegetation occurs to the south of Sahel zone covering Sokoto, Zamfara, Bauchi, Katsna, Kano and parts of Yobe states. Rocks mainly geises and igneous, form the Basement complex. Many of the trees of the Sudan savanna have small leaves or leaflets. Species of *Acacias* trees are also common. The grasses in the area are short and feather-like and area does not send up fresh shoots until just before the rains. Frequent grazing by cattle in the area has an important effect on the vegetation.

**GUINEA SAVANNA** – This vegetation lies to the south of Sudan savanna and covers parts of Oyo, Plateau, Taraba, Niger, Gombe States. It is the most extensive of the vegetation zones. The typical vegetation of the area is an open woodland with tall grasses and trees. The vegetation is burnt almost yearly during the dry season and suas such fire resistant species of trees are dominant.

**DERIVED SAVANNA** - It is a transitional vegetation between the forwat and the savaanna. The vegetation is a mixture of patches of forests, derived savanna farmland and bush fallow. Derived savanna is a gradual transition from more or less continuous forest in the south to more or less continuous savanna in the north. The appearance of the zone is very similar to that of the southern guines savanna. The zone comprises parts of Oyo; and Osun, Ondo, Adamawa and parts of Edo states.

### **ACTIVITY**

Draw a map of Nigeria to locate the types of savanna vegetation based on your own knowledge of the part of the unit.

### **FOREST VEGETATION**

**LOWLAND RAINFOREST** - The lowland rain forest lies between the mangrove swamps s to the south and derived savanna to the north. It covers part or whole of Oyo. Ondo, Osun, Akwa Ibom and Edo states. The vegetation is comprised of all trees, growing up to 15 meters or more in height, with spreading crowns and short stems. Due to high population and farming activities, natural rain forests occuers only in the forest reserves, national parks, game reserves and borders of rivers in the south ern Nigerian.

**FRESH WATER SWAMP FORESTS** – Lagoons and streams with fresh water are not surrounded by mangrove but by fresh water swamp communities. This is located in the extreme area south of thr lowland rain forest; and states within this area include Delta, Rivers, Ondo, Abia and Cross Rivers states *Raffia* palms are dominant in the border vegetation zone and also trees of fresh water swamp which grow to the height of 30 meters or more. Climbing palms with hooks and clumps of ropes as climbers are typical in the area. Large trees of varying sizes in height and stem girth are common inthe vegetation.

**MANGROVE FOREST AND COASTAL VEGETATION** - -This type of vegetation is located along the coastal and delta area of Nigeria where the water is saline, i.e. salty,or brackish. Parts of Ondo, Delta, Rivers and Lagos fall within this vegetation. The most prominent feature of the zone is the stilt roots of *Rhizophora* which do not penetrate the ground.

## THE PECUIAR VEGETATION

**JOS PLATEAU** - The Jos Plateau is distinct because the high altitude 1200 metres high. It has suffered wide spread degradation by man to the extent that only relics of guinea wood land remain. Examples are the orchids. The Plateau has less trees located at the centre of Jos in Plateau state of Nigeria.

**MONTANE REGION** – It is located at the south eastern border of Nigeria on the Cameroon mountains. The forest vegetation here extends as high as 1600 – 2400 meters and is replaced by grassland. Trees are not common in this vegetation but dominated by bushy plants which are not necessarily trees.

## SUMMARY

In this unit you have learnt that:

The Nigerian Vegetation is divided into two broad groups:

The Savanna and Forest

The savanna is further sub-divided into:

- b. Sahel savanna
- c. Sudan savanna
- d. Guinea savanna

The forest is further sub-divided into:

- e. Lowland Rainforest
- f. Fresh water swamp forest

Mangrove forest and coastal vegetation – are classified because of their distinct features.

The peculiar vegetation are:

- g. Jos plateau
- h. Montane region

## ASSIGNMENT

1. Name the factors which allowed for the classification of the Nigerian vegetation.
2. Compare natural and artificial vegetation using the Nigerian situation.

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## UNIT 6 BY PRODUCT OF FOREST

### INTRODUCTION

By-products of forest are those products and services, distinct from the major product for which a forest is known and established. Forests are typically located in rural areas, where timber may not be very important to the local populace. However, forests are virtually a part of the life of rural community dwellers because they get virtually their live sustenance from the forest. The importance and values of the products and services which the rural dwellers derive from forests hardly features in the financial or economic statistics of the government. This is because monetary values are not attached to these by-product and services. Occasionally these by-products are exploited to a point at which the forest is severely degraded. There are also hardly any statistics of the yield and harvests of these by-products. What is certain, however, is that the rural dwellers that are close to the forest suffer more when a forest is severely degraded. This is because the degraded forest virtually removes a part of their sustenance. The purpose of this unit is to enlighten you on what constitute by-products of forest and to suggest ways of putting costs to some of them.

### OBJECTIVES

After studying this unit, you will be able to:

- Identify the by – products of forest;
- Narrate the immense importance and economic values of the by products;
- explain a suggested method of putting costs to the by-products

### WORD STUDY

Timber – Refers to wood

Product – Refers to manufactured good

Orthodox – Refers to traditional

### BY-PRODUCTS OF FOREST

However, other products that are not of timber are got from the forest. These are referred to as by-products, or more conventionally, as Non-timber Forest Products (NTFP). The by-products or NTFPs vary from place to place depending on the needs of the local community. They can be combined into broad groups for earlier consideration. Recognised groups of by-products of forest or NTFP are food, medicine, fuelwood and others. Others include services such as protection, recreation, biodiversity and wood use wastes.

Among these only vegetables like *Vernoria amvgdalina* (bitter leaf); fruits like *Parkia bisdoboda* (locust bean) *Vitellaria paradox* (shea nut); seeds as in *Tamariodus indica* (Tsamya) and *Irvingia wombulu* (Ogbono) *Artocarpus Commanis* (Breadfruit) and (phyllo) *Chrvbophvllum albiclun* are good fruit trees familiar to people in southern Nigeria.

Forest Medicine: The rural community dwellers depend on traditional medicine made from herbs, tree leaves and roots from the forest rather than on orthodox medicines. Among the forest plants that are used as medicine are *Cajarus Cajan* which is used for treating metals. *Vernoria amnrDALINA* (bitter leaf) for

treating fever. Garciniawla (bitter cola) is used for repelling snakes. Irvingia gobonensis and kigella africana all used for treating sores. Tetrapleura tetrapleta is used for treating birth tears. A tree, Ancistroclarius spp has been implicated in the nature of AIDS. This tree exists in the Cross River state forests which merges into a similar forest in the Cameroon Republic. The Cameroon Government has declared the tree a protected tree.

### **Animal Fodder Trees**

These are plants used for feeding livestock. Ficus exasperate (the sand leaf tree ), Spondial monibine. and Alchomea cordifolia.

Putting values to some services provided by forest is difficult. One way of estimating the value of forest service like forest protection is to find the cost of what will be lost if the forest were not there. Such cost could be regarded as the cost of the forest protection services.

Among the services that forests provide is that of protection. Forests protect the soil where it is based, from erosion and from desiccation.

Forests protect the immediate environment of its location from strong winds. In arid parts of the country, this protective function is taken advantage of by planting artificial forests to use as wind breaks. The species commonly used in the arid areas of Nigeria are *Eucalyptus camaldulensis* and *Azadiractita india* (Dongoyaro).

Forests also serve recreational purpose as in avenue forests, parks and gardens and arboreta. These create aesthetic views to those who love to take a walk in them.

Forests are a reservoir of biodiversity. This is useful for breeding and improvement. Waste from forest products processing all also regarded as by products. Recently wastes in the form of saw dust and wood chips have been recombined to make reconstituted boards used in place of wood or plywood. Sawdust is also being processed into high quality tiles and ceiling boards.

Forests provide protection to fragile sites that are erosion prone areas, sand dune-prone environment, as well as provide protection to water sheds.

### **ACTIVITY I**

Visit a market on any market day. Go to the area of the market where fresh vegetables are sold. Note the ones that are collected from forest. Ask if they are from trees, shrubs or climbers.

### **SUMMARY**

In this unit you learnt that:

By- products of forest are those that are different from the major forest product which is timber.

These by-products are conventionally called non-timber forest products (NTFPs)

They include food, medicine animal fodder and services such as recreation, protection, biodiversity and wastes in the forest provide food for the dwellers of rural communities, just as they provide them with sources for medicines and fodder. Forests protect farmland water courses and fragile sites.

## **ASSIGNMENT**

1. Give names of plants that are used for food.
2. Give names of forest plants that are used for medicine.
3. Give names of plants that are commonly used for fodder.
4. Suggest ways of providing cost for the protection services of forest.

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## **UNIT 7      CONCEPT OF WILD LIFE AND WILDLIFE CONSERVATION**

### **INTRODUCTION**

To many, wildlife and the bush that houses it, have been seen as the primary source of bush meat, which they love to take regularly. The supply of bush meat has caused the decimation of the population of wild animals and degraded their habitat. Some have seen wild animals in the bush. The rate at which people are attracted to zoos, where some of these animals are kept, at least to the fact that many would love that that the wild life shall be maintained. That there is continue decline in wildlife population and wildlife habitat indicate the need to enlighten the populace at large about the need to control the use of the wild life such that both the wild animals that yield the bush meat and their environment are sustained.

### **OBJECTIVES**

After studying this unit, you should be able to:

1. define wild life conservation and wild life conservative;
2. explain what a game reserve is;
3. mention some of Nigeria's wild life;

### **WORD STUDY**

domestics - taming

Game reserve - a forest protected for animal viewing

Sanctuary - A forest protected specifically ensure the security of animals that live in it.

Scales - over-lapping plates covering fishes or reptiles.

Weaned- accustomed to food other than mother's milk.

### **CONCEPT OF WILDLIFE AND WILDLIFE CONSERVATION**

Wild life is a contraction of the two words 'wild' and 'life.' Wild means undomesticated and uncultivated. Life means" state of living, not dead. Thus wildlife implies living things that are not cultivated or domesticated. It connotes all things that are outside the control of man by way of culturing domestication or cultivation. Elements of wildlife will thus include all uncultivated plants of the bush and forest, all non- domesticated or cultured fishes of the streams, rivers or seas, all reptiles and amphibians, birds and mammals that man has not domesticated but live in the bush without any form of improvements on them. Many are familiar with trees and other forms of plants in the bush. More conventionally, components of the wildlife that interest most people arc the wil d animals. Thus virtually all informlation about wildlife is almost exclusively about wild animals. Nigeria is very rich in wildlife. Most of the larger land animals of the wild in Nigeria are mammals. As mammals, they have hair on their body, have constant body temperature and give birth to young ones which are fed on milk until they are weaned. The reptiles are relatively smaller animals compared to the mammals. They are often covered with scales instead of hair and most of them lay eggs. The young ones from the hatched eggs can fend for themselves and do not receive any parental care.

The most conspicuous and perhaps the most abundant land animals are herbivores which live on plant materials. Some of them feed almost exclusively on grasses and herbs while some feed on parts of trees

those that feed on grasses are grazers while those that feed on trees are browsers. There are others that feed on the flesh of other animals - the carnivores. These latter group are often less numerous than the grazers or herbivores on which they feed. Carnivores are also described predators. However, there are some herbivores that also eat meat. These are omnivores. Prominent herbivores among the wildlife animals of Nigeria are the cane rat or grass cutter (*Thryonomys swinderrianus*) the West African grand squirrel (*Xerus enytoropu*) which are rodents and the African elephant (*Loxondonta Africana*) and the Bush buck (*Tragelaptus scriptus*). Among the carnivorous wild animals of Nigeria are spotted hyena (*Crocuta crocuta*), Lion (*Panthera Leo*) and Leopard (*Panthera pardus*) Among the birds of Nigeria wildlife are the alm nut vulture (*Gypohierax angolensi*) Beaudoin's harrier eagle (*Circaetus beaudouini*) and the Giant King fisher (*Mego-Cergle Maxima*).

Conservation implies the maximum use of the greatest amount of available natural resources that are valuable to the greatest possible number of people who need the resources and for the longest period of time. This infers that conservation is a way of careful use and management of all that is available on earth in such a way that the requirements of both mankind and other living creatures are met as much as possible and for the longest possible period of time - almost indefinitely. Thus conservation does not indicate that the resources of the earth are to be preserved untouched but to be rationally used such that they will be available virtually for ever. Wildlife conservation is the wise use of all the living things of the earth, in such a way that the needs of both mankind and other living things are satisfied, and in such a manner that the resources will be available on a sustainable basis. In the case of wild animals, otherwise known as games, the wise use will involve the control of the methods of hunting such that the numbers of the animals remain high. It could also imply the restriction in the types of weapons and hunting methods, season of hunting, reserves where hunting is to be done.

The first and most developed game reserve, the Yankari Game Reserve was created in 1956. It is situated in Bauchi State. It has a total land area of 2,240 Km<sup>2</sup>. Since then, many other game reserves have been created. A national park, the Kainji National Park, made up of former Borgu and Zugurma game reserves have been created. Prominent among the countries wildlife reserves are the Yankari Game Reserve, The Kainji National Park, the Old Oyo Game Reserve and the Okomu, show records that the total area reserved for the purposes of protecting the Nigerian wildlife is 1.7% of the country's 919,800 km<sup>2</sup>, while another 1.1 % has been proposed for protection.

The habitat of Nigeria's wildlife cut across the ecological zones of the country. There they are to be found in all of the mangrove swamps, High forest, Guinea Savanna, Sudan Savanna and the Sahel Vegetation types. Thus the 250 species of animals that Nigeria is reported to have are distributed among these vegetation zones. Similarly, the thirty games reserves and six national parks, one Nature Reserve and one biosphere reserve are distributed among the country's vegetation zones.

Wildlife is a principal source of animal protein to the rural people in Nigeria. Bush meat from wildlife was reported to have contributed about 4% Nigeria's GDP in 1965. To the rural people, wildlife is very important in traditional medicine. It is also important for medical research. By far the most economic importance of wildlife is the fact that wildlife of game reserves are potential tourist attraction from which certain nations like Kenya and Tanzania earn a good part of their national incomes.

## **ACTIVITY I**

1. Locate an area, 4 metres by 4 metres beside your home. Count the number of male lizards and the female lizards. Note the ratio of female to male lizards. Watch for up to 40 minutes the movements of the male lizards. Observe how friendly or unfriendly the male lizards are. Watch the Lizards feed.

## **ACTIVITY II**

1. Visit a zoo in the town nearest to you. Observe the number of reptiles, birds and mammals in the zoo. What animals make up the mammals in the zoo.

## **ACTIVITY III**

1. Go to a stream close to your home or school and spend twenty minutes in the morning and in the evening on two consecutive days. Observe the birds that visit the trees or shrubs at the edge of the stream. Note their colours. Check if the birds that visit in the morning are the same for the two days. Also check if the ones that visit in the evenings on the two days are the same. Check if the birds that visit in the mornings are the same that also visit in the evenings.

## **SUMMARY**

In this unit you learnt that:

- Wildlife includes all uncultivated and non-domesticated living things.
- Conservation is the rational use of reserves.
- Wildlife conservation is the controlled and rational management of all living components of the natural resources on a sustained basis.
- Wildlife animals are a dominant feature of wildlife. Wildlife, which is the main source of bush meat is being exploited also to a point of virtual extinction.
- Conserving the wildlife in game reserves and sanctuaries, with controlled use for the supply of bush meat and provision of game viewing, will contribute immensely to animals protein supply and enhance the nation's revenue.

## **ASSIGNMENT**

1. Explain the terms wildlife and conservation.,
2. List some of the benefits of wildlife conservation.
3. Give examples of Nigerian Wildlife rodents, and birds.
4. Explain some of the feeding patterns of Nigerian wildlife animals.

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## **UNIT 8: MANAGEMENT AND CONSERVATION TECHNIQUES IN WILDLIFE**

### **INTRODUCTION**

In this unit, you will learn about the art of wild life management. You will understand the philosophy of and objectives of wildlife management. You will learn the methods of and the information required for controlling cropping of wildlife. You will also learn the sustainable yield cropping of wildlife

These forest reserves complete for use as game reserves, sites for timber production, or grazing, or as farmland for crop production. The realization of the derivable benefits from wildlife conservation depends on the efficiency with which the wildlife manager preserves the species, enhances and even increases the population of the useful species to as to make room for cropping to yield bush meat. The manager also matches the wildlife harvests against annual production capacity. You also read in Unit 8 that wildlife conservation implies a controlled use of the natural resources of wildlife such that the benefits will be sustained. The art of controlling the use of wildlife resources, enforcing restrictions on method, seasons, areas of and tools for cropping of wildlife, along with the promotion of the values of wildlife are aspects of wildlife management.

### **OBJECTIVES**

After studying this unit, you should be able to:

1. plan the yield of a wildlife garden;
2. control the cropping of the wildlife and maintain the habit of a wildlife reserve.

### **WORD STUDY**

Degradation - reduction in the quality of

Habitat - the natural home

Ecosystem - the totality of the combination of living organisms and their environment.

### **MANAGEMENT AND CONSERVATION TECHNIQUES IN WILDLIFE**

Wildlife management is the application of ecological knowledge to manipulate a population of vertebrate animals and their plant and animals associates in a manner that strikes a balance between the needs of those populations and the needs of man. This implies that the populations could be left without any human interference, or directly manipulated by cropping or culling, or indirectly manipulated by altering the vegetation, depending on the circumstances of the population and the needs of man.

The main objectives of wildlife management are the preservation of the species already present in the reserve; the maintenance of the population of useful species; the stabilisation or decrease of certain species to maintain the ecological balance of the ecosystem of the reserve; and the limiting of the cropping of the wildlife to the value of the annual production level of the reserve.

The consumptive uses of the wildlife reserve include fruits from the abut associates as well as bushmeat from the animals component. The non-consumptive uses of wildlife include recreation interms game viewing, aesthetic, sport, hunting, bird watering, fuelwood gathering for heating and leaves gathering for wrapping foods.

The inhabitat of the wildlife is in most cases a forest environment. This habitat needs to be monitored and prevented from degredation. You need to monitor the animals themselves, know the total number of species, the birth rate and the survival of the young ones until age of production.

The habitat of the wildlife can be controlled through a modification of the species and the rate of their growth. Fire 1S often used

### **ACTIVITY I**

Animals frequently visits streams, rivers and lakes to drink water. Go to a stream in a bush, hide close to the stream such that you can see the stream. Watch the stream for two hours and observe which animals came to stream to drink water. Also carefully observe if they browse on any plant close to the stream. Observe whether they come singly or in a group. See if there are young ones.

### **SUMMARY**

- To get the benefits of wildlife conservation, the game reserve will need to be efficiently managed.
- Wildlife management is the application of ecological principles to manipulate the animals and associated plants and other living things for the maintenance of an appropriate balance.
- The main objective of wildlife management is to maintain a good balance of the population of the species, while enhance an increase of desired species for eventual cropping. Cropping is controlled such that it should not be more than the value of the annual yield.
- The techniques of wildlife management and conservation involve the maintenance of wildlife habitat and the control of and monitoring of the population rise is often used as tool for habitat manipulation.
- The techniques of wildlife management and conservation involve the maintenance of wildlife habitat and the control of and monitoring of the population rise is often used as tool for habitat manipulation.

### **ASSIGNMENT**

Give the objectives of wildlife management.

1. How would you control the cropping of your wildlife population?
2. Give the objectives of wildlife management.
3. What other land uses compete with the use of a forest as a game reserve
4. Give some consumptive uses of wildlife

## UNIT 9 BASIC ECONOMIC PRINCIPLES OF DEMAND AND SUPPLY

### INTRODUCTION

In order to know how a market economy works and how resources are located in an economic system. It is very important to understand what determines the demand and supply of goods and services.

### OBJECTIVES

By the end of this unit , you should be able to:

- Define demand and supply
- Explain the law of demand and supply
- Explain the factors affecting demand

### WORD STUDY

Consumer: buyers of goods and services

Income: amount of money received over a period of time either as payment for work, goods, or services, or as profit on capital.

Commodities: an item that is bought and sold, especially an unprocessed material.

**DEMAND:** This is the quantity of that commodity which a consumer is willing and able to buy at a given price during a given period of time.

### Laws of Demand

1. The law of demand states that the lower the price, the greater (higher) the quantity of goods that will be demanded.
2. The higher (greater) the price, the smaller (lower) the quantity that will be demanded.

**Demand Schedule:** This is a table showing the relationship between the price and quantity of that commodity demanded.

#### Demand Schedule For Yam

Price of Yam (N)	Quantity of Yam Demanded (N)
5	10
4	20
3	30
2	40
1	50

## **Factors Affecting Demand**

1. The price of a commodity, the higher the price the lower the quantity that will be demanded.
2. The price of other commodities will make consumers to look for close substitutes.
3. Taste of consumer for a particular commodity.
4. Income of the consumer will determine the quantity of commodity to be demanded.
5. The amount of tax will also influence the quantity to be demanded of a given commodity.
6. Other factors like the population of a place, expectation of changes in price of commodity or period of festivals like Christmas and salah will also affect the quantity of goods to be demanded.

## **Elasticity of Demand**

This is the degree of responsiveness of demand to a small change in price of a commodity.

### *Types of Elasticity*

1. Price elasticity
2. Income elasticity
3. Point elasticity

### *Types of Price Elasticity*

1. Unit elasticity.
2. Inelasticity of demand.
3. Elastic demand.
4. Zero elasticity of demand.
5. Perfect or infinite elasticity of demand

## **Shift in a Demand Curve**

It is possible for the quantity of the product demanded by a consumer to change while the price remains unchanged, hence there is a new demand curve that shows relationship between quantity demanded and price.

### **Demand curve can shift through the following**

- (i) Rise or fall in consumer income.
- (ii) Customer taste.
- (iii) Prices of other related products.

## **Basic Assumptions of Demand**

- That there are no very close substitutes.
- That the habits of the consumer remain unchanged.
- There is no change in taste.
- No change in consumers' behaviour.
- That the income of consumer remains the same.



## ACTIVITY I

Explain the term demand

## ASSIGNMENT

Enumerate the factors affecting demand

## SUPPLY

This is the quantity of goods which producers are able and willing to offer for sale at given prices over a period of time.

### Law of Supply

The law of supply states that the higher the price, the greater the quantity that will be supplied and the lower the price, the smaller the supply.

### Supply Schedule

This is a table which shows the relationship between price and quantity of commodity supplied. This shows the quantity of goods that can be supplied at a given price.

**Supply Schedule For Rice**

Price of Rice (N)	Quantity of Rice supplied (Kg)
10	100
8	80
6	60
4	40
2	20

### Factors which cause change in supply

- 1 Changes in price of commodity.
- 2 Changes in the cost of production.
- 3 Changes in the technique of production.
- 4 The effect of weather.
- 5 The effect of taxation.
- 6 Shift in consumption by consumers.
- 7 Change in demand.
- 8 Change in distribution or marketing channels.
9. Change in the number of producers.
10. Aims and objectives of the farmers.

Supply curve may shift to the left or right depending on the factors which may reduce or increase supply at a given price.

A change in the following can lead to a shift in supply.

- (i) Prices of substitutes. (ii) Level of technology.

(iii) Prices of factors of production

### Elasticity of Supply

This is the degree of responsiveness of supply to little changes in price of goods.

$$\text{Elasticity} = \frac{\text{Percentage change in supply}}{\text{Percentage change in Price}}$$

#### Types of Elasticity of Supply

- 1 Unit elasticity of supply  $E = 1$
- 2 Inelastic supply:  $E < 1$
- 3 Elastic supply:  $E > 1$
- 4 Zero elasticity of supply
- 5 Infinite elasticity of supply

#### Implications of Demand and Supply

For Agricultural Production

- 1 When the demand for a farm produce exceeds supply, prices would tend to rise and farmers would tend to produce more of such goods.
- 2 When the demand is lower than supply, price would fall, and farmers would be discouraged from production.
- 3 When there is increase in the income of consumers there will be increase in the demand for agricultural products and vice versa.
- 4 Higher supply of agricultural products by producers may lead to reduction in price and demand.
- 5 High cost and lack of farm inputs may lead to low supply and high cost of farm products.
- 6 The increase in the number of farmers will lead to higher supply and reduction in price of products and vice versa.

#### Equilibrium Price

This is the price at which the quantity of goods demanded and supplied are equal.

Price (N)	Quantity of Yam	
	Demanded (kg)	Supplied (kg)
1	500	100
2	400	200
3	300	300
4	200	400
5	100	500

#### Law Of Diminishing Returns

The law of diminishing returns states that as more and more of a variable factor of production is added upon a fixed factor of production, the output tends to increase up to a certain point above which each

successive unit of the variable factor makes smaller and smaller addition to the total output and finally total output may even decrease.

## ACTIVITY II

State the law of Diminishing Returns

## SUMMARY

You have learnt that:

**Demand:** This is the quantity of that commodity which a consumer is willing and able to buy at a given price during a given period of time

**Supply:** This is the quantity of goods which producers are able and willing to offer for sale at given prices over a period of time.

## ASSIGNMENT

What are the factors affecting supply?

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## **UNIT 10      SUMMARY**

### **INTRODUCTION**

Forestry and wildlife management is a discipline that is hardly known by either the public at large. It is a fact that forests stabilize the environment, protein and also provide many industrial raw materials. Forestry is an applied science of the study of plant and animal lives in the forest. Wildlife management is the aspect of forestry concerned with study of uncultivated and non-domesticated plants and animals.

### **OBJECTIVES**

By the end of this you should be able to:

1. Appreciate the place of forest in the life of any person.
2. Appreciate the place of forestry and wildlife management in the socio-economics of the nations.
3. State the basic economic principles of demand and supply.

### **Forestry and Wildlife Management**

Forestry and wildlife management as a discipline is the applied science of the study of forest and vegetation types and also the living plants and animals in the forest and vegetation types. A forest is a type of plant community that made up predominantly of trees to the virtual exclusion of grasses.

There are different types of forests based on their being located in the temperate or tropical plants of the world. They also differ in structure, appearance and the types of trees in them. We have tropical forests in Nigeria. The forests provide immense amounts and different types of products which contribute to the economic growth of the nation. The timber from forests contributes to saw milling, furniture manufacture and boat building. Paper is made from forest trees. There individual activities involving forest trees. There individual activities involving forest derived raw materials provide employment opportunities. Some other forest plants provide food, building materials and medicine. Forest also protects the environment. In Nigeria, the prevailing types of forest are the tropical forest. Towards the south, close to the coast, is the mangrove vegetation. Closely surrounded by the fresh water swamp is the low land tropical rainforest. The vegetation zone contains most of the timber species. The northern part of the country has the dry forest, otherwise called the savanna vegetation. There are different types of savanna: The guinea savanna, sudan savanna, and sahel savanna.

A savanna is a vegetation of plant community predominantly of grasses but with some trees.

### **ACTIVITY I**

1. Move out of your home take a taxi or a boy outside your city until you are few kilometers after the last horses of the city.
2. Look at both sides of the road and decide which type of vegetation you are watching.

### **Concept of Wildlife Conservation and Agroforestry**

Every Nigerian tree has been described in a book called “Nigerian Trees”

The useful ones among the trees, after their identification, can be grown in plantations. Most trees stay for several years in the plantations before they are due for harvesting to yield revenue while trees are yet to mature for cropping. This method of planting trees with food crops with economic trees species on the same plot of land.

The animals in the forest may also be preserved and managed for desired benefits chief among which is often for bush meat. The animals in the forest which have not been domesticated are referred to as wild life conservation.

The science of manipulating the wildlife, using knowledge of the animals and their environment is called wildlife management. Chief among the techniques of managing and conserving wildlife is that the harvested animals (referred to as cropping) must not be more than the annual yield of the animals.

A piece of forest where wild animal stay and is protected by law is called a game reserve. To save the animals and preserve them for future generations, wild animals especially the types that people value for bush meat are now domesticated and mass produced.

Snails and cane rats (grass – cutter) are among the types already being domesticated.

## **ACTIVITY II**

1. Wake up before 6:00 am on any day stay under a tree close to your house.
2. Listen to the music by the birds that visit the tree. See how many types of birds you can observe and note which birds is making which sound.
3. Judge how melodies the birds' music is.

## **SUMMARY**

Forestry and wildlife management is the applied science that deals with study of forests and vegetation and the plants and animals contained in them.

There are different types of forest and vegetation

Most economic trees are in the forest vegetation.

The trees have been studied and described and can now be identified using a special key for which sixteen characters are used.

The animals of the forest are also being conserve and managed for bush meat and viewing.

## **ASSIGNMENT**

Tick the correct answer

1. A forest has plenty of grasses (True or False)
2. A dry forest is another word for savanna (True or False).

3. Cropping should be more than annual yield (True or False).
4. Wildlife domestication stalls conservation (True or False).

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# ANSWERS

## MODULE ONE

### MEANING, HISTORY AND IMPORTANCE OF AGRICULTURE

#### UNIT 1 MEANING OF AGRICULTURE

##### ACTIVITY I

1. Agriculture is the science and art of cultivating the land to produce plants and rearing of animal for the use of mankind.
2. Business and occupation opportunities in agriculture include:
  - a. Agricultural production - This deals with the actual cultivation of crops and rearing of animal (Fanning)
  - b. Marketing, distribution and transportation of the product and occupation in agriculture.
  - c. Agricultural produce processing in industries.
  - d. Farm Management - agricultural business.
3. Professions in Agriculture include
  - i. Agricultural Science Teachers (Agric Educators)
  - ii. Research Specialists,
  - iii. Agricultural Extension service agents.
  - iv. Veterinary officers

##### ASSIGNMENT

1. Agriculture is the art and science of cultivation and rearing of animals which constitute farming. It also includes the study of supply of inputs, the processing and uses of agricultural outputs. (15 marks)
2.
  - i. Agriculture as an industry is said to have farming as its centre because farming involves cultivation of plants that produce the raw materials for all other industrial processes to produce the finished products that are consumed by people. (15 marks)
  - ii. Agriculture provides employments in the listed areas below. People specialize in particular areas and make the area their profession.
    - (a) Farming,
    - (b) Agricultural Education
    - (c) Research Specialists
    - (d) Agricultural Extension Services providers
    - (e) Horticulturists
    - (f) Veterinary Officers
    - (g) Agro-allied chemist, etc, (20 marks)

Total = 50 marks

## UNIT 2 THE HISTORY OF AGRICULTURE

### ACTIVITY I

The two phases of the history of Agriculture were Paleolithic and Neolithic ages.

1. The two periods differed greatly. Paleolithic age - was the Old stone age. During this period, people wandered from places to places in quest of food. Hunting and fishing, gathering of wild berries and other fruits were the major occupations. There was no fire, people ate food and animals raw. No villages, no property, only weapons used in hunting.  
The Neolithic age IS also known as the New Stone age. Agriculture was discovered by accident. People settled down in homes to cultivate and rear animals.  
Domestication of animals and crops started during this period. People were also engaged in different occupations e.g pottery, weaving of cloths etc.
2. It was by accident that agriculture was discovered by a woman. The woman went out gathering berries. Some fell and germinated, some grew and bore fruits. People then settled and started domesticating animals Instead of their wandering practices. Domestication of plants and animals took off and mixed farming started.
- 3
  - a. The animals, reared were goats, sheep, cattle & horses. Crops cultivated were, rice, wheat, Barley oats, sorghum, millet, tobacco and groundnut.
  - b. The implements or tools used were Neolithic hoes, Neolithic sickle, wooden digging stick of South African bushman. Also were the jaw bones of animals with teeth and sharpened chipped flints with cutting edges.

### ASSIGNMENT

The prehistoric period of Agriculture dates back to between I million and five thousand years before Christ (1,000,000 - 5,000 BC). The early history of Agriculture is usually discussed in two periods namely Paleolithic age and Neolithic age.

The Paleolithic age is characterized by wandering for food by hunting, gathering of wild berries, nuts and other fruits. No idea of fire, food were ate raw, and special weapons consists of simple wooden clubs, bones and horns of animals.

The Neolithic age was the age when Agriculture was accidentally discovered and crops and animal domestication began. People then began to settle from their wandering life. People also started processing their crops during this period and special tools started developing. (50 marks)

## UNIT 3 TOOLS OF EARLY FARMING

### ACTIVITY I

1. Tools used by the Early fanners Included:
  - a. Neolithic hoe
  - b. Neolithic sickle
  - c. Wooden digging stick.

**Neolithic hoe has the following features:**

- wooden handle
- pointed stone at the head



- use for breaking the soil clods.

**Neolithic Sickle has the following features:**

- wooden handle
- groove lined with flint cutting blades
- used for harvesting
- cutting of grasses and weeding

**Wooden digging stick:**

- wooden handle
- weight of stone at the centre, for deep penetration.
- Used for ploughing and cultivation
- Also used for Digging, planting and harvesting root crops.

**Advantages**

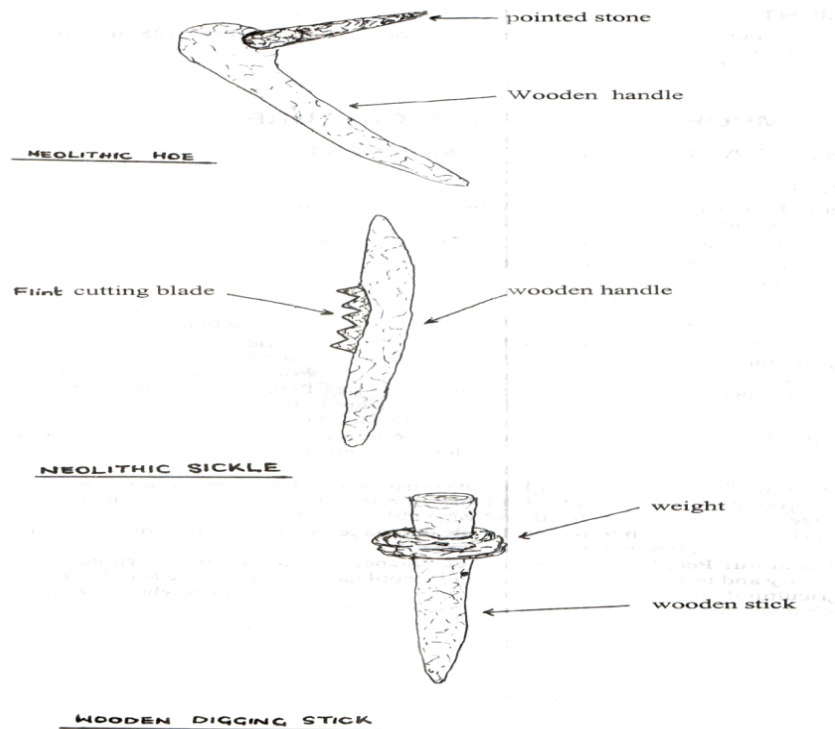
- No special training to operate.
- Cheap and easy to maintain,
- Can be easily constructed and operated,

**Disadvantages**

- Poor Economic efficiency in terms productivity.
- Time consuming in operation.
- Labour intensive and energy consuming.
- Not suitable for all types of soil and crops.

These early farmers' tools do not enhance productivity. They are used for small scale area cultivation.

2. Drawings of main tools used by early farmers



## ASSIGNMENT

1. Discuss your answers with your course tutor at the study centre (25 marks)
  2. Correct construction (25 marks)
- Total = (50 marks)

## UNIT 4 IMPORTANCE OF AGRICULTURE

### ACTIVITIES

1. Agriculture is important to people because it has the following to offer:
  - Production
  - processing and conversion of Agric produce
  - Inspection and quality control
  - Marketing
  - Research and education
  - Maintenance, finance and insurance
  - Catering and management
2. Agriculture as a key factor to rural development.  
Agriculture products are raw materials for industries.  
They give rise to the establishment of small scale and cottage industries. People are employed in these industries. Better standard of living is ensured. Infrastructure, institutions, utilities like water, light and made available. Good roads are linked to the areas, rural-urban migration by the youth will be limited. Finally with all the above, the area will rise to urban status as development set in.
3. Agriculture provides food for human consumption. Balanced ration is provided as carbonhydrates are made available through the agricultural products like maize, yam, egg, beans, fruits and vegetables, etc.  
**Foreign Earnings:** International trade is engaged with the export of agricultural produce. This attracts foreign earnings.  
**Education:** People are trained to be teacher of agriculture in primary, post primary and tertiary institutions. Some people are engaged in research work on agricultural problems. People are trained as trainers of trainers who disseminate technical ideas on

### ASSIGNMENT

1. Agriculture as a key factor to rural development.  
Agriculture products are raw materials for industries.  
They give rise to the establishment of small scale and cottage industries. People are employed in these industries. Better standard of living is ensured. Infrastructure, institutions, utilities like water, light and made available. Good roads are linked to the areas, rural-urban migration by the youth will be limited. Finally with all the above, the area will rise to urban status as development set in.

## UNIT 5      DIFFERENT AREAS OF AGRICULTURE

### ACTIVITY

1. The areas of Agricultural Science - this can be represented in a pie like chart as follows:



2. Two major areas of Agriculture are:

Crop science and animal science

**Crop Science:** A branch of agriculture that deals with the production of crops. It emphasizes on the place of food crop in the economy of the nation. It has many areas like Agronomy and Crop protection. It deals with distribution of crops, climatic factors of production, soil requirement and management, harvesting, storage and procession etc. It offers job in the areas of production, marketing agricultural produce, research and education.

#### **Animal Science**

This is a field that deals with the production of domesticated animals. It involves management, diseases and their control, breeding selection, processing, storage and marketing of the animal products. This area offers many jobs as the area is subdivided. There is job in production, processing and marketing healthcare under vet medicine.

2. Occupations in Agricultural Science education are:

- Agricultural production
- Agricultural produce processing
- Marketing of Agric Produce
- Teaching/Education
- Research
- Agricultural Engineering and mechanization
- And civil service jobs.

3. Agricultural Engineering and mechanization

This deals with the application of machines in agricultural operations

Objectives of Agricultural engineering farm mechanization are:

- To ensure high productivity
- To reduce druggery in the farm

- Timelessness

<b>Agricultural Education</b>	<b>Agricultural Extension</b>
Formal education	Informal out of class education
Hemogeneous clientele	Heterogeneous clientele
Examination is the source of Evaluation	Exhibition and agric shows are the way of evaluation
Carried out in the classroom	Carried out in the home and farm
Entry qualification e.g. SSCE, TC II, NCE, etc.	No entry qualification required
Set out curriculum by the school	Planned on the need of the farmer

### ASSIGNMENT

- Any five of the following make up area of agriculture.
    - farming and farm
    - Soil and water management
    - extension and research services
    - horticulture
    - Climatology
    - Agricultural Education
    - Crop Science
    - Animal Science
    - Fisheries
    - Forestry
    - Vet medicine
    - Agricultural Engineering
    - Farm mechanization (15 marks)
  - The listed areas of agriculture in these questions are treated in details at the tertiary level of our educational system but the foundation and basic knowledge are developed step by step from primary, through secondary to the tertiary level of education. It is, therefore, important to take Agricultural Education seriously from the basic education level (primary and junior secondary schools). (20 marks)
  - Agricultural science is the systematic study of the input, process and products of agriculture. It is divided into crop science and animal science and further subdivided according to roles they play in improvement of agriculture. (15 marks)
- Total = 50 marks

### ASSIGNMENT

- Provide raw materials for agro-allied industries
  - Provision of food
  - Increase the farmer's income etc. (15 marks)
- Maize, Rice and Sorghum (10 marks)

3. - Cowpea, Beans and Groundnut  
- Lettuce, Cabbage and Tomatoes. (15 marks)  
Total = 40 marks

## **UNIT 6 PROBLEMS OF AGRICULTURE IN NIGERIA**

### **ACTIVITY I**

#### **Problems of Agriculture in Nigeria**

- 1) Inadequate Land or Land Tenure System
- 2) Inadequate Finance or Credit Facilities
- 3) Poor Transportation Network.
- 4) Inadequate Storage and Processing
- 5) Inadequate Farm Inputs
- 6) Poor Marketing System
- 7) Inadequate Agricultural Education and Extension
- 8) Problems of Pests and Diseases

### **ASSIGNMENT**

How the problems of Agriculture do affect agricultural production?

1. By reducing its yield
2. Inadequate agricultural Education and Extension will hinder the farmers from knowing new methods for maximum production, knowledge of improved seeds
3. Poor marketing System hinder the sales of farm products, produce and inputs.
4. Inadequate storage and processing brings surplus during harvest and scarcity after harvest.
5. Inadequate land reduces the production of both crop plants and animal
6. Inadequate credit facilities, reduces production, no loan to increase, inputs, labour or even purchase more land.

## **UNIT 7 SOLUTIONS TO THE PROBLEMS TO AGRICULTURE**

- a. Inadequate Land or Land Tenure System  
Fertilizers and manure should be used to increase production of crops in the available land. Crop rotation should be practiced by farmers.
- b. Inadequate Finance or Credit Facilities  
Agricultural banks like Nigeria Agricultural and Co-operative Bank (N.A.C.B.) should make loans available to farmers.
- c. Poor Transportation Network.  
Construction of new feeder roads to open up the rural areas, construction of water ways to link up the riverine areas and railways to connect rural areas to urban centres
- d. Inadequate Storage and Processing
  - Storage facilities should be provided by the government at subsidised rates.
  - More people should be trained on the technology of food storage and processing.
  - Government should buy excess produce and store for future use.
  - Provision of silos in the rural areas for storage of grains by government.

- Farmers should be encouraged to construct cribs, barns and rumbus for proper storage of farm produce after harvesting.
- Provision of cold stores for perishable produce and livestock products.

**e. Inadequate Farm Inputs**

- Farm inputs, like fertilizers, pesticides, feeds, drugs, etc., should be made available in adequate quantities to farmers.
- Government should subsidise the cost of farm inputs.
- Farm inputs should be supplied at the right time to farmers.
- Local sourcing of these inputs should be encouraged.
- Establishment of tractor-hiring unit at affordable costs to farmers.
- Establishment of seed service for the production and distribution of improved seeds to farmers.

**f. Poor Marketing System**

- Government should buy excess produce from farmers.
- Government should stabilise prices of farm produce.

**g. Inadequate Agricultural Education and Extension**

- Mass literacy programme should be embarked upon by the government, e.g. nomadic education.
- Rural farmers should be trained on modern systems of farming.
- Adequate and qualified extension officers should be employed to teach peasant farmers new innovations and techniques in agriculture.

**h. Problems of Pests and Diseases**

Insecticides and other chemicals used in the control of pests and diseases should be supplied at subsidised rates.

Pests and diseases control units or departments should be established to control pests and diseases.

**ASSIGNMENT**

Same as answers to activity 1.7 above with brief explanation.

**UNIT 8 LAND AND ITS USES**

**ACTIVITY I**

**Uses of Land**

- Land is used for the production of food crops like yam, rice, maize, cassava, cowpea, etc., as well as production of cash crops like cotton, rubber, cocoa, groundnut, etc.
- Provision of food e.g. maize, yam, cassava, etc.
- Provides employment to many people.
- It provides income to farmers
- It provides raw materials for industries, e.g., cassava, maize, rubber, cocoa, etc.
- It aids the development of towns where commercial agriculture is practised.
- Some crops are sources of foreign exchange for the nation.

- Land is also used for natural grazing for livestock like cattle, sheep and goats. Large areas of land are set aside in savanna belts where there are abundant grasses for grazing by livestock.
- Livestock provides food in form of protein, e.g; meat and eggs.
- It provides employment, e.g., cattle rearers, poultry farmers, etc.
- It provides feed for farm animals.
- It also provides hides and skin for making musical drums, belts, shoes, etc.
- It can provide foreign exchange for the nation when livestock or its products are exported.
- It is also used for the construction of residential houses and buildings. It also involves the development towns, housing estates and all other forms of settlements. In urban areas, a large proportion of land is needed for the construction of residential buildings.
- Land is also used for construction of many forms of roads, railway line as well as airports. Transportation by road alone constitutes one of the uses of land, especially in urban areas
- Industries are also located on land. Majority of the industries are located in industrial estates which constitute a large proportion of urban land.

### **ASSIGNMENT**

Land where minerals are found are used for mining. In Nigeria, most of the lands where petroleum, coal, tin and other minerals are located are used mainly for mining purposes

## **UNIT 9 LAND USE DECREE**

### **ACTIVITY I**

Advantages of Land Use Decree

1. People can acquire land outside their tribe or state, that is, anywhere within Nigeria.
2. Large hectares of land can be acquired for agricultural purposes.
3. Certificate of occupancy can be used to source for loan from banks.
4. Land can be used efficiently and properly.
5. It has made land acquisition relatively easier for new entrants into agriculture.
6. It has reduced the number and frequency of court cases over land ownership.
7. It prevents fragmentation of land since land acquired under the decree cannot be shared into bits.

Disadvantages of Land Use Decree

1. It makes it difficult for the federal government to acquire land.
2. Land acquisition now lies on the few rich individuals.
3. It makes land use difficult.
4. It creates room for irregularities as many land speculators may backdate land agreement before the decree.

### **ASSIGNMENT**

Aims of the Land Use Decree

1. This decree is aimed at reallocating land in order to make more lands available to intending farmers for large-scale agricultural production.
2. To also remove the bad effects and arguments which land has generated in Nigeria.
3. It facilitates planning of programmes for a particular land use.

4. It allocates land and creates opportunity for enterprising farmers to acquire more land for large scale farming.

## **UNIT 10                      SUMMARY**

### **ACTIVITY I**

1.     Agriculture is the science and art of cultivating the land to produce plants and rearing of animal for the use of mankind.
2.     The two phases of the history of Agriculture were Paleolithic and Neolithic ages.  
The two periods differed greatly. Paleolithic age - was the Old stone age. During this period, people wandered from places to places in quest of food. Hunting and fishing, gathering of wild berries and other fruits were the major occupations. There was no fire, people ate food and animals raw. No villages, no property, only weapons used in hunting.  
The Neolithic age IS also known as the New Stone age. Agriculture was discovered by accident. People settled down in homes to cultivate and rear animals.  
Domestication of animals and crops started during this period. People were also engaged in different occupations e.g pottery, weaving of cloths etc.

### **ASSIGNMENT**

1. Agriculture is important to people because it has the following to offer:
  - Production
  - processing and conversion of Agric produce
  - Inspection and quality control
  - Marketing
  - Research and education
  - Maintenance, finance and insurance
  - Catering and management

### **2. PROBLEMS OF AGRICULTURE IN NIGERIA**

- 1) Inadequate Land or Land Tenure System
- 2) Inadequate Finance or Credit Facilities
- 3) Poor Transportation Network.
- 4) Inadequate Storage and Processing
- 5) Inadequate Farm Inputs
- 6) Poor Marketing System
- 7) Inadequate Agricultural Education and Extension
- 8) Problems of Pests and Diseases

### **3. Uses of Land**

- Land is used for the production of food crops like yam, rice, maize, cassava, cowpea, etc., as well as production of cash crops like cotton, rubber, cocoa, groundnut, etc.
- Provision of food e.g. maize, yam, cassava, etc.



- Provides employment to many people.
  - It provides income to farmers
  - It provides raw materials for industries, e.g., cassava, maize, rubber, cocoa, etc.
  - It aids the development of towns where commercial agriculture is practised.
  - Some crops are sources of foreign exchange for the nation.
  - Land is also used for natural grazing for livestock like cattle, sheep and goats. Large areas of land are set aside in savanna belts where there are abundant grasses for grazing by livestock.
  - Livestock provides food in form of protein, e.g; meat and eggs.
  - It provides employment, e.g., cattle rearers, poultry farmers, etc.
  - It provides feed for farm animals.
  - It also provides hides and skin for making musical drums, belts, shoes, etc.
  - It can provide foreign exchange for the nation when livestock or its products are exported.
  - It is also used for the construction of residential houses and buildings. It also involves the development towns, housing estates and all other forms of settlements. In urban areas, a large proportion of land is needed for the construction of residential buildings.
  - Land is also used for construction of many forms of roads, railway line as well as airports. Transportation by road alone constitutes one of the uses of land, especially in urban areas
  - Industries are also located on land. Majority of the industries are located in industrial estates which constitute a large proportion of urban land.
4. It states that:
- All the land in Nigeria belong to the government
  - The right to allocate land is vested in the hands of the state governor.
  - The state governor or any person delegated by the governor is the only one who can issue "certificate of occupancy" to an individual and with this certificate, the person can now have or lay claim to the land.
  - The period of ownership of land will not exceed ninety-nine years.
  - Crop production is allotted 500 hectares while grazing is allotted 5,000 hectares
  - Adult Nigerians of twenty years and above have a right to acquire land.

## **MODULE 2**

### **PLANT FORMS, CLASSIFICATION**

#### **UNIT 1      EXTERNAL FEATURES OF MONOCOTYLEDONS AND DICOTYLEDONS**

##### **ACTIVITY I**

1. The external feature of monocotyledon is divided into two parts
  - a) Vegetative part - which is made up of Root, Stem and Leaf
  - b) Reproductive part which is the Flower
2. Distinguishing features of monocotyledon include
  - a) possession of one cotyledon in the embryo
  - b) narrow, oblong leaves, with parallel veins
  - c) floral parts are usually in threes or multiples of three.

## ASSIGNMENT

1. Flowering plants are plants which at certain stage of their growth produce flowers and seeds and are classified botanically as Angiosperm. There are two main types of flowering plants (monocotyledon and dicotyledon). (15 marks)
2. Differences in the external features of monocot & dicot are as tabulated below:

<b>Monocotyledon</b>	<b>Dicotyledon</b>
(a) Leaves are usually narrow oblong and parallel-veined petiole often absent	(a) Leaves are broader with net – venation. Petiole usually present.
(b) Fibrous root system	(b) Tap root system
(c) Possess flower parts in threes or multiples of three	(c) Possess flower parts in fours, of fives or multiples four of five.

Total = 30 marks.

## UNIT 2

### ACTIVITY I

1. **Crops** are classified based on:
  - their life cycle
  - their agronomic classification
2. Annual crops: are those crops that complete their life cycle in one growing season. Example, maize, rice, wheat  
Biennial crops: are those crops that complete their life cycle in two growing seasons. In the first season they produce vegetative parts while the seeds are produced in the second growing season or year. Examples include Onions and garlic.  
Perennial Crops: These crops live for many years and once fully developed they produce seeds each year. Examples are cash crops like cocoa, oranges, coffee, mangoes etc.

## ASSIGNMENT

Based on this, a crop classification based on life cycle is grouped into:

- **Annual crop**
  - **Biennial crops**
  - **Perennial Crops**
2. Based on this, a crop may be.
    - a) **Annual crop**: . Examples include maize, rice, and wheat.
    - b) **Biennial crops**: Examples include Onion, garlic and pepper.
  3. **Perennial Crops**: Examples are cash crops like Cocoa, Coffee, and Palm trees.

## UNIT 3

### ACTIVITY I

1. Millet - Cereal  
Rice - Cereal  
Maize - Cereal, Forage  
Potato - Root

Yam - Root  
Cotton - Fibre  
Cowpea - legume.

2. a) Silage:  
Crops grown and cut down in succulent condition for animal feed. An example is maize ploughed
- b) Green Manure:  
These are crops grown and then ploughed under in the green state to improve soil properties. An example is soya bean.

### ASSIGNMENT

1. Discuss your answers with your study-mate and your Course Tutor. (25 marks)
2. Crop Classification Examples given in this unit.  
Spices \_\_\_\_\_ Pepper, ginger  
Beverages \_\_\_\_\_ cocoa, Coffee  
Supplement Crops \_\_\_\_\_ Soya bean or cowpea inside maize  
Companion Crop \_\_\_\_\_ Banana as nurse to cocoa seeding. (25 marks)  
Total = 50 marks.

## UNIT 4 ANNUAL, BIENNIAL AND PERENNIAL CROPS

### ACTIVITY I

1. Annual crops: are those crops that complete their life cycle in one growing season.  
Biennial crops: are those crops that complete their life cycle in two growing seasons.
2. a. Form staple food in many parts of the world.  
b. Source of nutrients for man like carbonhydrates, protein and vitamins

### ACTIVITY II

1. Perennial crops are those that live and grow for 3 or more seasons.
2. Herbeceous: Examples are Rhizomes, corn, bulbs and tubers. They may also be Trees or Shrubs.

### ASSIGNMENT

1. i. Annual ii. Biennial iii. Perennial (15 marks)
2. Annual; Maize cowpea  
Biennial: carrot, cabbage  
Perennial: Mango, Ginger, Onion. (15 marks)  
Total = 30 marks

## UNIT 5 AGRICULTURAL CROPS I: CEREALS

### ASSIGNMENT

1. List of cereal crops produce in Nigeria:  
Maize, rice, sorghum, millet, wheat etc
2. The explanation to give to local farmers on the need to apply fertilizer to maize farms includes:

Increase in yield per hectare of farm land and for the same labour compared with when fertilizers are not applied.

3. (i) Diseases and pests of maize are:
    - Maize rust disease
    - Maize smut diseasePests (a) stem borer (b) Army worm
  - (ii) Disease and pest of rice are:
    - Rice blasts
    - Rice smutPests (a) stem borer (b) rodent
  - (iii) Disease and pest of sorghum are:
    - Open smut
    - Downy mildewPests (a) weevils (ii) midge larvae (iii) birds
4. Botanical names
    - Maize - *Zea mays*
    - Rice - *Oryza sativa*
    - Sorghum - *Sorghum* spp.

## UNIT 6 AGRICULTURAL CROPS II (LEGUMES)

### ASSIGNMENT

1. Legumes should be included in a crop rotation because they can fix nitrogen in the soil. (5 marks)
2. To spray with insecticides against insect pests in both field and during storage, field sanitation, and good weeding. (5 marks)
3. The root system of a leguminous plant has nodules attached to it while that of cereals do not. (5 marks)
4. The botanical names of the following:
  - i) Soya bean - *Glycine max*
  - ii) Cowpea - *Vigna unguiculata*
  - iii) Groundnut - *Arachis hypogaea* (15 marks)Total = 30 marks

## UNIT 7 AGRICULTURAL CROPS III: ROOT CROPS

### ASSIGNMENT

1. The tubers crops discussed in this unit are as follows»
  - i) Yam
  - ii) Cassava
  - iii) Cocoyam.

Relative planting distance commonly use for

- i) Yam is 90/100cm
- ii) Cassava is 90x90cm
- iii) Cocoyam is 90x90cm

Compare these with the local spacing in your area, and discuss reasons for any difference.

2. Capping is done to prevent excessive heat from the sun which may affect the immediate soil environment of the yam and also to reduce the rate of evaporation.
3.
  - i) Yams -Vegetative propagation
  - ii) Cassava - vegetative propagation
  - iii) Potato - vegetative propagation
  - iv) Cocoyam - vegetative propagation
4. i) White Yam - *Dioscorea rotundata*

- ii) Water Yam - *Dioscorea alata*
- iii) Aerial Yam - *Dioscorea bulbifera*
- iv) Bitter Yam - *Dioscorea dumetorum*
- v) Cocoyam - *Xanthosoma sagittifolium*

## UNIT 8 AGRICULTURAL CROPS IV: (VEGETABLE CROPS)

### ASSIGNMENT

Leaf vegetables are: Amaranth, Indian spinach, water leaf, Bitter leaf, Lettuce, cabbage etc.

Fruit vegetables are: Tomato, sweet pepper, Garden egg, Okro, Pumpkin, Cucumber, and so on.

Legumes vegetables are: Beans and Peas, Cowpeas, Lima beans, winged beans, French bean etc.

Root vegetables are: Risga and Tumuku, Sweet Potato, Chinese Yam, Irish Potato; cocoyam, Carrot, Onions, Ravish, Beetroot, Shallots, Leeks etc. (20 marks)

2. A vegetable is that edible portion of a herbaceous annual or perennial crop; Vitamin A, Thiamine and Vitamin C. (10 marks)
3. Backyard gardening - Done at backyard of houses, manage by families, has a small area, it is labour Intensive. (5 marks)  
 Extensive vegetable farming - done at large scale, it is mechanized, done far away from cities. (5 marks)
4. Factors are:
 

a) Rainfall	b) Temperature	c) Humidity
d) Day length	e) Soil Condition	f) Transportation
g) availability of labour	h) Marketing.	(10 marks)

Total = 50 marks

## UNIT 9 STORAGE

### ACTIVITY I

The types of food crops that are fast in perishing are:

- a. Fruits like mango, pawpaw
- b. Vegetables like spinach and lettuce.

### ACTIVITY II

The possible reasons why farmers store their food crops are:

- a. To have food throughout the year
- b. To have seeds for the next planting season
- c. To sell during the period of scarcity and make more money
- d. To have food during festivities.

### METHOD OF STORAGE I

#### ACTIVITY III

- (a) Maize grains have to be bagged and raised on platform before storage because:
- i) it helps to reduce the menace of pests
  - ii) it conserves space in the storehouse

- iii) it helps in keeping the grains dried
- iv) it is easier to transport

#### ACTIVITY IV

- (a) The industries that are well known for storing their grains in silos are
  - i) the brewery
  - ii) the flour mill
- (b) Grains in the brewery are used for brewing beer and some soft drinks like malting. The flour mill uses grains to process it into flour of sermovita and flour for baking bread

#### ACTIVITY V

- a. The students should write down their findings.
- b. The best types of grains that are stored in rhumbu are unthashed guinea corn and millet.
- c. Rhumbu is common in the north because:
  - i) most of the food crops produced in the north are cereals
  - ii) the amount of rainfall in the north warrants its durability
  - iii) the rhumbu which is built with mud and thatch roof helps to keep the high temperature cool.

#### ACTIVITY IV

- a. Yams are raised in racks because
  - i) to reduce the attack of rodents
  - ii) to keep it dry
  - iii) to prevent it from coming into contact with some organisms that may cause its rot
- b. One of the main reasons why yam is tied singly on racks is to avoid them from contacting disease from each other. When a rotten yam touches a healthy yam, there is that tendency that it will also rot.

#### ANSWERS TO ASSIGNMENT

1. Reasons why yams without rot should be put in barns
  - a. to avoid others from becoming rotten too
  - b. to keep the barn dried
  - c. to reduce organisms that are likely to cause damage to the yam
  - d. to allow enough space for healthy yams to be stored (20 marks)
2. Grains are stored in silos when the quantity of grains is very large. (10 marks)
3. First the rhumbu is constructed using mud walls with a thatched roof. The side constructs a small window just large enough to put or remove the grain. The grains are then put through the window. (20 marks)

Total = 50 marks.

#### ANSWERS TO ACTIVITIES

##### ACTIVITY VI

- a. Food items that have to be processed before storage include:
 

Cassava	processed into gari
Tomato	processed into tamato paste
Milk	tinned milk (Peak milk)
Meat	corn beef
Fish	fish meal.
- b. The student should be able to notice that on most of the containers of processed foods, there is a processing and an expiration date indicated on them. Most of these processed foods have a period not exceeding two years before use.

## ACTIVITY V II

- a. An oven is a heated chamber mainly used for baking.
- b. Meat can be stored using these two methods among others
- c. canning
- d. dehydration - this include drying, frying, smoking.

## ANSWERS TO ASSIGNMENT

1. The best method of storing meat is by freezing. This keeps the meat fresh for a long period. The taste of it is retained. A large portion of meat can be stored using this method  
However, this method is only effective where there is electricity to make the freezers work. (25 marks)
2. The things to be noted of before one can store fish in an oven may include:
  - a. the fish should be properly washed
  - b. apply some little salt on the fish
  - c. spread it in the oven
  - d. adjust the oven to a suitable temperature
  - e. close and on the oven. (25 marks)

Total = 50 marks.

## UNIT 10 SUMMARY

- I. Perennial crops are those that live and grow for 3 or more seasons.
- II. Oranges, mangoes, pears, Avacadro, coconut, guava, cashew, cocoa, rubber etc.

## ASSIGNMENT

1.

- 3 cereal crops produce in Nigeria.

- Maize, rice, sorghum,

2.

- 3 legume crops produce in Nigeria.

- Soya bean, cowpea, groundnut

- 3 cereal crops produce in Nigeria.

- Amaranthus, Tomatoes, Lettuce, Onions, Cabbage

## MODULE 3

### AGRICULTURAL IMPLEMENTS AND FARM MACHINES

#### UNIT 1 SIMPLE FARM TOOLS

##### ACTIVITY I

**Hand trowel:** This is made of curved heart shaped metal blade with short wooden handle. The curved surface is called a scoope.

**Cutlass** - This made of short wooden handle and metal steel blade. It is of various sizes and shapes.

## ASSIGNMENT

1. The tools will differ from locality to locality. Show your answer to your course tutor. (20 marks)
  - 2 & 3 Show your drawing to your course tutor (30 marks)
- Total = 50 marks.

## UNIT 2 USES AND CARE OF FARM TOOLS

### ACTIVITY I

#### 1.Hoe:

- It is used for making ridges, mounds and beds.
- It is used for harvesting yams, cocoyam, cassava etc.

#### Cutlass

- It is use for clearing bushes and cutting down trees.
- It is used for digging shallow holes.

#### Sickle:

- It is use or harvesting rice, guinea corn, wheat etc.
- It is used for cutting forages for livestock

#### 2. Maintenance of farm tools:

1. Grease or oil the metal parts to avoid rusting.
2. Well and replace the damage parts
3. Sharpen the blunt blades.

## ASSIGNMENT

1. Importance of farm tool
  - It increase efficiency of the farmer
  - It helps to increase productivity.
  - It help farmers to increase the hectares of land cultivated (15 marks)
2. Use of:
  - a. Garden fork
    - It is used for transplanting seedlings
    - It is used for spreading and mixing manure
  - b. Watering can
    - It is used for watering seedlings and flowers during the dry season.
    - It is used to spray insecticides to crops (15 marks)
3. General care of simple farm tools are
  - Farm tools should be used for the specific purpose it was meant for.
  - Farm tools should not be littered everywhere after use. They should be kept on a farm tool box or in the store.
  - All farm tools with metal blades should be greased or oiled to avoid rusting.
  - All farm tools with wooden handle should be replaced when damaged and hanged in a rack to avoid termite bite. (20 marks)

Total = 50 marks



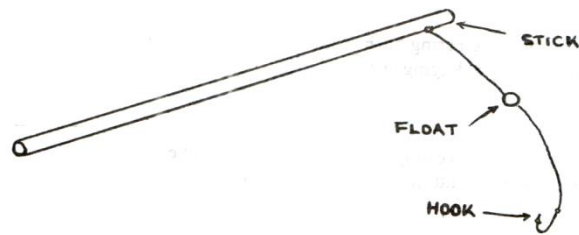
### UNIT 3 SIMPLE FISHING TOOLS

#### ACTIVITY I

Some local fishing tools in my locality are – baskets, spear, bow and arrow, hook and line, net, calabash and trap.

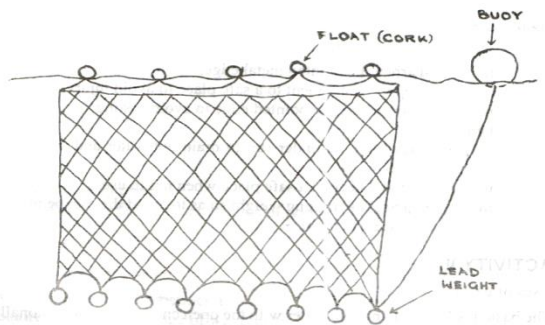
#### ACTIVITY II

#### HOOK AND LINE



This tool is made of long stick, float and a strong thread attached at one end of the stick. At the end of the thread, there is a hook made of iron which is bent. The stick, float, thread and hook and what is known as hook and line.

#### GILL NET



It is made of strong thread in form of curtain hanging vertically in the water. The float is attached at the top while the weight made of lead are attached the bottom that is sub-merged into the sea.

#### ASSIGNMENT

1. Hook and line, basket, calabash, spear-any one (5 marks)
2. i. To enable the fishermen to harvest in large quantity  
ii. it increases efficiency in fishing.

To make fishing interesting (10 marks)



Fishing basket is similar to ordinary household basket but much deeper and tapers from the open end of the closed bottom. (5 marks)

## UNIT 4 USES AND MAINTENANCE OF FISHING TOOLS

### ACTIVITY I

Maintenance practices for

- a. Spear:
  - i. Sharpen the pointed metal edge.
  - ii. Keep the implement to a safe place to avoid injury.
  - iii. Oil or grease the pointed edge to avoid rusting.
- b. Drag net:
  - i. Spread the net under sun to drain out water and avoid the growth of mould.
  - ii. Fold and keep in a safe place when not in use.
  - iii. Replace the missing weight so as to avoid the escape of fish.,
  - iv. Replace when old.

### ACTIVITY II

Uses of basket:

The basket is lowered into the water with the open end in front. Occasionally it is lifted up and inspected to see if any fish is caught.

Also the basket can be left in the water over night with a bait (earthworm). The basket is then inspected the following day to see if any fish is caught.

### ASSIGNMENT

Uses of:

1. a. Hook and line  
Hook and line: a float is thrown into the river. The earthworm is attached to the hook. The movement of the float indicates that fish is trapped by the hook.  
(10 marks)
- b. Cast net:  
When the fishermen sees fish, the net is thrown quickly and the metal pieces (sinkers) allow the edges of the net to sink thereby enclosing the fishes within the area where the net covers. By pulling the strong cord attached to the edges of the net, the edges come closer and form something like bag in which the fishes are trapped. (15 marks)
2. The reasons are:
  - i. Some of the fishing tools are expensive and fishermen cannot always afford to buy them.
  - ii. It will help one to advise an intending user of fishing tools. (10 marks)
3. Care of basket:
  - i. Dry the basket under the sun when not in use.,
  - ii. Close up all the openings to prevent fish loss
  - iii. Remove all the dirt collect in the basket. (15 marks)

Total = 50 marks

## UNIT 6 FARM POWER

### ACTIVITY I

Five sources of farm power are:

- i. Man

- ii. Animal
- iii. Solar
- iv. water
- v. mechanical
- b. Advantage of man power
  - i. Man co-ordinate other sources of power with his knowledge.

## ACTIVITY II

The disadvantages of water power:

- i. It is very expensive to construct darns.  
it requires expert knowledge of what to do.

## b. WIND POWER

- i. It is sporadic (uncertain)
- ii. it is very expensive

## ASSIGNMENT

1. The use of power supply is to help to reduce drudgery (hard work)  
It helps to increase area of farm for cultivation.  
Power from electricity also helps in heating, drying and lighting on farms.  
It helps to increase production of crops. (15 marks)
2. Powers to be kept on ideal farm are:
 

i. Mechanical power	ii. Man power	iii. Water power
iv. Fuel power	v. Animal power	vi. Electrical Power.

(15 marks)
3. Power supply
  - a. Wind  
Advantages of wind power
    - i. It is used in winnowing and drying agricultural products.
    - ii. It can be used to turn wind mill which can pump water to water crops.
 Disadvantages of wind power
    - i. It is expensive to construct
    - ii. Wind 15 uncertain. (15 marks)
4. a. Sources of farm power:
 

i. Man power	ii. Animal power	iii. Mechanical power
iv. Wind power	v. Water power	vi. Fuel power
vii. Electrical power	viii. Solar power	(20 marks)

  - b. One use of these sources
    - Man power - Man power is used to control other sources of farm power
    - Animal power - Animal power is used to pull other farm implements
    - Mechanical power - Power from machines are used in heavy operation like stumping, harvesting etc.
    - Wind power- It is used in winnowing and drying of agricultural product.
    - Water power- This is used to generate electricity

Fuel power- This is used to produce energy in machines which can be used to work.

Solar power- This is used in drying of farm produce. (15 marks)

Total = 80 marks

## **UNIT 7 FARM MACHINERY AND TYPES**

### **ACTIVITY I**

Five advantages of Mechanization are.

- |                             |                                |                               |
|-----------------------------|--------------------------------|-------------------------------|
| i. Increased productivity   | ii. Increased income           | iii. Increased human drudgery |
| iv. Timeliness of operation | iv. Thoroughness of operation. |                               |

### **ASSIGNMENT**

#### **1. Advantages of using Machines**

It is time saving, and thus, leads to increase in production by individual farming family.

Expansion of cultivated area (hectare) is made possible with mechanization such that few people can feed a large population.

Drudgery and human suffering associated with the use of traditional tools has been eliminated, because farmers now manage labour rather than supplying it.

Farming become attractive and could influence young enterprising people into farming

More income is likely to accrue to the farmer. This will help in raising the standard of living of the farming family.

More through work is achieved by using machine than when manual labour is applied.

More job opportunity is made possible in agriculture with the use of machinery. Drawers, Mechanics could be trained and refined for agricultural purposes.

2. These are mechanically operated equipment that are used in agricultural production.
3. a. Making Tractor hiring at Agro-centre located near local farmers and at the appropriate line.  
b. Ensuring steady supply of fuel.

## **TYPES OF FARM MACHINERY**

### **ACTIVITY I**

General purpose tractor/Bulldozer/Dryer/Incubators/Milking Machine/Sheller

### **ACTIVITY II**

Tractor coupled implements/Mouldboard plough/Disk plough and Disk harrow/Planter/duller  
Sprayer/Harvester/Fertilizer distributor

### **ASSIGNMENT**

1. As in Activity I and II (20 marks)
2. Tractor coupled implements includes Disc and Mouldboard.  
Disk harrow  
Planters/seed drolleries  
Boom sprayer  
Tractor trailer (15 marks)

3. Farm Machinery used in crop production
- |                               |                 |                                |
|-------------------------------|-----------------|--------------------------------|
| i. Disk or Mould board Plough | ii. Disk harrow | iii. Ridger                    |
| iv. Planter/ Seed driller     | v. Sprayer      | vi. Fertilizer/manure spreader |
| vii. Harvester                | viii. Sheller   | Any 4. (15 marks)              |
- Total = 50 marks

## UNIT 8 USES AND MAINTENANCE OF FARM MACHINERY

### ACTIVITY I

Compare uses of sheller and harvester

#### Sheller

1. Cracks/break the outer covering of nuts without cutting the crop
2. Separate the grain/seed from its husk or shell
3. May combine with thresher in rice milling

#### Harvester

1. Cuts standing crop
2. Tresh the crop harvested
3. Separate grains from chaff
4. Use in baling grass
5. Transport the harvested crop

### ACTIVITY II

The most common machines used in local areas are (1) Tractor (2) Sprayer.

Reasons

The ability of tractor to travel in rough terrain

It has different implements that can be used in different ecologies.

- b. The sprayer
- i. It is cheap
  - ii. Easy to operate
  - iii. The problem of pest and diseases is serious to avoid losses farmers endeavour to buy chemicals and spray.

### ASSIGNMENT

Tractor

1. Transporting workers and farm produce
2. Ploughing the land
3. carrying fertilizer to the farm

#### Incubator

1. Allow the farmer to time when he wants to receive the young chicks.
2. A hatching of egg
3. Could be used to hasten or delay hatching by adjusting temperature

#### Sprayer

1. Used to spray herbicides to control weeds
2. Used to spray pesticide or insecticides to control crop pests

3. Powdered chemical could be sprayed as dust using boom sprays.

### **Dryer**

To facilitate processing of produce

Facilitate storage by removing excess moisture

Used for drying tobacco, and drying meat, fish

### **Bulldozer**

1. Removal of unwanted tree and stumps on the farm.
2. Bush clearing of newly found land
3. Used for road construction on the farm. (50 marks)

Total = 50 marks

## **MAINTENANCE OF FARM MACHINERY**

### **ACTIVITY II**

Regular checking for wear and tear, tightening of bolts and nuts replacing same when they are bad, cleaning or parts and applying antirust chemicals, sharpening the shares when they become blunt.

### **ASSIGNMENT**

- i. i. Farm machines are maintained to reduce depreciation cost, so that it could be sold easily when the farmer decides to dispose it.  
ii. Extending the working life of the machine  
iii. Ensure that the machine is always in readiness for work at any time. (15 marks)
2. Methods of preventing rusting  
i. Painting of the metal surface  
ii. applying grease and oils on rubbing parts  
iii. applying steel coating (15 marks)
3. i. Prevent over heating by removing dirt's and grease accumulation  
ii. Daily examination for loose nuts and bolts to ensure safety  
iii. Lubricate all rubbing parts to prevent mal functioning. (15 marks)
4. i. Bolts and nuts are tightened to get moving parts in position ensures that parts fits tightly.  
ii. To prevent the removal of parts for example, types while at work.  
Total = 60 marks

## **UNIT 9 FARM STRUCTURE**

### **ACTIVITY**

Farm structures are simple and temporal buildings on the farm that are designed to serve specific purposes.

## **UNIT 10 SUMMARY**

1. Five sources of farm power are:
  - i. Man
  - ii. Animal

- iii. Solar
  - iv. water
  - v. mechanical
2. Some local fishing tools in my locality are – baskets, spear, bow and arrow, hook and line, net, calabash and trap.
  3. Advantages of water power
    - Electricity are transmitted to homes, offices and industries for use
    - It can be use as a source of power for processing machines.
    - Environmental Pollution is eliminated.
  4. Hand trowel as farm tools
 

This is made of curved heart shaped metal blade with short wooden handle. The curved surface is called scoope. It is used to transplant seedlings.

Cutlass as farm tools

The cutlass consists of flat blade made of steel or short wooden handle. One edge of cutlass is normally sharp, while the other end is blunt. It is used for weeding and felling (cutting) trees.

## ASSIGNMENT

- **Advantages of using Machines**

1. It is time saving, and thus, leads to increase in production by individual farming family.
  2. Expansion of cultivated area (hectare) is made possible with mechanization such that few people can feed a large population.
  3. Drudgery and human suffering associated with the use of traditional tools has been eliminated, because farmers now manage labour rather than supplying it.
  4. Farming become attractive and could influence young enterprising people into farming
  5. More income is likely to accrue to the farmer. This will help in raising the standard of living of the farming family.
  6. More through work is achieved by using machine than when manual labour is applied.
  7. More job opportunity is made possible in agriculture with the use of machinery. Drawers, Mechanics could be trained and refined for agricultural purposes.
- Farm machinery is defined as mechanically operated devices that are used in agricultural production. There Machines used in crop production include tractor, and tractor drawn implements such as disc plough, or Marldboard Plough used for primary tillage.
  - Uses of Farm Supply
    - The use of power supply is to help to reduce drudgery (hard work)
    - It helps to increase area of farm for cultivation.
    - Power from electricity also helps in heating, drying and lighting on farms.
    - It helps to increase production of crops

## MODULE 4 SOIL

### UNIT 1 DEFINITION AND PHYSICAL COMPOSITION OF SOIL

#### ACTIVITY I

1. **Materials needed:** glass Jar, soil sample, and water.

**Procedure:** Take a glass jar, put some soil sample into it, then pour some quantity of water into the glass jar containing the soil sample.

**Observation:** It will be immediately observed that some bubbles of air will be seen on top of the water showing that water is displacing the space created by air.

#### ACTIVITY II

The four components of soil are

- |      |                |   |     |
|------|----------------|---|-----|
| i.   | mineral matter | - | 45% |
| ii.  | organic matter | - | 5%  |
| iii. | water          | - | 25% |
| iv.  | Air            | - | 25% |

#### ASSIGNMENT

- Soil is used as a place where plants can grow on
  - The soil houses the living organisms which help in the decomposition (breaking down) or organic matter. (10 marks)

2. **Mineral matter -functions.-**

Mineral matter is also known as parent material which is broken down as a result of weathering to form gravel, sand, clay, silt etc. So, how fertile a particular soil is depends on the parent material from which it was derived from.

**Organic matter - functions:-**

Organic matter increases the fertility of the soil.

It improves the water holding capacity of the soil. It improves the amount of air present in the soil. It increases the nutrient content of the soil.

**Living organism - Functions:-**

They bring about the breaking down of organic matter in the soil.

They help in the mixing of the top soil.

They facilitate aeration (amount of air) in the soil.

They improve the water holding capacity of the soil and water retention.

**Soil water:- Functions**

It helps to dissolve plant food.

It helps to cool temperature. (20marks)

**Soil types are as follows:**

Gravel, sand, clay, silt. (20marks)

Total = 50 x 2 = 100marks.



## UNIT 2 MAJOR TYPES OF SOIL

### ACTIVITY I

1. Major types of soil: clay, sand, silt, clay and loam.
2. Similarities between silt and clay:  
Both of them feel smooth and soft.  
The movement of air and water in the two types of soils is the same.

### ACTIVITY II

When shapes or ribbon forms very readily and can easily bend into a ring when moistened, then it is clay soil.

### ASSIGNMENT

1. Two crops that can do well on clay soil are rice and sugarcane. 20marks
2. Weathering: - weathering is the breaking down of rocks by certain agents into smaller particles to form soil. 20marks
3. A farmer can improve on clay and silty soils by adding some organic materials to them. (20marks)
4. Characteristics of sandy soil have been provided in the unit
  - It is loosely packed and has large particles.
  - It is coarse, gritty or rough.
  - Rate of water percolation is high.
  - Has low water retention
  - It cannot form shape when moistened (or any other correct answer) 40marks.

Total = 100 marks

## UNIT 3 FERTILITY MANAGEMENT I (by Rotational Cropping)

### ACTIVITY I

Soil fertility is the ability of the soil to supply the growing plants with enough air, water and nutrient.

### ACTIVITY II

Using maize, yam, soya bean, and cassava, plan a four course crop rotation.

#### PLAN OF A ROTATION

Yr	1 <sup>st</sup> Plot	2 <sup>nd</sup> Plot	3 <sup>rd</sup> Plot	4 <sup>th</sup> Plot
Yr 1	Maize	Yam	Soyabean	Cassava
Yr 2	Yam	Soyabean	Cassava	Maize
Yr 3	Soyabean	Cassava	Maize	Yam
Yr 4	Cassava	Maize	Yam	Soyabean

## ASSIGNMENT

1. Using the plan of a crop rotation designed in Activity II, You can see that maize was planted on the first plot, during the first year, followed by yam on the second plot, followed by soya bean and lastly by cassava.  
Maize, soya bean area shallow rooted crops while yam and cassava and deep rooted crops are following the deep rooted crops. The soya bean in the rotation is a leguminous crop, so will help in fixing nitrogen into the soil, thereby replacing the nutrients that were used up by crops like maize. (40 marks)
2.
  - i. Crop rotation: crop rotation is the growing of different types of crops in a definite order on the same piece of land in successive years. 10 marks.
  - ii. Inter-planting: it is the growing of a major crop in between planting of another major crop on the same piece of land. 10 marks
  - iii. Intercropping: it is the planting of quick growing and quick maturing crops between slow growing and slow maturing crops. 10 marks.
3. Advantages of crop rotation
  - It helps in regaining soil fertility
  - It makes available plant nutrient requirement to the next crop to be grown on the land and hence increase the yield.
  - It requires no technical knowledge to practice bush fellow. (5 marks)Total = 25 x 4 = 100 marks

## UNIT 3 FERTILITY MANAGEMENT (BY ROTATIONAL CROPING)

### ACTIVITY I

1. Soil fertility is the ability of the soil to supply the growing plants with enough air, water and nutrients.
2. The principles of crop rotation can be stated as follows:
  - i. The crops should be arranged in such a way that an increase in the yield of one results in an increase in the yield of the next crop. For example, a good legume crop will increase the nitrogen content of the soil with the results that, if the next crop is maize, which requires nitrogen, it will do well.
  - ii. Crops that require high nutrient should come first in a rotation.
  - iii. Deep rooted crops should follow shallow rooted crops. This enables the deep feeder crops to collect some of the nutrient materials that could be washed into deeper layers of the soil (sub soil).
  - iv. It is necessary to consider the pests and diseases that attack the crops in the rotation. As far as possible; the crops that are attacked by the same pest or diseases should not follow each other.
  - v. Crops that are closely related must not follow each other in a rotation.

## UNIT 4 ORGANIC MANURE

### ACTIVITY I

It will be observed that the crops growing on soil A will perform better because of the presence of organic matter in the soil. The addition of organic matter will

- i. Increase the nutrient of the soil
- ii. Improve the water retention of the soil.

- iii. Improve the aeration (movement of air) of the soil.

### ACTIVITY II

You are expected to choose a good place in your area and prepare a heap compost. You should use the guidelines provided in the unit.

### ASSIGNMENT

1. It is a mixture of livestock droppings with plant materials used as beddings or litter. 5marks
2. Micro-organism that will help compost materials rot very easily
  - Bacteria
  - earth worms
  - fungi
  - algae (any 3) 6marks
3. Micro organism facilitate rate of decomposition of organic manure. 5 marks
4. Advantages of green manure
  - i. It increases the organic matter content of the soil.
  - ii. It reduces leaching.
  - iii. It is used to fix nitrogen into the soil, if legumes are used.
  - iv. They reduce the rate of evaporation of water from the soil. (any 3)  
9marksTotal = 25 x 4 = 100marks

### INORGANIC MANURE

#### ACTIVITY III

1. Inorganic manures are materials that are synthetic or artificially prepared by chemical means which are added to the soil to supply certain elements essential to the growth of plants.
2. There are 3 groups of fertilizers
3. Compound fertilizers, straight fertilizers and complete fertilizers.

#### ACTIVITY IV

1. Primary plant nutrients are Nitrogen (N) phosphorus (P) and Potassium (K).  
Secondly plant nutrients are calcium (Ca) magnesium (Mg) and Sulphur (S)
2. The primary nutrients are considered more important because they influence the availability and functions of the secondary nutrients.
3. **Nitrogen** - growth may stop in affected plants, leaves of plants will lose their normal green colour and turn to yellow.  
**Phosphorus** - red purple colour will be produced along the edge of leaves.  
**Potassium** - leaves of affected plant will look dry especially along the tips and edges of lower leaves. Leaves may begin to curl. This can lead to poor yield or death of plants.
4. Apply the required fertilizer to the affected plant through the soil

## ASSIGNMENT

1. in organic manures are made by chemical means while organic manures are naturally made. (10marks)

2.

Major or Macro	Minor or Micro	Naturally occurring
Nitrogen	Manganese	Carbon
Phosphorus	Iron	Hydrogen
Potassium	Zinc	Oxygen
Sulphur	Molybdenum	
Calcium	Boron	
Magnesium	Copper	
	Chlorine	

3.

Primary Plant Nutrient	Secondary Plant Nutrient
Nitrogen	Sulphur
Phosphorus	Calcium
Potassium	Magnesium

### 4. Nitrogen

It gives plants the green colour,

It is responsible for grain or fruit formation in plants.

### Phosphorus

It helps in fruit ripening

It helps plants to mature

### Potassium

It is needed for chlorophyll development.

It helps in root formation. (2marks)

Total  $50 \times 2 = 100$ marks

## UNIT 5 NUTRIENT LOSS

### FERTILIZER APPLICATION

#### ACTIVITY I

1. Band method. Ring method. Broadcast method and foliar method.

2. No

#### ACTIVITY II

1. The rain will cause downward movement of the fertilizer. This helps to dissolve the fertilizer.

### ASSIGNMENT I

1. Soil erosion carries with it dissolved plant nutrients into streams, river and oceans. 5 marks

2. True. 3 marks

3. Leaching 5 marks

4.
  - a. Apply humus or organic matter
  - b. Apply lime
  - c. Apply fertilizer. 12marks
 Total 25 x 4 = 100 marks

### ASSIGNMENT II

1. The various ways of applying fertilizers are:
  - a. Broadcast.
  - b. Band.
  - c. Ring.
  - d. Foliar (20marks)

2.

CROPS	Method of fertilizer Application
a. Leaf vegetable	Band
b. Tomato	Band or Ring
c. Okra	Band
d. Egusi melon	Band or Ring (20 marks)

3. Leaching is the downward movement of dissolved plant nutrients by soil moisture. 5marks
  4. Leaching could be minimized or avoided by applying fertilizer in splits. 5 marks
- Total 50 x 2 = 100marks

## UNIT 6 SOIL AND WATER CONSERVATION

### ASSIGNMENT

1.
    - a. Bush burning
    - b. Bush clearing.
    - c. Grazing by livestock
    - d. Deforestation (20marks)
  2.
    - a. strip cropping
    - b. plant cover crops
    - c. Plant trees as wind breaks
    - d. Apply mulch or organic matter.
    - e. construct terraces.
    - f. Adopt minimum tillage practice (any 5 for 20marks)
  3. Capillary water is referred to as the available water; because it stays around the soil particles. 6 marks
  4. False. 4 marks
- Total 50 x 2 = 100 marks

## 4.7 PROCESSES AND FACTORS OF SOIL FORMATION

### ACTIVITY

Factors of soil formation:

(i) climate (ii) parent materials (iii) topography (iv) biotic (living organisms) and (v) time.

**1. Climate:** Elements of climate such as rainfall, temperature, wind and pressure are all very important in soil formation.

(i) **Temperature:** The alternating heating and cooling of rocks result in the continual expansion and contraction which eventually result in cracks in the rocks and its consequent breakdown into small pieces to form the soil.

(ii) **Rainfall:** The action of running water from rainfall causes the gradual wearing away of rocks during erosion to form soil. Rainfall provides water for hydrolysis. Also, rain drops may break down some parent rocks to form soil.

(iii) **Wind:** High-wind velocity in deserts carries with it other tiny rocks which collide with one another or other rocks, resulting in the breaking of rocks into tiny pieces to form soil.

(iv) **Pressure:** High pressure on a hanging rock may cause such rock to fall down and break into tiny pieces, resulting in the formation of soil.

**2. Parent material:** Parent materials constitute the major materials from which soil is formed. They are igneous, sedimentary and metamorphic rocks.

**3. Topography:** The shape of the ground in relation to the underlying rock of the earth's surface is known as topography.

**4. Biotic Factors (Living Organisms):** The activities of living organisms help to speed up the process of soil formation.

- (i) Termite, earthworm, rodent mix the mineral and organic matter together, and this results in the formation of soil.
- (ii) They also allow water and air into the soil which eventually react with rocks to cause
- (iii) The activities of man during tillage and other farm operations indirectly help to break rocks into tiny pieces to form soil.

**Soil Time:** Time also plays an important role in soil-formation. It takes a long time for mature soil to be formed.

- (i) It takes a long time for small pieces of rock to disintegrate into grains of soil.
- (ii) It also takes a long time for plants to decay and become part of the soil.
- (iii) It also takes time for rainfall to leach chlorides, sulphates and carbonates from the soil.
- (iv) It takes a short time in the formation of immature soil.

## ASSIGNMENT

Role of the following in soil formation:

- ii. Parent material
- ii. Soil time
- iii. Living things

See above for answers

## **UNIT 5 SOIL COMPONENTS**

### **ACTIVITY I**

Mention 5 components of the soil.

1. mineral of inorganic matter
2. organic matter
3. soil water
4. soil air
5. living organisms

### **ASSIGNMENT**

Explain the following soil components: 1. Soil air                      2. Soil living organisms

**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. T

**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).

## **UNIT 9 SOIL PROFILE, TEXTURE AND STRUCTURE**

### **ACTIVITY I**

Soil texture can be determined by various methods. These methods include:

1. By feeding
2. By mechanical analysis through sieving
3. Sedimentation

### **ASSIGNMENT**

Explain mechanical analysis through sieving for determination soil texture.

By mechanical analysis through sieving: The various sizes/fractions present in a sample of dried soil can be separated by putting the sample into a series of various measured mesh diameters and shaking

vigorously. One starts 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 belong to the corresponding grade of soil.

A sample of soil is placed inside a glass jar and large volume of water is added and the mixture is vigorously shaken and allowed to settle. At the end, large particles like coarse sand and gravel settle at the bottom, while the organic materials float on top of water in the glass jar.

## **UNIT 10 SUMMARY**

### **ACTIVITY I**

1. Similarities between silt and clay:
  - Both of them feel smooth and soft.
  - The movement of air and water in the two types of soils is the same.
2. Components of soil and their percentages

The four components of soil are

- |      |                |   |     |
|------|----------------|---|-----|
| i.   | mineral matter | - | 45% |
| ii.  | organic matter | - | 5%  |
| iii. | water          | - | 25% |
| iv.  | Air            | - | 25% |

### **ASSIGNMENT**

1. Three basic types of soil water
  - I. Hydrosopic water
  - II. Field capacity
  - III. Capillary water and
  - IV. Gravitational water
2. Four ways of soil erosion
  - a. Bush burning
  - b. Bush clearing.
  - c. Grazing by livestock
  - d. Deforestation

## **MODULE 5**

### **5.1 AIMS AND OBJECTIVES OF TEACHING AGRICULTURAL SCIENCE IN THE PRIMARY SCHOOL.**

#### **ACTIVITY I**

1. The five (5) aims of teaching agricultural science in primary school include:
  - (a) To build a rational and consistent awareness about agriculture in the pupils.
  - (b) To gain effective understanding of agriculture



- (c) To develop some skills in practicing agriculture.
  - (d) To cultivate the interest in pupils in order to take to farming as a means of livelihood
  - (e) To Inculcate in the pupils basic scientific approaches, attitude and spirit of inquiry and skills in solving agricultural problem.
2. The aim teaching agricultural science In primary school is to create awareness in the pupils about the usefulness of agriculture to mankind and to the entire nation More Important IS to the bring about desirable changes in behaviour in the pupils not to regard agriculture as a punishment subject.
- Another basic am is that children from the non-agrarian homes are motivated and trained to become farmers. The interest has to be put into the pupils' right from the primary school which is understood to be the foundation of all education.

## ACTIVITY II

1.
  - (a) By the end of the lesson on any topic on agriculture you would expect your pupils to; convert, depend, distinguish, estimate, explain, extend, generalize, give example, infer, paraphrase, predict, re-write and summarize what was taught. All these variables fall within a core variable called comprehension.
  - (b) By the end of the lesson on any topic in agriculture, the pupils are expected to define, describe, identity, label, list, name, outline, select and state what was taught. All these fall within a core variable called information.
  - (c) By the end of the lesson on any topic in agriculture, you would expect pupils to breakdown, illustrate, outline, point out, select, separate and sub-divide what was taught. All these full within a core variable called Analysis.
  - (d) By the end of the lesson on any topic in agriculture, you would expect your pupils to categorize, combine, compile, compose, create, device, design, explain, generate, modify, organize, plan, re-arrange, construct, relate, re-organize, and tell what was taught. All these fall within a core-variable called synthesis
  - (e) By the end of the lesson on any topic in agriculture, you would expect your pupils to: appraise, compare, conclude, contrast, criticize, describe, discriminate, explain, justify, interpret, relate, summarize and support what was taught. All these fall within a core variable called Evaluation.
2.
  - (a) By the end of the lesson on any topic in agriculture, you would expect pupil to; appreciate, pay attention, accept, get, hold and direct what was taught. All these fall within a core variable called receiving.
  - (c) By the end of the less on any topic in agriculture, you would expect you pupils to: endure, and practice what was taught. All these full within a core variable called responding
3.
  - (a) By the end of the lesson on any topic in agriculture, you would expect your pupils to physically distinguish, recognize, compare, taste, smell, see, hear and touch what was taught. All these fall within a core variable called perceptual abilities.
  - (b) By the end of the less on any topic in agriculture, you would expect you pupils to; endure and practice what was taught. All these full within core variable called physical abilities.

## ASSIGNMENT

1. The term 'aim' means long term outcome required at the end of the course or the programme. In this context; it refers to desirable changes in behavior of pupils towards agriculture at the end of the course or programme. The term aim gives rise to specific objectives. 10 marks  
The term objective refers to desirable outcome at the end of the lesson. This describes the achievement of pupils at the end of the each lesson within the 45 minutes. Specific objectives in this context are categorized into three domains called the cognitive, affective and psychomotor. Since agricultural science IS practically - minded you are expected to assess your pupils on these three domains so as to make suitable Judgment with respect to skill acquisition. (10 marks)
2. The core variables of specific objectives of teaching agricultural science in primary school include:
  - (a) By the end of the lesson, you would expect your pupils to provide concrete and attainable information based on the instructional materials and learning experiences provided.
  - (b) By the end of the lesson, you would expect your pupils to comprehend adequately all the learning experience in lessons taught.
  - (c) By the end of the lesson, you would expect your pupils to apply in practical terms all that was taught to them within that particular lesson.
  - (d) By the end of the lesson, you would expect your pupils to analyze all the learning experience on that particular lesson.
  - (e) By the end of the lesson, you would expect your pupils to synthesize all the facts taught.
  - (g) By the end of the lesson, you would expect your pupil to value the entire lesson on particular topic in agriculture.
  - (i) By the end of the lesson, you would expect your pupils to perceive facts and principles taught.
  - (j) By the end of the lesson, you would expect your pupils to physically practice all that was taught.
  - (k) By the end of the lesson, you would expect your pupils to finally evaluate the whole teaching learning activities on that particular topic. (any 8) 40 marks
3. The four expected outcome from cognitive, affective, and psychomotor after a lesson on agricultural science include:
  - (a) **COGNITIVE**
    - (i) By the end of the lesson, you would expect your pupils to state clearly the definition of agricultural science.
    - (ii) By the end of the lesson. the pupils should be able to prepare soil samples.
    - (iii) By the end of the lesson. the pupils should be able to give concrete illustrations on the importance of agriculture.
    - (iv) By the end of the lesson, the pupils should be able to construct a large for birds. (20 marks)
  - (b) **AFFECTIVE**
    - (i) By the end of the lesson, you would expect your pupils to accept the concept of modernized fanning systems.

- (ii) By the end of the lesson, you would expect your pupils to internalize the lessons taught for subsequent recall.
  - (iii) By the end of the lesson, you would expect your pupils to pay attention to your teaching.
  - (iv) By the end of the lesson, you would expect your pupils to know the worths of your lesson. (20 marks)
4. As an agricultural science teacher, you will motivate your pupils to practice agriculture through the following ways.
- (i) By allowing them to participate fully in the classroom discussions and on the school farm.
  - (ii) By not allowing them to work under serious sun and rain.
  - (iii) By giving them some agricultural produce harvested from the school farm.
  - (iv) By allowing them to participate in the selling of agricultural produce harvested from the school farm,
  - (v) By t preent and animals in the zoo. (any 4) 20 marks Total = 100 marks

## **UNIT 2      TECHNIQUES OF TEACHING AGRICULTURAL SCIENCE IN THE PRIMARY SCHOOL**

### **ACTIVITY I**

1. Expository approach means verbal presentation of your lesson notes. Through this approach you explain your lessons to your pupils in form of story - telling while your pupils listen without contribution. Using these methods, your pupils are merely at the receiving ends. Since agricultural science is practically- oriented, this method is not good enough for passing information to pupils. It is used for pupil who can reason abstractively. This method will not all on pupils to participate activity and so the required skills emphasized will not be acquired. Expository approach is one of the oldest methods of teaching rural science and primary science so it is outdated in the era of practical and skill acquisition.
2. The four(4) fundamental quidelines for effective usage of exprository approach to the teaching of agricultural science in primary school include:
  - (a) Expositony approach should not merely consist of verbal presentation of facts. If you should use it at all, then you should endeavor to involve pupils as much as possible by askmg questions which lead to critical thinking.
  - (b) There should be continuous interaction between the teacher and pupils so as to minimise tiredness on the part of the pupils.
  - (c) Expository approach should be used to develop concepts and should be directed to principle.
  - (d) Expository approach should not be used alone

### **ACTIVITY II**

1. Discovery/inquiry approach refers to the process whereby pupils find out things about an existing problems themselves with little or no assistance from the teacher. Through this method, the pupils fully participate through learning – by doing. Skills are easily acquired through this method. On the other hand, guided inquiry assist teachers to adopt method of thinking from simple to complex as well as from complex to simple.
2. The five (5) fundamental guidelines of discovery/inquiry approach to teaching of agricultural science in primary school include:

- (a) Discovery approach can be used when agricultural science is moderately structured in a way that it can give teachers some kind of guidance.
- (b) Discovery approach is used when a pre – activity discussion precedes the actual lesson.
- (c) Post – activity discussion should be part of discovery lesson so that questions based on pupils activities can be discussed by the whole class.
- (d) Discovery approach cannot be

### ACTIVITY III

Problem solving approach is the type of training given to pupils to be able to find out answers to problems themselves. In this case, the pupils actually carry out activities without the supervision of the teachers, however, teachers carry out introduction and presentation of teaching materials and learning experience at the beginning of the lesson.

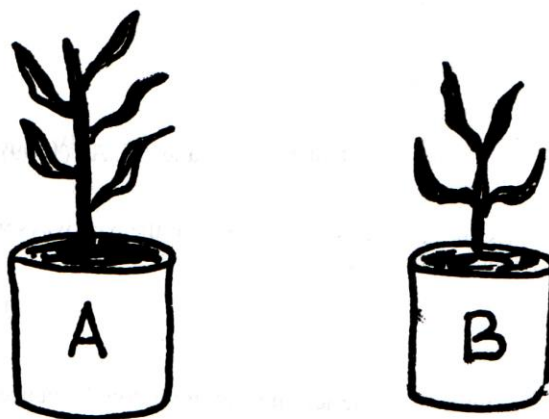
It IS Important to use problem solving approach to teach agricultural science in primary school for the following reasons.

- (a) It easily stimulates pupils’ interest in finding out solutions to problems.
- (b) It enhances active participation of pupils.
- (c) It enhances learning and re-learning through trial and error approach.
- (cl) It enables pupils to understand how to reason critically.
- (c) Since agricultural science is practically-oriented, it will assist pupils to acquire the desirable skill

### ACTIVITY IV

The term pictorial riddle refers to the presentation of pictures and stimulating questions during the teaching/learning process. The teacher presents pictures; posters and agricultural related materials to pupils. In addition, he asks thought - stimulating questions. So the combination of the pictures and questions makes pictorial riddle.

An example of pictorial riddle in agricultural science is the potted healthy growing groundnut plant and non-healthy growing groundnut plant.



The combination of these picture and the questions makes up pictorial riddle.

### ACTIVITY V

1. The term concept map refers to presentation of meaningful related concepts linked together by words in form of a chain.
2. Two importance of concept map in the teaching of agricultural science include:

### Methods of Teaching Agricultural Science

- (a) It enhances long -term remembering ability of pupils.
- (b) It makes easier definition of term in agriculture

### ACTIVITY VI

1. The term 3 - dimensional riddle refers to those objects in their real nature with three dimensions such as height, breadth and weight. These real objects include: hoe, cutlass, shovel, tractor, plants, goat, cow, etc.
2. 3 - dimensional riddle is used in teaching agricultural science in primary school for the following reasons.
  - (a) It creates opportunity for pupils to have direct and personal contact with farm implements and equipment
  - (b) It enhances practical skills of pupils
  - (c) It enhances interest of the pupils
  - (d) It results to perfect recall of learnt materials.

### ASSIGNMENT

1. Two viable approaches required for effective teaching of agricultural science in primary school include:

It enhances practical skills of pupils

  - (a) Discovery / inquiry approach
  - (b) 3 - dimensional riddle

10 marks each = 20 marks
2. Expository approach is regarded less viable in the teaching of agricultural science in primary school due to the following reasons.
  - (a) It allows only teachers to do the talking.
  - (b) It prevents active participation of pupils in the classroom.
  - (c) It does not support practical lessons.
  - (d) Pupils are mere listeners.

15/2 marks each = 30 marks

Total 50 x 2 = 100 marks

## UNIT 3 SCHEME AND PLANS OF WORK PREPARATION

### ACTIVITY I

1. The following are the steps involved in the preparation of Scheme of work for agricultural science.
  - (a) Title of the Course (e.g.) Agricultural Science.
  - (b) Entry behaviour of your pupils.

- (c) Unit Objectives
- (d) Content of the Course
- (e) Methods and Activities
- (f) Materials needed
- (g) Evaluation

### **ASSIGNMENT**

1. The term scheme of work refers to the initial preparations for effective teaching and learning of those learning activities and provision of pupils activities which lead to the achievement of set down objectives.  
Scheme of work covers the entire weeks within the term. (10 marks)
2. As a teacher, you are expected to cover all the necessary details in the scheme of work before examinations. The following procedures will assist you to complete your lessons meant for the whole week.
  - (a) Study the entry points of your pupils.
  - (b) Know their levels of maturity and readiness to accept your teaching.
  - (c) Present your lesson in a simpler manner so as to enhance quick understanding of the subject matter.
  - (d) Involve your pupils actively by sharing out assignments and activities under each unit.
  - (e) Grant them opportunity to form discussion groups under each Unit. (15 marks) Total 25 x 4 = 100 marks

## **UNIT 4 PREPARATION OF LESSON PLANS FOR THE TEACHING OF AGRICULTURAL SCIENCE IN PRIMARY SCHOOL**

### **ACTIVITY I**

1. Some benefits of agriculture to mankind include:
  - a) Provision of food
  - b) Provision of money
  - c) Provision of raw materials for the Industries
  - d) Provision of shelter.
  - e) Provision of employment
  - f) Provision of foreign exchange i.e. money from abroad.
2. The following are all the procedures/steps of preparing comprehensive lesson note.
  - a) Name of the subject e.g. agricultural science
  - b) Topic of the lesson e.g. meaning and importance agriculture.
  - c) Instructional objectives.
  - d) Subject matter (i.e the main note)
  - e) Instructional materials
  - f) Evaluation strategy.

## ASSIGNMENT

1. A planned organised amount of subject matter and learning experience that the teacher will communicate to the a learners with details of how the instruction will take place within a lesson period 10 marks

The lesson plan can be in any topic but must contain all the essential components of a lesson plan (25 marks)

- i) Provision of food
- ii) Provision of money
- iii) raw material for industries
- iv) Provision of shelter Provision of employment
- v) Provision of foreign exchange

(Any 5 correct importance) 3 marks x 5 = 15 marks Total 50 x 2 = 100 marks

## UNIT 5 CLASSROOM, FIELD/PRACTICAL AND LABORATORY MANAGEMENT I

### ACTIVITIES

1. You can effectively manage your classroom through the following ways.
  - a. Have well-prepared lesson note.
  - b. Arrange your pupils' seat well
  - c. Do not pile your pupils on one seat.
  - d. Make available adequate teaching materials.
  - e. Involve all your pupils in the teaching/learning process by asking them questions.
  - f. Keep to your time - table.
2. Practical lessons are effectively managed through the following ways:
  - a. Arrange tables
  - b. Display materials on the table.
  - c. Attach pupils to each material.
  - d. Go round the class and supervise the pupils individually.
  - e. Allocate plots to each pupil.
  - f. Give out working tool to each pupil.
  - g. Supervise each pupil while working on the farm.
3. Pupil's are taught on the farm through the following ways
  - a. Individually
  - b. In a small group.

### ASSIGNMENT

1. Some ways pupils could be involved in maintaining farm tools are;
  - a. as a small group.
  - h. As individual
  - c. Active combination with the teacher. Any 2 (10 marks)
2. The Importance of laboratory management include:
  - a. Increasing the life span of the animals and tools.
  - b. assisting pupils to acquire the necessary skills.
  - c. Prevention of breakages and damages in the laboratory.

- d. Protection of animals and equipment from sun and rain. (any 3) 5 marks - Total = 25 x 4 = 100 marks

## UNIT 6 CLASSROOM, FIELD AND LABORATORY MANAGEMENT 11

### ACTIVITY I

1. The classroom is used for Teaching and Learning.  
The Laboratory is used for Practical demonstration such as test.
2. The four Laboratory Facilities include:
  - a). Microscope
  - b). Thermometer
  - c). Reagents
  - d). Litmus Paper
3. Two things you must not do in the lab.
  - i). Do not eat in the lab.
  - ii). Do not smoke in the lab.

### ACTIVITY 11

1. The functions of the following laboratory equipments.
  - a) Refrigerator: Keeps foods, drugs and its contents cold, fresh and preserved.
  - b) Thermometer: used to measure temperature
  - c) First-Aid kit: used to treat an accident victim before the victim is taken to the Hospital.
  - d) Incubator: used in the hatching of eggs.

For a student with a serious cut on the hand, the equipment to use is the First-Aid kit, because the kit contains basic drugs to treat the students before going to the hospital.

### ACTIVITY III

1. Laboratory management refers to the decision and control of laboratory facilities.
2. Two precautions taken to prevent Accident:
  - i) No Eating in the lab
  - ii) No smoking in the lab
3. Two things that should never be done in the lab:-
  - i) No eating because it can cause chemical poisoning.
  - ii) No smoking because of the presence of inflammable substances in the lab.

### ASSIGNMENT

Facility	Function
Microscope	To aid the eye see very small objects
Reagent	Facilities chemical Reactions
Limtus	Help determine Acidic or Basic environment
First-Aid kit	Used in treatment in cases of accident
Thermometer	Used in measuring temperature

100 marks



## **UNIT 7      AVOIDANCE AND TREATMENT OF ACCIDENTS IN THE FIELD AND IN THE LABORATORY**

### **ACTIVITY I**

1. Accidents can be caused when we are careless, when we underestimate dangers and when we do not take precaution.

### **ACTIVITY II**

Treatment for a student with serious cut in lab session

First get the first-aid kit nearby, then get water and wash the cut thoroughly to remove or prevent infection, then apply first - Aid treatment (i.e. apply iodine and tie within bandage) to prevent excessive loss of blood. Rush the students to the nearest hospital to get full medical attention. (Do not delay taking the student to the hospital).

### **ACTIVITY III**

1. The best method of avoiding accidents in the field and Laboratory is to take appropriate precautionary measures. (Prevention is better than cure).
2. Two safety measures that should be followed in the lab.
3. No smoking in the Laboratory.
4. Switch off all Electrical appliances after every Laboratory session

### **ASSIGNMENT**

1. Precautionary measures to take while in the lab.
  - (a) Carefulness in handling laboratory equipment/instruments.
  - (b) No smoking in the Lab.
  - (c) No eating in the Lab.
  - (d) Put on protective wears.
  - (e) Adhere strictly to safety instructions. (15 marks)
2. two sources of common accidents in the Lab.
  - (i) faulty electrical appliance.
  - (ii) Leakage in gas taps. (10 marks)

## **UNIT 8      SPECIAL PROBLEMS OF AGRICULTURE IN SCHOOLS**

### **ACTIVITY I**

1. Agriculture should be taught in Nigerian schools for the following reasons:
  - i) It provides food for Nigeria
  - ii) Generates foreign exchange from export
  - iii) Provide raw materials for industrial development
  - iv) Provides employment for many Nigerians

### **ACTIVITY II**

1. Two problems facing Agricultural Science in Nigerian Schools include:
  - i) Inadequate finance: Agricultural science requires huge financial investment in setting up laboratories and farms. Most schools do not have enough money to set up good laboratories and farms

- ii) Poor staffing: Most schools offering agricultural science do not have qualified agricultural science teachers. This is so because there are very few trained agricultural science teachers.

### **ASSIGNMENT**

1. Because Agriculture is very important to the Nigerian economy employing many 70 - 80% of Nigerians, providing food for the whole population, generates foreign exchange and provides raw materials for the industries. (10 marks) Inadequate land affects agriculture in school in the following way:

Agriculture as a science discipline requires a lot of practical activities. These practical activities are carried out on the farm. For a demonstration farm to be set up, large expanse of land is required. Without adequate land, it will be impossible to have a demonstration farm. (10 marks) Total = 20 x 5 = 100 marks

## **UNIT 9            QUALITIES OF A GOOD AGRICULTURAL SCIENCE TEACHER**

### **ACTIVITY I**

1. The five desirable qualities of good agricultural science teachers include:
  - i) The teacher should have the basic qualification
  - ii) the teacher should be friendly
  - iii) The teacher should understand the abilities needed by the pupils
  - iv) The teacher must be competent, strong and in good health.
  - v) The teacher should have leadership skills.
  - vi) The teacher should be very patient
  - vii) The teacher should be a pleasant person
  - viii) The teacher should be visionary
  - ix) The teacher should be committed
  - x) The teacher should have professional ethics.

### **ASSIGNMENT**

When a teacher does not have the basic qualification, the teacher will:

- i. not be able to teach the subject to the understanding of the pupils
- ii. not be respected
- iii. exhibit poor or bad leadership skills be incompetent
- iv. not be patient.

## **UNIT 10            SUMMARY**

1. **Four** laboratory facilities  
The four Laboratory Facilities include:
  - a). Microscope
  - b). Thermometer
  - c). Reagents
  - d). Litmus Paper
2. Two things you must not do in the lab.
  - i). Do not eat in the lab.

- ii). Do not smoke in the lab.

## ASSIGNMENT

1. The five desirable qualities of good agricultural science teachers include:
  - i) The teacher should have the basic qualification
  - ii) The teacher should be friendly
  - iii) The teacher should understand the abilities needed by the pupils
  - iv) The teacher must be competent, strong and in good health.
  - v) The teacher should have leadership skills.
  - vi) The teacher should be very patient
  - vii) The teacher should be a pleasant person
  - viii) The teacher should be visionary
  - ix) The teacher should be committed
  - x) The teacher should have professional ethics.
2. The best method of avoiding accidents in the field and Laboratory is to take appropriate precautionary measures. (Prevention is better than cure).

## MODULE 6

### UNIT 1 FARMING AND CROPPING SYSTEMS

#### ACTIVITY

1. Differences between monocropping and monoculture

Monocropping	Monoculture
One crop is planted on the same piece every year. If this crop is harvested, another one crop could be planted, i.e. one crop occupies the land in the season, but not same crop e.g. maize, cowpea.	In this case, one single crop (same crop) is planted on the same piece of land every year, or the same crop occupies the same piece of land for several years e.g. cocoa.

### 6.2 TYPES OF FARMING SYSTEM I (MIXED FARMING)

#### ACTIVITY I

When maize is planted on a plot of land fertilized with poultry droppings, you will observe good growth of the maize. When you compare this to a plot that is not fertilized at all, you will notice differences in the growth, the greenness of the leaf and the total yield of the maize crops. That plot not fertilized will have lower yield as a result of the poor growth.

#### ANSWERS TO ASSIGNMENT

1. Three (3) advantages of mixed farming are:

- a. The fanner gets regular income flow from the sale of animal products such as eggs, meat and milk.
- b. The fertility of the soil is maintained or improved by the deposited faeces and urine on the soil.
- c. Saves the farmer the trouble of buying inorganic fertilizer. (5 marks each = 15 marks)

Mixed farming can be practised in a locality by planting plot(s) of arable crops and raising of livestock such as poultry, pigs, sheep, etc. In the local areas, because these arable crops will be disturbed during the growing season, the animals are either fenced, e.g. pigs, or tethered e.g. goats. Their dropping are swept and poured on the crop plot. This improves the fertility of the soil for the arable crops. When the crop is harvested, the animals are released and allowed into plot to feed (10 marks) Total = 25 x 4 = 100 marks)

### **TYPES OF FARMING SYSTEM 11 (ARABLE FARMING)**

#### **ACTIVITY II**

1. Cotton as a fibre crop produces the cotton lint which is used in textile manufacturing industry to make clothes that people put on in my community. The seeds are also valuable because salad oil is extracted from them. From this salad oil, margarine can also be manufactured. The residue resulting from this oil extraction known as cotton-seed cake act as a valuable protein source in livestock feeding.

#### **ASSIGNMENT**

1.
  - a) Annual crops are crops that require only one season to grow to maturity e.g. Guinea corn, Yam, Maize (5 marks)
  - b) Biennial crops are crops that require two seasons of growth to reach maturity, e.g. Cassava. (5 marks)
  - c) Perennial crops are crops that require more than two seasons of growth to reach maturity. Once they reach maturity, they produce flower every season, e.g Kola, Cocoa, rubber. (5 marks)
2. The class of crop in the discussion that produces nicotine is the drug crops (from tobacco). Nicotine which is extracted from the leaf and stem of tobacco, can be used in the manufacture of drugs and insecticides. (15 marks)

Total= 25 x 4 = 100 marks

### **TYPES OF FARMING SYSTEMS III (NORMADIC HERDING)**

#### **ACTIVITY II**

1. The nomadic herder moves from one place to another in search of green herbage and water.
2. The consequences of overgrazing are as follows:
  - a) When a land is overgrazed, it means, virtually grasses covering the soil surface are completely removed. This exposes the soil surface to excessive heat. It also exposes the soil to erosion either by wind or by water when there is rain.

#### **ACTIVITY III**

1. The main difference between nomadic herding and ranching is that, while nomadic herding is a primitive form of animal husbandry, Ranching involves a well organized operation on commercial basis.

2. The choice of which to recommend will depend entirely on many factors such as availability of the needed capital, technical skill, land, life style and culture of the people, climatic conditions etc.

**ANSWERS TO ASSIGNMENT**

1. Characteristics of a pastoral farming system are:

- a) raising of livestock is practised.
- b) it is a settled form.
- c) Sole source of income is livestock
- d) practised in areas of low rainfall and rough terrain

20 marks

2. Differences between ley fanning and ranching.

Ley farming is the cultivation of pastoral and food crops in rotation. Ranching is based on management and maintenance of improved livestock breeds.

10 marks

3. Based on the income status of the inhabitants of a locality and availability of necessary resources, you could recommend either of the two.

5 marks

Total 25 x 4 = 100 marks

**UNIT 3 TYPES OF CROPPING SYSTEM  
MONOCROPPING AND MIXED CROPPING**

**ACTIVITY I**

- 1. In this process of harvesting the maize in a plot containing maize. okra and cowpea, you will trample on cow pea mainly and also some okra plants, This is one of the disadvantages of multiple or mixed cropping.
- 2. If the harvester is used to harvest rice in the plot containing a mixture of rice and cowpea, the machine could have destroyed the cowpea completely at the end of the harvest. This is an example of a system that does not permit mechanization, since you cannot have machinery that can harvest these two crops at the same time.

**ASSIGNMENT**

1. Differences between monocropping and monoculture

Monocropping	Monoculture
One crop is planted on the same piece every year. If this crop is harvested, another one crop could be planted, i.e. one crop occupies the land in the season, but not same crop e.g. maize, cowpea.	In this case, one single crop (same crop) is planted on the same piece of land every year, or the same crop occupies the same piece of land for several years e.g. cocoa.

(10 marks)

2. Advantages of monoculture are:

- a. It may encourage specialization in certain crops which could lead to better

production in quality and quantity.

- b. Farm operations could easily be mechanized. (10 marks)
3. Crops that can be grown in mixture based on their root system.
- (a) Maize - shallow-rooted + yam - deep-rooted
  - (b) Groundnut - deep-rooted + maize-shallow rooted
  - (c) Guinea Com- shallow, rooted + Cassava-deep-rooted. (5 marks for any two) Total 25 x 4 =

**100 marks**

## **CONTINUOUS CROPPING AND CROP ROTATION**

### **ACTIVITY I**

1. If the activities are carried out as directed. You would have practiced crop rotation as follows. The yam + maize in mixture are heavy feeders and would take a lot of nutrients from the soil. After it is harvested, and you plant cowpea or soyabeans, which are legumes; These add or improve the nitrogen status of the soil. By this, you have some-how replaced part of the nutrients taken away from the soil by yam and maize.

### **ASSIGNMENT**

1. Continuous cropping differs from crop rotation in the following ways:-
- (a) In continuous cropping, the cultivation is on the same piece of land every year while in crop rotation, there is allowance for a fallow period.
  - (b) Continuous cropping is practised where there is land scarcity while it is not so with crop rotation.
  - (c) Continuous cropping leads to destruction of soil structure and exhaustion of soil nutrients, whereas crop rotation improves soil structure and soil nutrient status. (15 marks)
2. Continuous cropping is practised in areas with high population density and is characterized by shortage of land for agricultural activities. The land is continuously activated because the population pressure is too high to allow any fallowrest period. (10 marks) Total 25 x 4 = 100 marks

## **SHIFTING CULTIVATION AND BUSH FALLOWING**

### **ACTIVITY I**

Farmers in most localities nowadays practise bush following or crop rotation. Shifting cultivation is rarely practised because of increased population which implies increased pressure on the land. Because of this pressure land cannot be left to follow for long.

### **ANSWERS TO ASSIGNMENT**

1. Shifting cultivation is a cropping system whereby a piece of land is cultivated for a period of time (usually between 4 and 6 years) and abandoned because of declining productivity for a new piece of land. 10 marks
2. Conditions that favour the practice of shifting cultivation are:
- a. Abundance of land.

- b. Low population density
  - c. Community ownership of land
  - d. Quick regeneration of natural vegetation to restore soil fertility. (10marks).
3. Disadvantages of shifting cultivation
- i. It is limited to subsistence agriculture
  - ii. It impoverishes the soil
  - iii. It encourages erosion
  - iv. It encourages loss of organic matter by burning
  - v. It cannot be practiced where land is scarce or where population density is high. (10 marks)
- Disadvantages of Bush following
- I. It is completely dependent on nature for the renovation of soil fertility
  - II. It cannot be practised where land is scarce
  - III. It cannot be practised where population density is high. (Any 2).  
(10 marks)
4. The two systems are not widely practised as before because of increasing population which increases pressure on the land. This means land cannot be left to follow for too long. (10 marks)  
(Total = 50 x 2 = 100 marks)

#### **UNIT 4 LIVESTOCK PRODUCTION I (CATTLE)**

##### **ACTIVITY I**

- 1.
  - a) Zebu Breed (Sokoto Audali, White Fulani, Red Boron)
  - b) Humpless breed (N'dama Muturu)
  - c) Fresian breed – imported breed.
- 2. Activity No. 2 is a practical Exercise to be undertaken in groups.
- 3. Dairy cattle – cattle that are used for milk production dual purpose cattle e.g. White Fulani cattle that are used for both meat and milk production example N'dama.

##### **ACTIVITY II**

- 1. Extensive system or nomadism – entails movement of animals about as per availability of water and pasture.
- 2. Government and Research Stations employ intensive and semi intensive system. They are more productive but more capital intensive, hence cannot be adopted by local producers. Animals can also be closely observed for data collection and study.

##### **ASSIGNMENT**

- 1. Pathogenic infections such as viruses, bacteria, and fungi.
  - Control - Vaccination
  - Use of resistant breed
  - Keep hygienic environment (15 marks)
- 2.
  - a) Reduced labour needed
  - b) Availability of cheap feed like roughage
  - c) Inexpensive (15 marks)
 Total = 30 marks.

## **UNIT 5 LIVESTOCK PRODUCTION II (SHEEP)**

### **ACTIVITY I**

1.
  - a. Uda - found in Sudan savanah
  - b. Balami - found in Sahel savanah
  - c. Yankasa Sudan, sahel and Guinea savanah
  - d. West Africa Dwarf - Forest Zone.
2. Rams have horns, ewe have no horn.
3. Extensive system, herding, tethering, Nomadic system

### **ACTIVITY II**

1. Disease: Foot rot: Controlled by
  - i. Removal on infected part.
  - ii. Proper sanitation (10% formalin)Pest: Helmintaiasis: Controlled by:
  - i. deworming
  - ii. Proper sanitation
2. The last two months

### **ASSIGNMENT**

1. In the village traditional system of sheep production is practiced. Owners do not know when the sheep are pregnant, hence no supplement is given to the pregnant animal. This leads to either abortion or birth of weak lamb. (15 marks)
  2. This is feeding of sheep (1-3 in number) on special return by livestock farmer to hasten the development of the animal for commercial purpose. (15 marks)
- Total = 30 marks.

## **UNIT 6 PROBLEMS OF LIVESTOCK PRODUCTKON IN WEST AFRICA**

### **ACTIVITY I**

- a. Livestock production: This is the rearing of animal such as sheep and goats for the use of man and industry.
- b. Three examples of livestock known to me are – poultry, swine and cattle.
- c. There are two types of animal farming, subsistence and commercial farming. A subsistence farmer produces enough of animals for his personal use; while the commercial livestock farmer produces more that the needs, the excess is for sale in the market.

### **ACTIVITY II**

- a. Five problems of livestock production in West Africa are:
  - Climate
  - Pest and diseases
  - Finance
  - High cost of feeds
  - Shortage of well-trained problems of livestock
- i. Climate: This can be taken care of by studying the environment and keeping breeds that can survive in such environment.



- ii. High cost of feeds: The farmers should be encourage to produce their own feeds and to process and store excess feeds.
- iii. Financial problem: The government and commercial banks should assist farmers with loans, subsidies and other credit facilities.

### ASSIGNMENT

1. Two problem of livestock production amongst local farmers are:
  - Problem of diseases and pest
  - Low production because of the use of unsuitable breeds.
  - Local livestock farmers should keep breed that can live in their areas, and those resistant to common diseases and pests. Also they can cross-breed their local breeds with foreign breeds or buy such improved breeds. (10 marks)
2. A list of domestic poultry include:
  - Local fowl or chicken
  - Duck,
  - Turkey
  - Guinea-fowl
  - Pigeon
  - Geese, and so on. (20 marks)

Total = 30 marks,

## UNIT 7 POULTRY PRODUCTION

### ACTIVITY

1. Two breeds of poultry, based on the purpose of keeping them are:
  - i. The dual purpose breed, example the Rhoden Island Red
  - ii. The egg breed example, the white leghorn.
2. The ancestors of the domestic fowl are:
  - i. Red Jungle fowl, the
  - ii. Green or Jaran fowl, and
  - iii. Singalese Jungle fowl, and the
  - iv. Grey Jungle fowl.
3. The three major branches of poultry production are:
  - i. Egg production
  - ii. Table meat production, and
  - iii. Feed production
4. The two ways of rearing poultry are
  - i. The traditional system, and the
  - ii. Modern system of rearing poultry,
    - a. Characteristics of the traditional system:  
The birds fend for themselves, with little or no housing, level of production is low high mortality rate, and poor record keeping.
    - b. Characteristics of modem system of rearing poultry:  
Improved breeds are used, proper housing and feeding of birds is proper record keeping emphasized,

- c. While mortality rate is low.
5. Three importance of poultry to man are:
    - Source of protein, egg and meat.
    - Source of income, and
    - Source of manure for farming purposes.
  6. Parts of a poultry (see the drawing and labelling of a chicken).

**ANSWERS TO ASSIGNMENT**

1. Poultry production should be encouraged for two main reasons:
  - a. because of its contributions in meeting the local requirements of meat and egg; and
  - b. as a source of earning income to the farmer and to the Government. (20 marks)

Total = 20 marks.

**UNIT 8 POULTRY FEEDS AND FEEDING: HEALTH AND MANAGEMENT**

**ACTIVITY I**

1. Feeds are the organic and inorganic materials used in aiding or supporting life. Examples are grains, cakes from legume crops, and so on. Feeding on the other hand, is the act and science of giving feed to animals.
2. Common feeding stuffs for poultry are: Maize, wheat, rice, millet, barley, rats, cassava, sweet potato, soya bean meal, groundnut cake meal, cotton seed cake meal, limestone, oyster shell, common salt, fish meal, bone meal, green feeds, cod-liver oil, sunshine, sea foods and sea weeds, and water.
3. Importance of feeding to a chicken:
  - For growth, repair of dead body cells, and for production of eggs and meat;
  - Energy feeds give them warmth and energy for body activities and production;
  - Minerals and vitamins help them to grow well, produce well, and for good health;
  - Water is used by the chicken for cooling its body, for body reactions and for removal of waste from the body.
4. Health in poultry farming, this means a state of well-being whereby the animal's body organs and systems are functioning normally. It can also mean the absence of uneasiness or disorderliness.
5. The following are the common infectious diseases of poultry.

	<b>Names of disease</b>	<b>Causal agent</b>	<b>Treatment</b>
i.	New castle disease	Virus	none
ii.	Infections bronchitis	virus	none
iii.	Fowl pox (Avian Pox)	virus	none
iv.	Fowl Typhoid	Bactrium Salmonella	Sulfa drugs, Antibiotics
v.	Coccidiosis	Protozoa (Eimeria)	sulfa drugs.
vi.	Chromic Respiratory Disease (ARD)	Mycoplasma (MG)	Antibiotics

**ASSIGNMENT**

The following are the basic principles of feeding poultry:

- i. Feeding should always be provided to them. as they have a fast rate of digesting feed.

- ii. Do not feed them with coarse and fibrous feeds, such feeds don't digest easily,
- iii. Their diets should be of high quality.
- iv. Their feeds should not be finely - ground.
- v. Do not give them dusty, musty or stale feeds as these can expose them to diseases.
- vi. Provide water for them always.
- vii. watch their feed intake once this is established, drop in feed intake may be a sign of disease onset.

(25 marks)

Total = 25 marks

## **UNIT 9 POULTRY BREEDING AND HATCHERY MANAGEMENT**

### **ACTIVITY I**

1. The principle behind animal selection is the improvement of our livestock by selecting breeds that meet the desires of the farmer in terms of appearance, and possession of the desired traits or characters.
2. Two main breeding systems are:
  - i. In breeding, as in close breeding or line breeding. In this case, related animals are mated.
  - ii. Out – breeding, the mating of non-related animals.
3. The local breeds will be recommended for breeding for three main reason:
  - i. When the farmer lack the experience of breeding the exotic breeds/hybrids,
  - ii. When the hybrids are not available,
  - iii. And when proper management is not guaranteed.
4. Ways of improving the local breeds of chicken by replacing the local cocks with more productive cocks,
  - i. By culling unproductive birds or chickens, and
  - ii. By proper management of poultry.
5. Qualities of a good egg for hatching
  - i. must be fertile or fertilized.
  - ii. Should be clear. of moderate size, and not damaged,
  - iii. Collected at the right time and properly stored.
  - iv. the date of collection shun id he noted.
6. The basis of sexing chicks in a farm are:
  - i. The appearance (the colour of their combs and their tail feathers),
  - ii. the length of the rudimentary wing feathers amongst the hybrid chickens
7. Qualities of a good broody he:
  - i. they make a characteristic broody sound,
  - ii. they have a wrinkled comb,
  - iii. they enjoy staying in the nest.
  - iv. she collects many eggs at a time.

### **ASSIGNMENT**

The incubation period of different breeds of poultry is different. The major factor determining this amongst poultry is the size of the eggs. Generally, the larger the egg, the longer it takes to incubate. The following are the incubation period of different species of poultry.

<b>Species</b>	<b>Incubation Period</b>
1. Chicken	21 days
2. Guinea fowl	26 – 28 days
3. Turkeys	28 days
4. Ducks	30 days
5. Geese	30 – 35 days

Total = 25 marks.

## **UNIT 10 SUMMARY**

### **ACTIVITY I**

1. The term farming system is used to describe the combination of livestock keeping and crop production activities.
2. Types of Farming System
  - Mixed Farming
  - Arable Farming
  - Pastoral Farming
  - Nomadic Farming

### **ACTIVITY II**

#### **Five problems of Livestock production in Nigeria**

1. Climatic problem.
2. Financial problem.
3. Pest and disease problem.
4. Use of improved breeds.
5. Problems of high cost of feeds.
6. Land tenure problem.
7. Shortage of well-trained personnel.
8. Cost of technology.

### **ASSIGNMENT**

1. The main difference between nomadic herding and ranching is that, while nomadic herding is a primitive form of animal husbandry, Ranching involves a well organized operation on commercial basis.
2. The choice of which to recommend will depend entirely on many factors such as availability of the needed capital, technical skill, land, life style and culture of the people, climatic conditions etc.

## **MODULE 7**

### **UNIT 1 RECORD KEEPING**

#### **ACTIVITY I**

Record keeping is important in agriculture because it helps in knowing the progress and the failure of the farm. It also helps in planning and budgeting of the farm.

## ACTIVITY II

Records a Poultry farmer keeps.

Item	Date	No.of animals	Sex	Age	Valuer (N)
Beginning	-	-	-	-	-
Purchase	3/2/2000	100	mixed	day old	30,000
Deaths	5/2/2000	4	mixed	2 days	3,000
Sales	1016/2000	80	mixed	13 weeks	18,000
Consumption	varied	16	mixed	13 weeks	12,000

It shows the yield and produce of livestock and poultry.

## ASSIGNMENT

1. Farm records is the recording of activities on the farm. Three types of records are sale, Labour and purchase records  
(10 marks)
2. Farm inventory records (10 marks)
3. It helps in determining the yield of the farm.  
It determines profit or loss.  
It enables the farmer obtain loans from the bank.  
It determines the actual tax to be paid.  
(20 marks)
4. Record keeping must be accurate, neat, and complete. (10 marks)

Total = 50 marks.

## UNIT 2 LAND PREPARATION FOR NURSERY BEDS

### ACTIVITY I

The reason for digging the soil surface during nursery bed preparation is to allow drainage and aeration take place.

### ACTIVITY 11

The reasons for rotating crops planted on bed are:

1. To improve soil nutrients
2. To control Pests
3. To prevent the spread of disease organisms.

## ANSWERS TO ASSIGNMENT

1. Nursery beds are raised in the rainy season because of drainage. Raised beds allow water to move down freely from the beds  
(10 marks)
2. In selecting a nursery bed, the following are considered.
  - (a) Readily available water supply.
  - (b) Absence of Nematodes, Perennial weeds such as spear grass, nutgrass, carpet grass, Bermuda grass, Tridax weed etc.

(c) Type of soil

(10 marks)

3. The reasons are to maintain soil nutrients, control the spread of pests and diseases.

(10 marks)

4. Nursery bed must have fine tilt and fiat surfaces so as to avoid flooding, water logging and erosion

(10 marks)

5. Four farm tools used in preparing beds are (1) Garden fork (2) rake (3) Hoe (4) spade

( 10 marks)

Total = 50 marks.

### **UNIT 3 CARE OF PLANTS BEFORE AND AFTER TRANSPLANTING**

#### **ACTIVITY I**

If nursery seedlings are not properly mulched they will loose water. They will also be affected by erosion and sun heat (Solar radiation). The seedlings will also be exposed to weed competition.

#### **ACTIVITY II**

The following are materials used for mulching seedlings: grass, leaves, saw dust, wood shavings and polythene sheets.

#### **ASSIGNMENT**

1. Mulching is the covering of nursery beds and transplanted plant base in order to avoid exposing the seedlings to harsh environmental conditions e.g. erosion, heat, evaporation etc. (10 marks)

Four mulching materials are grass, Leaves, saw -dust and wood shavings.

2. Water is necessary in nursery because it helps in dissolving mineral salts, maintaining the structure of the cells and also for moderating the temperature of the plants. (10 marks)

3. Seedlings are best transplanted during cool weather period or cool evening time. (10 marks)

4. Pricking out is the transplanting of healthy and rigorous seedlings. During pricking out all diseased and weak seedlings are discarded while healthy and vigorous ones are transplanted in the farm. (10 marks)

5. Nursery beds or feed boxes are watered or soaked to moisture them so that pulling out of the seedlings will be easier. (10 marks)

Total = 50 marks

### **UNIT 4 PLANTING PRACTICES**

#### **ASSIGNMENT**

1. Planting is the putting of seeds or part of plant into the ground to grow. The best method for planting crops is drilling in rows. (10 marks)

2. Five crops that require planting in- situ are watermelon, pumpkin, okro, dwarf beans, radish.

(10 marks)

3.

Crop	Recommended planting distances
Beans	45cm x 22 cm
Okro	56cm x 55 cm
Radish	22cm x 4 cm
Egg-plant	60cm x 60 cm

(10 marks)

4. Four reasons for thinning crops are:

- i) it allows the crop plant to have more space
- ii) it gives room for growth and development
- iii) it helps in exposing the plant to light
- iv) it reduces competition amongst crops for mineral salts (food) ( 10 marks)

5. Two simple farm tools that are used for weeding in a nursery bed are

- a) small hoe
- b) hand trowel. ( 10 marks)

Total = 50 marks

## UNIT 5 IDENTIFICATION OF MATERIALS USED IN IRRIGATION

### ACTIVITY I

1. An irrigation is the artificial application of water to the soil to supplement insufficient rainfall for the production of crops.
2. Five importance of irrigation.
  1. Makes early planting possible
  2. It adds water to the soil in order to supply the moisture for plant growth.  
Soften the soil for easy tillage operation.
  1. Facilitates the survival of crops during drought.
  2. It influences time of harvest.
  3. Reduces salination in the soil.
3. Sources of irrigation water
  - (1) Rivers (2) From ponds (3) From streams
  - (4) From Dams (5) Springs
  - (7) From wells (8) Reservoir

### ACTIVITY

1. 3 types of irrigation system
  1. Surface irrigation
  2. Sub-surface irrigation system.
  3. Over head irrigation system.
2. Definitions
  - a. Surface irrigation -

This is the type of irrigation system in which river, dam or stream overflows its bank, so as to flood the whole area where furrows are constructed between ridges to provide water to plant crops.

b. Sub-surface irrigation -  
System by which water is supplied to the crops below the surface of the soil to farms by using perforated pipes which carry the water to roots of crops through capillary action.

c. Over head irrigation -  
This is the system by which water is supplied to the crops above the surface of the soil.

3. Examples of irrigation.

a. Flood water irrigation

b. Shadoofs.

### **ASSIGNMENT**

An irrigation is mostly practiced in Northern Nigeria because rainfall is slight and unreliable in this part of the country. (10 marks)

2. Watering Can:

a. Supplies water to the seedlings in the seedbeds or nursery.

b. It is used for watering or irrigating flowers, and crop plants. (10 marks)

Total = 20 marks

## **UNIT 6 PREPARATION OF COMPOST MANURE AND METHOD OF APPLICATION**

### **ACTIVITY I**

(1) Compost manure is artificial manure, usually called farm yard manure made from plants and animals remains. Because of this it is called organic manure.

(2) a.- FY.M. (Farm Yard Manure) e.g dung of cow, goats, etc.

b - Crops residues e.g. straws, dry leaves

c - Household waste ego food waste, garbage.

(3) Composting:

It refers to the act of rotting the plants and animals' remains in heaps before residue s are applied to the soil for farming activities.

(4) Industrial waste is not commonly used as a source of waste for compost preparation because the Industrial wastes contain heavy metal pollutants.

## **UNIT 7 METHOD OF APPLICATION OF COMPOST MANURE**

### **ACTIVITY II**

1. There are two methods of compost preparation.

(i) Heap or stack method

(ii) Pit approach or method

2. How Heap is stack approach is done.



1st - get we 11 drained plain ground - to be filled with composting materials

There are 4 heaps to be made.

2nd - Water is sprinkled on all the four heaps to create moist environment.

3rd - Turning the compost which will supply enough air to promote process of decomposition.

Benefits of compost manure to the soil.

- a. Serves as a source of plant Nutrients
- b. Improves soil structure fixture and other soil physical properties
- C. Hosts and serves as food 'to other living organisms in the soil.
- d. It controls soil temperature.
- e. It absorbs moisture in the soil.
- f. it is a buffering mechanism.
- g. Prevents soil water erosion.

Five methods of manure application

- ( 1) Broadcasting Method.
- (2) Band Placement Method
- (3) By Row or side band application
- (4) By top dressing
- (5) By ring Method.

#### **Top dressing Method:**

This involves spreading of compost manure on the surface of soil on which crop plants are already growing.

#### **ANSWERS TO ASSIGNMENT**

- (1) Compost manure is an artificial manure made from plants and animals remains - while - composting is the process of rotting the plants and all imals remains to farm the compost manure.  
(15 marks)

Total 30 marks

## **UNIT 8 IDENTIFICATION OF SIMPLE ANIMAL PESTS**

### **ACTIVITY I**

- (1) An animal pest is any organism which causes any sort of damage to animals advantageous to man.
- (2) Pests stick to animals in order to suck blood and other fluids of the tissue.
- (3) Categories of animal pests & their example
  - a. Insecta example - lice
  - b. Arachnida e.g. ticks
  - c. Platyhelminthes e.g flatworm
  - d. Cestoda e.g tapeworm
  - e. Nematoda e.g roundworm.

## ACTIVITY II

- (1) Lice are wingless insect pests. They have flattened bodies. They are specific to their host i.e. each species of lice is parasite on only one kind of an animal. They visit animals in order to suck blood.-
- (2) Lice of an animal cannot live on man successfully because lice are specific to their host.
- (3) I. Families - Arachnida e.g Ixodidae (hard tick)  
ii. Families - Arachnida e.g Argasidae (soft ticks)
- (4) Sexual Dimorphism: That means the male is different from the female.
- (5) Lifecycle of hard tick.  
After mating the female engorges blood very rapidly and drops off the host  
It continues to live without feeding and proceeds to lay thousands of eggs over a period of four weeks.  
After laying eggs it dies  
Eggs laid on ground, bushes, stones are hatched to larvae which later develop to an adult.

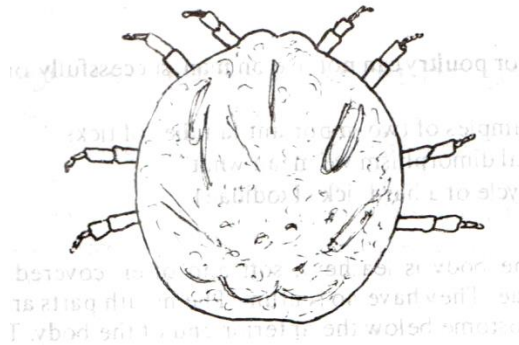
## ACTIVITY III

- (1) Differences between hard tick and soft tick.  
Hardtick - has covering body known as scutum.  
Soft tick - has no scutum.  
Hardtick - There is sexual dimorphism in this group of ticks.  
Soft tick - In this group there is no sexual dimorphism  
Hardtick - Lays eggs on ground, bushes and on stone, later dies.  
  
Soft tick - The eggs remain with the host and develop to larvae
- (2) Life cycle of an Argasidae (soft tick).  
Lays eggs and eggs remain with host and later develop into larvae for about a week.  
Nymphs are usually night feeders and hide themselves during the day time .  
Adult ticks also feed during the night as they visit the host animals. Some species of this group can live for years without a meal of blood.
- (3) Effects of ticks to an animal.
  1. Ticks cause havoc by sucking the blood from animals.
  2. Bites of ticks cause skin irritation, wounds become infested by bacteria.
  3. They help in the transmission of diseases e.g redwater fever, east coast fever, etc.

## ASSIGNMENT

- (1) Life cycle of Hard tick (Ixodidae)  
After mating, the female of hard ticks engorges blood very rapidly and drops off the host.  
It continues to live without feeding and proceed to lay thousand of eggs.  
After laying eggs the female dies.  
Eggs are laid on bushes, stones and on ground  
Eggs later develop to larvae which develop to adults. (25 marks)

2. How soft tick looks like with the aid of Diagram.



Soft tick has no scutum

In this group of ticks, there is no sexual dimorphism

When they lay eggs, the eggs remain with the host animals. They have a leathery soft covering body

Their mouth parts are hidden as seen from the Diagram. (25 marks)

Total 50 marks

## UNIT 10 SUMMARY

### ACTIVITY I

1. Examples of Farm Records
  - a) Sales records
  - b) Purchase records
  - c) Yield or production records
  - d) Profit and loss records
  - e) Farm diary records
  - f) Farm inventory of tools and properties records.
  - g) Labour records
  - h) Annual valuation records
  - i) Farm input utilization records:
  - j) Income and expenditure or cash records.
2. Nursery seedlings need to be raised under shade to protect them from:
  - Excessive wind
  - Excessive sunlight
3. Nursery seedlings need water to absorb dissolved nutrients for growth and also to reduce the effect of heat to the soil.

### ACTIVITY II

1. An irrigation is the artificial application of water to the soil to supplement insufficient rainfall for the production of crops.
2. Compost manure is artificial manure, usually called farm yard manure made from plants and animals remains.
3.
  - a.- FY.M. (Farm Yard Manure) e.g dung of cow, goats. EtC.
  - b - crops residues e.g. straws, dry leaves

- c - Household waste ego food waste, garbage.

### **ASSIGNMENT**

1. Industrial waste is not commonly used as a source of waste for compost preparation because the Industrial wastes contain heavy metal pollutants.
2. Nursery beds are raised in the rainy season because of drainage. Raised beds allow water to move down freely from the beds

## **MODULE 8**

### **FORESTRY AND WILD LIFE MANAGEMENT**

#### **8.1 DEFINITION AND TYPES OF FOREST**

##### **ACTIVITY I**

- i. Forest is a particular type of plants community most of the constituent members are trees. That are wood and grasses are virtually absent.
- ii. Types of forest
  - (a) Temperate forest
  - (b) Tropical forest
  - (c) Swamp forest
  - (d) Mangrove forest
  - (e) Fresh water swamp forest

##### **ASSIGNMENT**

1. Different types of tropical low land rainforest sub division in Nigeria.

They are: (i) The upper or emergent stratum

(ii) The middle stratum

(iii) The lower stratum

- 2 (a) what is a stratum in the tropical rainforest? The horizontal layer of canopy of the trees at different height levels is called strata while each layer of the canopy of trees of different height is called stratum.

## **UNIT 2 ECONOMIC IMPORTANCE OF FOREST**

### **ACTIVITY 1**

Mention five uses of forest

- I. Forest provides wood for poles of electricity
- II. Some wood and wood products like teak and mahogany provide general income.
- III. Forest products are used for medicinal purposes
- IV. Forest provides habitat for wildlife
- V. Forest provides wood for energy generation (working)
- VI. Forest provides wood for local industry like paper industry, boat building, furniture, sawmill.

Unite 8.2 Answers

Assignment

- I. Name any two trees common in Nigeria  
Teak and mahogany
- II. Name some principal uses of forest trees and wood.
  - Forest wood is in sawmill, forest trees are swamn into different forms and sizes for different uses.
  - Used as furniture, the forest provides wood swamn into different furniture terms like chairs beds, tables, wardrobes etc,
  - For boat building and construction of jetties.
  - Wood for paper industry forest wood is processed into pulp for manufacture of paper products and new points.
  - Forest provides wood for domestic uses, fire wood.

## **UNIT 3 BASIC PRINCIPLES OF AGRO-FOREST**

### **ASSIGNMENT**

Forestry and Wild Life Management

1. True (5 marks)
  2. Better use of the solar energy
    - I. Guarantees soil fertility and Nutrient cycling
    - II. Guarantees soil conservation (15 marks)
  3. Based on the product expected, Based on major function of the component, Based on the relative distribution of components in both time and space. (20 marks)
- Total = 40 marks.

## **UNIT 4 NIGERIAN VEGETATION**

### **ACTIVITIES**

Discuss your answer with your course tutor at the study centre.

## ASSIGNMENT

1.
  - a. animal population
  - b. climatic factors
  - c. soil factors
  - d. species of vegetation
  - e. composition of vegetation (15 marks)
2.
  - a. Natural vegetation is one in which no farming or other activities have taken place.
  - b. Artificial vegetation is the vegetation made by man e.g maize, rice or wheat farm.  
15 marks
3. False 10 marks
4. False 10 marks

Total = 40 marks

## IDENTIFICATION AND MAINTENANCE OF ECONOMIC FOREST TREES

### ANSWERS TO ACTIVITIES AND ASSIGNMENT

- I. Some of the character for tree identification are:
  - a. spines
  - b. latex
  - c. exudate
  - d. leaves (10 marks)
2. The Nigerian trees volume II by R.W.J. keay, C.F.A. Onoctic and D.P. stonfield, published by the Federal Department offorest Research in the book that contains the key for identification of Nigerian trees (10 marks)
3. Weeding is reduced through planting the trees in mixture with arable crops, a system called Agroforestry. (10 marks)
4. Insects are eliminated from a plantation by spraying with an insecticide (10 marks).

Total = 40 marks

## UNIT 5 BY-PRODUCTS OF FOREST

### ANSWERS TO ACTIVITIES AND ASSIGNMENT

1. Plants that are used for food include:
  - (a) Vemoni amygdalina (Bitter leaf), used as a leafy vegetable
  - (b) Artocarpus cumminis (Bread fruit), eaten as substitute for pounded yam. Fruit is cooked and pounded
  - (c) Yiiellaria paradox (shea nut); nuts yield oils that are edible.
  - (d) Earkia bjglobQsa (locust bean) seeds used as soup condiment.

### Forestry and Wild Life Management

2.
  - (a) Cajarus QUan (Pigeon pea), used for treating measles.
  - (b) VemQnia amygdalina, leaves boiled and used for treating fever.
  - (c) Garciria.cilia (Bitter cola), used as snake repellent.

- (d) *Irvingia gabonensis*, used for treating sores (20 marks)
- 3. (a) *Eicus exespera* (sand paper leaf tree)
- (b) *spondees monbine*
- (c) *Alchomia Cordifolia*

They are used for feeding small ruminant in the rural communities of the southern parts of Nigeria.

(15 marks)

- 4. Forests are often used for protection such as for erosion or for water shed. Costs are offer difficult to adduce to the protective services. If you take the protection against erosion, you can look at a situation in which the trees or forest is not there and there is erosion. Look at the cost of rectifying the erosion damage. May be a house is wasted away. What is the cost of re pairing or rebuilding the house'? That is about the cost of the protective service of the forest that provided the protection. (25 marks)

Total = 80 marks.

## UNIT 6      CONCEPT OF WILDLIFE AND WIDLIFE CONSERVATION

### ACTIVITY I

The wall lizards will identified by their red heads and large sizes. Chances are there will be more females than males. If there are more males and when they come across one another, they are not likely to be friendly. They may fight until the defeated one runs away. If you find the lizards feeding, most times, they are likely to be feeding on ants.

### ASSIGNMENT

- 1. Wildlife includes all uncultivated or undomesticated living things including plants, fishes, reptiles and amphibians, birds and mammals. However, animals appear to be the prominent elements of the wildlife.

Conservation is the rational use of natural resources in such a way that the resources are available for use to both mankind and other living organisms in maximum quantities and on a sustained basis. This is in contract to the preservation of the resources and prevented from being utilised. Wildlife conservation is the wise and controlled use of natural resources to the maximum benefit of mankind and other living organisms is such a way that the resources will virtually be available indefinitely

(25 marks)

- 2. The benefits of wildlife conservation include the following:- the supply of bush meat; medical research to purposes; traditional medical practices; maintenance of biodiversity and of the gene pool; contributes to tourism. Enhances revenue of both the country and the immediate communities.

(25 marks)

- 3. Examples of Nigerian wildlife rodents are: cane rat (or cutting grass) (*thryoaomys swinderriances*); West African ground squirrel (*Xerus erythropus*) Examples of Nigerian wildlife birds are: The Palmnut vulture (*Gyohienrax angolyopsis*), Beaudoin's harrie eagle (*Circaetus beaudoini*) and the Giant King fisher (*Mega -Cercyle maxima*)

(25 marks)

- 4. Some of the Nigerian wildlife animals feed on plant materials. These are herbivores e.g. the cane rat (*Thryonomys Swinderriannmus*) and the ground squirrel (*Xerus erythropus*). Among the herbivores,

some feed on grasses. These are grazers. Some of the wildlife animals feed on the flesh of other animals. These are carnivores and they include the spotted hyena (*Crocuta crocuta*). Lion (*Panthera Leo*) and leopard (*Panthera pardus*)

(25 marks)

Total = 100 marks.

## **UNIT 7      MANAGEMENT AND CONSERVATION TECHNIQUES IN WILDLIFE**

### **ACTIVITY I**

The different animal species observed to come to the stream to drink water are a reflection of the types of wildlife animals in the vicinity. The plants that they browse are their preferred browse food. There are the plants that partly determine food availabilities for the animals, some animals move in groups, others move singly.

### **ACTIVITY II**

With practice one is able recognise some animals based on their foot prints and droppings.

### **ASSIGNMENT**

1. The other land uses that compete for the use of a forest as a game reserve include. uses for lumber production, grazing of domestic animals and use for farmland (10 marks)

2. The cropping of wildlife population may be controlled through the limiting of the cropping to the value of the annual production level of the reserve, the restriction of the cropping area, season and to certain species.

(10 marks)

3. The objectives of wildlife management include:

Bush - Meat production, promote game viewing, preserve national heritage, general employment, preserve the species, maintenance of the population of desire species and limiting the utilisation of harvests to annual production.

(15 marks)

4. Three ways of monitoring the population of a game reserve are:

a. A census of the total number of animals in the reserve.

b. Determination of the birth and mortality in the population.

c. The determination of immigration and emigration.

(15 marks)

Total = 50 marks.

### **ASSIGNMENT**

1. False (1 mark)

2. True (1 mark)

3. False (1 mark)

4. False (1 mark)

Total = 4 marks.



## **UNIT 8      MANAGEMENT AND CONSERVATION TECHNIQUES IN WILD LIFE**

### **ACTIVITY I**

Animals frequent streams, rivers and lakes to drink water. Discuss your observation with your tutor.

## **UNIT 9      BASIC ECONOMIC PRINCIPLES OF DEMAND AND SUPPLY** **DEMAND**

### **ACTIVITY I**

**DEMAND:** This is the quantity of that commodity which a consumer is willing and able to buy at a given price during a given period of time.

### **ASSIGNMENT**

Factors affecting demand

1. The price of a commodity, the higher the price the lower the quantity that will be demanded.
2. The price of other commodities will make consumers to look for close substitutes.
3. Taste of consumer for a particular commodity.
4. Income of the consumer will determine the quantity of commodity to be demanded.
5. The amount of tax will also influence the quantity to be demanded of a given commodity.
6. Other factors like the population of a place, expectation of changes in price of commodity or period of festivals like Christmas and salah will also affect the quantity of goods to be demanded.

### **ACTIVITY II**

The law of diminishing returns states that as more and more of a variable factor of production is added upon a fixed factor of production, the output tends to increase up to a certain point above which each successive unit of the variable factor makes smaller and smaller addition to the total output and finally total output may even decrease.

### **ASSIGNMENT**

#### **Factors affecting change in supply**

- 1 Changes in price of commodity.
- 2 Changes in the cost of production.
- 3 Changes in the technique of production.
- 4 The effect of weather.
- 5 The effect of taxation.
- 6 Shift in consumption by consumers.
- 7 Change in demand.
- 8 Change in distribution or marketing channels.
- 9 Change in the number of producers.

## **8.10 SUMMARY**

### **ASSIGNMENT**

- 1. False**
- 2. True**
- 3. False**
- 4. False**