NATIONAL OPEN UNIVERSITY OF NIGERIA

SCHOOL OF MANAGEMENT SCIENCES

COURSE CODE: COP111

COURSE TITLE: INTRODUCTION TO GENERAL AGRICULTURE

MAIN COURSE

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COURSE GUIDE

COP 111
INTRODUCTION TO GENERAL AGRICULTURE I

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INTRODUCTION

COP111 - Introduction to General Agriculture I is a two- credit unit course for students pursuing first degree in Co-operative Management. It will also be useful for those who want to practise agriculture in any way.

The course consists of seventeen units covering basic concepts in agriculture and the practice of agricultural production, especially with regards to common food crops. This course guide gives you insight into the nature of the course, the materials you are going to use and how you are to use the materials for meaningful benefits.

You are encouraged to devote, at least, two hours to studying each of the seventeen units. You are also advised to attempt the self-assessment exercises as they are necessary for proper understanding of the units. You are also requested to pay more attention to tutor-marked assignments (details are provided in a separate file).

There will be tutorial classes, while practical activities will come up in the second semester. Details of the time and location of the tutorials will be made known to you; this is a great opportunity for you to have face to face contact with your course coordinator. Any area that is not clearly understood will be properly explained.

WHAT YOU WILL LEARN IN THIS COURSE

The overall aim of this course is to introduce you to the fundamental principles of agriculture and how it applies to practical farm activities and production. During the course, you will learn about the importance of agriculture and its socio-economic importance- as it affects the enhancement of the standard of living of the rural populace (i.e., rural development and contributions to the economy of Nigeria).

COURSE AIMS

The aim of the course is to give you a better understanding of agricultural development, bearing in mind the development and modernisation of agriculture, especially in relation to food production.
The aim of the course will be achieved by:

- introducing you to agricultural practices- right from the traditional approach to the use of modern implements
- exposing you to the concept of land tenure system
- helping you to understand the various factors that affect agricultural production
- exposing you to the main problems of agriculture

- exposing you to the characteristics and types of soil
- giving you insight into methods and strategies in agricultural extension practices.

COURSE OBJECTIVES

To achieve the aims set out above, the course sets overall objectives. In addition, each unit also has specific objectives. The unit objectives are always given at the beginning of a unit; you should read them before you start working through the unit. You may also want to refer to them during your study of the unit so as to check on your progress. You should always look at the unit objectives after completing a unit. In this way, you can be sure that you have done what was required of you by the unit.

Below are the wider objectives of the course, as a whole. By meeting these objectives, you should have achieved the aims of the course as a whole. On successful completion of the course, you should be able to:

- define agriculture and state its branches
- explain the importance of agriculture- in terms of its contributions to the economy of the country
- explain types of land tenure system and factors affecting them in Nigeria
- describe traditional farming types in Nigeria and compare them with modern farming
- explain the merits and demerits of each of the farming systems
- describe the importance of research to modern agricultural development
- describe types of cropping system
- explain the problems militating against agricultural development
- proffer solutions to these problems
- explain the importance of extension services in agriculture
- explain the various types of soil and crops
- discuss the type of soil suitable for crops.

WORKING THROUGH THIS COURSE

To complete this course you are required to read the study units, as well as other related materials. Each unit contains self-assessment exercises, and at certain points in the course, you are required to submit assignments for assessment purposes. At the end of the course, you are going to sit for a final examination. The course should take you about 42 weeks, in total, to complete. Below you will find listed all the components of the course, what you have to do and how you should allocate your time to studying the course.

COURSE MATERIALS

The major components of the course including the following:

1. Course Guide
2. Study Units
3. Textbooks and references
4. Assignment file
5. Presentation Schedule

STUDY UNITS

There are seventeen study units in this course as follows:

Module 1

Unit 1 Introduction to Agriculture
Unit 2 Agricultural Development
Unit 3 Essentials of Agriculture
Unit 4 Problems of Agricultural Development
Unit 5 Land Use System in Nigeria

Module 2

Unit 1 Methods of Farming in Nigeria
Unit 2 Importance of Research in Agriculture
Unit 3 Agricultural Systems
Unit 4 Agricultural Extension Service
Unit 5 Importance of Agricultural Extension

Module 3

Unit 1 Importance of Agricultural Production
Unit 2 Environmental Factors Affecting Agricultural Production
Unit 3 Types of Soil
Unit 4 Identification of Crops

Module 4

Unit 1 Common Food Crops
Unit 2 Vegetable Crops
Unit 3 Root Crops

The first five units concentrate on the basic theory of agriculture and land use in Nigeria; this constitutes Module 1. The next five units address the methods of farming, agricultural system and the extension

services and these constitute Module 2. Units 11-14 highlight the different type of crops with the other environmental factors affecting agricultural production; while Module 4 comprising units 15 -17 deal with the production of crops, especially food crops.

Each unit includes specific objectives and summaries of key issues and ideas. There are textbooks which will also provide additional information. The exercises in each unit have to be done to make sure that you are following the course. Doing the exercises is also a way to gauge your progress and to reinforce your understanding of the material. Together with tutor-marked assignments, these exercises will assist you in achieving the stated learning objectives of the individual units, and the course as a whole.

TEXTBOOKS AND REFERENCES

It is advisable that you have at least two of the following textbooks:

Adegeye, A. J. & Ditto, J.S. (1982). *Essentials of Agricultural Economics.Centre for Agricultural and Rural Development* (CARD).

Agbo, F. U. (1999). *Elements of Agriculture for Cooperative Colleges, Polytechnics and Universities*.

Aweto, R.A. (1996). *Agricultural Cooperatives*.

ASSIGNMENT FILE

In this file, you will find the details of the work you must submit to your tutor for marking. The marks you obtain will form part of your total score for this course.

ASSESSMENT

There are two aspects to the assessment of the course. First are the Tutor-Marked Assignments (TMA) and there is a written examination. You are advised to be sincere in attempting the exercises. In attempting the assignments, you are expected to apply the information, knowledge and techniques gathered during the course.

The assignments must be submitted to your tutor for formal assessment in accordance with the deadlines stated in the presentation schedule and the assignment file. The work you submit to your tutor for assessment will count for 40% of your total course mark. At the end of the course,

you will need to sit for a final examination; this examination will count for 60% of your total course mark.

TUTOR-MARKED ASSIGNMENT

You are encouraged to submit your assignments as required. Each assignment counts for 10% of your marks for the course. You will be able to complete your assignment from the information gathered from reading the study units and other recommended texts. However, it is desirable that you research more and read other references as this will give you a broader view point and may provide a deeper understanding of the subject.

When you have completed each assignment, send it to your tutor. Make sure that each assignment reaches your tutor on or before the deadline given in the presentation schedule and assignment file. If for any reason, you cannot complete your work on time, contact your tutor to discuss the possibility of an extension. Extensions will not be granted after the due date, except for exceptional circumstances.

FINAL EXAMINATION AND GRADING

The final examination for this course will take three hours and have a value of 60% of the total course grade. The examination will consist of questions which reflect the types of self-assessment exercises and tutor-marked assignments you have previously encountered. All areas of the course will be assessed. Take time to revise the entire course before the examination. The examination covers information from all parts of the course.

PRESENTATION SCHEDULE

Your course materials give you important dates for attending tutorials and the timely completion and submission of your Tutor-Marked Assignment. Do remember that you are required to submit all your assignments by the due date. You should guard against falling behind in your work.

COURSE MARKING SCHEME

The following table lays out how the actual marking scheme is broken down.

Table 1: Course Marking Scheme

Assessment	Marks
Assignments 1 – 4	Four assignments count 12.5% each = 40% of course marks
Final Examination	60% of overall course marks
Total	100% of course marks

COURSE OVERVIEW

This table brings together the units, the number of weeks you should take to complete them and the assignment that follows them.

Table 2: Course Schedule

Units	Title of Work	Weeks Activity	Assessment (End of Unit
	Course Guide		
	Module 1		
1	Introduction to Agriculture	1	
2	Agricultural Development	1	**Assignment 1**
3	Essentials of Agriculture	1	
4	Problems of Agricultural Development	1	
5	Land use System in Nigeria	1	**Assignment 2**
	Module 2		
1	Methods of Farming in Nigeria	1	
2	Importance of Research in Agriculture	1	
3	Agricultural Systems	1	**Assignment 3**
4	Agricultural Extension Service	1	
5	Importance of Agricultural Extension	1	
	Module 3		
1	Importance of Agricultural Production	1	
2	Environmental Factors Affecting Agricultural Production	1	**Assignment 4**
3	Types of Soil	1	
4	Identification of Crops	1	
	Module 4		**Assignment 5**
1	Common Food Crops	1	
2	Vegetable Crops	1	

3	Root Crops	1	**Assignment 6**
	Revision	**1**	
	Examination	**18**	

HOW TO GET THE MOST FROM THIS COURSE

In distance learning, the study units replace the conventional university lecturer. This is one of the great advantages of distance learning; you can read and work through specially designed study materials at your own pace, and at a time and place that suit you best.

Each of the study units follows a common format. The first item is an introduction to the subject matter of the unit and how a particular unit is integrated with the other units and the course as a whole. Next is a set of learning objectives. These objectives let you know what you should be able to do by the time you have completed the unit. You should use these objectives to guide your study. When you have finished the unit, you must go back and check whether you have achieved the objectives. If you make a habit of doing this you will significantly improve your chances of passing the course.

Self-assessment exercises are interspersed throughout the units. Working through these exercises will help you to achieve the objectives of the unit and prepare you for the assignments and the examination. You should do each exercise as you come to it in the study unit. There will also be numerous examples given in the study units; work through these when you come to them, too.

FACILITATORS/TUTORS AND TUTORIALS

There are 20 hours of tutorials (ten two-hour sessions) provided in support of this course. As soon as you are allocated a tutorial group, you will be notified of the dates, times and location of tutorials, together with the name and phone number of your tutor.

Your tutor will mark and comment on your assignments; he/she will keep a close watch on your progress and on any difficulties you may encounter and provide assistance to you during the course. You must mail your tutor-marked assignments to your tutor well before the due date (at least two working days are required). They will be marked by your tutor and returned to you as soon as possible.

Do not hesitate to contact your tutor by telephone, e-mail, or via the discussion board if you need help. The following might be circumstances in which you would find help necessary.

Contact your tutor if:

- you do not understand any part of the study unit
- you have difficulty with the assignments/ exercises
- you have a question or problem with your tutor's comments on any assignment or with the grading of an assignment.

You should try your best to attend tutorials. This is the only chance to have face to face contact with your tutor and to ask questions. You can raise any problem encountered in the course of your study. To gain the maximum benefit from the tutorials, prepare a list of questions before hand, you will learn a lot from participating actively in the discussions.

SUMMARY

COP 111- Introduction to General Agriculture I is a course that intends to introduce you to agricultural activities ranging from land preparation, planting, weeding, harvesting to the entire agricultural production value chain(even storage activities). Upon the completion of this course, you will be equipped with the basic knowledge of the nature, scope, principles and techniques of production and farm management activities in agriculture. You will be able to answer these kinds of questions:

- What do you understand by the term agriculture?
- What are the essential factors for agricultural development?
- How can you identify the conditions favourable for the growth of food crops?
- How can you identify the different types of soil?
- Why is it necessary to practice agriculture?
- What is the contribution of agriculture to Nigerian economy?
- What is the contribution of agriculture to rural development?
- What are the various pests and diseases affecting agricultural crops?

The list of questions that you can answer is not limited to the above alone. To gain a lot from this course you should try to apply the principles you have learnt- especially, in the area of production of food crops.

We wish you success and hope that you will find the course both interesting and useful. Good luck.

MODULE 1

UNIT 1 INTRODUCTION TO AGRICULTURE

CONTENTS

1.0 INTRODUCTION

This first unit is designed to enable you understand the impact of agriculture on the socio economic development of Nigeria. The unit will, briefly, explain the introductory part of the course to you. It will also take you through the importance of agriculture.

Now, go through all the sections carefully, as they are designed to make you understand the course better. For instance, pay due attention to all the self-assessment exercises; this will enhance your understanding of the content of the unit, so that the stated objectives for the unit can be achieved.

2.0 OBJECTIVES

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

- define agriculture
- state the branches/divisions of agriculture
- explain the importance of agriculture.

3.0 MAIN CONTENT

3.1 Origin of Agriculture

Right from the creation of man, agriculture has been a major occupation in existence. Man has survived as a hunter and as a gatherer of fruits; he has depended on the elements of nature such as vegetation, rivers and lakes, just as all other living animals have done. The early man- in the course of searching for food, clothing and shelter, adopted agricultural practices as his technical skill and materials resources grew. His primary objective, then, was to get fed and once this was accomplished, he was contented. With the passage of time, man observed that seeds thrown away germinated and produced fruits similar to the original ones consumed. Sticks and woods were the first farming tools. By trial and error, some animals were made to live in close contact with man through the keeping of the young ones caught during hunting. Animals were, thus, domesticated.

Today, man consciously selects plants and animals, according to the principles of genetic modifications and breeds form more closely adapted to his requirements. These advances in breeding plants and animals, advances in the use of irrigation, the exchange of crops between America, Europe and Africa, the development of fertilizers and pesticides and the invention combustion engine, have revolutionised primitive agriculture in many parts of the world.

In many developing countries like Nigeria, increase in food production is still often obtained by the dependence on traditional agricultural practices, rather than mechanised farming. The development of new varsities of crops and exotic breed of animals have resulted in a very substantial increase in world food production- an increase sometimes referred to as the green revolution. However, it is increasingly clear that the use of rapid growing varieties of crops requires a very heavy input of fertilizer and pesticides. Needless to say that using fertilizer and pesticides can be very expensive, and can constitute environmental hazards when they are used indiscriminately and without consideration for their long-term effects on the total environment.

SELF-ASSESSMENT EXERCISE

Look around you, or think of the past and mention three types of traditional farming and human behavioural patterns in agriculture.

3.2 The Meaning of Agriculture

Agriculture, to many people, simply implies food production. The word agriculture came from two Latin words- "*ager*" and "*cultura*", meaning field and cultivation, respectively. Hence, the term agriculture, literally, implies field cultivation and production of livestock. On the other hand, a concise definition of agriculture proposes that it is the science and art of cultivating the soil, production and management of crops, livestock production- preparation and processing of their products and by-products for the use of man. It also involves the disposal of these products through marketing. Agricultural activities begin with the clearing and preparation of the land for food production, and end with the final consumers. The activities of small-scale industries connected with the processing of agricultural products also come under the purview of our definition of agriculture here.

3.3 Scope of Agriculture

Agriculture is a subject/course with a wide range of activities. It is an applied science, which makes use of the principles of the basic sciences such as biology, chemistry, physics and geography. It is therefore studied under the following specialised disciplines:

a. Agronomy
This is the study of the relationship between crops and soil. Agronomy can be further split into soil science and crop science. While soil science involves the study of soil components as they relate to crop production, crop science is concerned with the physiological development and production of crops for the use of man.

b. Agricultural biology
This is another discipline related to crop as being affected by pests and diseases- and their control, for increased agricultural production.

c. Agricultural biochemistry and nutrition
This aspect involves the study of the biochemistry of all agricultural products and their nutritional value. It also relates to the formulation/production of livestock feeds.

d. Agricultural economics
This is the application of basic economic principles in the operations of the agricultural industry. It involves allocation of resources, organisation of farms, availability of agricultural inputs, pricing system of inputs and outputs and marketing of agricultural products. The effective utilisation of limited agricultural resources with a view to attaining optimum output

is at the core of agricultural economics. In like manner, formulation and study of agricultural policies, programme planning, finance and the demand and supply of agricultural products are important components of agricultural economics.

e. Agricultural extension

The agricultural extension worker is mainly concerned with the behaviour of the rural populace and their attitudes toward changes. There are various methods of, effectively, transmitting agricultural innovations to farmers. Where appropriate, agricultural extension also he1ps to build up groups of local farmers and organisations, so that they can benefit from extension programmes. Agricultural extension, therefore, provides the indispensable elements that farmers need to improve their agricultural productivity.

f. Animal science

This discipline entails the production and management of animals (livestock) and their various products.

g. Veterinary science

This is similar to animal science, but more inclined to specialised study of all the medical issues relating to livestock and other domesticated animals including cattle, goats, sheep, dogs and birds.

h. Forestry

This relates to the cultivation of economic trees for the use of man.

i. Wild life

This is the discipline that deals directly with the production and management of wild life.

j. Fisheries

This relates to the production and management of fish and their products.

k. Agricultural engineering

This is the study that deals with farm machinery and mechanisation. Agricultural engineers are inventors of agricultural implements; they design, fabricate and maintain various agricultural implements and equipment used within the agricultural sector.

SELF-ASSESSMENT EXERCISE 2

Based on your reading of section 3.3, list the specialised disciplines in agriculture.

3.4 Importance of Agriculture

A thorough understanding of the meaning and scope of agriculture, as discussed in the preceding sections above, reveals the extent of the importance of agriculture to the survival of mankind. Therefore, it cannot be neglected; rather, it should be accorded priority, in terms of development programme, especially, in the third world or developing countries like Nigeria. In general terms, agriculture provides the following to any economy:

Food

Agriculture provides the basic food requirements for the teeming population of the world. Owing to improved standard of living and improved medical and health services which have increased life expectancy and reduced infant mortality, the population of the world is increasing at a fantastic rate. This means increased demand for food. The fact that this teeming world population cannot depend on the collection of wild fruits and animals for their food emphasises the importance of agriculture.

Self-sufficiency in food production is one of the cardinal objectives of a nation, especially Nigeria. No nation delights in persistent dependence on other nations for her food supply. Self-sufficiency in food production implies the following:

- production of food, in adequate quality, to meet the nutrition requirements of all classes of the populace; thus preventing malnutrition, which can manifest as Kwashiorkor, marasmus and other devastating accompanying effects
- provision of food in adequate quantity, and at reasonable prices- to ensure affordability, so as to meet the caloric requirement of citizens . This implies little or no food imports
- exportation of food, which earns foreign exchange, which can be used to acquire capital goods and services that cannot, possibly, be provided locally due to natural constraints.

Self-sufficiency in food production ensures political, social and economic stability of a country.

Raw materials

Agriculture provides the raw materials for local industries. It provides cocoa for the beverage industry, cotton for the textile industry, timber and pulp for the wood and paper sectors, and latex (rubber) for the tyre and plastic industries etc. The raw materials provided should be

adequate to meet the needs of the industries and allow for future expansion. This will also help to conserve foreign exchange and create employment opportunities.

Foreign exchange

Agricultural products produced in excess of local demands can be exported to earn foreign exchange. This is of vital importance, because of a country's need for foreign exchange to produce certain capital goods and services.

Employment opportunity

Agricultural sector provides job opportunities for all categories of workers, principally because of its large size, compared with other sectors of service and industry within the country. The agricultural sector absorbs a sizeable proportion of the population into the farming business; this can range from the peasant farmer, farm labourers, agricultural officers, extension officer, to researchers, to mention a few.

In Nigeria, according to the 1953 census, over 80% of the population is engaged in agriculture. However, this has now been reduced to less than 60-70%, or thereabout. The percentage is even higher in some other underdeveloped countries. Even in developed countries, a considerable percentage of the population is in agriculture and its allied industries. For example in the United States about 85% of the people are directly in agriculture while about 42% are in industries connected with agriculture.

Provision of capital

Agriculture provides some sort of financial backing to other sectors of the economy, through savings and the purchase of goods and services from these sectors. Besides, the direct taxes paid by the large number of small scale farmers and few large scale farmers constitute sources of income for the government.

SELF-ASSESSMENT EXERCISE 3

Mention the major importance of Agriculture.

4.0 CONCLUSION

Looking at the contribution of agriculture to a nation’s economy,-as discussed above, you must have observed that agriculture is the main stay of the economy any nation. This observation is authenticated by the fact that over 70% of the population of a nation can be engaged by the agricultural sector- from the subsistence farmer, the researcher/scientists

who investigate agricultural problems, to workers in the industries that use agricultural materials for the production of their goods, transporters, and to traders (retailers/middlemen)-engaged in the marketing of agricultural products.

5.0 SUMMARY

In this unit, you learnt the origin, meaning, scope and importance of the agriculture. You also learnt about the contributions of agriculture to the Nigerian economy through the enhancement of the growth of gross domestic product (GDP) and reducing the rate of unemployment. You also learnt that other importance of agriculture include provision of food for man and animals, provision of capital and foreign exchange.

6.0 TUTOR-MARKED ASSIGNMENT

1. Examine the role of agriculture in the development of your country.
2. Discuss the scope of agriculture.
3. Give reasons why cooperative is studied under agricultural economics.

7.0 REFERENCES/FURTHER READING

Anyanwu, A.C., Anyanwu, B.O. & Anyanwu, V.A. (1998). *Agricultural Science for Schools and Colleges.* (5th ed.).

Aweto, R.A. (1996). *Agricultural Cooperatives.*

Komolafe, M.F., Adegbola, A.A., Are L.A. & Ashaye, T.I. (1980). *Agricultural Science for West African Schools and Colleges.* Ibadan: University Press Limited.

UNIT 2 AGRICULTURAL DEVELOPMENT

CONTENTS

1.0 INTRODUCTION

This is the second unit of this course; our focus here is on the term agricultural development- with special reference to West Africa, and Nigeria in particular. The transformation of subsistence agriculture to more productive forms of agriculture in Nigeria and other African countries requires the development of agricultural training research and extension programmes, the formulation of appropriate government policies, and the development of government regulations and programmes designed to enhance agricultural production. Science and technology are applied to agricultural operations to improve man's skill and to improve methods of cultivating the land, protecting crops and livestock against diseases and pests, thereby increasing agricultural productivity.

2.0 OBJECTIVES

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

- define the term agricultural development
- state the main characteristics of agricultural development
- discuss the role of science and technology in agriculture.

3.0 MAIN CONTENT

3.1 Development Provisions

Agricultural development is facilitated by the provision of certain social, health and educational facilities and services such as rural infrastructure (good road network); regular water supply, electricity, health, recreational and educational facilities for the people (farmers and families). When these are provided for, the rural populace they become independent of the urban people and facilities. All these are, however, accompanied by appropriate development programmes to sustain the development process. It therefore implies that agricultural development is not a revolutionary process. It is a planned process of change which requires adequate planning.

SELF-ASSESSMENT EXERCISE 1

Briefly define agricultural development.

3.2 Concept of Agricultural Development

With respect to the agricultural sector, development implies sustained improvement, advancement or growth in the various facets of the sector-i.e. crops, livestock etc., which simultaneously enhance the standard of living of vast majority of the people, especially farmers. Thus, there can be agricultural growth without development; for example, when few farmers (in most cases, rich farmers/industrialist,) experience increased output and standard of living. Suffice it to opine that there is reduction in unemployment and under-employment when a large proportion of the population is engaged in agricultural production. This is also reflected in increased gross domestic product of the economy.

3.3 Fully Monetised Economy

A fully monetised economy has exportation of agricultural products as one of its policy objectives. Also, agricultural development in such an economy reflects the features of basic subsistence economy; in addition to increased cash or export crop production. Invariably, there will be improvement in the quality of the crops exported; foreign exchange earnings are used to purchase capital goods which are needed for the various stages of development process within the economy.

3.4 Industrial Economy

Within an industrial economy, agricultural development occurs when there is adequate supply of raw materials to local agricultural industries.

This leads to expansion of industries, creation of job opportunities, reduction in underemployment. Thus, there is increase in food supplies to the growing industrial population. Although the number of people engaged in farming may decline, the productivity of the people remaining will increase, with the use of improved farming practices and efficient implements.

It is important to note that in all the three types of economy, there is a sustained increase in farmers' output, leading to increase in income and standard of living of the farming population. Besides, each economy has the feature of the three types of economies discussed above. Hence, there is rarely a distinction or demarcation between the three.

3.5 The Role of Science and Technology in Agriculture

Consequent upon the desire to increase efficiency in agricultural production, some farmers now specialise in some specific aspects of agriculture, such as poultry, cattle rearing, piggery and cultivation of specific crops. Thus, science and technology has played a significant role in the areas of mechanisation of agricultural production, protection of crops and animals, improvement of soil fertility for increased crop yield, production of disease resistant varieties of crop and species of animals.

Still on the major contributions of science and technology in agriculture, let us consider the following.

a. Mechanisation of agricultural production

Mechanisation enhances significant improvement in the design and fabrication of agricultural machineries and tools. Cultivation of land is now done with the use of ploughs and harrows. Tractor-driven implements like planters, harvesters etc., are now used in the farm. Besides, simple farm tools like cutlasses, hoes are being modified for increased efficiency. Battery cages are fabricated for poultry production; recently, with the high cost of procuring conventional metal battery cages wood is now used to build battery cages in Nigeria.

b. Protection of crops and livestock

Various agro-chemicals have been produced by scientists to control pests and diseases of crops and livestock. Insecticides, pesticides, fungicides are used to control the infestation of crops and animals in farms. Fungus disease in maize is controlled by using fungicides; while herbicides are used to control weeds. Animals are treated in the farm by

veterinarians; and vaccination ensures that animals are immunised against diseases.

c. Breeding

High yielding varieties of plants and animals are developed through breeding to increase farmers' output. Besides, varieties which are resistant to pest and diseases are also produced by scientists; for instance, high yielding varieties of cassava developed by scientists at the International Institute of Tropical Agriculture (IITA) is now widely cultivated by farmers in Nigeria. Artificial Insemination (AI) was developed to effect fertilisation in the female animal without being in contact with the male counterpart. This method has the advantage of reducing wastage of sperm, thereby enhancing increased production. Scientists have developed high yielding cowpeas varieties (such as *ire brown*) which are resistant to multiple diseases and insects- which reduce grain quality and seed viability, thus making seed unfit for planting.

d. Improvement of soil fertility

Soil scientists have discovered the use of inorganic chemical compounds in replenishing soil minerals. The mineral depleted from the soil due to excessive cropping can be replaced through application of inorganic fertilizers as well as organic manures. Scientific agricultural systems (crop rotation) have been discovered by scientists to improve farmer's performance in agricultural productions.

SELF-ASSESSMENT EXERCISE

List and explain the role of science in agriculture.

4.0 CONCLUSION

In this unit, you have learnt that agricultural development implies sustained improvement, advancement or growth in the various facets of the agricultural sector (i.e. crops and livestock, etc.). Thus, there can be agricultural growth without development. Science and technology has also made a major impact in agricultural operations so as to keep pace with socio-economic development.

5.0 SUMMARY

This unit has revealed that the concept of agricultural development varies from one economy to another- depending on the stage of economic development attained by a country. Hence, agricultural

development enhances the standard of living of vast majority of the people, especially farmers.

6.0 TUTOR-MARKED ASSIGNMENT

1. Briefly explain agricultural development from the socio-economic point of view.
2. It is often said that science and technology has contributed significantly to the development of agriculture. Explain why this is so.

7.0 REFERENCES/FURTHER READING

Adegeye, A.J. & Ditto, J.S. (1982). *Essentials of Agricultural Economics.* Ibadan: Centre for Agricultural and Rural Management, University of Ibadan.

Aweto, R.A. (1996). *Agricultural Cooperatives*.

Agbo, F.U. (1999). *Elements of Agriculture for Cooperative Colleges, Polytechnics and Universities.*

UNIT 3 ESSENTIALS OF AGRICULTURAL DEVELOPMENT

CONTENTS

1.0 INTRODUCTION

This is the third unit of this module. Remember that unit two dealt with the concept of agricultural development, while this unit will give a detailed explanation on the factors responsible for agricultural development. However, agricultural development cannot take place without the support of other sectors (industry and service) of the economy and vice versa.

2.0 OBJECTIVES

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

- identify the various factors responsible for agricultural development
- explain these factors of development- as it relates to the productive base of the economy.

3.0 MAIN CONTENT

3.1 Factors Responsible for Agricultural Development

From our discussion in unit two, you would have observed that agricultural development is a necessary condition for economic development in any nation, particularly an agrarian economy; hence agriculture is one sector in which Nigeria has a comparative advantage as it offers the greatest potential for expanding the productive base of the economy and diversifying its sources of foreign exchange through exports. The factors responsible for agricultural development are discussed below.

a. Effective agricultural planning

Agricultural planning is a conscious, sustained and systematic attempt made by the government, Non-Governmental Organisations (NGOs) or private sector to utilise the available agricultural resources of the country to the benefit of farmers and the entire populace. Proper planning of all activities within the agricultural sector is, therefore, imperative for rapid development.

b. Agricultural inputs

The main inputs used for agricultural production include agro-chemicals, fertilizers, herbicides, pesticides, fungicides etc., improved seeds and seedlings, agricultural machinery (tractors, combine harvesters, planters, riggers) etc. For improved agricultural production and agricultural development, there is need for efficient distribution of these inputs, especially to small scale farmers. The inputs need to be procured and supplied timely and in adequate quantity to farmers, in view of the complementary nature and seasonality of their application on the farm. This will enable the farmer to benefit, fully, from the use of the inputs.

c. Financial resources

Capital is very essential for agricultural development, because a lot of infrastructure is needed. Besides, agricultural production requires the purchase of farm inputs- as mentioned above. Planning- in relation to manpower, research and staff emoluments require large capital outlay. These are carried out at macro-level. Capital is needed by farmers to break the vicious cycle created by low productivity, low income and low savings. You will remember that in the past, the family was the major source of agricultural labour. In recent times, as a result of increased educational opportunities and rapid exodus of able-bodied agricultural labour to urban centers, there is great strain on the little family labour on the farm. Consequently, there is greater need for hired labour.

As with the other sectors of the economy, the increased demand for labour has resulted in rise in labour wages. To meet these, farmers need to have access to credit facilities. Such credit can also be used to purchase inputs to achieve increased productivity. Thus, credit need to be made available at the time required by farmers and at reasonable interest rates. Adequate supervision of the use of the credit is, however, necessary to ensure that it is spent on productive activities only. Some experts have argued that in order to achieve the prudent use of the production credit facility, farmers should be given consumption credit in addition to the agricultural production credit. This, as suggested, will

assist the farmers in meeting their consumption expenses during the period between planting and harvesting or unfavourable weather conditions.

d. Manpower development

Manpower development involves training of all categories of agricultural personnel. These include agricultural officers, agricultural superintendents, technicians and technologists. Manpower development is vital and crucial for rapid development. It ensures effective, management of the various phases of agricultural development process. Consequently, institutions such as universities, schools of agriculture and associated training institutes like Agricultural Research and Management Training Institute (ARMTI) are of paramount importance for the development of high and middle level manpower.

e. Agricultural land resources

The total land resource of Nigeria is estimated to be about 98.3 million hectares. Out of this about 71.2 million hectares is arable land. However, it is estimated that about only 34.0 million hectares is under cultivation. Thus, the cultivable land resources of Nigeria are grossly under utilised. The under-utilisation of land is a function of some institutional constraints. The land tenure system in operation is responsible for the fragmentation of farmland holdings and the difficulties encountered by individuals who are interested in farming. For rapid agricultural development, land need be made available to farmers. The land tenure system should allow expansion of fields and provide high degree of security to the cultivators. Equitable distribution of land permits as many people as possible to undertake farming as a business venture with reduced constraint.

f. Irrigation

Irrigation facilities such as dams are, particularly, essential in areas where there is insufficient rainfall. As an alternative to rain, irrigation ensures adequate supply of water, which is an important input for production of forage for livestock and other uses. This reduces the effects of weather hazards on crop and animal production.

g. Efficient marketing system for agricultural products

This is an important pre-requisite that requires time for consumers and stabilising farmer's income. Beside effective communication system, good roads are equally essential for conveyance of farm inputs and outputs, to and from farms. All these factors lead to increased output, income, and standard of living, thereby aiding agricultural development. They also result in generation of employment opportunity in the rural areas and reduction in rural-urban drift. They also ensure availability of good quality food to meet the nutritional requirement of the populace. It is important to note that attempts made to increase production need to be accompanied with commensurate measure to improve the efficiency of the marketing system; as it is fruitless to increase production which will later be lost as a result of spoilage due to inefficient marketing system.

h. Government policy

In view of the important role of agriculture in providing basic food requirement for the people, government of many countries- through their agents directly or indirectly, control agricultural activities to ensure rapid agricultural development. Consequently, policies are formulated while plans, programmes and projects are developed at different times and levels to facilitate the development of the sector. Some government measures to facilitate agricultural development in Nigeria include the following:

1. Agricultural credit scheme was launched in 1978 and was aimed at achieving rapid increase in the production of food stuffs. The scheme provided credit facilities to farmers for increased production of crops and livestock.
2. Establishment of Marketing Boards in 1997 which was to facilitate increased production of export crops and stabilise famer's income.
3. Establishment of National Supply Company (NSC) which performed anti-inflation role through massive importation of the so-called "essential commodities" (i.e. milk, rice, vegetable oil etc.).
4. Provision of subsidy for agricultural inputs such as fertilizers, agro-chemicals, improved seeds and seedlings and drugs for livestock production.
5. Guarantee of minimum prices and income for food producers aimed at stabilising the income of farmers.
6. Launching of Operation Feed the Nation (OFN) in 1976 and the Green Revolution (GR) in 1979. OFN was short-lived due to the change of government in October 1979 and was replaced by Green Revolution by the new government. Inefficient

management during the implementation stage and lack of continuity often constitute the bane of these programmes. Thus, continuity and efficient management of these programmes to attain the policy objectives are imperative for agricultural development (and its sustenance).

i. Institutional arrangements

Agricultural related institutions such as extension organisation, farm organisation, financial institutions, and farmers' cooperative associations are essential for agricultural development. These institutions are established, primarily, to give assistance of diverse nature ranging from financial to technical assistance to farmer members.

The assistance is aimed at improving farmers' techniques, overall production, income, standard of living and general welfare. The institutions are either established by the farmers themselves or through external agencies.

j. Technology

Technology does not, necessarily, imply complete change to the use of heavy machineries. The use of mechanical devices and applied science in response to changes in the total environment of the farmers and users of agricultural output is relevant here. Thus, rapid development of agricultural sector requires improved technology. This includes improvement of agricultural production technique, use of improved simple farm tools, management techniques, storing, processing and transportation of agricultural products.

The importance of changing technology is to enable the sector cope with the changes in the socio-economic characteristics of the dynamic population. Thus, farmers are able to maximise their returns due to effective use of limited resources. Besides, technology can only have significant impact on the sector if the products are readily available and affordable. Availability of local technology saves foreign exchange, creates job opportunities within the sector, increase farmers' productivity, income and standard of living leading to rapid development of the sector.

k. Research

Research is an advanced stage of study undertaken to discover or establish facts or principles. In agriculture, it involves finding solutions to farmer's problems through systematic experimental procedures. There are two types of research, namely:

i. Basic research
ii. Applied research

For research to be meaningful, it must be relevant to the needs of farmers. Thus, the farmers should participate fully in the identification of their problems/felt needs from the planning stage of the research. This is attained through close interaction between the farmers and the research team. This is referred to as "up steam" research. Findings of the research are transmitted to farmers through extension officers.

l. Extension Service

Extension service is defined as a voluntary out-of-school educational arrangement created to increase the production capacity, and thus, the standard of living of the rural and urban populace. It is either established by the government or non-governmental organisations to disseminate useful information relating to the discipline in focus, to the people concerned. Specifically, agricultural extension officers transmit research findings from research institutes or universities to farmers and obtain feedback from farmers to the researchers for further research, analysis and validation of facts.

SELF-ASSESSMENT EXERCISE

List five of the factors responsible for agricultural development.

SELF-ASSESSMENT EXERCISE

Which of these factors do you consider most important?

4.0 CONCLUSION

By now you must have realised that the various factors responsible for agricultural development include, financial resources, agricultural planning, agricultural inputs, manpower development, and research- to mention a few. These, in the long run, contribute to farmer’s income and increase in the standard of living, thus leading to rapid development.

5.0 SUMMARY

In this unit, you have studied the various factors responsible for agricultural development. All these have contributed to the growth and development of agriculture, which confirms that agricultural development is a necessary condition for economic development of any nation, particularly an agrarian economy.

6.0 TUTOR-MARKED ASSIGNMENT

1 a. How would you define agricultural development?
b. What are the factors required for rapid development of agricultural sector.

7.0 REFERENCES/FURTHER READING

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UNIT 4 PROBLEMS OF AGRICULTURAL DEVELOPMENT

CONTENTS

1.0 INTRODUCTION

Developing countries, especially, West African countries and Nigeria in particular are faced with numerous problems which militate against the development of Agriculture. About 78% of Nigerian population lives in the rural areas, and are, basically, subsistence farmers. This is an evidence of lack of development; since everybody will have to produce his own food and nobody will use his own resources to plan and create development in other sectors. Since there is the need for development-both in agriculture and other sectors, the problems militating against the development of agriculture needs to be identified and tackled.

2.0 OBJECTIVES

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

- state the various problems of agricultural development
- highlight the solutions to all these problems.

3.0 MAIN CONTENT

3.1 Agricultural Development: Problems

These problems account for almost 90% of Nigeria's under development issues, and once these are tackled with appropriate solutions, Nigeria will be regarded as an industrialised country. Let us consider some of these problems.

a. Land tenure

Land is one of the most important factors of agricultural production. Land tenure is the way land is owned in a society. The prevailing land tenure systems in Nigeria often discourage agricultural land utilisation. Land is owned by inheritance; hence, land is fragmented over generations. Increase in population has increased the various alternatives to which land can be put. This further puts pressures on available land. The only solution is the strict adherence to the land use decree of 1978 as amended by the 1990 Act. This can make land available to prospective and genuine farmers.

b. Poverty/lack of financial assistant

This is one of the major problems of agricultural development in Nigeria. Modern scientific agriculture requires some substantial capital to acquire land, improved breeds of plants and animals, and equipment-just to mention a few. Majority of farmers don't have this capital, and therefore, have no alternative than to engage in subsistence farming. Lack of credit facilities aggravates the problem. Banks insist on reasonable collaterals before they can give any loan and these farmers do not have such collaterals. The solution to this problem is that farmers should form themselves into co-operatives to generate capital for members. Government may also provide credit through some institutions with little or no stringent measures. Banks should be more liberal in making credit available to farmers.

c. Lack of basic amenities

Basic amenities are good roads, good drinking water, electricity, educational institutions, health facilities and market-these should be available in the rural areas. Young people like to enjoy the good things of life. Lack of these amenities in the rural areas has the effect of making the young energetic members of the communities to drift from the villages to the towns where the amenities are available.

The result is that the villages where the agricultural lands are found are abandoned to the poor and old people who may just manage to earn their living from the land. Amenities like good roads, electricity and water supply are necessary for agricultural development. Provision of these basic amenities will discourage rural-urban migration.

d. Ignorance and lack of good agricultural education

Most of the farmers in the developing countries are not educated enough in the technicalities relating to agricultural product. These educated

farmers do not tend to be conservative. Enlightened people tend to be guided in their decision by reason. The farmers are dogmatic and adamant to changes and very suspicious of any new innovations since they are unscientific in mind and in thinking and not willing to accept technological changes. Most of the farmers are unwilling to even learn how to use and apply fertilizers, insecticides and new farm tools. All these bring about low agricultural productivity.

In Nigeria, agricultural education is seriously being pursued. Research station or institutes are increasing and extension services are encouraged to ensure that the result of researches is made available to farmers. Demonstration farms are established at strategic places to help educate rural farmers. Adult education has been embarked upon with vigour through government agencies.

e. Poor tools and farm machine

Most farmers still rely on the use of tools like hoe, cutlass, rake- and so on, for their farm operation instead of using mechanised implements like riggers, ploughs, cultivators etc.; there is the need to have agricultural tools that are suitable for use in the tropics. At present, these are not readily and sufficiently available; where some are seen, they are very expensive and out of reach of the rural farmers. Also, Maintenance costs are high and the spare parts may not be readily available.

There is also need for skilled manpower for the maintenance and repair of the tools and machines. It may be necessary to encourage local production of the necessary tools and machines. This will have the effect of reducing the cost of purchasing and maintenance, and thereby making spare parts readily available. Government should train farmers on the most recent agricultural technology, and there should be subsidies on the cost of farm machinery. Government can also create agencies in most of the local governments where tractors/machines can be hired.

f. Poor storage and processing facilities

In Nigeria, a large percentage of farm products are lost after harvest. Prices of these products fall too low immediately after harvest, because the farmer cannot store or preserve them, properly, till they can have better prices. Since these products are perishable and the farmer has no technology to process or preserve them, the entire products are offered for marketing immediately. Prices are forced down and the farmer may not be adequately rewarded for his labour. The situation is worsened by lack of adequate marketing systems for most of the farm products.

A large amount of farm products are lost during harvesting season because they can neither be disposed of properly or be preserved or processed. Storage facilities are inadequate. It is necessary that government should establish adequate marketing system. Also, government should make efforts to provide storage and processing facilities like crib, barns, shelters millers, grater, etc.; excess farm products should also be purchased by the government so as to prevent glut and bring them to the market during scarcity.

SELF-ASSESSMENT EXERCISE

i. Explain five major problems of agricultural development.
ii. Give solutions to the five major problems mentioned above.

g. Inefficient marketing system

The sole aim of commercial agriculture is profit making. This cannot be achieved due to the activities of the middlemen who try to remove all the gains, create artificial scarcity with poor pricing policies. Prices continue to fluctuate and there is more marketing channels for farm produce coupled with the lack of good roads to help evacuate perishable farm produce to target market at the right time. The government should make provision for another board that should also pay the farmer prices that will give him enough profit to keep him in business. Such an arrangement will draw more capital into agriculture since people tend to invest in sectors that yield maximum profit.

h. Pest and diseases

In Nigeria, pests and diseases that destroy crops and animals abound. There are pests in the soil, pests that attack the aerial parts of the crops and storage pests. Very often, rural farmers are completely helpless in the face of these pests and diseases for they neither know how to control them nor can they afford the chemicals with which to do so if they happen to know what the disease or pests are and what chemicals to use. The results are:

i. large quantities of farm products are lost- both in the field and in store.
ii. farmers spend extra money on chemicals purposely to control the pests and diseases.
iii. there is reduction in quantity and quality of products. It is necessary to note too that very often, the chemical controlling the pests and diseases may not be available.

i. Inadequate agricultural inputs

Agricultural chemicals such as insecticides fungicides, are very expensive while inputs like improved seeds and seedling, improved animal materials like the parent stock in birds are lacking, some inputs are very substandard and do not meet the desired result while application of some chemicals can lead to pollution of the environment. Very often, supply of fertilizers are made when the farmer is about to start harvesting the crops. These inputs, as I have said above, are also very expensive and beyond the reach of majority of the rural farmers.

Government intervention is very necessary in this area. Farm inputs should be highly subsidised and also supplied at the right time for effective use. It is also necessary to reinforce the extension services to ensure that farmers are properly guided in the acquisition and proper use of the right type of agricultural chemicals and fertilizers.

j. Inconsistent government policies and programmes

Government lacks basic consistent policy on the management of agriculture. There is need to use government policies and programmes to solve most of the problems of agricultural development. For example, government can provide loans and credit facilities to promote expansion in agricultural production. It can subsidise the prices of specific agricultural materials and inputs in order to enable farmers obtain them at reasonable prices. Development of rural communities, especially, the farming communities is a programme that can help to attract farm labour to the rural areas where it is needed. Government can also initiate policies that can make farming so profitable that it will attract a lot of private capital.

k. Poor extension workers

Extension helps in disseminating information to a large number of farmers, within a very short time. This is not the case in developing countries because most extension workers are too ill-equipped for the work while language is another barrier- as well as the uncooperative attitude of farmers. At most periods, there is a lack of recent research work; poor remuneration of extension officers has also been a challenge. The funding of the extension programmes must not only be done by the government but also non-governmental organisations, cooperative societies and other financial institutions.

l. Unpredictable climate

This is a major factor which must be controlled to suit agricultural production. Unfavourable climate reduces all farm activities while drought or long period without rain leads to poor harvest; flooding or excessive rainfall also reduces yield as well. Inadequate sunshine reduces the photosynthetic ability of the plants while excessive sunshine leads to increase or abnormal temperature for crops. Development of irrigation system and proper methods of preventing degradation of the environment should be accorded priority by al1 the agencies responsible for environmental control.

4.0 CONCLUSION

The solution to all these problems is within –the purview of the government; agriculture should be given priority in annual budgets.

5.0 SUMMARY

In this unit, you have been exposed to the problems confronting agricultural development. Suffice it to say that agricultural development is a necessary condition for the development of the economy of any nation- particularly an agrarian economy. The development of agriculture can only be achieved if these problems are attended to as appropriate.

6.0 TUTOR-MARKRD ASSIGNMENT

1. "The problems of agricultural development could be attended to if only the government makes agriculture a priority". Discuss.
2. Enumerate and discuss five problems of agricultural development in Nigeria.

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UNIT 5 LANDS USE SYSTEM IN NIGERIA

CONTENTS

1.0 INTRODUCTION

In this unit, we are going to consider land tenure system and factors affecting land use in Nigeria. You will remember that land is one of the factors of production, and its importance in agriculture, generally, cannot be over emphasised. Hence, a better understanding of this unit will be of immense advantage to you.

2.0 OBJECTIVES

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

- define land tenure system
- explain types of land tenure system and factors affecting them in Nigeria
- highlight the steps government has taken to combat land use problems in Nigeria

3.0 MAIN CONTENT

3.1 Definition of Land Tenure System

Land tenure system describes the various ways land is controlled by the community, family or individual- either for permanent or temporary use. It also refers to the economic, legal and political arrangements regarding the ownership and management of land and its resources. This is very important because it affects the way land is used for both agricultural and industrial development.

3.1.1 Types of Land Tenure System

Land tenure system in Nigeria varies with tribe, clan, state or community. Let us consider the following.

a. Communal land tenure system

This is the traditional system of land ownership, whereby land is generally regarded as the property of the community. This makes individual ownership rare, particularly in rural areas. The community may be a family, a village, a clan- always headed by a family head, village or clan head. In this system, every member of the community is entitled to a piece of land for farming, but individual ownership is not allowed. Land cannot be sold to strangers since there is ancestral ownership.

Allocation of the land among the community members is usually decided by the head of the community, acting on the authority of the entire community. The community does not control whatever is grown on the land and has no claim on the products of the land. The member to whom the land is allocated decides what should be grown on the land- which must not be permanent crops. He also has claims over the products, especially the arable crops he has planted such as maize, rice, yams, melons, cassava etc.; but perennial crops such as oil palm belong to the community and are harvested and shared among the members of the community.

Disadvantages of communal ownership of land

The major disadvantages of communal ownership of land are as follows.

i. Inadequate maintenance of soil fertility- if a farmer realises that the portion of the land he is farming this year may not fall to him the next year, he may not be willing to invest enough into the soil to maintain its fertility. He will only be interested in how much he can get from the soil during the period he farms on it. This will eventually lead to rapid depletion of soil fertility.

ii. Useful time is wasted in consulting large number of people whenever government wants a piece of land for developmental purposes. Often, customary tenure rules are transmitted orally through generations. This resulted in lack of documented records and has led to land disputes and court cases over land ownership and boundary demarcation.

Advantages of communal ownership of land

The advantages of this system are as follows.

i. Each member of the community has the opportunity to request for farmland to provide food and earn some money for his family.
ii. It is possible to organise communal and cooperative farms on such lands, since the land is extensive.
iii. Modernised farming on economic scale is possible.
iv. It is easier to transfer the land to a prospective farmer, since individual attachment is almost absent.

b. Tenure based on individual inheritance of free-hold land ownership

This is the commonest method of acquiring land in some developing countries; here, the land owner has the freedom to do what he likes with his land. When the farmer dies, his holdings are transferred by inheritance to his sons. The piece of land is continually fragmented from one generation to another and it is usually shared among the male children of the farmer. Each son, usually, prefers to invest in the land in order to improve its fertility for agricultural production. If the land is large enough, mechanised farming can also be practiced.

The right ownership to the land can be transferred from one man to another by outright sale or purchase. This is sometimes rare for two reasons:

a. there is the religious, sentimental attachment to land in many communities.
b. there is also the rigorous and unnecessarily long negotiation associated with such transfer or purchases.

Disadvantages of free-hold land ownership

This system of land ownership has the following disadvantages:

i. lack of government control over land which is an important asset
ii. over-independence and abuse of land by land owners, resulting in excessive and uneconomical fragmentation of the land
iii. land may belong to some people who have no interest in land development or in making optimal use of it
iv. those who have no land, or those who have very limited areas for their needs may be unable to buy or rent land from individual owners.

Advantages of free-hold land ownership

The main advantages are:

i. the individual owner often prefers to invest in the land in order to improve its fertility for agricultural production since the land belongs to him
ii. he can also use the land as security to obtain loans from commercial banks
iii. this system gives the land owner security of tenure; it makes for proper future planning and efficient investment on the land.
iv. Mechanised farming can be practiced if the land is large enough.

c. Lease-hold tenure or landlord-tenant agreement

This is a situation whereby a farmer is permitted by the land owner to work on a piece of land for a fixed length of time and under stipulated condition. The real land owner may be an individual, government or a government agency or a community. A good example is the *Taungya* system- whereby the Forestry department releases a portion of its fertile land to farmers for a specific period of time for the cultivation of food crops, while at the same time nursing some tree seedlings.

This system permits effective control of land by the land owner or the community. At the expiration of the period of tenancy, the land reverts to the land owner.

d. State or government ownership of land

Some land belonging to the government may be leased out to an individual; payment can then be made into government treasury. The disadvantage of this system is that the government can recover its land at a very short notice.

It should be mentioned here that the disadvantages of the various systems described above are obstacles to agricultural development; and co-operative societies are expected to be used to circumvent these obstacles. This is because farmer's access to communal land has been found to be faster on the platform of these cooperative societies rather than as individual.

SELF-ASSESSMENT EXERCISE

What do you understand by communal ownership of land?

SELF-ASSESSMENT EXERCISE

List the advantages and disadvantages of communal ownership of land.

3.2 Government Laws on Land

Poor Land tenure systems have been identified as one of the major bottlenecks preventing agricultural development in the developing world; hence, a suitable and functional land tenure system is the pivot for rapid agricultural production in any nation. It was in the recognition of this fact that the Nigerian government in 1978 promulgated the land use decree which later became the Land Use Act. The declared objectives of this Act are as follows:

i. To remove bitter controversies which land has generated in Nigeria.
ii. Streamlining and simplifying the management and ownership of land in the country.
iii. Assisting the citizenry, irrespective of their social status, to own a piece of land both for shelter and farming.
iv. Bringing under government control the use to which land can be put in all parts or the country; and thus, facilitate planning or formation of programmes for particular land uses.

As it is today, as regards land transaction- to consider whether this 1978/1979 Land Use Act has fulfilled these objectives is a vexed question; as it can be safely said that the land tenure systems prevailing in all rural areas of this country before this Act have survived till date.

3.3 Principles of Land Use

The principles of land use aim at optimal use of land and the avoidance of wastage. Land can be used for three main purposes, namely- agriculture, forestry and wildlife conservation or game reserve. Let us take a cursory look at these.

i. Agriculture and forestry

These aim at the production of food vegetables, timber and fuel. The use of land for any of these purposes is often decided by the zone to which the land belongs- i.e. weather it is in the forest zone or savannah zone.

In the forest zone, land is used mainly for timber, perennial and special tree crops and animal, protein production; whereas in the savannah region, land is best used for pasture, subsistence crops, and production of animal protein. The use of land in the savannah zone is best decided

by vegetation. However, a good use of the land can make it possible to have both forests and agricultural products from the piece of land. If the forest trees are well specified, the leaves from the trees will serve as manure for food crops or even for pasture in the derived savannah zones.

In very strong wind belts, forest trees can be used as wind breakers for agricultural crops, thus using forestry to the advantage of agriculture.

i. Wildlife conservation

This started in United States when people felt that certain animals they needed for sports were decreasing and at the risk of becoming extinct. These provided games reserves for tourism and holidays. In Nigeria, you will recollect that we have such reserves as the *Yankari* in Bauchi State (which is about the best reserve in West Africa), the *Borgu* in Niger State and the Upper Ogun in Oyo State.

SELF-ASSESSMENT EXERCISE

Mention the objectives of the Land Use Act of 1979.

4.0 CONCLUSION

From the explanation in this unit, you will agree that the Land Use Decree was one of the most progressive attempts to develop modern agriculture. This was aimed making land available to those who have the knowledge, resources and zeal to farm. It is unfortunate that the noble objectives of this programme could not be achieved due to strong attachment of people to their land and other considerations bordering on politics and ethnicity.

5.0 SUMMARY

Land for agricultural activities, especially in the rural areas, is acquired mainly through inheritance; where a piece of land owned by a great ancestor is transferred within the family from generation to generation. The land tenure system has only succeeded in removing just few bottle-necks in urban areas.

6.0 TUTOR-MARKED ASSIGNMENT

1. Define land tenure system.
2. Give a list of the land tenure system with which you are familiar.
3. Which of these systems has the greatest influence on agriculture?

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MODULE 2

UNIT 1 METHODS OF FARMING IN NIGERIA

CONTENTS

1.0 INTRODUCTION

Farming started with man using the power of human muscles. Many centuries passed before he started to use animal power to supplement the human muscle. With the advent of science and technology coupled with research findings, agricultural production moved from subsistence farming to the use of machines, which is regarded as mechanisation- for commercial purposes.

2.0 OBJECTIVES

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

- discuss the various types of farming and their characteristics
- explain the merits and demerits of each type of farming.

3.0 MAIN CONTENT

3.1 Hunting and Gathering

The early man lived by hunting wild animals and gathering wild fruits. His primary objective then was to get fed; and once this was accomplished, he was contented. This system was characterised by the use of primitive tools like stones, bows and arrows, traps, clubs and plough. There was little to eat and no reserves were made for the farming season. This method was quickly jettisoned- with the advent of civilisation.

3.2 Subsistence Farming

This is a system of fanning whereby a farmer cultivates crops and rears animals in order to produce food for use by himself and his family only. In crop production, the subsistence farmer concentrates on arable food crops as yam, cassava, maize, millet, sorghum, groundnuts, soya beans, and cowpeas. The subsistence farmer may also be involved in the establishment of plantations using traditional methods. The farmer may plant such crops as oil palm, cocoa, rubber, kola, tea, coffee, banana, and citrus trees.

In livestock production, the subsistence farmer keeps a few goats, sheep, rabbits or pigs. In the arid regions, the subsistence livestock farmer is mainly nomadic and moves with his animals from place to place in search of water and pasture.

Characteristics of subsistence farming

1. Labour is provided by the farmer and his family.
2. Only small area of land is used.
3. Crude implements like hoe, cutlass, digger, baskets are used.
4. The produce from the farm are not necessarily for sale.
5. The yield is also very low compared to mechanised farming.

Problems of subsistence farming

1. Control of pests and diseases is difficult.
2. The farmers are illiterate.
3. Use of crude tools.
4. Labour supply is erratic and unreliable.
5. The practice of subsistence farming wastes land and there is no means of replenishing soil.

6. The process is boring because the work is unchallenging and there is little or no profit, since farm products are not for sale.

SELF-ASSESSMENT EXERCISE 1

i. What is subsistence farming?
ii. List the problems associated with subsistence farming.

3.3 Cash Crop Production

This is a more advance stage of agricultural production. They are tree crops which are planted and could stay on the same piece of land for many years. The farmer specialises on cultivating cash crops like cocoa, kola, rubber, citrus, groundnut, and oil palm. These require processing into finished products before they are to be consumed.

Most of the plants in this category can stay for 5 to 50 years; and because of this, they require:

a. initial fertile soil
b. adequate and well distributed rain fall
c. suitable cultural practice.

3.4 Commercial Agriculture

This is a type of farming that is done on a large scale; this involves the use of machineries to do the work formally done manually (mechanisation). Machines have been produced which increases productivity in agriculture. In advanced countries, most farm operations have been mechanised. Bulldozers are used for clearing the farm. Tractor mounted instruments like ploughs and harrows are used in tilling the soil. There are machines for planting and making ridges; also, we have cultivators, spraying machines and machines for applying fertilizers. Many types of harvesters are now available and there are machines used in processing agricultural produce of any type. In livestock farming, we now have incubators, egg graders and milking machines. These machines make work in the farm easier, faster and less burdensome. Take note of the following features.

1. It is very expensive to practice.
2. Large area of farmland is required.
3. Requires the use of machines like cultivators, tractors, planters, harvesters, etc.
4. Labour is both manual and mechanical, and specialists are required, at some stages of production.
5. Returns are very high at the end of season or harvest time.

6. Marketing of products is specialised and sometimes requires advertisement.
7. It involves a lot of research into the various aspects of production.
8. It requires good record keeping to be able to make proper decisions.

3.4.1 Advantages of Mechanisation

Let us consider the following benefits of mechanization

1. With machines, a farmer does much greater work within a given time- and does the work more efficiently.
2. Very often, machines do more thorough work that the hands can do.
3. Larger areas of land are cultivated with machines than with human labour.
4. Farm drudgery is very much reduced.
5. Labour is saved and released from the farm to other areas of production.
6. It is cheaper to produce with machine; this increases the profit margin of the farmer.
7. Mechanisation makes it possible for the farmer to make use of optimum production period.
8. Since larger areas are cultivated with greater efficiency, food and raw materials will be produced in greater quantities.

3. 4.2 Disadvantages of Mechanisation

Mechanisation is a blessing to agriculture, but it has disadvantages and limitations. Some of the disadvantages include the following:

1. It is capital-intensive - this is so because a lot of money is needed to purchase tractors and other implements; only rich farmers can acquire the necessary equipment. Also, the cost of hiring machines is often above what the ordinary farmer can afford. In Nigeria for instance, many state governments (Oyo State) have established tractor hiring units, but it will take time before many farmers can afford to take advantage of this.
2. It generates unemployment; because of the improved rate of work as a result of mechanisation, a good number of workers are displaced, unemployed people constitute social problem.
3. Mechanisation of seedbed preparation destroys or alters soil structure, which is not good for plants.
4. Mechanisation creates pollution since the machines will use power that often generates fume. The smoke that escapes from

the exhaust of the tractors is carbon monoxide, which is dangerous.

3.4.3 Limitation to Mechanisation

The cost of buying source of power and machines is very high and only very few rich farmers can go for mechanisation now. Also, majority of farmers- especially rural farmers cannot afford the cost of hiring farm machines. Even at that, the available machines are not enough to reach all those who would like to hire them. There is scarcity of spare parts for the machines available. As a result, most of the machines lie waste most of the time. For the machines to last long, they have to be properly maintained, regularly.

SELF-ASSESSMENT EXERCISE 2

1. What is meant by mechanisation of agriculture?
2. Mention two advantages and two disadvantages of the system.

3.5 Differences between Commercial and Subsistence Agriculture

Commercial Agriculture	Subsistence Agriculture
1. Large scale farming is adopted.	1. Small scale farming is adopted.
2. Mechanisation is the main focus.	2. Traditional farming is being practiced.
3. It is ideal for mono-cropping, intensive animal production and fish farming.	3. Ideal for mixed farming, bush fallowing and shifting cultivation.
4. Highly capital intensive-which can be gotten through the bank.	4. Low capital requirements-which can be provided by friend and family members.
5. Labour is highly specialised and expensive.	5. Labour is from friends, family members; and it is cheap.
6. Marketing of product is specialised.	6. No special marketing skills are required.
7. Research into aspects required.	7. No research activity is required.

8. Highly scientific with no superstitious belief.	8. Highly traditional and superstitious in nature.
9. Yield (and often, returns) are high- meant for everybody.	9. Yields are low and meant for family members.
10. Processing of final product is common.	10. No processing of any form is practiced.
11. It requires good record keeping so as to be able make good decisions.	11. No record keeping is done and so no improvement is expected.

4.0 CONCLUSION

It can be clearly stated that despite the high yield and high proceeds from commercial agriculture, most small scale farmers still operate subsistence farming as a result of the low capital outlay involved. The state and federal governments should provide capital for small-scale farmers.

5.0 SUMMARY

From the understanding of the various types of farming in this unit, it is clear that mechanisation of agriculture will be the solution to boosting agricultural production. Also, it is worthy of note that subsistence farming can still be developed, especially with the provision of capital to small scale farmers.

6.0 TUTOR-MARKED ASSIGNMENT

1. Explain the term commercial agriculture.
2. State five differences between commercial agriculture and subsistence agriculture.
3. Give the characteristics of subsistence agriculture.

7.0 REFERENCES/FURTHER READING

Anyanwu, A.C. *et al.* (1998). *A Text Book of Agricultural Science for Schools and Colleges.*

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UNIT 2 IMPORTANCE OF RESEARCH IN AGRICULTURE

CONTENTS

1.0 INTRODUCTION

Research has played tremendous role in the development of agriculture in Nigeria. Traditionally, research in agriculture in Nigeria has concentrated on cash crops which are of value to industrialised economics. Lately, the scope of research has been expanded with the principal objective of developing improved systems which will maintain soil fertility and consistent high yields. Also, the system is expected to be economically viable, socially and culturally acceptable; as well, it has to be within the abilities of the small farmer and can adapt to different ecological conditions.

2.0 OBJECTIVES

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

- state the contributions of science and technology to agriculture
- highlight the impact of research activities on agriculture
- discuss ways of encouraging farmers to adopt innovations.

3.0 MAIN CONTENT

3.1 Definition

Research is an advanced stage of study undertaken to discover or establish facts or principles. In agriculture, it involves finding solutions to farmers' problems through systematic experimental procedures.

There are two types of research, namely:
a. basic research and
b. applied research.

3.1.1 Basic Research

This is carried out by the intellectuals in universities, and at times, in research institutes for the sake of acquiring knowledge and not for solving immediate problems of farmers. The findings are however, sometimes utilised later in applied research.

3.1.2 Applied Research

This is often carried out by the intellectuals, mainly in the research institutes, and at times, in the universities purposely for solving immediate problems in the country. The methods and the techniques employed in this type of research are often drawn from the fundamentals of the basic research carried out some years back. Problems of the farmers are taken to the research workers by the extension officers for analysis and solution.

SELF-ASSESSMENT EXERCISE 1

i. Explain the term research.
ii. What is applied research?
iii. Mention two advantages of research work to farmers.

3.2 Research Institutes

As of today, Nigeria has over 35 Research Institutes which are established purposely to carry out research work in various fields, especially on agricultural activities. Such institutes include:

a. The Cocoa Research Institute of Nigeria (CRIN) - this is located at Onigambari, near Ibadan. It engages in research activities which are related to specific problems of tree crops like cocoa, coffee, kola nut, cashew and tea. It has experimental stations in different parts of the country where the crops thrive.

b. **Nigeria Institute for Oil Palm Research (NIFOR)-** this institute conducts research on soil analysis and production of palm produce. It also deals with specific problems of oil palm farmers in the country. The headquarters is in Benin-City, Edo State.

c. **Livestock Research Institute, Vom (Jos) -** this institute is saddled with research activities on livestock. The headquarters is at Vom, near Jos, in Plateau State.

d. **National Institute for Social and Economic Research (NISER)-** this deals with research into various economic and social problems in the country. It carries out feasibility studies on various socio-economic and agricultural problems. It organises seminars, conferences and workshops related to any of these problems.

e. **National Root Crops Research Institute, Umudike(NRCRI)-** this is a body charged with the responsibility for research into root and tuber crops such as yam, cocoyam, cassava, potatoes.

f. **International Institute of Tropical Agriculture (IITA)-** this is a non-profit international agricultural research center with its headquarters at Moniya in Ibadan; it has experimental farms in Abuja and some selected states in the country. The goal of this institute is to increase the productivity of major food crops and to develop sustainable agricultural systems capable of replacing fallow or slash and burn cultivation in the humid and sub-humid tropics through research. The institute's crops improvement programmes focus on cassava, maize, plantain, cowpeas, soya beans and yam. The research findings are shared through international cooperation programmes, which include training, information and exchange activities.

The findings of these various research institutes are usually passed to farmers through extension officers. Varieties of crops which are resistant to various disease infesting local crops are produced and sent to the farmers along with improved package of farming methods and techniques. Similarly, the government is often advised on a number of socio economic factors affecting the production process so that policies which may encourage farmers are formulated.

Also from the research activities of these institutes over the years, new and improved varieties of a number of crops such as maize, rice, cocoa, rubber, grasses legumes have been developed. Better and more

economic ways of cultivation have been introduced and better yields and qualities of animals have evolved by selection and cross breeding.

For research to be meaningful, it must be relevant to the need of farmers. Thus, farmers should participate fully in the identification of their problems/needs- from the planning stage of the research. This is attained through close interaction between the farmers and research team. This is referred to as "Up Stream" research. All the findings of the research are transmitted to the farmers through extension officers.

SELF-ASSESSMENT EXERCISE 2

Mention five research institutes and state their research activities.

3.3 Applied Research

These are research efforts that should be disseminated to farmers, purposely to assist in their agricultural practice. This may be regarded as new ideas, methods, practices or techniques, which give the means of achieving, sustained increase in farm productivity and income. The innovations can be grouped into technical and social innovations.

3.4 Innovations

In view of the importance of science and technologies to the development of the agricultural sector, there is need to ensure that innovations are effectively transmitted to farmers. Farmers need to be encouraged and sensitised on innovations; some of the strategies for this include the following:

i. Adequate financial assistance should be provided to farmers for easy adoption of innovation. This can be in the form of subsidy which accompanies the introduction of a particular innovation or provision of credit at fair interest.

ii. Continuous education and training of farmers- cooperatives are institutionalised organisations with continuous education of members as part of their principles. They can be cheaply and conveniently used by extension officers to educate members about innovations.

iii. The use of contact farmers in reaching other farmers in the community is relevant. Contact farmers are those with relatively high educational background, good past farming performance and are able to command the respect of their contemporaries. Contact

farmers efforts tend to supplement the efforts of extension officers.

iv. Demonstration farms should be used liberally by extension officers while introducing new techniques. This reveals results of innovations and enhances farmers' understanding of the techniques.

v. All inputs or facilities required for optimum benefits of the innovations should be provided when due, to sustain farmer's confidence in extension officers and the innovations.

vi. There is need for formulation and implementation of consistent policies. However, where there is the likelihood of negative impact of a policy on farmers, government should provide a safe measure to absorb or reduce the impact.

vii. Agricultural extension officer should be provided with adequate resources (finance, mobility etc.) to enhance their performance. Besides, government should address the problem of acute shortage of extension officers.

3.5 Quarantine Services

Government provides quarantine services purposely to aid agricultural development. Plant quarantine regulations are meant to prevent the introduction and distribution of foreign plant diseases and pests into a country. The primary objective is to protect the crops which are produced in the country. Quarantine measure can also be applied to eradicate and prevent the spread of plant diseases and pests within the country. These measures require strict supervision of the importation of plant materials like seeds or nursery stock.

During the quarantine period, the imported materials are kept under strict observation in sealed compartments for a period which is long enough for any disease symptoms to appear. If the disease symptoms appear, the infected materials are destroyed or they may be re-exported at the expense of the person or organisation that imported the plant.

3.6 Research Contributions

The contributions of science and technology in the areas of agricultural development are as follows:

- Improvement of crops and animals through genetic manipulations (breeding).
- Control of diseases and pests.
- Improvement and better management of the soil and its resources.

- Better and precise methods of studying climate which is one of the environmental factors affecting agricultural productivity.
- Mechanisation of farm operations purposely to maximise yield by more efficient operations.
- Construction of good roads for easy evacuation of farm produce.
- Increase in productivity of crops and animals through better techniques.

SELF-ASSESSMENT EXERCISE

i. What is innovation?
ii. Mention four ways of encouraging farmers to adopt innovation.

4.0 CONCLUSION

Both basic and applied research should be well funded so as to get more facts in improving agricultural activities with the ultimate aim of fostering rapid development of agriculture and providing food for all.

5.0 SUMMARY

Research as contributed, in no small way, to the rapid development of agriculture. Farmers should also be encouraged to adopt innovation through adequate financial assistance, continuous education and training bearing in mind the major contributions of science and technology to agricultural development.

6.0 TUTOR-MARKED ASSIGNMENT

1. Explain the following terms:
   a. basic research
   b. applied research
   c. innovations.
2. Give five ways of encouraging farmers to adopt innovations.
3. Mention four research institutes and explain their research activities.

7.0 REFERENCES/FURTHER READING

Agbo, F.U. (1999). *Elements of Agriculture for Colleges, Polytechnics and Universities.*

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UNIT 3 AGRICULTURAL SYSTEMS

CONTENTS

1.0 INTRODUCTION

This unit takes a look at the agricultural system in Nigeria and the various methods used by different groups of people for crop production and livestock management in order to supply human needs. In these systems, the aim of the farmers has always been the same - to make his land produce as much as he needs and to keep the soil fertile to support sufficient agricultural productions.

2.0 OBJECTIVES

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

- discuss the various agricultural systems in Nigeria
- describe accurately any three of the methods of farming
- highlight the strengths and weakness of traditional farming system.

3.0 MAIN CONTENT

3.1 Shifting Cultivation

The most common system of agriculture practised in Nigerian traditional villages is shifting cultivation. Under this system the farmer clears a piece of land and plants his crop. After one to three successive planting seasons, he leaves this piece of land and clears another, to allow the first piece of land to regain its fertility. He (farmer) may come back to the first piece of land after many years. During this period, this first piece of land grows into a bush and the land regains its richness through the leaves that fall and decay on the soil. This system was practicable in the older days because population was small and the farmer plants only for himself and his family. Nowadays, because of increase in population, shifting cultivation may not be desirable and practicable, in some areas.

3.2 Land Rotation

A modified form of shifting cultivation is called land rotation. Under this system, a farmer makes use of a piece of land, over a number of years, when he feels that the land is becoming poor, he leaves it for another plot only to come back to the original plot, after some years. Land rotation is still practiced in some part of the tropics, especially in sparsely populated districts. This, in a region known for rapid re-growth of its secondary vegetation- like the equatorial and rain forest zones, present no problem to its pre-cultivation level. However, the condition is different for grass land areas, as the grass does not drop enough litter to restore the fertility of the soil rapidly.

Another factor which makes shifting cultivation and land rotation undesirable in grassland areas is frequent destruction of humus through indiscriminate bush burning etc. This is due to the method of disposing rubbish after cleaning since the vegetation in the tropics cannot easily be buried after clearing; the easiest way of disposing of it is by burning. During burning, fire burns the humus of the soil and in addition destroys some of the elements of nutrient like nitrogen, sulphur and carbon. Sometimes, the fire spreads over the fallow plots and destroys the vegetative cover, as well as any litter that could have been added to the soil. The soil is exposed to unnecessary leaching and soil wash. Some of the features of shifting cultivation are mixed cropping, bush fallow, subsistence farming and extensive farming.

SELF-ASSESSMENT EXERCISE

Mention the two traditional agricultural systems we have just discussed.

SELF-ASSESSMENT EXERCISE

Briefly explain shifting cultivation.

3.3 Mixed Farming

This means planting more than one type of crop on one plot of land at the same time. Yam, Maize, Melon, and Okra often go together, while maize, cassava and okra are planted on the same plot. The purpose of planting more than one crop on a plot of land is to prevent crop failure and to fully utilise the fertility of the soil. It has even been argued by some people that under the traditional methods of farming, mixed cropping is more economical; they held that total proceeds from a plot on mixed cropping have been found to be greater than that for a similar plot on sole crop. In order to achieve this successfully, the following points are very essential:

a. The soil must be in a very fertile condition.
b. The crop must be such that none disturbs the progress of the other.
c. All the crops should not be equally vigorous at the same time to allow even nutrient uptake.
d. Some must be shade tolerant.
e. The nutrient requirements of the crops should not be too identical to avoid excessive competition.

The most suitable combination of plants for intercrop planting involves those that have a definite difference in their rate of growth. Hence, a crop that matures after several months may be intercropped (with an advantage) with a crop that matures in half the time. When the early maturing crop is harvested, it gives room for the late maturing to develop fully. Examples of typical combinations for inter-cropping with local crops are- tomatoes and green vegetable, hot pepper and okra, egg plant and spinach/green vegetable , sorghum or millet, cowpeas/millet or cowpea/cotton, guinea corn/cowpea/groundnuts, maize/cassava/barbara groundnuts. With modern farming methods, mixed cropping has the following disadvantages:

a. The fel1ilizer mixture suitable for one of the crops may not be suitable for the other crops. This may reduce the yield of the other crops.
b. A plot containing different crops of varying heights and distances cannot be easily adapted to mechanisation.

3.4 Bush Fallow

Here, when a farmer observes that the soil has lost much of its fertility, he moves over to another plot of land leaving the former plot to re-grow into a bush. When a plot is under bush fallow, there is hardly any addition of nutrients to the soil. If, however, the fallow period extends to five or more years, the roots of the plants in the plot will grow deeper into the subsoil. Thus, they will recapture the nutrient elements lost from the topsoil through leaching and return them to the topsoil through leaf fall. This accounts for the rejuvenation of soil under bush fallow.

3.5 Continuous Cropping

This system, practiced in densely populated areas involves putting a piece of land under cultivation from year to year. The crop planted may either be annual or perennial. Continuous cropping can be well organised in a crop rotation system but it often leads to soil exhaustion, erosion and low productivity.

3.6 Mono-cropping (Sole Cropping)

This is the practice of growing exclusively one type of annual crop and harvesting it before planting another one on the same plot of land. It is a risky system, analogous to carrying all one's eggs in one basket. The farmer will be exposed to the danger of poor harvest, in case of adverse climatic condition or invasion of pest and diseases; and he may be forced to depend on other farmers for other food crops that he does not produce.

3.7 Crop Rotation

This is the third stage in the evolution of farming system. Crop rotation can be defined as fixed sequence of growing different crops on one field at different times. Crop rotation involves the use of land- but the crops planted on the land are changed from year to year or from season to season.

Crop rotation has replaced land rotation and shifting cultivation in all advanced countries. Even in more primitive societies, the rapid increase in population has forced people to come closer to crop rotation. Under the population pressure, it is no long possible to allow a fallow period of up to three years, in most communities. In that case, the land has to be used almost continuously. In such a circumstance, the fertility of the soil has been maintained by the application of manure and fertilizer- different crops require different amount nutrient. Some use much and are known as exhaustive crops- e.g. maize, yam, and cassava. Others can

actually add nutrients to the soil e.g. legumes. Every year, a different kind of crop is planted in order to prevent depletion of nutrient.

The crops should be arranged such 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 result that if the next is maize- which requires nitrogen, it will do well. Crops that require high nutrient should come first in the rotation. Some crops have deep root that go deep into the soil and therefore feed deep, others have shallow roots. This enables the deep feeder to collect some of the nutrients materials that could be washed into the subsoil.

It is necessary to consider the pest and diseases that attack crops in the rotation. As far as possible, the crops that are prone to being attacked by the same diseases or pests should not follow each other. Where a pest or disease has been identified, crops that are very resistant to the pest or diseases should be planted first. This will lower the incidence of the disease. Cultural practice should also be given adequate consideration. The only snag in this system is the cost involved; stumping especially can be very expensive, particularly in the forest zones.

3.7.1 Inter-planting

This involves growing any major crop in between another crop, on the same piece of land. The crop planted later remains on the plot after the first crop has been harvested. Cassava and maize can be grown in this way.

3.7.2 Inter-cropping

This is the planting of quick-growing and quick-maturing crops between slow-growing and slow-maturing crops. Melon is intercropped with Yam, for example. The life cycle of both crops are short enough for them to fall within the same course, in the same year- e.g. groundnut is followed by late maize.

3.7.3 Advantages of Crop Rotation

a. It facilitates the control of weed, pest and diseases.
b. It makes for effective utilisation of plant nutrient.
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 being destroyed.

3.7.4 Plan of a Rotation

Divide your land according to the numbers of crop, according to the numbers of years. Suppose you have four crops- a, b, c, and d to be planted on four plots of land A, B, C, and D respectively for the first season; during the second season, crop b goes to A, c to B, d on C and a on D. During the third season, c goes on a, d on E, a on C and b on D for the fourth season, d goes on A, a on B, b on C and c on D; the rotation is completed and the system starts all over again.

Table 3.1: Year Crop Rotation Plan

1st Season	2nd Season	3rd Season	4th Season
A A	A c	A c	A d
B B	B c	B d	B a
C C	C d	C a	C b
D D	D a	D b	D c

An efficient rotation is one that maintains soil structure and controls pest and diseases. This can be judged on long term basis. In this rotation, yam is inter-planted with vegetables like *telfairia*, which helps to cover the soil against splashing or rain-drop erosion.

Basic concepts

Table 3.2: A Rotation Plan with Local Crops

	BLOCK I	BLOCK II	BLOCK III	BLOCK III
1st Year	Yam i.p.w. Vegetables	Early maize i.p.w. cowpeas f.b. late maize	Cassava	Cowpeas
2nd Year	Early maize i.p.w. cowpeas f.b. late maize	Cassava	Cowpeas	Yam i.p.w. Vegetables
3rd Year	Cassava	Cowpeas	Yam i.p.w. Vegetables	Early maize i.p.w cowpeas f.b. late maize
4th Year	Cowpeas	Yam i.p.w. Vegetable	Early maize i.p.w. cowpeas f.b. late maize	Cassava

i.p.w.: interplanted with
f.b.: f.p;pwed nu

At the end of the third year, a lot will have been removed from the soil. Cowpea is then put in to help replenish the soil. In this rotation, it has been assumed that no pests or diseases have been detected to prevent late maize from following early maize.

3.8 Mixed Farming

The integration of animal production and crop production on the same farm is described as mixed farming. By this method, the farmer can operate throughout the year and he can operate economically. He can feed his animals - cattle, pigs, chickens with his farm products, especially at times when such crops are attracting low price in the market. Also, the need to have a source of manure in order to maintain effective rotation makes some people to combine crop production with animal husbandry. Another advantage of this system is that farm yard manure can be used to enrich the soil, and also farm by-products like straws, groundnut, and cowpea can be used as livestock feed. In some communities, the animals not only supply manure but also serve as a means of transportation and provide labour for ploughing.

SELF-ASSESSMENT EXERCISE

Differentiate between crop rotation, mixed cropping and bush fallowing.

SELF-ASSESSMENT EXERCISE

List five traditional agricultural systems.

4.0 CONCLUSION

It has been highlighted to you in this unit that, from time immemorial, traditional agriculture in the forest and savannah zones has proved to be man's most effective response to his environment in ensuring his survival and prosperity.

5.0 SUMMARY

Agricultural systems are the various method used by different groups of people for producing crops and livestock in order to supply human needs. Some of these systems include shifting cultivation, crop rotation, mono cropping, monoculture, and mixed farming, to mention just a few.

6.0 TUTOR-MARKED ASSIGNMENT

1 a. What is crop rotation?
b. State the advantages of crop rotation.

2. Write a short note on the following:

   a. shifting cultivation
   b. mixed farming
   c. pastoral farming.

7.0 REFERENCES/FURTHER READING

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UNIT 4 AGRICULTURAL EXTENSION SERVICE

CONTENTS

1.0 INTRODUCTION

Agricultural extension is one of the necessary conditions for the development of agriculture. It is regarded as the centre of the activities between the researcher and the farmer. To many people, it is just the provision of technical advice to farmers to help them increase their agricultural output; but in our discussion in this unit, it will be revealed that extension takes a central position in relationship to the other aspects of agriculture such as crops production, livestock, forestry and so on.

2.0 OBJECTIVES

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

- state the relationship between agricultural extension and the functional components of agricultural systems, namely-production, supply, and credit marketing, research and regulation
- describe how extension helps farmers to adopt improved practices for agricultural development.

3.0 MAIN CONTENT

3.1 Definition of Agricultural Extension

Agricultural extension is a form of educational service for training and influencing farmers (and their families) to adopt improved practices in crop and livestock production, management conservation and marketing. Here, the concern is not only about teaching and securing adoption of particular improvement practices, but about changing the outlook of the

farmer to the point where he will be receptive to innovation- and on his own initiative, can continuously seek means of improving his farm business and home.

3.2 The Concept of Agricultural Extension

It is a broad concept which does the following:

1. Provides information/education to the farmer and his family.
2. Asks the farmer to adopt improved practices in the following areas:
   a. increasing his agricultural production
   b. management
   c. conservation
   d. marketing.

3. Makes him receptive to innovation, and thus motivated to continuously seek means of improving his farm business and home.

Specifically, the agricultural extension officer transmits research findings from research institutes or universities to farmers and obtains feedback from farmers (for researchers) for further research, analysis and validation of facts. These duties are carried out through a systematic educational approach under the atmosphere of mutual trust and respect. Figure 4.1 shows the pathway of information within extension service.

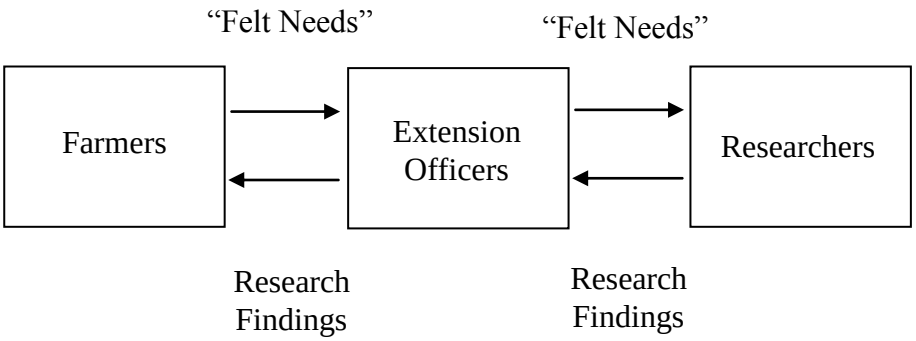

Fig. 4.1: Pathway of Agricultural Extension Services

SELF-ASSESSMENT EXERCISE

i. Give a clear definition of agricultural extension.
ii. What do you understand by the term research findings?

3.3 Dissemination of Information

Categories of relevant information transmitted to farmers through the agricultural extension officers include the following:

i. Agricultural inputs- importance and techniques of applying fertilizers, insecticides, pesticides etc.; and information on sources of supplies or provision of these inputs to farmers.

ii. Agricultural practices- improved techniques of soil cultivation, conservation and general management of farm land.

iii. Appropriate techniques for production, management, harvesting processing and storage of different crops.

iv. Improved techniques of production and management of livestock including processing and preparation of their products.

v. Information about rural institutions that are relevant to the needs of farmers-for example, financial institutions, market, cooperation etc.

When the information is passed to the farmers, they need to accept and adopt same to improve their harvest and livestock production output. However, while some farmers readily adopt (early adopters) the innovations, some are hesitant (late adopters) and others do not adopt the innovations (non-adopters), due to several factors related to the three principal actors within the extension service system.

3.3.1 The Principal Actors

Within the extension service system, the principal actors are:

i. the farmers, who are sole beneficiaries of all agricultural extension work
ii. the extension officers whose responsibility it is to disseminate the information to the farmers, and
iii. the government, that determines the extension services through the development of manpower, recruitment of extension officers, provision of resources (funds, transportation, communication etc.) for effectiveness of the services.

3.4 Rate of Adoption

Some of the factors which are responsible for the rate of adoption of innovations by farmers are as discussed below:

i. Economic factor

This includes the capital outlay required by the farmer in order to practice the new techniques; and it also includes the economic returns. Any new technique that attracts high cost tends to be adopted slowly; while those of low cost implication but with high returns are readily adopted. Thus, any doubt on the reliability or profitability of the innovation reduces its chances of being adopted.

ii. Complexity of the innovation

The more complex the techniques are, the more difficult it is for the farmers to adopt the innovation. Farmers tend to accept innovations that are simple to understand and practicalise than those that require high skill to execute.

iii. Visibility of returns

Agricultural business depends on nature, hence farmers contend with more risks than entrepreneurs in other sectors. On account of this, farmers are generally unwilling to take additional risks arising from adoption of innovation. For instance, the idea of taking insurance on farming business is not something that farmers will readily jump at. Although farmers are aware of the advantages of insuring their farms, the benefit will not be enjoyed by an insured farmer except risk occurs.

iv. Divisibility of innovations

Nigerian agricultural sector is characterised by millions of small-scale farmers. As such, they are the focus of agricultural development programmes. Innovations should, therefore, be such that could be easily adopted by small scale farmers on their small farm land holdings. Techniques which can be easily tried on a small scale level are often readily adopted by farmers, than those to be practiced on large scale only. Farmers with small land holdings do not readily adopt innovations compared with their contemporaries with large land holdings.

v. Compatibility of innovations with community belief

Innovations must be consistent or compatible with existing ideas, belief or norms of the target community. Those which seem to contradict the customs or ideas of beneficiaries are usually rejected. An example of this is production of pig in a predominantly Islamic community.

vi. Socio-economic status of farmers

Farmers who are wealthy and highly influential in the community often seek for and make greater use of extension information. Thus, they take greater risk than farmers of low socio-economic status.

vii. Educational level of farmers

Farmers' rate of adoption of innovation, sometimes, depends on their educational background. The more educated the farmers are, usually, the more readily they adopt innovations introduced to them.

viii. Role conflicts

Farmers are the target of cooperative extension officers and agricultural extension officers. Problems of role and personality conflicts often arise between the agricultural and cooperative extension officers on the field. This tends to negatively influence farmers rate of adoption of new farm techniques.

ix. Reliability of extension officers

Extension service is an enormous task which demands a large population of dedicated extension officers for effectiveness. However, the problem of shortage of extension officers, lack of financial resources, mobility etc., prevent them from performing their duties effectively. Thus, farmers tend to lose confidence in the whole package of innovation introduced to them. The failure of an extension officer to keep his/her promise of providing inputs of production or additional information reduces the confidence of farmers in him/her.

x. Extension officer's approach

The approach of communicating with farmers is very relevant- to enhance acceptability. Thus, extension officers need to understand each situation, based on the socio-cultural characteristics of the target group. Mutual respect and trust is paramount to the success of extension service. Farmers tend to be less interested in the innovation introduced to them disrespectfully. The methodology of imparting information is also essential. In this regard, the use of audio-visual aid, motion picture (video), demonstration plots etc., tend to enhance the understanding of farmers and their acceptance of innovation.

xi. Malpractices/fraudulent acts

It is human to make errors. However, when errors are committed intentionally, it becomes fraud. Cases of the involvement of extension officers in fraud are observed on the field. Thus, farmers who have been victims of such malpractices in the past are usually skeptical about innovations brought to them by innocent extension officers.

xii. Insufficient financial resources

Government, rarely, provides adequate funding for extension services in the country. Extension officers are unable to perform effectively due to lack of mobility and non-payment of traveling expenses. The poor state of rural infrastructures- such as roads, hampers extension services.

xiii. Shortage of extension officers

The shortage of extension officers is due to failure on the part of the government to recruit adequate manpower for extension service programmes. The present extension service manpower level is grossly inadequate to cope with the contact with the extension officers. Thus, innovations previously adopted by farmers are later dropped when they are faced with difficulties, and there is no extension officer to consult.

xiv. Frequent changes of government policies

Government formulates policies to ensure rapid agricultural development. However, there were cases in the past when farmers adopted innovations, and then along the line, a new policy is formulated with adverse effect on the farmer's business. A farmer who has suffered this in the past is often hesitant when it comes to accepting new techniques.

For example, government policy may encourage importation of maize to meet increased demand of the poultry sector. On assessing the performance of the agricultural sector, another policy such as ban on importation of all grains may be announced to protect the local producers of grains, if local demands exceed supply; many farmers may be forced out of the industry.

xv. Availability of facilities which must accompany innovations for achievement of expected results

Modern agriculture depends mostly on the use of high yielding varieties (HYV) which depend on fertilizers and irrigation. Thus, timely provision of fertilizer in adequate quantity and irrigation facilities tend

to encourage farmers to adopt new planting materials. This is because irrigation reduces the effects of the adverse weather conditions on crops and livestock production.

SELF-ASSESSMENT EXERCISE

List ten of the factors responsible for the rate of adoption.

4.0 CONCLUSION

You would have realised that agricultural extension is a system of disseminating information from research institutes to farmers within the shortest possible time; more so, rural farmers are trained so as to acquire the necessary skills and knowledge.

5.0 SUMMARY

From the concept of agricultural extension, it has been made clear to you that agricultural extension serves as the rallying point for the components of agricultural systems, namely- production, supply, credit marketing, research and regulation which forms the nerve center of agricultural development.

6.0 TUTOR-MARKED ASSIGNMENT

Explain the term agricultural extension. What are the factors responsible for the rate of adoption?

7.0 REFERENCES/FURTHER READING

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UNIT 5 IMPORTANCE OF AGRICULTURAL EXTENSION

CONTENTS

1.0 INTRODUCTION

In the last unit, you were taken through the introductory aspect of agricultural extension service. In this unit, you will learn about the importance of agricultural extension.

2.0 OBJECTIVES

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

- discuss various learning methods
- highlight the stages of adoption
- state the methods of dissemination.

3.0 MAIN CONTENT

3.1 Importance of Agricultural Extension Services

Here, let us consider the following.

1. Contribution to economic growth

This is seen in improved production efficiency and better use of resources through improved yield; it helps in getting more export earnings. This contribution was felt much during the time major emphasis was on cash crops for export- i.e. before the discovery of petroleum products in Nigeria.

2. Educational services to farmers

Farmers benefit much under extension programme. This contribution has a far reaching effect on the well-being of the farmer and his family. For many, this is the only hope of learning and making their lives better. It has brought education to those who have lost the opportunity of formal education.

3. Rural development

It helps the rural populace in the organisation of activities other than agricultural production. Activities may extend to social and cultural activities- with the benefit of the education and training gained in extension. Health services such as immunisation of children can gain from extension services.

4. Leadership training

Through extension education and training many farmers acquire leadership training which helps them in playing important roles in their communities.

5. It plays the role of an agent of transfer of knowledge from government research centers, universities and other areas to the farmer.

6. It helps farmers to manage his farming better and see his farming as a business and not for subsistence. The farmer learns to use economic factors in decision-making.

3.2 Rate of Learning and Adoption

Let us consider the following.

a. Farmer’s speed of learning

Farmers differ in their speed of learning and adoption. The process by which a new idea spreads among people in an area is known as diffusion. Not all farmers will accept a new idea at the same time. In any rural community, the readiness to accept new ideas and put them into practice varies, depending on each farmer's previous experience with new ideas, the personality of the farmer and the amount of land and other resources available. Thus, we can identify different categories of farmers in terms of their abilities to adopt new ideas.

b. Innovators

Innovators are farmers who are eager to accept new ideas. Usually, there are only few people in this class in a farming community. They are often farmers who, having spent some years outside the village, feel that they can make their own decision without worrying about the opinions of others. In villages, innovators are often looked on with suspicious and jealousy. Yet they are important to the success of an extension programme since they can be persuaded to try new methods and thereby create awareness in the community. However, the extension agent should exercise tact and caution, and avoid over-praising innovators in public or spending too much time with them. This could result in rejection of the idea by the rest of the community because of jealousy and suspicion- as the innovator's motives in adopting new methods is seen in bad light.

c. Early adopters

Farmers who are more cautious and want to see the idea tried and proved under local conditions are known as early adopters. They express early interest but must first be convinced of the direct benefit of the idea by putting up a demonstration. Usually, this group of farmers includes local leaders and others who are respected in the community.

d. The majority

If the rest of the farmers adopt a new idea, they will do so more slowly and perhaps less completely. Many farmers will lack the resources to adopt the new idea at all, while others may only do so slowly and with caution. The majority who can and do adopt the idea are likely to be more influenced by the opinions of local leaders and neighbors than by the extension agent or the demonstrations he arranges.

SELF-ASSESSMENT EXERCISE

Explain the importance of extension service.

3.3 Stages of Learning and Adoption

Learning and adoption occurs in stages. Different types of learning are involved in extension. Before a group of farmers can decide to try out a new idea/practice, they must first learn of it. They may then have to learn some new skills. Five stages have been identified in the process of accepting new ideas. Let us consider these now.

i. Awareness

A farmer learns of the existence of the ideas, but knows little about it; hence, he is willing to know more.

ii. Interest

The farmer develops interest in the idea and seeks more information about it from a friend, community leader or the extension agent.

iii. Evaluation

How the idea affects the farmer must now be considered. How will it be of benefit? What are the difficulties or disadvantages of this new idea? The farmer may seek further information or go to a demonstration or meeting, and then decides whether or not to try out the new ideas.

iv. Trial

Very often, farmers then decide to try the idea on a small scale. For example, they may decide to put manure or fertilizer on a small part of one field and compare the result with the rest of the field. To do this, they seek advice on how and when to apply the fertilizer or manure.

v. Adoption

If the farmers are convinced by the trial, they accept the idea fully and it becomes part of their customary way of farming.

3.4 The Act of Dissemination

Disseminating information to the farmer is a complex exercise. It involves different facets which have their own peculiarities. Any act of communication, be it a speech at a public meeting, a written report, a radio broadcast or a question from a farmer includes four important elements.

1. **The message-** this is the information (innovation) or the new idea to be communicated.

2. **The source/communicator-** this is where the information or ideas comes from.

3. **The channel-** this is the way the message is transmitted; the medium which the communicator uses to reach his audience (fanner).
4. The receiver/audience- this is the person for whom the message is intended- which is the farmer.

Any communicator must consider all the four elements carefully, as they all contribute to effectiveness. As earlier stated, the duty of an extension worker is to encourage farmers to adopt innovations of proven value.

SELF-ASSESSMENT EXERCISE

i. Mention the stages of learning and adoption of innovation.
ii. What are the different facets involved in dissemination of innovation?

3.5 Methods of Dissemination

The methods of disseminating information could be classified as follows:

i. Mass method

These are usually designed to create general awareness and interest in the new ideas and techniques among the people or farmers. They include radio broadcast, newspaper articles, agricultural shows, film shows sponsored by the extension service. The service may also produce bulletins, which provide very useful information (which can be technical, economic and social) to the rural population. Leaflets can also be made for mass distribution.

ii. Group methods

These are employed to advance people's awareness and interests to the point where they express their willingness to try and experiment with the new idea (innovation). These methods teach farmers in groups and are mainly in the form of practical demonstrations. The first is called method demonstration; which teaches farmers how to do particular jobs- e.g. how to spray or plant. The second is result demonstration, which is used to teach farmers the result that could accrue from doing something in a certain way- e.g. the effects of good spraying on the health of a cotton field. It provides the farmer with the practical proof that the improved practice is applicable locally and is superior to an established traditional practice.

Group meetings are also part of the methods of extension teaching. They involve organising a gathering of farmers with similar interest for the purpose of teaching them some techniques about their areas of interest.

iii. Individual method

Although a great deal of extension teaching is done in groups, learning is always an individual process. Hence, the extension agent is not only concerned with the group but also with individual farmers. The agents must know the farmer, his situation and aspiration. Some of the individual teaching methods employed in extension teaching include personal contacts or visit by the agent to the fanner and his family, sending letters about important events, conducting tutorials and discussing major problems directly with individual farmers.

4.0 CONCLUSION

The channels influence different group of farmers in different degrees. Innovators and early adopters make use of the mass media more than the other groups. Extension agents, however, use a variety of channels to reach their farmers.

5.0 SUMMARY

Face-to-face contact by the extension agents is known to be a very effective way of selling innovations to farmers; farmers desire the extension agent to talk to them, to demonstrate to them. Adoption of innovation depends more on the adoption process.

6.0 TUTOR-MARKED ASSIGNMENT

1. Enumerate the importance of agricultural extension services.
2. Explain the main methods of disseminating an innovation.
3. Learning and adoption occur in stages, enumerate and discuss these stages.

7.0 REFERENCES/FURTHER READING

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MODULE 3

UNIT 1 IMPORTANCE OF AGRICULTURAL PRODUCTION

CONTENTS

1.0 INTRODUCTION

You will remember that we enumerated the importance of agriculture earlier on and revealed the extent of the importance of agriculture to the survival of man, especially in the provision of food and raw materials for the growing population and the industries. We now want to examine, in details, the Nigerian economy in terms of livestock and crop production- and the combination of productions in both fishery and forestry, for agricultural development.

2.0 OBJECTIVES

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

- discuss the importance of agriculture

- describe crops of agricultural importance in Nigeria
- explain the contributions of both crop and livestock production to the Nigerian economy.

3.0 MAIN CONTENT

3.1 Importance of Agriculture

Here, we are going to consider this under certain parameters.

a. Food

This is the prime necessity of life; and agriculture is the only sector that provides food for the teeming population. Food can be in form of crop or livestock products purposely to keep life going. Food is required for growth, good health and increased productivity. Large quantities of food items are obtained from agriculture, namely- rice, maize, yam, cassava, vegetables, fruits, milk, egg, meat, etc.

b. Employment opportunity

About 80% of the Nigerian population is employed within the agricultural sector and it provides job opportunities for all categories of works. Also, the agricultural sector absorbs a sizeable proportion of the population in farming business; this ranges from the peasant farmer, to farm labourers, agricultural officers, extension officers, researchers and industrial workers.

c. Provision of industrial raw materials

Agriculture provides the raw materials for industries so that they can be processed into finished products. Provision of local industries with adequate raw materials controls excessive use of foreign exchange. The most important raw materials used by the industries are palm oil, palm kernel, cocoa, rubber, tobacco, groundnuts, cotton, copra, hides and skin.

d. Formation of capital

Agriculture provides some sort of financial backing to other sectors of the economy through savings and the purchase of goods and services from these sectors. It is also a source of income for farmers. The sale of agricultural products provides farmers with income for investment in agricultural production.

e. Foreign exchange

Agriculture is a good source of foreign exchange. A large proportion of earnings from international trade is from the export of agricultural raw materials. Foreign exchange is earned through the sale of palm produce, cocoa, bees, coffee, groundnut, rubber, etc.

f. Shelter and clothing

Materials for shelter can be provided from agricultural products such as oil palm, timber while clothing is produced from wood and cotton.

g. Rural development

The government usually targets rural farming areas as areas for infrastructure development. To meet with the increasing commercial activities in farming in these areas, certain social amenities like pipe borne water, road, and electricity are now being provided thereby transforming the rural areas to urban centers.

SELF-ASSESSMENT EXERCISE 1

Comment on the economic importance of agriculture.

3.2 Livestock production

Livestock production in Nigeria is carried out mainly by traditional method; and under this system, animals are rarely housed or given adequate healthcare. Mortality rate under this traditional production practices is as high as 30 – 40%, due to poor management. Farmers are therefore advised to form themselves into cooperatives so as to adopt modern techniques of livestock husbandry; this is because it is both labour and capital intensive and cooperative action will enhance their ability to pay for modern livestock production equipment.

The basic livestock production includes:

a. poultry production which comprises birds like chickens, ducks, turkeys, geese, swans, pigeons, and ostriches.
b. swine production
c. horses production
d. rabbit keeping
e. goats/sheep production

3.2.1 Economic Importance

The economic importance of livestock production includes:

a. Food

Farm animals are raised for food, which may be gotten as meat, eggs, and milk. The protein aspect is for the rapid development of body tissues.

b. Financial income

This is very crucial for farmers, particularly, as it relates to increasing standard of living. Money is realised from the sales of animals or its products such as meat, eggs, hides and skin, milk production. Most farmers use the income to raise capital for other areas of production.

c. Prestige

For many years in this country, some people have kept animals purposely for prestige purposes. They have herds of them and would neither sell them for money nor kill them for food. They are just happy to be recognised with having a large number of animals. In this country, this idea has always been uppermost in the minds of chiefs and other traditional rulers some year ago.

d. Sport (pleasure)

Few people breed animals for pleasure or for sports. Horses are usually bred for sports; while some good looking ones are usually kept for exhibition.

e. Labour (work)

Some animals are reared purposely to supply labour on the farm, for example, cows and donkeys. They are used for farm activities, especially in carrying loads.

f. Security

Some animals, especially dogs, are trained to render some important activities for man- especially in the area of security. These animals are trained purposely to provide this essential service- as it is common with our law enforcement agency.

g. Laboratory animals

With the recent development in scientific study, some animals are now being used for scientific investigation. Chicks and rabbits, for example, are used in research work. Goats are kept in laboratories and various investigations have been carried out on them.

3.3 Crop Production

Mainly, peasant farmers carry out crop production in Nigeria with the traditional methods and this has really affected the production of both food and tree crops. Pests and diseases have really ravaged crops, especially during past harvesting periods. Lack of good storage facilities has even aggravated this so much.

3.3.1 Economic importance

1. Vegetable crops are grown, principally, for consumption; for instance, some vegetables are consumed raw or cooked. They are good sources of vitamins.

2. Grains or cereals constitute a major source of starch/carbohydrate for our people. Grains are a form of staple food for most Nigerians and farm animals.

3. Root crops, like grain crops, are good sources of carbohydrate and are common all over the country. It should be noted however, that although food crops are grown/cultivated mainly for food, any quantity in excess of family needs may be sold. Sometimes farmers may engage solely in the farming of some food crops just for commercial purposes; and the profit accumulated can then be set aside for other farm operations.

4. Crops which are grown, specifically, for money and which may be exported to other countries to provide foreign exchange are referred to as cash crops, for example- cocoa, rubber, timber oil palm, coffee, kola nut, etc.

5. Most of these cash crops, mainly, provide raw materials for local industries; such crops include rubber (supplying latex) for the manufacture of tyres and tubes; while palm oil (from palm) is used for soap making, and timber is used in the furniture and allied industries.

SELF-ASSESSMENT EXERCISE 2

Discuss the economic importance of 1ivestock production.

3.4 Fish Production

Fishes are obtained by fishermen using several devices such as traps, nets, and trawlers. Since fishermen cannot predict their catch and because of the risks involved, as well as many other considerations, artificial methods of growing fish have been developed. Fish can successfully be cultivated in a fishpond in such a way that quantity and type of fish can be predicted and fish can be grown anytime. Fish ponds have become a familiar sight in most towns in Nigeria. You have surely visited one such pond. Fish culture is very important to the rural economy in the following ways:

3.4.1 Economic importance

1. It is essential for the supply of proteins to people, particularly where enough animals are not raised to supply enough meat.

2. It provides higher yield, even higher than that got from animal husbandry.

3. It can be undertaken by peasant farmers in their gardens. In this way, they can supplement the protein from other sources.

4. Intensive fish culture can increase the income of the farmer. Also, demand for industrial by-products can make fish farming very profitable.

5. Through fish culture, the danger posed by standing waters in dams and ponds can be prevented by keeping the water clean and getting rid of the vegetation.

3.5 Forestry

Forest may be regarded as a complex ecological system dominated by trees which form a buffer for earth against the full impact of the sun, wind and precipitation. Trees create a special environment which affects the forest. Depending on the nature of the trees we may have evergreen forests or deciduous; or even depending on the zones, we may have tropical or temperate.

You will agree with me that the importance of forests is far reaching and this has been known in various parts of the world and for ages. The

importance of forests may be seen from benefits derived from it. The benefits may be grouped into two, as you are going to see now.

3.5.1 Direct Benefits

These deal with the produce from the forest and the employment opportunities it offers. The major product of a forest is its woody materials. These make up the timber and the firewood. The latter is very important in areas where coal, kerosene and gas are not readily available for use. Timber is used manly as building material. It is also converted into paper, cardboard and other products. The raw materials for many industries are supplied by the produce from forests. For example, oil palm supplies oil- the raw material needed in the manufacture of soaps, candles and margarine. Finally, forestry also creates opportunities for many jobs in various fields.

3.5.2 Indirect Benefits

The indirect benefit of forestry, although not apparent, can be very important to man and his future. Forestation is a method being employed to check desert encroachment. Forests help to make the local climate more comfortable. They protect animals and crops and prevent erosion.

4.0 CONCLUSION

It is obvious that the importance of agricultural production cannot be over-emphasised, bearing in mind the centrality of agricultural contributions to the socio economic development of Nigeria.

5.0 SUMMARY

The units have provided you an opportunity to understand the contributions of agriculture to the economic development of Nigeria; particularly as it concerns the vast majority in the rural areas.

6.0 TUTOR-MARKED ASSIGNMENT

1. Discuss the five major criteria used in assessing the performance of the agricultural sector in your country.
2. Examine the role of agriculture in the development of any country.

7.0 REFERENCES/FURTHER READING

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UNIT 2 ENVIRONMENTAL FACTORS AFFECTING AGRICULTURAL PRODUCTION

CONTENTS

1.0 INTRODUCTION

This unit will focus, mainly, on the environmental factors affecting agricultural production, especially in Nigeria. The environment in any particular place determines the types of soil that can be formed in the place, the type of crops and animals that thrive in the place and their rate of multiplication or decrease. As a result of the limited resources available to Nigerian farmers, farming business is affected, to a greater extent, by the capacity of the soil to provide nutrients and to hold water. Nigeria falls within the area designated as tropical region and it is characterised by high temperature and heavy rainfall, throughout the year.

2.0 OBJECTIVES

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

- highlight the main climatic factors affecting agriculture
- describe the various factors suitable for the growth of crops.

3.0 MAIN CONTENT

3.1 Environmental/Climatic factors

The environment factors affecting agricultural production in Nigeria can be grouped into climatic, soil or edaphic factors and biotic factors.

Climate is the average weather condition. Its factors are insulation, temperature, pressure, wind and rainfall. Each of these factors has its own influence on agriculture.

i. Temperature

This is about the most important factor influencing the physiological functioning of plants. Variation in temperature influences agricultural practices in different parts of Nigeria. The average monthly temperature varies between 21^{0c} and $35^{0c.}$ The range is increasing from the coast towards the interior, but the northern part has hotter days and cooler nights giving rise to higher yield of some crops like tomatoes in some areas of the north than in the south. Tomato thrives more in a condition of hot days and cooler nights.

Also with increase in altitude, temperature becomes cooler and this is the cause of excellent performance of tea and Arabica coffee on the Mambila Plateau, in Nigeria. As a result of high temperature, some temperate crops that thrive in Nigeria cannot flower because they need a period of exposure to cold to induce flowering.

The low productivity of our livestock is mainly blamed on the effect of high temperature; while poultry could still be comfortable at 35^{0c}, the cattle can no longer cope at a temperature above 32.2^{0c}. High temperature may give rise to all or some of the following conditions in farm animals:

a. reduced feed intake or loss of appetite
b. decrease in productive processes of growth, rate of egg laying, rate of milk yield etc.
c. reduced body weight
d. embryonic death and dwarfing
e. reduced fertility in exotic male animals.

Attempts have, however, been made to modify the environment of crops and animals to the extent of the level of our technology. For instance, shade treatment is given to our crops from nursery through all the juvenile stages of the cocoa plant. Grazing animals are also provided shade in their paddocks and are also sheltered at night. Grazing pattern

also designed to ensure that the animals are under shelter in the afternoons.

ii. Relative humidity

This is the amount of moisture in the atmosphere; low humidity can cause heat, while high humidity reduces evapotranspiration. The effects on crops and animals include change in rate of heat loss and decrease in water consumption, in spite of increase in frequency of drinking. The effect of situation is increase in heat loss which can disorganise the metabolic system of the animal. Changes in temperature aggravate the effect of relative humidity. In low humidity areas of Nigeria, evaporation takes place rapidly such that evapotranspiration balance is in jeopardy. Similarly, in hot humid areas of the country, evaporation takes place slowly, hence, the rate of heat loss in both plants and animals. All these have some serious effects on agricultural productivity in Nigeria.

3.1.1 Day Length: Short-Day Plants

There is almost a constant day length phenomena, throughout the year, in Nigeria. However, the little difference that exists has more remarkable effects on plants and animals. Plants are therefore classified into (1) Short-day (2) Long-day and (3) Day neutral.

Short-day plants are those that starts flowering when the length of day is short e.g. okra (*Hibiscus esculentus*). The short-day variety is the early maturing ones which complete their life cycle within 60-72 days.

3.1.2 Long-day Plants

These are plants that will start flowering when day length is long- e.g. a variety of okra which stays in the field for about 270 days before flowering (i.e. the late maturing variety).

3.1.3 Day Neutral Plants

These are plants which start flowering at any period, irrespective of day length- i.e. non-photosensitive plants e.g. tomatoes (*Iycoperiscon esculentus*). Farmers are advised to take advantage of the photoreaction of our different local crops while planning for their farming activities.

iii. Rainfall

Rainfall has the greatest control over agricultural production activities in Nigeria. The types of crop grown in different ecological zones of the

country are direct response to the pattern of rainfall in these parts. As we move from the southern part to the northern part of the country, the amount of annual rainfall decreases, and becomes more unevenly distributed. Associated with this change is the gradual transition from rainforest vegetation, through wood land to savanna vegetation. The wettest parts of the country have two rainfall peaks separated by a short period of insufficient rainfall (usually, August) for crop growth and this interval demarcates the early and late starting seasons.

To the northern part, especially the far north, unevenly distributed rainfall per year lasts 3 months which (baring supplemental irrigation) allows only one planting season per year. The crops with short life span, especially small grains are suited for this zone. Cashew can, of course, grow well in many parts of the North; while other trees crops which require a lot of water are better suited for the southern zones.

The effect of rainfall on land productivity is highly remarkable in all the ecological zones of the country. In the rain forest zone of the south, the soil tends to be infertile because of the impact of heavy rainfall which causes leaching and erosion, thereby resulting in low yield. In the North, insufficient and irregular pattern of rainfall also makes crop yield unpredictable. For example, except sorghum and millet are planted with the first rains, the resultant establishment problems may necessitate replanting or reduced plant population; both of which may lead to reduction in yield or total crop failure if rains cut off abruptly at the critical reproductive period of the crops.

The seasonal pattern of rainfall in Nigeria also affects livestock production activities. Rainfall pattern affects ultimately the amount of feed that can be produced for livestock, the length of time forage will maintain high quality, the grazing pattern to adopt, and the requirement for stored and supplementary feed supplies. In all, the southern part of the country experiences an average of 7 months of rainfall and about 5 months of fairly dry season, while in the northern part the opposite is the case.

To reduce these adverse effects of environmental factors, Nigerian scientists have continually reviewed the requirements of crops and animals in a bid to modify the existing production systems, so as to attain self sufficiency in crop and livestock production.

iv. Air movement

This is air in motion; and the rate affects evaporation of transpired water droplets from plant leaves. At moderate temperature, the more rapid the movement of air is, the more effective it will be in reducing heat load of

animals when moisture is present on the skin. It also influences the amount of radiant energy that plants and animals receive by altering the temperature of surrounding objects. To ensure free flow of air movements through tree crop plantations, cultural practices like weeding, pruning and spacing suitable for each crops is adopted.

v. Solar radiation

Solar Radiation is very important in agriculture; this is because it is the source of energy used by plants during photosynthesis. The amount of this energy received on the earth surface (isolation) tallies with the latitude of the area and season of the year. It affects the rising and roosting of animals and also accounts for the opening and closing of the petals of certain flowers- e.g. sunflower. It is, as well, necessary for the maturity and germination of seed. Lack of solar radiation leads to etiolation- as plants will become yellow and thin. In Nigeria there is sufficient solar radiation throughout the year. However, the amount of solar radiation received on the earth surface each day depends upon:

i. the intensity of the radiation
ii. the amount of the cloud cover
iii. the length of day.

SELF-ASSESSMENT EXERCISE 1

i. Explain the term environment.
ii. Mention three environmental factors.

3.2 Soil Factors (Edaphic)

Soil is the home of crops. Crops get their food from the soil in form of solution. The nutrients in the soil are dissolved by water and thereafter picked up through the roots of plants. Without the soil therefore, there cannot be agriculture. The type of soil, its richness or otherwise and the type of minerals available in it determine the crops that grow on it. The soil has different qualities. For example, there are differences in texture, structure, nutrient content and even content of poisonous and harmful materials.

There are differences in soil-pH; crops will grow on soils that have qualities that they can tolerate. In the same way, animals including man, feed on the plants that they can tolerate, and survive more in places where those things they want abound. In general, the soil may be acidic (pH less than 7), neutral (pH is 7) or alkaline (pH higher than 7) poor crop growth obtained in acid soils may be due to aluminum toxicity,

calcium and magnesium deficiency or manganese toxicity. Liming of such soils reduces the toxic effect.

3.3 Biotic Factors

The biotic factors influencing agriculture include pests, diseases and soil micro organisms that exist in the neighborhood of plants and animals. We have micro organism that lives in the soil and the air. These are predators i.e. organism that feeds on other organisms. There are parasites and saprophytes. Parasites are living organisms that depend on other living organism for their food, while saprophytes are living organism that lives on dead and decaying remains of other living organisms. There is competition among living organisms for all the necessities of life. The success or failure of any crop or animal in any particular place is affected by its relationship with the other organisms that live in the same place and interact with it.

SELF-ASSESSMENT EXERCISE 2

i. Give an account of the way rainfall affects agricultural production in Nigeria.
ii. Explain the environmental factors affecting agricultural production in Nigeria.

4.0 CONCLUSION

Climatic factors influence agricultural production in Nigeria, while rainfall distribution, more or less, determines the rate and distribution of agricultural products. Hence, adequate presence of these factors definitely leads to a bumper harvest.

5.0 SUMMARY

In this unit, you have been exposed to the environmental factors influencing agricultural production in Nigeria. These factors determine production and yield during the season, especially for both crop and animal production.

6.0 TUTOR-MARKED ASSIGNMENT

1. Give an account of the ways in which rainfall affects agricultural production in Nigeria.
2. Explain the effect of climatic factors on agricultural production.

7.0 REFERENCES/FURTHER READING

Agbo, F.U. (1999). *Elements of Agriculture for Cooperative Colleges*, Polytechnics and Universities.

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UNIT 3 TYPES OF SOIL

CONTENTS

1.0 INTRODUCTION

This unit deals mainly with various types of soil. You will recollect that agricultural practices without appropriate soil requirements will give poor rewards to farmers. Proper soil composition with efficient management will definitely lead to bumper harvest. This is because the soil itself is the basis of farming.

2.0 OBJECTIVES

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

- describe the various types of soil
- discuss the characteristics of each of the soil
- state the importance of soil to successful farming.

3.0 MAIN CONTENT

3.1 Definition

Soil can be defined as the loose material covering the surface of the earth which supports life and is the basis of farming. The soil itself is a natural body consisting of layers or horizons of minerals which differ in their characteristic, physical, chemical and mineralogical components. This is but the merit component of the soil. The active component comprises of some micro-organisms that belong to the families of soil flora (plants) and fauna (animals). Together with the soil is, therefore, a natural medium for the growth of crops.

3.2 Physical Characteristics of the Soil

The most important physical characteristics of the soil are soil texture and soil structure. Let us consider this, briefly.

a. Soil texture

This is the relative proportion of various fraction or particle sizes in a given soil. For instance, the basic particles of the soil are sand, silt and clay. The division of soil particle into these fractions is based on the size or diameter of the particle. For example, soil particle is said to be:

a. sand- if the diameter is between .002.02mm.
b. silt -if the diameter is between .0 – 0.002mm
c. clay- if the diameter is less than 0.002mm.

b. Soil structure

If soil particles are left on their own without binding them together then farming will be impossible. Soil structure, therefore, explains the binding together of soil particles into soil aggregates. It is in the form of these aggregates that soil can support good growth of crops.

3.3 Importance of Soil Structure to Farmers

It is important that you understand the structure of the soil because of the following reasons:

a. Soil structure determines the physical properties of the soil- e.g. water and air content, as well as type and sizes of the pore in the soil.

b. It also influences the chemical properties, e.g. mineral composition, non-content, the level of exchangeable cat ion etc.

c. Soil structure also influences the rate of leaching and other processes of the translocation of soil articles e.g. erosion. This affects the amount of nutrient available for crop growth.

d. Soil activities also influence the biological activities in a given soil, for instance, the activities of soil micro-organisms that help in the decomposition of organic matters.

SELF-ASSESSMENT EXERCISE 1

I a. Explain the term soil.
b. What are the physical characteristics of a good soil?
ii. Why is it that soil structure is very important to you as a farmer?

3.4 Major Components of the Soil

Here, we are going to consider the major components of the soil.

a. **Inorganic matter**- this include sand, clay silt, gravel, etc., which is about 45% of the total volume of the soil. It contains nutrients like nitrogen, calcium, magnesium, iron, etc., and holds water in the soil. It serves as anchor for plants and it is the home for soil organisms which may improve the growth of plants. It can also hold air for plants, as well as helping in moderating soil temperature; but the porosity of the soil can be affected by its mineral content.

b. **Organic matter**- organic materials which are made up of plant and animals are about 5% of the total volume of the soil. It may be decayed plant and animal products leading to the formation of humus; it is a rich source of plant nutrients. The total number of soil micro-organism- like bacteria, fungi, can be increased, while the texture and structure of the soil can be improved. Water holding ability of the soil can also be improved and the PH of the hydrogen ion concentration can be moderated. It prevents soil erosion.

c. **Soil air**- this is the amount of gases found inside the soil. The amount of air is inversely proportional to the amount of water in the- soil which is about 25% of the total volume of the soil. It is essential for respiration of soil micro-organisms, and helps in the absorption of plant nutrients. It is very essential for root development; and it is needed for respiration of the root. It is also required for seed germination and needed in nitrogen and carbon cycles. Oxygen is necessary for growth and development, while carbon dioxide and sulphur react with water to form weak acids which aid weathering of rocks.

d. **Soil water**- this is the amount of water in the soil, and that is available to plant; and it is about 25% (in volume) in the soil. Soil nutrients are dissolved by water and this aids root absorption. It is essential for plant metabolism e.g. transpiration, photosynthesis, translocation. It is also influenced by the physical properties of the soil. The water under the influence of gravity is

called gravitational water. It is essential in the tillage and improvement of soil structure. However, you should please take note of the following:

a. Avoid tampering with soil pores, ploughing should be done only when the soil is moist, but not wet.

b. Only minimum pulverisation (harrowing) is permitted and to avoid the reduction of medium and large pores and increasing small pores.

c. Ploughing in succulent thrash/plants should be encouraged to aid microbial activities and encourage aeration.

Available water to plant

Available water to any growing crop plant depends on:

- the structure and texture of the soil
- the humus contents of the soil
- the composition of ions or cat ions in the soil
- and the amount of silt in the soil, especially in the tropical region.

3.5 Chemical Characteristics of the Soil

The types of minerals present in the soil confer on the oil some distinct chemical characteristics. For instance, if hydrogen ions (H^+) and aluminum ions $(A1^3)^+$ predominate in a soil, the soil is bound to be acidic; but if it is hydroxyl ion (OH) that is common, the soil is alkaline or basic. When both hydrogen ions (H^+) and hydroxyl ions (OH) are of equal proportion, the soil is neutral. An instrument known as the PH scale is used to measure the chemical reaction of the soil-whether the soil is acidic, alkaline or neutral. Soil PH affects the nutrients available to plants. Some crops are tolerant to acidic soils- e.g. oil palm, but majority of crops plants will perform best under slightly acidic to neutral conditions.

SELF-ASSESSMENT EXERCISE 2

i. Explain the major compounds of the soil.
ii. Available water to any growing plant depends on a number of factors. What are the factors?

3.6 Types and Properties of Soil

There are three major types of soil properties, sandy, clay, and loamy; let us take a look at these.

a. Sandy soil

It is made up of quartz; the range in diameter is between 2.00mm and 0.02mm, and it is coarse grained and gritty. Sandy soil is well drained, loose and highly aerated, with low capillary actions and high percolation feature. Leaching is high, with low plant nutrients. Therefore, sandy soil does not support the growth of plants because there is little or no nutrients required by plants for good growth.

b. Clay soil

Clay has very good chemical properties but poor physical properties. It is rich in nutrients, but because of its adhesive nature, the nutrients are not readily available to plants. The high water holding capacity makes percolation low and leaching may not be possible. Capillary is very high when wet. The particles are tightly bound together with little poor spaces; while the colour is usually brown.

c. Loamy Soil

This is a soil that combines the three panicles of sand, silt and clay in suitable proportion and therefore is the best soil type for cropping. It is very rich in plant nutrients and has loose particles. It can withstand moderate period of drought, because percolation is low and capillary is high. The lumps of loam fell apart easily and so they are friable. Loams are classified as heavy, light or medium, according to the proportion of clay present. Its water-holding capacity is very high, while erosion and water-logging are not usually possible. Loam can also contain decayed organic matter or humus. The colour varies from brown to dark brown or even black.

Special categories of soil

These are the soil particles which cannot easily fit into the above three particles, but they are a combination of one or two, or all the above soil particles. They arc silt, silt-loam, clay-loam, medium and heavy clay and silt-clay.

4.0 CONCLUSION

This unit has really highlighted to you the various types of soil with their characteristics which range from soil texture to soil structure.

5.0 SUMMARY

The unit has exposed you to the characteristics of each soil; it has also highlighted the importance of soil to successful farming. The point has been affirmed that if soil is fertile and managed properly, yield will be bountiful.

6.0 TUTOR-MARKED ASSIGNMENT

1. Briefly describe the following:
   a. Soil texture
   b. Soil structure.
2. State four properties each of clay and sandy soils.

7.0 REFERENCES/FURTHER READING

Anyanwu, A. C. *et al.* (1998). *A Textbook of Agricultural Science for Schools and Colleges.*

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UNIT 4 IDENTIFICATION OF CROPS

CONTENTS

1.0 INTRODUCTION

You will remember that we dealt with the various types of soil in the last unit. In this unit, we want to identify various plants so as to make a link between these plants and the suitable soil which will facilitate their growth, under suitable climatic conditions. The unit will, definitely, lead us to the various types of soil that accommodates plants.

2.0 OBJECTIVES

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

- classify crops according to nature of produce
- identify the various types of plants
- describe the suitable types of soil required for these plants.

3.0 MAIN CONTENT

3.1 Classification According to Life Cycle

Life cycle is the period from germination to harvesting. On this basis, crops are subdivided into four groups.

a. Annual crops

These are crops that complete their life cycle once in a year or a growing season- during which the vegetative and reproductive stages are completed, e.g. maize, rice, cowpea, millet, vegetables, cotton, groundnut, etc.

b. Biennial crops

These are crops that complete their life cycle in two years or two growing seasons. In the first year, a plant undergoes the vegetative stages, where leaves and roots are produced in abundance, the plant also elongates; but during the second year, plants undergo reproductive stages where flowers, fruits and seeds are produced, e.g. carrot, lettuce, cabbage, ginger, etc.

c. Perennial crops

These are crops that complete their life cycle once in three years. In the first two cycles (once in three years) they undergo the vegetative stages, while in the last year, the reproductive stages will be completed, e.g. rhizome, sugar cane, banana. A perennial plant that can survive for thirty years and above is called permanent crop- e.g. cocoa, kola nut, mango, oil palm, rubber, and coconut, etc.

d. Ephemerals

They are crops that complete their life cycle once in three or four months and can undergo two or three life cycles in a year, e.g. tomato.

SELF-ASSESSMENT EXERCISE 1

Give example of these crops:

(i) Annual (ii) biennial (iii) perennial

3.2 Classification According to Nature

Here, let us take a look at the following.

a. Vegetables

Vegetable crops are grown, principally, for their leafy nature; they are consumed, raw or cooked. They are good sources of vitamins. They are tropical crops that perform well at high temperature and high humidity. They can be grown all the year round, provided that there is sufficient water supply. They require well-drained soil that is rich in humus. Vegetable crops include tomatoes, pepper, lettuce, cabbage, cucumber, carrots.

b. Cereal crops

Cereal crops or grain crops are those which are cultivated for their seeds. They constitute a bulk of the world's food supply; cereals crops are more compact and can be stored for a much longer period than root crops, mainly due to their low moisture content. They also have the advantage of a high yield relative to the seed planted; cereals crops are regionalised. Oats are the dominant cereals of the colder regions of the world. Wheat and barley are the most important cereals of warm temperature zones; while in the tropical regions of the world, rice, maize, guinea com and the millet form the bulk of the diet of large sections of communities. The cereals/grains have high starch content and also contain varying amount of protein, the embryo contains oil and vitamins occur in the outer tissue of the seeds.

Soil Requirements for Cereals

Cereals are regionalised, and because of this reason soil requirement varies with the type of region. For example, consider the following.

i. Rice (*Oryza sativa)*

Rice requires rich loam to clayey soil retentive of water and rich in humus; however, rice can be grown practically on all types of soil-provided there is adequate supply of moisture. However, too light or porous and heavy soils are not recommended. Rice can stand a pH level of 4.5 to 8.7, but it does best at pH 5 to 6.5. Swamp rice prefers flooded conditions, but it is, however, not aquatic and so it needs aeration; while upland rice prefers well-drained soil, under humid conditions.

ii. Maize (*Zea mays*)

This requires a wide range of well-drained soil; precisely, it requires from sandy-loam to clayey-loam which are rich in humus, and plant nutrients. The soil should be alkaline or almost neutral. Maize does poorly on heavy or sandy soil. The good performance of maize does not depend so much on the amount of rainfall, but on distribution.

iii. Guinea corn *(Sorghum spp.) Dawa*

Guinea corn grows well in most soil, but does poorly on sand and clay. It thrives best on loamy soil. It can stand salty soil due to its ability to tolerate alkaline conditions. It is a short-day plant and is typically suited for the tropics having high temperature.

iv. Millet *(Pennisetum spp.) Gero*

Millet requires less moisture to germinate compared to any other crop. The crop performs best in rich, well-drained soil, but it will do well in loamy soil, sandy-loams and in soil lacking humus.

v. *Wheat* *(Triticum monococcum)*

Wheat performs best in soil with medium to heavy texture such as silt and clay-loam; the soil must be well-drained and very fertile. The soil should be, particularly, rich in nitrogen, which is necessary for the production of highly proteinous grains such as wheat.

c. Root and Stem

Root and stem crops constitute the main sources of starch to the greater part of 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 attack from pests, and are of very high yield. Among the most important of these root and stem crops are cassava and yam, respectively. Others include coco-yam, potatoes, etc.

They can grow in almost all types of soil but perform best on well-drained, sandy loam or light alluvial soil rich in nutrients. Too dry soil can cause poor tuber development and too wet soil tends to make tuber putrid.

d. Legumes

Legumes constitute an important part of the diet of most of tropical communities. They are important not only in their food value to human beings but also in the fact that they supply the pertinacious fodder for tropical livestock. Legumes also replenish soil nitrogen due to the presence of nodules on their roots. Their ability to replenish soil nitrogen gives them a key position in crop rotation.

Soil requirements for legumes- note that because of the differences in the amount of rainfall the soil requirements for legumes differ.

i. Groundnut *(Arachis hypogea)*

This grows on almost any type of soil, except heavy clay- low in organic matter. However, groundnut prefers light sandy soil for good seed formation. The soil should also be rich in phosphate and sulphur. It requires plenty of sunshine and, relatively high temperature, particularly at maturity, harvesting and storage.

ii. Cowpea *(Vigina unguiculata)*

Cowpea is a very hard crop, adapted to a wide range of soil. It does best on well-drained sandy loam soil but can do well on sandy or clay soil. However, very fertile soil induces excessive vegetative growth and poor pod formation. The appropriate nitrogen-fixing bacteria must also be present.

iii. Soya bean *(Clycine max.)*

This crop requires a fairly flat to moderately slopping, well-drained loamy soil; gravel and heavy textured soil should be avoided. There must be sufficient moisture for the crop to germinate. Its moisture requirements before germination are greater than that of maize. Yield is very badly affected if draught occurs during pod filling stage.

e. Oil crops

These are crops that provide vegetable oil for domestic and industrial use- e.g. sun-flower, soya-bean, oil palm, groundnut, melon, coconut and cotton.

i. Oil palm *(Elaeis Guineensis)*

Oil palm thrives well in closed-loam of alluvia friable types; and the optimum pH is 5.5-6.5. Average daily sunshine should be up to 6 hours per day.

ii. Cotton *(Gossypium spp.)*

This requires well-drained, rich loamy soil and not very high organic matter- to check excessive vegetative growth which reduces formation.

f. Tree/cash crops

Tree crops are plants which can stay on the same piece of land for many years. They are at times, also called cash crops. Transplanting to the permanent site follows if the crop goes through the nursery e.g. cocoa or oil palm. Routine cultural practices like weeding or slashing, roughing, spraying, etc., will be recurrent activities to eliminate pests that compete for light, water and nutrients. Most of the plants in this category can stay for 3 -50 years, yielding every year; because of their long stay on the permanent farm site, they require:

a. Cocoa *(Theobroma cacao)*

Cocoa requires soil that is well aerated and retains moisture during the dry season. The soil should be easy to penetrate but need not, necessarily, be very deep; but it must be enough to allow root penetration. It should be rich in nutrients and have good structure and texture. The best soils are clay and loam; this is because they retain more moisture during the dry season. Shallow soils with impervious layers are not good for planting cocoa, because the impervious layer does not allow for root penetration which may be up to a depth of about 7m.

b. Rubber *(Hevea brazillensis)*

The rubber plant is a member of the family Moraceae. It is classified as *Ficus elastic.* An attractive tree, a member of the mulberry family, grown as a houseplant in its juvenile state; it thrives well around the tropics, growing-perhaps, to a height of 30 m (100 ft). Its thick, deeply veined leaves are a glossy, dark green and can grow to be 38 cm (15 in) long. It flourishes under adverse conditions.

SELF-ASSESSMENT EXERCISE 2

i. Differentiate between root crops and cereals.
ii. Explain the soil requirements for the following crops:
(a) Maize (b) cocoa, (c) rice.

4.0 CONCLUSION

In this unit, classification of plants according to the nature of produce has given a clear distribution of these crops- in terms of the different soil requirements necessary for growth and development.

5.0 SUMMARY

This unit has exposed you to how to identify various types of plants based on soil requirements. These requirements not only enhance good growth, but they also give the farmer better deal for his efforts.

6.0 TUTOR-MARKED ASSIGNMENT

1. Crops could be classified according to their life cycle. Discuss.
2. Discuss the soil requirements of the following crops:
maize, cocoa, cassava, and cowpea.

7.0 REFERENCES/FURTHER READING

Agbo, F.U. (1999). *Elements of Agriculture for Co-operative Colleges, Polytechnics and Universities.*

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MODULE 4

UNIT 1 COMMON FOOD CROPS

CONTENTS

1.0 INTRODUCTION

In West African countries in general, and in Nigeria particularly, tomatoes and pepper form a very important part of ingredients used regularly- a crucial part of the diet in many homes. The fruits of tomatoes are used for salad, vegetables and in canning industries. They are also used for the preparation of tomato sauces and tomato juice. Tomato is an important source of vitamins and is therefore crucial to a balanced diet. Due to their importance, they are grown in every state of this country, most especially during the early part of the dry season.

2.0 OBJECTIVES

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

- describe accurately how tomato and pepper are cultivated and harvested

- explain correctly why staking is very important during the cultivation of tomatoes
- state two diseases of each of tomato and pepper and describe how they can be controlled
- discuss the importance of tomato and pepper.

3.0 MAIN CONTENT

3.1 Varieties

Tomato has a large variety of cultivated type suited to many different environments. These varieties have local names and have common varieties like mar globe, money maker marred, valiant pork best of all, dwarf gem, and many others.

Improved varieties

a. NH Le 158-3-local indeterminate big red fruits, big red fruits, suitable for planting in both northern and southern states.

b. NH Le 7-7-1 local indeterminate pink fruits and high1y tolerant of diseases.

c. Ife No.1 - determinate round red fruits-suitable for planting in bulk north and south.

d. Ibadan Local -indefenninate plant. Big pink fruits. Well adapted to Rainforest zone.

e. Roma VF –determinate, pear-shaped, red fruit. Suitable for planting in the north, and during dry season in the south.

3.1.2 Climatic and Soil Requirements

Tomato is a warm season crop. High temperature and high humidity favour foliage production but hot dry conditions result in the dropping of flowers and foliage. Tomato requires high light intensity, because this influences the ascorbic acid content. If light is low, ascorbic acid content will be equally low. Tomato requires well drained loamy soil that is rich in humus. Heavy and water logged soils should be avoided, the crop tolerate high acidity, and as such, liming is not recommended unless the pH is 5 or lower.

3.2 Cultural Practices

Let us look at the following common practices related to the cultivation of tomatoes.

a. Bed fumigation

If is usual to treat nursery soil moisture with fumigant to kill pests, fungi weed, etc. which may be in the soil. *VAPAM* is recommended at the rate of $1dm^3$ to $20dm^2$ of water per bed of 1m x 10m; when used, wet soil heavily to a depth of 15cm and cover with palm fronts. Do not sow seeds until 9-10 days after treatment. In the absence of fumigants, apply heat removing the ash.

b. Nursery preparation

Nursery can be prepared on the ground, or alternatively in boxes, and baskets. For ground nursery, the land should be tilled very well- to a depth of 38cm, and the bed neatly prepared; but for nursery in baskets or shallow boxes the containers are filled with mixture of:

i. three parts of good top soil
ii. two parts of well rooted compost
iii. one part fine river sand; the three must be properly mixed together.

c. Sowing in the nursery

Seeds are planted singly 2.5cm to 5cm apart and 2.5cm to 5cm between rows. Press the seed into the soil, but not more than 0.5cm deep and cover seeds lightly with fine loose soil. The boxes are then placed in sheltered position out of rain and sun. Water daily, using a can with fine hose. The seeds will germinate in about 5 to 7 days, and then transplant in about 6 weeks.

d. Shading and watering

Provide shade in the nursery to protect seedlings from hot sun and heavy rain; but be sure you water the seedlings every morning. Reduce quality and frequency of watering during hardening of seedlings. Generally, water should be moderate because over watering may make plant soft, and susceptible to diseases.

e. Transplanting

After making a good bed, the seedlings are well-watered before transplanting- to bind soil to the root. Seedlings should be removed singly with ball of earth; and as far as possible, minimise damage to root system.

Transplanting should be done under cool weather, or preferably in the evenings. After transplanting, the seedlings are watered and very tender ones are lightly shaded to reduce excessive light intensity. It is usual to plant tomatoes in double rows of 45cm to 60cm apart, with plants 30cm -38cm apart in the row.

f. Weeding and staking

Weeding is an essential practice after transplanting. The crop does not tolerate competition with weeds. Weeding should be done as need arises. Weeds reduce yield and attract pests and diseases. Stake, immediately, after planting to reduce damage (by wind) to roots and stems. Do not allow the stems to drop on the ground for these increases the chances of destruction by crickets and other soil pests.

g. Fertilizer application

Tomatoes respond very well to fertilizers, particularly, those applied in liquid form and both potash and nitrogen are essential to stimulate initial growth. Apply 15: 15: 15 mixed fertilizer at 340kg to 680kg around 4-6 weeks after transplanting.

h. Harvesting and storage

Fruits are ready for harvest about 3 to 4 months after planting. Harvest when half ripe and then wrap in soft paper to ripen fully. The fruits harvested when half ripe give best flavour and firmness. Yield varies from 7.5 to 10 tonnes per hectare depending on the variety. Tomatoes cannot be kept for too long, when just harvested. They are best stored in processed form. Harvesting when half-ripe helps to preserve the fruit until when it will be taken to the market. The fruits should be stored dry and no damaged fruits should be stored along with healthy ones.

3.3 Pests and diseases of tomatoes

Tomatoes have many pests and these include mole insects, caterpillars, grasshopper, eelworms, fruit worms, etc. These can be controlled by hand picking- in the case of caterpillars, by digging up crickets and also by using insecticides. *D.D.T*. is used for pre-fruiting treatment and vefox 85 wip is used from the fruiting stage.

There are four major diseases of tomato as shown below:

i. **Fusarium wilt [root rot]-** this is a fungal disease caused by *fusarium oxysporium*. This attacks young seedlings and causes it to wilt. Control is mainly by the use of resistant varieties.

ii. **Bacterial wilt-** this is a disease which attacks solanaceous crops at almost all stages of their development, causing rapid wilting of the leaves, followed by the death of the whole plant. The disease is soil-borne, and it attacks roots. Control is by removing all infected plants and burning them, immediately, to reduce the spread of the disease.

iii. **Leaf spots and blight-** these are wide spread during raining season; viral spots of various sizes and colours occur on petioles and stems of leaves. The older leaves become yellow and die as the infection progress upwards to young leaves. Control is by spraying with Dithame m - 45 or coprantol of Bordeaux mixture.

iv. **Other diseases-** other common tomato diseases are physiological disorder brought about by unfavourable growing conditions and root knot diseases, which is caused by nematodes.

SELF-ASSESSMENT EXERCISE 1

i. Describe the soil and temperature condition under which tomatoes will grow well.
ii. Name three diseases of tomato and describe how you will control one of them.
iii. When should fertilizer be applied to tomato seedlings.

3.4 Peppers [*Capscum species*]

These are popularly grown in every tropical country and they provide the chief species of the hotter parts of the world. Peppers are species, which are popularly used for making soups in Nigerian homes, for instance. Many varieties exist due to their ability to adapt to different environments. They belong to two species:

a. *Capsicum annum* (sweet pepper)
b. *Capsicum frutescent* (hot pepper).

3.4.1 Climatic and Soil Requirements

The two species are grown in most parts of Nigeria. The fruits of *Capsicum* annum are larger than those of *Capsicum frutescent*. The

fruits vary in shape, size, colour, flavour and hotness. Pepper can grow on many classes of soil- from light sand to clay, but they are best grown on well-drained soil. They can also survive various changes. The best soil is in a well-drained, light loamy soil which is rich in lime, and then a rainfall of 650 – 130mm is required.

3.4.2 Cultivation

A seed-bed is constructed in a shady area, preferably near water. Planting is done by scattering viable seeds on the seed beds after the soil has been sterilised or sprayed with Dittane m-45. Germination takes place in 6-10 days. The developing seedlings are transplanted after 4-6 weeks when they are between 10 to13cm high. Newly transplanted seedlings should be watered daily, until the roots are firmly established in the soil. A spacing of 60 to 90cm apart can be maintained. Weeding of the farmland is important, at least, twice in the dry season and thrice in wet seasons. A mulch of dead grass and leaves could be used to cover the soil around the plants, when necessary.

Pepper plants will benefit from the application of organic manure of about 2.5kg per m^2. In the absence of organic manure, inorganic fertilizer can be applied in a ring- about 10cm away from the base of each plant.

3.4.3 Pests and Diseases

Peppers are attacked by pests and diseases. The major pests are birds and nematodes. Birds are attracted by the bright-coloured ripened fruits, and then, the fruits are pecked off. Nematodes stunt the growth of infected plants, causing leaves to turn yellow before the plant eventually dies. Nematode can be controlled by applying a chemical called MOCAP granules.

Viruses cause two diseases of pepper-these are mosaic and leaf curl. The infected plants have wrinkled leaves and stunted growth. The diseases can be controlled by uprooting and burning infected plants. Draping off can be controlled by sterilising the soil, before planting begins. Leaf spot can be controlled by nursery (with a chemical called dithane) on a weekly basis.

3.4.4 Harvesting and Storage

Fruits are ready for harvest 3-4 months after planting; handpick the ready peppers. Then the harvested fruits are treated with hot water for about 30 minutes, after which they are dried. After drying, the fruits can either be crushed into powder and sold or stored.

SELF-ASSESSMENT EXERCISE 2

Name three diseases of pepper and describe how one of the diseases can be controlled.

3.4.5 Importance

Peppers are used as condiments for the preparation of stews, soups and for preparing curry powders for seasoning foods. Peppers are good sources of vitamins A, C, and E. In Nigeria, *Capsicum annum* is grown, primarily, for export.

4.0 CONCLUSION

Tomatoes and peppers are very important ingredients for making stews, soups in, virtually all Nigerian homes, and they both thrive well in loamy soil. Yield can be improved with the application of either organic or inorganic fertilizer. Both crops are cultivated via the seed; and they are susceptible to being attacked by pests and diseases.

5.0 SUMMARY

This unit has really described accurately how tomato and pepper are cultivated and harvested. It has also revealed why staking is very necessary during the cultivation of tomatoes and highlighted the importance of both crops.

6.0 TUTOR-MARKED ASSIGNMENT

1. Describe the importance of (a) tomato (b) pepper.
2. Name three diseases of pepper and describe how each disease can be controlled.

7.0 REFERENCES/FURTHER READING

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UNIT 2 VEGETABLE CROPS (VEGETABLE, CARROT, CUCUMBER AND LETTUCE)

CONTENTS

1.0 INTRODUCTION

In the previous unit, we studied the cultivation of two important vegetables namely tomato and pepper. These vegetables are grown for their economic importance to man and are very familiar in every Nigerian home. Apart from these other vegetables, some other tropical crops have also been successfully cultivated in different parts of Nigeria.

These include lettuce, cabbage, cucumber and carrot. These four vegetables are very popular with people from temperate countries who live in Nigeria. The plants are a common feature of vegetable salad often served at cocktail parties, and other menu in big hotels. You will definitely see that they are a crucial part of the menu of the people.

2.0 OBJECTIVES

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

- discuss the conditions necessary for the successful cultivation of cabbage, carrot, cucumber and lettuce
- describe, at least, two diseases of the crops and how to control them
- state the differences between the cultivation of the vegetables
- explain the economic importance of each vegetable.

3.0 MAIN CONTENT

3.1 Cabbage (*Brassca oleraccal*)

Cabbage grows well in high latitude areas of Nigeria such as the Jos, Plateau State where the annual mean temperature is low. However, cabbages may successfully be cultivated in wet, hotter areas if suitable seeds are available and the seedlings and transplants are carefully managed. The time of planting must be carefully selected, while the plants must be adequately supplied with the right nutrients to ensure success. In addition to mean low temperature, the soil must be well manure and fertilized. Adequate shade is also necessary to prevent excessive loss of water.

3.1.1 Cultivation

It is possible to grow cabbages all year round. However, the best results are achieved when the sowing time is carefully selected. It is best when the heads of young plants are forming, at the coldest time of the year [December/January]. This timing enables the young plant to withstand harsh harmattan conditions. The seeds are sown in nursery beds individually, leaving about 46cm between adjacent plants. Seeds should be sown at a depth of 0.6cm. Germination takes place in about five days. Thinning of the seedlings should take place three days after germination. About four weeks after germination, the seedlings may be transplanted into well-fertilized and prepared beds. Each seedling should be lifted carefully with a ball of soil, around the roots to minimise the disturbance to the roots. Each cabbage plant is planted at 50cm intervals, under adequate shade.

3.1.2 Fertilizer Application

During the process of growth, a nitrogen-containing fertilizer such as ammonium sulphate or N.P.K. should be sprinkled on to the soil around the plant every 2-3 weeks. Cabbages are gross feeders, which require a lot of nitrogen, potassium and phosphorus.

SELF-ASSESSMENT EXERCISE 1

Why should cabbage seedling be transplanted with a ball of soil around the roots?

3.1.3 Harvesting

Cabbages are usually ready for harvesting two to three months after planting. During harvesting, the stalks are usually cut and thrown away. If however the stalks are left in the ground, they may develop into new cabbages, which could eventually be harvested.

3.1.4 Importance

Cabbages are cultivated for their abundant leaf growth. The leaves are either cooked or used as a major ingredient in the preparation of vegetable salad. The leaves also supply vitamins and minerals needed for maintaining good health. Cabbages are also of value as roughage, which facilitates digestion of food.

SELF-ASSESSMENT EXERCISE 2

State one economic importance of cabbage.

3.2 Carrot (*Daucus carota*)

Carrot is yet another foreign vegetable that has been successful1y cultivated in several parts of Nigeria. Two main varieties of carrot are commonly grown in Nigeria. These are the stump-rooted type and the point-rooted variety.

3.2.1 Cultivation

Unlike cabbages, the seeds are sown straight into the permanent beds where they germinate, grow, develop, bear fruit and become ready for harvest. Carrots prefer lightly, sandy soil with good supply of plant nutrients. Compacted clay soil may lead to poor formation of roots. The seeds are usually planted in drills (shal1ow depressions in the soil) in December or January, about 1.2cm to 2.5cm deep. The drills are usual1y

10-15cm apart. The drills are located in rows, which are about 30cm apart. The germination of the seeds can be increased by soaking them in a waster or mixing them with moist sand.

3.2.2 Seed Treatment

The worst pest of carrot seeds should be treated with chemicals such as *Dieldrin, Aldrin or Lindare* as a precaution against carrot fly. The optimum temperature for high yield is 60° - 70°F.

3.2.3 Seed Bed Preparation

Before sowing, a surface dressing of super phosphate fertilizer, ammonium sulphate and potassium sulphate should be done on the soil to speed up growth. The use of farm yard manure must be avoided as it causes the forking of roots. Similarly, application of excess nitrogen based fertilizer must be avoided as it causes the splitting of roots.

3.2.4 Seed-Bed Maintenance

Germination of seeds is slow as it occurs many days after sowing. The soil around young plants should be covered with dry grasses (mulching) to retain water in the soil and reduce the growth of weeds. When the plants are 2-3cm high, they are thinned to leave 5-8cm between plants. The young carrot plant bears a few fern-like compound leaves, which arise from the crown of the root. Availability of water in the soil is an important factor which affects root formation; therefore, the plants must be well watered during the processes of growth and development.

3.2.5 Harvesting

The harvesting of mature carrots is done 60 to 90 days after planting. During harvesting, the roots are pulled out of the soil. The shoots may and may not be removed before they are marketed. Harvesting of carrots must be timely as the roots can go woody if left too long. Carrot fly usually attacks carrots; also of great threat are fungi diseases such as leaf blight, bacteria and nematode diseases such as soft rot and root rot, respectively. To control the spread of bacteria and fungi diseases, infected plants should be burnt. Fumigating the soil with nonagon several weeks before the commencement of planting can control nematode disease.

3.2.6 Importance

Carrots are grown, primarily, as food crop because of their fleshy roots. The roots of the most suitable variety for eating have a milk flavour; and

are reasonably sweet, crisp and tender. Carrots have a considerable good nutritional value. They contain an orange coloured matter called carotene, which is particularly valuable in human and animal diets. Carotene is an important source of vitamin A, which is required for the normal functioning of the human eye. In addition, the roots contain sugar and calcium salts needed for the development of strong bones and teeth. The roots can either be eaten raw, used along with other vegetables for preparing salads; they can be cooked in different ways. The roots are rarely dried. However, when carefully roasted and ground into powder, they could also acts as a substitute for coffee. They can also be used as flavour in soups and stews. Extract from carrots are also used for colouring butter. In addition, several very large coarse and non-tasty varieties of carrot are cultivated abroad. These varieties are used as food for livestock, most especially, horses and rabbits.

3.3 Cucumber (*Cucumis sativus*)

The cucumber family of plants is climbing vegetables, which are very useful to man in both the tropical and temperate regions of the world. They are spreading or climbing plants. Many varieties exist such as cucumber, melons and pumpkins, which have been successfully cultivated in different parts of Nigeria. We shall limit our discussion to the cultivation of cucumber.

3.3.1 Cultivation

Cucumber grows well in outdoor ridges where there is sufficient warmth, moisture and a good supply of plant nutrient. It prefers a fairly loose soil enriched with organic manure. Cucumber may not do well in highly compacted waterlogged clay soil. Like carrots, the seeds are grown straight into permanent beds or ridges. They germinate, grow, and produce fruits, which are harvested.

The sowing of the seeds should begin at the end of the rainy season (about October). This may continue throughout the dry season, if adequate watering is maintained. The seeds are sown on previously prepared sandy beds, which have been adequately manured and fertilized. Two rows of seeds are sown per bed. A spacing of l0cm should be maintained between the rows and 60cm between the seeds. The seeds should be sown in little soil depressions not more than 2cm deep. When sowing is completed, the ridges are covered with dead grasses (mulching). This prevents excessive loss of waster, which could lead to the germinating seeds becoming dry. Have you noted the similarities between the cultivation of carrots and cucumber? You remember that:

i. the seeds are planted directed into the soil.
ii. they prefer fertilized, loose, sandy soi1.
iii. mulching is necessary for success.

Other similarities, and of course, some differences will be made known to you as you read on.

3.3.2 Germination

Germination of cucumber seeds occurs 3 - 4 days after sowing. As they are climbing vegetables, they soon develop climbing aids called tendrils, and then, start to climb. Hence, it is important that adequate support is provided for the seedlings, in advance. Shrub branches or sticks, which are approximately 1 meter in length, will provide an adequate support for cucumber. Have you noted some differences between the cultivation of carrot and cucumber? If you do not, remember that:

i. carrot seeds germinate very slowly, while cucumber seeds germinate in 3 - 4 days.
ii. carrot does not require any support, but cucumbers do.

Note too that provision of support is necessary in both the cultivation of tomatoes and cucumber, but for different reasons. Write down the reasons. If you have difficulty remembering the reasons go back and revise the relevant sections of previous units.

3.3.3 Disease Control

Mildew fungi readily attack the leaves of cucumber plants, causing a lot of damage. This decreases performance of the plant. To control this disease, the leaves of cucumber plants should never be sprayed directly with water. Watering should be restricted to the soil around the stem. Badly infected plants should be pulled up and burnt, to avoid the spread of the infection. A chemical used for, controlling fungal diseases (fungicide) such as dithane can be used to treat infected plants.

To ensure success, weeds must be closely controlled by hoeing. However, hoeing must be carefully done to avoid damage to stem roots, which are located around the surface of the soil.

3.3.4 Harvesting

Cucumber fruits mature in about two months, after the seeds are sown. The fruits are harvested manually, by plucking. Unless diseases destroy the plants, harvesting of fresh fruits may continue for another one month.

3.3.5 Importance

Cucumber plant is cultivated for its juicy and crisp fruit, which can be eaten raw. It can be used as an important ingredient in the preparation of vegetable salads. It is rich in vitamin C and mineral salts. The vegetable is sold in local markets to generate revenue for farmers.

3.4 Lettuce

Lettuce is not really a tropical crop. It is usually grown in temperate regions of the world. However, certain varieties have been successfully grown in the tropics with proper care. For example, *webb's wonder* has been successfully grown in the cold parts of Nigeria (for example, Jos Plateau). This variety has crisp curling, and glossy but fleshy leaves. Lettuce grows well in well-drained soil with adequate supply of organic matter.

3.4.1 Cultivation

Viable seeds are sown in nursery beds or boxes, which have been previously fertilized. Old seeds should not be planted. It is important to sterilize the soil in the nursery boxes to destroy harmful soil organisms such as bacteria, fungi, viruses and nematodes, which may attack the lettuce plant. Weeds are also destroyed through the process of sterilisation. This prevents such weeds from competing with lettuce plant for valuable plant nutrients.

3.4.2 Nursery

Recall that tomato and cabbage seedlings have to be given special nursery care to ensure success. If you do not remember this similarity in the cultivation of these vegetables, note it now. The seeds of lettuce are grown in drills of a depth of about 1.2cm to 25cm. After dropping the seeds into the drills, they are lightly covered with soil. The soil is subsequently pressed down with a planting shovel.

3.4.3 Germination

Germination takes place within a few days. The young seedlings should be well watered and provided with adequate nutrients through regular fertilization. The seedlings should be transplanted in 3-4 weeks when they have 4-5 leaves. Each seedling should be transplanted with a ball of soil around the roots. Recall the reasons for this practice? It is to ensure minimum disturbance and damage to the roots.

Seedlings should be spaced at 20cm intervals. There should be no more than four rows of plants per bed or ridge. Mulching should be done to prevent young seedling from drying out. During the dry season, plants should be watered frequently and possibly with light shading.

SELF-ASSESSMENT EXERCISE 3

Why should lettuce seedlings be mulched?

3.4.4 Disease Control

Bacterial leaf spot, mosaic virus and root knot nematode disease may attack lettuce plants. Sterilising the soil of the nursery bed can control these diseases. Badly infected plants should be pulled out and burned.

3.4.5 Harvesting

Lettuce is ready for harvesting six to twelve weeks after planting. The plants are pulled out of the ground and washed thoroughly and disinfected before consumption.

3.4.6 Importance

Like carrot, cabbage and cucumber, lettuce can be eaten raw. Lettuce is cultivated for its leaves, which are rich in vitamin C and mineral salts. The leaves are also used for preparing salad.

3.5 Related Cultural Practices

The table below summarises some of the important practices related to the cultivation of cabbage, carrot, cucumber and lettuce which we have discussed in this unit.

Table 2.1: Summary of Cultural Practices related to the Cultivation of Cabbage, Carrot, Cucumber and Lettuce

Vegetable	Planting Depth	Distance between Rows	Distance between Plants	Soil Requirement	Nursery Care	Staking Support	Mulching
Cabbage	0.6cm	90cm	4cm	Well Manure	Yes	No	Yes
Carrot	0.5cm	30cm	10cm	Light Sandy	No	No	Yes
Cucumber	0.6cm		180cm	Fairly Sandy	No	Yes	No
Lettuce	0.6cm	46cm	23cm	Well drained with organic matter	Yes	No	No

4.0 CONCLUSION

You have noticed that these vegetables are common features of vegetable salads and they also perform better in some locations in Nigeria than even some temperate countries. They supply vitamins and minerals needed for maintaining good health.

5.0 SUMMARY

This unit has really enumerated the importance of cultivating the four vegetables- cabbage, carrot, cucumber and lettuce. They are all cultivated from seeds while adequate fertilization and watering of seeds will improve their performance. Cabbage, carrot, cucumber and lettuce can be eaten raw as salad. They also serve as important sources of vitamin C and mineral salts.

6.0 TUTOR-MARKED ASSIGNMENT

1. a. Why should the seedlings of lettuce be mulched?
   b. State the economic importance of cucumber.
2. a. Why should the soil used for preparing nursery beds be sterilised.
   b. State two economic importance of carrots.
3. Compare and contrast, in a tabular form, the cultivation of carrots and cucumber.

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UNIT 3 ROOT CROPS

CONTENTS

1.0 INTRODUCTION

In the last two units we dealt with vegetable crops namely- tomato, pepper, cabbage, carrot and cucumber. In this unit, we want to concentrate on root crops- namely yam and cassava. These two crops have dominated the activities of small scale farmers in agricultural food production. You will agree with me that the two root crops have constituted a large percentage of food requirements for this country. In actual fact, the two cater for the main carbohydrates content of our food needs. There are many root crops grown all over the country and several varieties of each root crop exist.

2.0 OBJECTIVES

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

- state the main food crops of Nigeria
- discuss the varieties of yam
- describe the cultivation method for yam
- state the economic importance of root crops.

3.0 MAIN CONTENT

3.1 Yam (*Discorea spp.* Family)

Yam is one of the most important root crops. It is the staple food for many Nigerians and is classified on the level of specie. They are obtained from several species of *Dioscorea,* a very large climbing tropical plants. They are monocotyledonous plants.

SELF-ASSESSMENT EXERCISE 1

Draw the map of Nigeria and indicate the areas of the country where yam is cultivated as a major crop.

3.2 External Morphology

A description of the habitat of the crop will be based on the species- for purposes of easy identification.

i. *Dioscorea rotundata* (White yam)

Cultivated mostly in West Africa, and the West Indies, D.rotundata has cylindrical vines with leaves which are longer than they are broad. Their stipules and prickles are triangular in cross section. The tuber is white and requires about seven to twelve month to mature. Also it is generally thin skinned and the vines twine anti-clockwise.

ii. *D. cayensis* (Yellow Yam)

This has leaves that are broad and long, with cylindrical vines. Prickles, where not joined are long and slender, and cylindrical in cross section. Stipules are generally narrow and constricted towards the base. The tubers take about a year to mature and the flesh is yellow. The tuber skin is thick, and the brittle vines twine anti-clockwise. This specie has a male inflorescence which occurs singly or in pairs, but in groups.

iii. *D. alata* (Water yam)

Leaves are broadly ovate and are borne opposite each other on the stem and the vines are angular. There are no pricks or stipules. The tuber flesh is watery and creamy white and the tuber is unevenly shaped. The skin is thick and there is a creamy or bright purple epidermal layer immediately below the skin. Maturity is in about 8 to 10 months. The vines are weak and twine in a counter clockwise direction. The crop has both male and female inflorescences and produces fruits which are three-celled capsules containing two seed in each cell.

iv. *D. dumentorum* (Three-leaf Yam)

For this specie, stems are cylindrical with compound leaves of 3, 5, or 7 leaflets. Twining is clockwise. Tubers are bunched and the flesh colour varies from white to creamy white or yellow. Tubers may be bitter and sometimes they are soaked for about three days before being prepared. Some varieties are poisonous. Tubers reach maturity in about 10 months.

v. *D. bulbifera* (Aerial Yam)

Vines twine clockwise and are cylindrical. Vines carry cordite alternate leaves. There are buds which enlarge into bulbils which vary in size and shape, but are mostly bean-shaped. There are both male and female inflorescences. Maturity is in about 9 to 10 months.

vi. *D. esculena* (Chinese Yam)

Here, twining is in clockwise direction and bear alternative, pale green relatively small cordite leaves. The plant produces a bunch of soft, sugary tubers at the base of the stem. Tubers are small rounded structures, never attaining any large size. Maturity is in about eleven months. The tuber bruises easily and do not store well and sprout again within a short period.

3.3 Climatic and Soil Requirements

Yams, generally, require well drained loamy soils, rich in humus or alluvial soils. *D. rotundata* is grown more along the riverine areas, i.e. on alluvial soils. Yams like high temperature, direct simple sunshine and rainfall of about 75cm- spread over the first six months of its rapid growth.

SELF-ASSESSMENT EXERCISE 2

i. Name four varieties of yam.
ii. Give the soil requirements of yam.

3.3.1 Land Preparation

The first step is the clearing of the land. Controlled and light burning is advisable where it is difficult to clean the site. In grassland areas, the grass is pulled from the root and it may be used as mulch when dry.

Locally, holes are dug at intervals or heaps or mounds can be made; if erosion or flooding is anticipated, the mounds are made bigger. Also to

check erosion, bonds are built in-between the heaps. The bonds also help in retaining moisture when the areas are dry. The standard practice is however the making of ridges with hoes or tractors. Crossbars are made at intervals to prevent erosion. On sloping land, ridging is most advisable along the contour in order to minimise soil erosion.

3.3.2 Sowing

Sowing is normally during the early rains, but in areas where there are heavy soil or loose alluvial soil, yam can be sown at the end of the rains around November to December, otherwise sowing should be from February to March.

Planting can be done with yams sets or seed. Seeds rate should be about 2.5 to 5 tonnes per hectare with each yam set weighing 0.8kg to1kg; but for seed production, set should weigh between 0.2 to 0.5kg each. The sets should be treated against yam beetle by rolling them in Aldrin 2.5% dust before planting.

3.3.3 Planting Materials

It is true that it is possible to propagate yam through seed, but this has not been very easy and fast with those varieties that have viable seeds. It is also true that there have been some reported cases of producing tubers from vine cuttings, but this may require a long time of management before it can produce yams.

Yam is usually propagated by vegetative means, using tuber which is the edible part and which is in high demand for consumption. As a result, the demand on the tuber is too much. Since the use of tuber, most often, does not give more than 4 times the weight planted, it is necessary to find ways of reducing the use of the tuber as propagation material. In their search for ways of doing this, the National Root-Crops Research Institute, Umudike, Umuahia developed the *Minisett Technique* for multiplying planting materials.

3.3.4 Weeding

Weeding is done 2 to 4 times; early weeding is necessary. The first weeding is done when maize is being inter-cropped and this serves as seed-bed preparation for maize. The second weeding is for the yam and maize planted; and at the third weeding, vegetables are planted. By the time of the forth weeding, cassava is inter-planted and by this time, the yam is almost ready for harvesting. At each weeding, the mounds or ridges are moulded up.

There is the provision of some support for yam vines. Such staking materials as the stems of grasses, bamboos, raffia and palm fronds and the stems of erect plants are used. Crops are also used, in some cases. These are tied to trees and the vines directed to trail up the ropes. Yield can be reduced by about 50% if there is no staking.

3.3.5 Fertilizer Application

Apply 10, 10:20 mixed fertilizer at the rate of 260 - 500kg per hectare. Apply 10cm away from the stand and 10cm deep around each stand at 2-3 months of planting.

SELF-ASSESSMENT EXERCISE 3

Name other crops that can be grown on mixed cropping with yam.

3.3.6 Harvesting Storage and Yield

Harvesting can start when the tuber is still growing at about 6 to 7 months of planting. Topping is done to produce seed yams. The harvest, at this time, cannot be stored because it contains too much water, so it is eaten or sold. Early harvest provides food during the period of scarcity. The process of early harvesting while tuber is still growing is called *detuberisation* of topping and is most common with *rotundata*.

The main harvest starts about 7 to 9 months from planting when the leaves begin to weather and the vines also begin to turn yellow. However *D. esculentum* stays longer than all the other species before it is ready for harvesting. Harvesting is done carefully, to avoid bruising the tuber for this will shorten the storage period.

The tubers are tied in a shaded barn allowing free movement of air, after they have been well cleaned. In tying the tubers, space is left at the base of the stick to keep off rodents; and also no tuber is allowed to touch the other. The barn is inspected regularly and diseased tubers are removed. Sometimes, the yams harvested early may be buried for 1 to 2 months before tying in barns

Yield may reach 7 - 17 tonnes per hectare in case of sole crop, depending on the type of soil, variety of the yam and other environmental factors. However, where yam is grown under mixed cropping, yield varies between 5 – 12 tonnes.

3.3.7 Pests of Yam

One of the most important pests is yam beetle (*Hetroligus sp.)* These species have their breeding areas around rivers banks and low lying riverine areas. In the case of *Hetreligus rneles*, breeding usually starts in November to December. The eggs hatch in these areas and there are three larva stages. The first larvae feed on decaying matter and the second and third feed on grass roots. After a long prolonged larval life of about 20 weeks, the adults emerge around March and embark on the first flight, which is called the feeding migration. This occurs between April and June.

4.0 CONCLUSION

In this unit, you have learnt about root crops- namely yam and cassava, with special emphasis on yam. These two crops have dominated the activities of the small scale farmer in the agricultural food production.

5.0 SUMMARY

So far in this unit, you have been exposed to a major two food crop in Nigeria. You have also been taken through the varieties of the crop; the cultivation method and the economic importance of the crop.

6.0 TUTOR-MARKED ASSIGNMENT

Discuss the varieties of yam that you know.

7.0 REFERENCES/FURTHER READING

Bolger, F.J. (1975). *Rural Studies*. London.

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