



COP 111

**INTRODUCTION TO GENERAL
AGRICULTURE 1**

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MODULE 1

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

UNIT 1 INTRODUCTION TO AGRICULTURE

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1.0 INTRODUCTION

This is the first unit in this course General Agriculture and it is designed to enable you to understand the impact of agriculture on the socio economic development of Nigeria. This unit will briefly explain the introductory part of the course to you. It will also explain the importance of Agriculture and for the next two to three hours in going through details, all the activities will be well explained especially the self-assessment exercises which are designed to make you understand the course better in a twinkled of an eye.

At the end of the unit, there are again self-assessment questions which are meant for you. Please make sure you attend to them so as to master the details explained and the various points raised. This will not only help you but it will also make the course context easy in achieving the stated objects below.

2.0 OBJECTIVES

On completion of this unit, you should be able to:

- define agriculture and its branches; and
- 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, nut and berries. He has depended on the natural bounty of the forests, savannah lands, rivers and lakes, just as all other living animals have done. In search of food, clothing and shelter, man adopted agricultural practices as his technical skill and materials resources grew. It started with the early man as fruit gatherer and hunter moving from one place to another in search for daily food. 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.

As of today, man has consciously select both plants and animals according to the well established principles of genetic inheritance and breeds form more closely adapted to his requirements. These advances in plants and animals breeding, together with advances in the use of irrigation, the exchange of crops between Americas, Europe and Africa, the development of chemical fertilizers and pesticides and the invention of the combustion engine, have revolutionized primitive agriculture in many parts of the world.

In many developing countries of the tropics especially Nigeria, increase in food production are still often obtained by extending traditional agricultural practice into forested regions rather than the mechanized farming.

The development of new varieties of crops and the 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 both of which are expensive and have considerable polluting effects on the

environment when they are used indiscriminately and without consideration of their long term effects on the total environment.

SELF-ASSESSMENT EXERCISE 1

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

3.2 The Meaning

Agriculture to many people simply implies food production. The word agriculture coined 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 agric where is given as the science and art of the cultivating the soil, production feeding and management of crops and livestock, 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 small-scale industries connected with the processing of agricultural products also come under agriculture.

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 knowledge of the basic sciences such as Biology, Chemistry, Physics and Geography. It is therefore studied under the following specialized discipline.

a. Agronomy

This is the study of the relationship between crops and soil. Agronomy could 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 biochemistry of all agricultural products and their nutritional value. It also relates to the infonTlation of livestock feeds.

d. Agricultural Economics

This is application of another discipline which relates to the application of the basic economic principles of the operations of agricultural industry. It involves resource allocation as it occurs within the agricultural sector, organization of farms, availability sector, availability of agricultural inputs, changes in prices of inputs and outputs and marketing of cultural products. The effective utilization of limited agricultural resources with a view to attaining optimum output is paramount in the mind of Agricultural economics, formulation and study of agricultural polices, programmes planning, finance and the demand and supply of agricultural products are important components of agricultural economic.

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 the farmers are devised and employed by these workers. Where appropriate, agricultural extension may also help to build up local farmers group and organizations 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. Vetenary Science

This is similar to animal science but more inclined to specialized study of all the medical issues relating to livestock and other domesticated animal 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 the farm machinery and mechanization. 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

In your reading of section 3.1.3 list the specialized discipline 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 the subject to the survival of mankind and the growing population. It therefore cannot be neglected but 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 emphasizes 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 their food supply. Self-sufficiency in food production implies the followings.

Production of food in adequate quality to meet the nutrition requirements of all classes of the populace thus preventing malnutrition, which is, exhibited as Kwashiorkor in children and marasmus in adult and other devastating accompanying effects on the citizens.

Provision of food in adequate quantity so as to meet the caloric requirement of the citizens at reasonable prices which majority of the citizens can afford. This implies little or no food imports.

The exportation of food, which earns foreign exchange, 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 the country concerned.

Raw Materials

Agriculture provides the raw materials for the local industries. It provides cocoa for the beverage industries, cotton for textile, timber and pulp wood and paper industries respectively, rubber for 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 and result in Generation of employment opportunities and reduction in unemployment and under-employment. Provision of local industries with adequate raw materials control excessive use of foreign exchange.

Foreign Exchange

Agricultural products provide over and above local demands are exported to earn foreign exchange. This is of vital importance, because of the country's need for foreign exchange to produce certain capital goods and services must of necessity be imported and can only be paid for in foreign exchange.

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. Agricultural sector absorbs

sizeable proportion of the population in farming business ranging from the peasant farmer, farm labourers, Agricultural Officers, Extension Officer, Researchers, to mention a few.

In Nigeria according to 1953 census over 80% of the population are engaged in agriculture. However this has now been reduced to about 60- 70%. The percentage is even higher in some other underdeveloped countries. Even in the 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.

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. 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 which is employed for the Government which is employed for public investments.

SELF-ASSESSMENT EXERCISE 3

Go through sector 3.3, mention the major importance of Agriculture.

4.0 CONCLUSION

With the contribution of agriculture to the nations economy, you must have observed that agriculture is the main stay of the economy bearing in mind that over 70% of the Nigerians are employed in agriculture ranging from the farmers of production of food, Scientists who investigation agricultural problems, workers in the industries that use agricultural materials for the production of their goods and all the traders, middlemen, transporters, retailers-engaged in the marketing of agricultural products. You also learnt that other importance of agriculture include provision of food for man and animals, formation of capital, foreign exchange.

5.0 SUMMARY

In this unit, we have learnt the origin, its meaning, scope and importance of the agriculture. We also learnt about contributions of agriculture to the Nigerian economy through enhancing growth of gross domestic product (GDP) and reduction in the rate of unemployment.

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 co-operative is studied under agricultural economics.

7.0 REFERENCES/FURTHER READINGS

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UNIT 2 AGRICULTURAL DEVELOPMENT

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 - 3.2 Concept of Agricultural Development
 - 3.3 Fully Monetized Economy
 - 3.4 Industrial Economy
 - 3.5 The Role of Science and Technology in Agriculture
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 - 3.7 Protection of Crops and Livestock
 - 3.8 Breeding
 - 3.9 Improvement of Soil Fertility
- 4.0 Conclusion
- 5.0 Summary
- 6.0 Tutor-Marked Assignment
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1.0 INTRODUCTION

This is the second unit of the course which clearly explain the term Agricultural development with special reference to West Africa and Nigeria in particular.

The transformation of subsistence agriculture in Nigeria and other African countries to more productive forms of agriculture 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 infestation and hence increasing agricultural productivity.

2.0 OBJECTIVES

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

- define correctly the term agricultural development;
- state and explain the main characteristics of agricultural development; and
- state accurately 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 service such as rural infrastructure (good road network), clean regular water supply, electricity, health, recreational and educational facilities for 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 planned process of change which requires adequate planning

SELF-ASSESSMENT EXERCISE 1

Briefly define Agricultural Development.

SELF-ASSESSMENT EXERCISE 2

List five of its characteristics.

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 to mention a few which simultaneously enhance the standard of living of vast majority of the people especially farmers. Thus there could be agricultural growth without development. For example, when few farmers (in most cases rich farmers/industrialist) experience increased output and standard of living. Consequently, there is reduction in unemployment and under-employment since 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 Monetized Economy

A fully monetized economy has exportation of agricultural products as one of its policy objectives. It therefore follows that agricultural development in such an economy will mean manifestation of the characteristics of the basic subsistence economy. In addition to increased cash or exports crop production. Invariably there will be improvement in substance of the quality of the crops exported to earn 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 an adequate supply of raw materials to the local agricultural industries. This leads to an expansion of industries, creation of job opportunities, reduction in under employment. Thus there is increase in food supplies to the growing industrial population. Although the number of people engaged in farming decline the productivity of the people remaining increased consequently upon 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 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 specialize 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 mechanization of agricultural production; protection of crops and animals improvement of soil fertility for increased crop yield production of high yielding and disease resistant varieties of crop and species of animals.

The major contributions of science and technology in agriculture include the following:

3.6 Mechanization of Agricultural Production

Significant improvement in the design and fabrication of agricultural machineries and tools has been attained. Cultivated land is now being prepared with the use of ploughs and harrows. Tractors driven implements like planters harvesters etc. are being used for operations in the farm. Besides the simple farm tools like cutlasses, hoes are being modified for increase efficiency. Battery cages are fabricated for poultry production. Recently with the high cost of procuring the conventional metal battery cages wood is now used to build battery cages in Nigeria.

3.7 Protection of Crops and Livestock

Various agro chemicals have been produced by scientists to control pest and diseases of crops and livestock. Insecticides, pesticides, fungicides are used to control the infestation of crops and animals in the farms. The fungus disease in maize is controlled by using fungicides, while herbicides are used to control weeds farm animals are treated in the farm clinic by veterinarians and vaccinated ensure immunization against disease.

3.8 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 e.g. high yielding variety of cassava developed by scientist at the International Institute of Tropical Agriculture (IITA) is now widely cultivated by farmers in Nigeria. Artificial insemination (AI) was developed to effect fertilization in the female animal without being in contact with the male counterpart. This method has the advantage of reducing wastage of sperm, servicing of as many females as possible, thus increasing production. Scientists have developed high yielding cowpeas varieties such as ire brown resistant to multiple diseases and insects including bruchid, which causes direct reduction in dry weight, reduces grain quality and seed viability making seed unfit for planting.

3.9 Improvement of Soil Fertility

Soil scientists have discovered the use of inorganic chemical compounds in replenishing the soils minerals. This mineral which has been removed 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 the scientists to improve farmer's performance in agricultural productions.

SELF-ASSESSMENT EXERCISE 3

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 sector i.e. crops and livestock. Thus there could 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 reached by the country hence agricultural development enhances the standard of living of vast majority of the people especially farmers.

ANSWER TO SELF-ASSESSMENT EXERCISE 1

Agricultural development is defined as a process whereby the per capital income of the vast majority of the farming population increased over a long period of time leading to improvement in the standard of living of farmers, with a resultant increase in the gross domestic product of the country.

ANSWER TO SELF-ASSESSMENT EXERCISE 2

The five characteristics of agricultural development include:

- Agricultural and income distribution.
- Changes in rural institutions.
- Reduction or elimination of poverty amongst the rural people.
- Reduction or elimination of under and unemployment.

ANSWER TO SELF-ASSESSMENT EXERCISE 3

The term subsistence agriculture is the agricultural activities which produce only sufficient food for the farmer and his family. While subsistence economy occurs when the majority of the farming population produce enough food, in terms of quantity and quality to feed the populace and still have excess for sales which generates income to the peasants. The income generated increases their purchasing power and enable them to procure other necessities of life which they do not produce.

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 have contributed significantly to the development of agriculture. Explain why this is so.

7.0 REFERENCES/FURTHER READINGS

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UNIT 3 ESSENTIALS OF AGRICULTURAL DEVELOPMENT

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- 5.0 Summary
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1.0 INTRODUCTION

This is the third unit of the course. "You will remember that unit two dealt with the distribution and concept of agricultural development while this unit will give a clear picture and detail explanation on the factors responsible for agricultural development. However, agricultural development cannot take place with the support of other sectors (industry and service) of the economy and vice versa.

2.0 OBJECTIVES

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

- identify the various factors responsible for agricultural development; and
- 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 of 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 include:

3.11 Effective Agricultural Planning

Agricultural planning is a conscious sustained and systematic attempt made by either the Government, non-Governmental Organizations (NGOs) or private sector to utilize the available agricultural resources of the country in order to benefit the farmers and the entire population. Proper planning of all activities within the agricultural sector is therefore imperative for rapid development of the sector.

3.1.2 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 the small scale farmers. The inputs need to be procured and supplied timely and in adequate quantity to the 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.

3.1.3 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 already mentioned in 3.1.2. above. The planning of manpower, research and paying of agricultural staff salaries and wages 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 centres, there is great

strain on the title 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 of 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 the credit is spent on productive activities only. Some experts have argued that in order to achieve the prudent use of the production credit, 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.

3.1.4 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 (ARMTI) Agricultural Research and Management Training Institute are of paramount importance for the development of high and middle level manpower.

3.1.5 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 cultivable 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 utilized. The under-utilization 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.

3.1.6 Irrigation

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

3.1.7 Efficient Marketing System for Agricultural Products

This is an important pre-requisite that required creating time utility for consumers and stabilizing farmer's income. Besides effective communication system good roads is equally essential for conveyance of farm inputs and outputs, to and from the farms and pass information to farmers. All these factors lead to increased farmers output, income, and standard of living, hence 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 attempt made to increase production need 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 lack of marketing infrastructure and inefficient marketing system.

3.1.8 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 the 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 included the following:

1. The 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 stabilize farmers income.

3. Establishment of (NSC) National Supply Company 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 minimum prices and income for food producers aimed at stabilizing the income of the 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 undertaken to attain the policy objectives are imperative for agricultural development and its sustenance.

3.1.9 Institutional Arrangements

Agricultural related institutions such as extension organization, farm organization, financial institutions, farmers’ associations cooperatives 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 the farmers’ techniques and overall production, income, standard of living and general welfare. The institutions are either established by the farmers themselves or through external force.

3.1.10 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 modernization of agricultural production technique, use of improved simple farm tools, puts, management techniques, storing, processing and transportation of agricultural products. The importance of the 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 maximize the returns due to effective use of their limited resources. Besides, the technology can only have significant impact on the sector if the products are readily available, affordable and easily operated or practiced by the small-scale farmers. Availability of the 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.

3.1.11 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:

- a. Basic Research,
- b. Applied Research.

For research to be meaningful, it must be relevant to the farmers felt needs. 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 stream" research. Findings of the research are transmitted to the farmers through the extension officers.

3.1.12 Extension Service

Extension service is defined as a voluntary out-of-school adult education 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 organizations to disseminate useful information relating to the discipline in focus, to the people concerned. Specifically agricultural extension officer transmit research findings from research institutes or universities to farmers and obtain feedback from farmers to the researchers for further research, analysis and establishment of facts.

SELF-ASSESSMENT EXERCISE 1

List five of the factors responsible for agricultural development.

SELF-ASSESSMENT EXERCISE 2

Which of these factors do you consider most important?

4.0 CONCLUSION

By now you must have realized that the various factors responsible for agricultural development include, financial resources, agricultural planning, agricultural inputs, manpower development, research to mention a few which in the long run contributes to farmers income and increase in the standard of living leading to rapid development.

5.0 SUMMARY

You have studied in this unit the various factors responsible for agricultural development are vital to agricultural sector especially in the socio-economic contributions and 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.

ANSWER TO SELF-ASSESSMENT EXERCISE 1

The five factors responsible for agricultural development include:

- Financial resources
- Effective agricultural planning
- Agricultural inputs
- Research
- Manpower development.

ANSWER TO SELF-ASSESSMENT EXERCISE 2

All the above factors are very important equally.

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.

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UNIT 4 PROBLEMS OF AGRICULTURAL DEVELOPMENT

CONTENTS

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Main Content
 - 3.1 Definition
 - 3.2 Land Tenure
 - 3.3 Poverty/Lack of Financial Assistance
 - 3.4 Lack of Basic Amenities
 - 3.5 Ignorance and Lack of Good Agric Education
 - 3.6 Poor Tools and Farm Machines
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 - 3.8 Inefficient Marketing System
 - 3.9 Pests and Diseases
 - 3.10 Agricultural Inputs
 - 3.11 Government Policies and Programmes
 - 3.12 Poor Extension Workers
 - 3.13 Unpredictable Climate
- 4.0 Conclusion
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- 6.0 Tutor-Marked Assignment
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1.0 INTRODUCTION

Developing countries especially the West African countries and Nigeria in particular are faced with numerous problems which militate against the development of Agriculture. About 78% of the Nigerian population live in the rural areas who 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 to or desire in these areas for development both in agriculture and other sectors, the problems which militate against the development of agriculture needs to be identified and tackled.

2.0 OBJECTIVES

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

- understand the various problems of agricultural development; and
- proffer solutions to all these militating problems.

3.0 MAIN CONTENT

3.1 Definition

These militating problems account for almost 90% of Nigeria's under development and once these are tackled with appropriate solutions, Nigeria will be regarded as an industrialize country. The problem includes:

3.2 Land Tenure

Land is one of the most important factors of Agricultural production. The land tenure is the way land is owned in a society. The prevailing land tenure systems in Nigeria often discourage agricultural land utilization. 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 the available land. The only solution is the strict adherence to the land use decree of 1978 as amended in 1990 ACT. This can make land available to prospective and genuine farmers.

3.3 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 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. The 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 the farmers should form themselves to co-operatives to generate capital for members. Government may also provide credits through some institutions with little or no stringent measures. The bank should be more liberal in making credit available to farmers.

3.4 Lack of Basic Amenities

Basic amenities are good roads, good drinking water, electricity, educational institutions, health facilities and market in the rural areas. Young people like to enjoy the good things of life. The lack of these amenities in the rural areas has the effect of making the young energetic members of the communities 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 necessities for agriculture development.

Provision of these basic amenities will discourage rural-urban migration.

3.5 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. The adult education has been embarked upon with vigour through government agencies.

3.6 Poor Tools and Farm Machine

Most farmers still rely on the use of tools like hoe, cutlass, rake etc for their farm operation instead of using mechanized implements like riggers, ploughs, cultivators etc. there is need to have agricultural tools as mentioned above that are suitable for use in the tropics. At present, these are not 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 for the rural farmers. 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 might 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 make spares readily available. The government should train farmers on the most recent agricultural technology and there should be subsidies over the farm machinery or make provision for tractor/machines hiring units in most of the local governments.

3.7 Poor Storage and Processing Facilities

In this country a, large percentage of the products of the farm spoil after harvest. Prices of these products fall too low immediately after harvest, because the farmer cannot store or produce 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 the lack of adequate marketing systems for most of the farm products. A large amount of farm products are lost over harvesting season because they can neither be disposed off properly or be preserved or processed. Storage facilities are inadequate. It is necessary that the government should establish adequate marketing system. The 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.

3.8 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 fluctuates and there is more marketing channels for farm produce coupled with the lacks of good roads to help evacuate the farm produce to adequate market at the right times since most food crops are perishable within some hours after harvesting. 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 them maximum profit.

3.9 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, the 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. The large quantities of farm produce are lost both in the field and in store.
- ii. The farmer spends extra money in supplying to the farm and in the purchase of chemicals purposely to control the pests and diseases.
- iii. There is reduction in quantity and quality of the farmers products. It is necessary to note too that very often, the chemical controlling the pests and diseases may not be available.

3.10 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 action is very necessary in this area. Farm inputs should be highly subsidized 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.

3.11 Government Policies and Programmes

Government lacks basic consistent policy on the establishment and 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 subsidize 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.

3.12 Poor Extension Workers

Extension helps in disseminating recent 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, and the uncooperative attitude of the farmers. At most period there is lack of recent research work compiled with the poor remuneration of the extension officers. The training and funding of the extension programmes must not only be done by the government but also the non-Governmental Organizations, cooperative Societies and other financial institutions.

3.13 Unpredictable Climate

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

4.0 CONCLUSION

The solution to all these problems rest namely on -the government If agriculture is given priority in its budget year in year out.

5.0 SUMMARY

The development of agriculture could only be achieved if only these problems are attended to within a frame test of time hence since agricultural development is a necessary condition from economic development of any nation particularly an agrarian economy.

ANSWER TO SELF-ASSESSMENT EXERCISE

i. The problems of Agricultural development includes:

- Land tenure
- Poverty/lack of financial assistance
- Lack of basic amenities
- Ignorance
- Lack of storage and processing facilities.

6.0 TUTOR-MARKED 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 LAND USE IN NIGERIA

CONTENTS

- 1.0 Introduction
 - 2.0 Objectives
 - 3.0 Main Objectives
 - 3.1 Definition of Land Tenure
 - 3.1.1 Types of Land Tenure
 - 3.1.2 Communal Land Tenure System
 - 3.1.2.1 Disadvantages of Communal Ownership of Land
 - 3.1.2.2 Advantages of Communal Ownership of Land
 - 3.2 Tenure Based on Individual Inheritance
 - 3.2.2.1 Disadvantages of Free-Hold Land Ownership
 - 3.2.2.2 Advantages of Free-Hold Land Ownership
 - 3.2.3 Lease-Hold Tenure or Landlord-Tenant Agreement
 - 3.2.4 State or Government Ownership of Land
 - 3.3 Government Laws on Land
 - 3.4 Principles of Land Use
 - 3.4.1 Agriculture and Forestry
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- 4.0 Conclusion
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- 6.0 Tutor-Marked Assignment
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1.0 INTRODUCTION

This is the fourth unit and we are going to consider the 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 can not be over emphasized hence a better understanding of this unit will be of immense advantage in some of our subsequent units especially when we study agricultural production. You are advised to have a comprehensive understanding of this unit.

2.0 OBJECTIVES

After studying this unit, you should be able to:

- define Land Tenure;

- explain types of Land Tenure and factors affecting them in Nigeria; and
- explain the steps government has taken to combat land use problems.

3.0 MAIN CONTENT

3.1 Definition of Land Tenure

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 arrangement 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

The Land Tenure System in Nigeria varies with tribe, clan, state or community. It can be broadly classified into four as follows:

3.1.2 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. The 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 but not 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 the perennial crops such as oil palm belong to the community and are harvested and shared among the members of the community.

3.1.2.1 Disadvantages of Communal Ownership of Land

The major disadvantages of communal ownership of land are:

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

3.1.2.2 Advantages of Communal Ownership of Land

The advantages of this system are:

- 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 organize communal and cooperative farms on such lands, since the land is extensive.
- iii. Modernized farming on economic scale is possible.
- iv. It is easier to transfer the land to a prospective farmer since individual attachment is almost absent.

3.2 Tenure based on Individual Inheritance of Free-Hold Land Ownership

This is the commonest method of acquiring land in some developing countries in which 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 mechanized 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 and sentimental attachment to land in man communities.
- b. There is also the rigorous and unnecessarily long negotiation associated with such transfer or purchases.

3.2.2.1 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 the fullest 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 the individual owners.

3.2.2.2 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, makes for proper future planning and efficient investment on the land.
- iv. Mechanized farming can be practiced if the land is large enough.

3.2.3 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. The Taungya system in which 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 is a good example.

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.

3.2.4 State or Government Ownership of Land

Some land belonging to the government may be leased out to an individual. Payment by such individual which is done by cash is paid into the government treasury. The disadvantages of this system are that the government can recover its land with a very short notice.

It should be mentioned here that the disadvantages of the various system described above are obstacles to agricultural development and co-operative societies are expected to be used to circumvent these obstacles. This is because farmers access communal land have been found to be faster on the platform of these Co-operative Societies rather than as individual.

SELF-ASSESSMENT EXERCISE 1

What do you understand by communal ownership of land?

SELF-ASSESSMENT EXERCISE 2

List the advantages and disadvantages of communal ownership of land.

3.3 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 of 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 of 1979 constitution. The declared objectives of these Acts 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 where he and his family can live and farm.
- iv. Bringing to government control the use of which land can be put in all parts of the country and thus facilitate planning or formation of programmes for particular land uses.

From the present situation as regards land transaction you must be able to say whether this 1978/9 Land Use Acts has fulfilled these objectives is a silent question as it can be safely said that the land tenure systems prevailing in all rural areas of this country before this Art has survived till date.

3.4 Principles of Land Use

The principles of Land Use aim at the production of as much as possible from the land and the avoidance of land wastage. Land can be used for three main purposes namely: Agriculture, Forestry and Wildlife Conservation or Game Reserve.

3.4.1 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. whether 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 land is best used for pasture subsistence crops, and animal protein production. But the use of land in the derived 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 would 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.

3.4.2 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 game 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 3

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 at mobilizing the available land and making it 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, states and ethnicity.

5.0 SUMMARY

Agricultural Land activities especially in the rural areas are 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 bottlenecks in the urban areas.

ANSWER TO SELF-ASSESSMENT EXERCISE 1

In the communal ownership system, the land belongs to the community which may be an extended family, a village or a town and no members of the community can use land against the wishes of the rulers of the community. Any member of the community can plant annual crops on any part of the land.

ANSWER TO SELF-ASSESSMENT EXERCISE 2

Advantages include:

- i. It ensures that every member of the community has land to satisfy his needs.
- ii. It keeps the economic value of the land in the hands of the community members, hence land take-over by strangers is prevented.
- iii. It is possible to organize communal and cooperative farms on such lands, since the land is extensive.
- iv. Modernize farming on economic sale is possible.

Disadvantages include:

- i. Inadequate maintenance of the soil fertility.
- ii. There is fragmentation of land. When land is divided among all members of the community.
- iii. Refusal to allocate land to strangers is disadvantageous because such strangers may be more capable of making more economic use of the land.

- iv. In case a farmer needs more money and wants to get loan from banks, he cannot use the land allocated to him as collateral security.
- v. A community may also try to prevent individual members from getting more land than the rest thereby restricting every members output.

ANSWER TO SELF-ASSESSMENT EXERCISE 3

The objectives of the Land Use Act of 1979 include:

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

6.0 TUTOR-MARKED ASSIGNMENT

- 1. Define land tenure
- 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	Method of Farming in Nigeria
Unit 2	Importance of Research in Agriculture
Unit 3	Agricultural System
Unit 4	Agricultural Extension Service
Unit 5	Importance of Agriculture Extension

UNIT 1 METHOD OF FARMING IN NIGERIA

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3.2	Subsistence Farming
3.2.1	Characteristic of Subsistence Farming
3.2.2	Problems of Subsistence Farming
3.3	Cash Crop Production
3.4	Commercial Agriculture
3.4.1	Advantages of Mechanization
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3.4.3	Limitation to Mechanization
3.5	Differences between Commercial and Subsistence Agriculture
4.0	Conclusion
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6.0	Tutor-Marked Assignment
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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 finding a lot evolved agricultural production from the subsistence farming to the use of machines, which is regarded as mechanization for commercial purposes.

2.0 OBJECTIVES

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

- understand the various types of farming and their characteristics; and
- explain the merits and demerits of each types 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 feed and once this was accomplished, he was contented. This system was characterized 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 overtaken with the advent of civilization.

3.2 Subsistence Farming

This is a system of fanning whereby a fanner 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 fanner may also be involved in the establishment of plantation agriculture 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 fanner keeps a few goats, sheep, rabbits or pigs. In the arid regions the subsistence livestock fanner is mainly nomadic and moves with his animals from place to place in search of waster and pasture.

3.2.1 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 mechanized farming.

3.2.2 Problems of Subsistence Farming

1. Control of pests and diseases is difficult.
2. Illiteracy of the farmers.
3. The crude tools used by the farmers.
4. Labour supply is erratic and unreliable.
5. The practice of subsistence farming wastes land and there is no means of replenishing soil hence shifting cultivation which is migration to another fresh land.
6. The process bores down farmers because the work is unchallenging and there is little or no profit since the produce are not for sale.

SELF-ASSESSMENT EXERCISE 1

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

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 specializes in the cash crops like cocoa, kola, rubber, citrus, groundnut, oil palm they require processing into finished products before they are be consumed. The farmer 'sells the product in a consumed processed form.

Most of the plants in this category can stay for 5 -50 years, yielding every crop, and because of their long stay at the permanent site, they required:

- 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 alone on a large sale through the use of mechanization is the use of machineries to do the work formally done with the hands. Machines have been produced which increases productivity in agriculture. In advanced countries most of the farm operations have been mechanized. Bulldozers are used for in clearing the farm and falling trees. Tractor mounted instruments like ploughs, and harrows are used in tilling the soil. There are planters ridge making

machines, cultivators, spraying machines and machines for apply fertilizers. Many types of harvesters are not available and there are machines used in processing agricultural produce of any type. In livestock farming incubator, instead of natural hatching of eggs by fowls egg graders and milking machines. These machines make work in the farm easier, faster and less burdensome.

1. It is very expensive to practice.
2. Large area of farmland is required.
3. Requires the use of machines like cultivators, tractors, ploughs, harrows, planters, harvesters, etc.
4. Labour is both manual and mechanical and specialists are required, in some stages of production
5. The returns are very high at the end of season or harvest time.
6. Marketing of products is specialized and sometimes advertisement.
7. It involves a lot of research into the various aspects of production.
8. It requires good record keeping so as to make proper and adequate decisions.

3.4.1 Advantages 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 for cost of labour is higher than cost of hiring machines. This increases the profit margin of the farmer.
7. Mechanization 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 material will be produced in greater quantities.

3.4.2 Disadvantages of Mechanization

Mechanization is a blessing agriculture but it has disadvantages and limitations. Some of the disadvantages include:

1. It is capital-intensive product. This is so because it requires a lot of money to purchase tractors and other implements if already acquired, machines reduce the cost of product in that the cost of paying labour to do a piece of work is more than cost of achieving the same machine, but 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, many state governments (Oyo State) have established tractor hiring unit services but it will take time before many farmers can afford it.
2. It generates unemployment, because of the improved rate of work as a result of mechanization, a good number of workers are displaced, unemployed people constitute a social problem.
3. Mechanization of seedbed preparation destroys or alters soil structure, which is not good for plants.
4. Mechanization creates pollution since the machines will use power that often generates fumes and bad air. The smoke that escapes from the exhaust of the tractors is carbon monoxide, which is dangerous.

3.4.3 Limitation to Mechanization

The cost of buying source of power and machines is very high and only very few rich farmers can mechanize now. Also the majority of the farmers especially the rural farmers cannot afford the cost of hiring them. Even at that, the available machines in the different age services centers in the states are not enough to reach all those who would like to hire them. There is scarcity of lack 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 regularly and properly maintained.

SELF-ASSESSMENT EXERCISE 2

- i. What is meant by mechanization of agriculture?
- ii. 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. Mechanization is the major price	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 specialized and Expensive.	5. Labour is from friends, family members and cheap.
6. Marketing of product is specialized.	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 with superstitious in nature.
9. Yield and often returns are high meant for every body.	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 make good decisions.	11. No record keeping is done and so no improvement is expected.

4.0 CONCLUSION

It could be clearly stated that despite the high yield returns with the high proceeds from the commercial agriculture most of the small scale farmers which constitute the vast majority of agricultural production still operate the subsistence farming as a result of how capital require merits. The state and federal government should provide and immediate solution to the provision for large capitals for the small-scale farmers.

5.0 SUMMARY

From the understanding of the various types of farming in this units, it clearly give a better picture that mechanization of agriculture will be the only solution to population and that the subsistence farming could still be more developed in all ramifications especially with the provision of capital to the small scale farmers.

ANSWER TO SELF-ASSESSMENT EXERCISE 1

- i. Subsistence farming is a system of farming whereby a farmer cultivates crops and rears animals in order to produce food for use by himself and his family only. Labour is provided by the farmer and his family and the area of land used is very small, while the produce from the farm are not for sale.
- ii. The problems associated with the farming system include:
 - Control of pest and disease is very difficult.
 - The farmer is not educated and local in ideas.
 - The farmer still uses crude tools as hoes, cutlasses, etc.
 - Labour supply is erratic and unreliable.
 - The process bones down the farmers because there is little or no profit gained since the produce are not for sale.

ANSWER TO SELF-ASSESSMENT EXERCISE 2

- i. Mechanization of agriculture is the system of farming where the farmer employs the use of machines in all aspects of activities. A larger area of land is used while it is capital intensive while the returns are very high at harvest time with high proceed returns to the farmer. It also involves a lot of research into the different aspects of production with a good record keeping so as to make proper and adequate decisions.
- ii. The two advantages of mechanization include:
 - With machines a farmer does much greater work within a given time and does the work more efficiently.

- Labour is saved and released from the farm to other areas of production.

Disadvantages include:

- It is capital intensive.
- It generates unemployment.

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 READINGS

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UNIT 2 IMPORTANCE OF RESEARCH IN AGRICULTURE

CONTENTS

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Main Content
 - 3.1 Definition
 - 3.1.1 Basic Research
 - 3.1.2 Applied Research
 - 3.2 Research Institutes
 - 3.3 Applied Research
 - 3.4 Innovations
 - 3.5 Quarantine Services
 - 3.6 Research Contributions
- 4.0 Conclusion
- 5.0 Summary
- 6.0 Tutor-Marked Assignment
- 7.0 References/Further Readings

1.0 INTRODUCTION

Research has played tremendous role in the 'development of Agriculture in Nigeria. Traditional, research in agriculture in Nigeria has concentrated on cash crops which are of value to industrialized economics until lately when it was expanded with the principal objective in the development of improved permanent food producing systems which will maintain soil fertility and consistent high yields which will be economically viable, socially and culturally acceptable well as being within the abilities of the small farmer and which, will be adapted to the differential ecological conditions.

2.0 OBJECTIVES

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

- the contributions of science and technology in agriculture;
- the impart of research activities on agriculture; and
- the 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 the University and at times in research institutions for the sake of acquiring knowledge and not for solving immediate problems of farmers. The findings are however, sometimes utilized 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 the 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 the 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 as 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, Kolanut, 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 the research activities on livestock and products. The headquarters is at Vom new 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 organizes seminars, conferences and workshops related to any of these problems.
- e. National Root Crops Research Institute, Umudike, Umuahia (NRCRD). This is a body charged with the national responsibility for research into root and tuber crops such as yams, cocoyams, 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 with 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, soyabeans and yam. The research findings are shared through international Cooperation Programmes, which include training, information and germplasm exchange activities.

The findings of these various research institutes are usually passed to the farmers through the extension officers. Varieties of crops which are resistant to various disease infesting the 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 the 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 evolved by selection and cross breeding.

For research to be meaningful, it must be relevant to the farmers "felt needs". 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 research team. This is referred to as "Up Stream" research. All the findings of the research are transmitted to the farmers through the extension officers.

SELF-ASSESSMENT EXERCISE 2

Mention five research Institutes and state their research activities.

3.3 Applied Research

These are research findings that should be disseminated to the 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 be grouped into technical and social innovations.

3.4 Innovations

Ways of encouraging farmers to adopt 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 needs to be encouraged and sensitized to 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 the farmers: Cooperatives are institutionalized organization 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 timely 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 likelihood of negative impact of a policy on farmers, government should provide a safe measure mechanism to absorb or reduce the impact.
- vii. Agricultural extension officer should be provided with adequate resources (finance mobility etc) to enhance their performance. Besides, the acute shortage of extension officers need be addressed by the government.

3.5 Quarantine Services

The government provides quarantine services purposely to aid agricultural development. Plant Quarantine regulation are meant purposely to prevent the introduction and distribution of foreign plant diseases and pests into the country. The primary objective is to protect the agricultural crops which are produced in the country from other countries. Quarantine measure can also be applied to eradicate and prevent the internal spread of plant diseases and pests within the country. These measures require strict supervision of the importation of any 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 organization that imported the plant.

3.6 Research Contributions

The contributions of science and technology in the areas of Agricultural development are:

- Crops and animals improvement through genetic manipulations (breeding).
- Diseases and pests control.
- 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.
- Mechanization of farm operators purposely to maximize yield by more efficient operations.
- Construction of good roads for easy evacuation of farm produce.
- Increase productivity of crops and animals through better techniques.

SELF-ASSESSMENT EXERCISE 3

- 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 providing food for all and also for rapid development of agriculture.

5.0 SUMMARY

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

ANSWER TO SELF-ASSESSMENT EXERCISE 1

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

- ii. Applied Research: This is often carried out by the intellectuals mainly in the research institutes purposely for solving the immediate problems in the country.
- iii. The two advantages of research include:
 - Production of crops which are disease free and disease resistant.
 - Production of high yield varieties.

ANSWER TO SELF-ASSESSMENT EXERCISE 2

The five research institutes are:

1. National Cereals Research Institute, Badegi Researching into Cereal crops i.e. Rice, Maize.
2. Cocoa Research Institute (CRIN) Ibadan researching into tree crops i.e. Cocoa, Kola, Coffee, etc.
3. Nigerian Institute for Oil Palm (NIFOR)'is into oil palm and palm produce.
4. National Root Crops Research Institute Yom Jos is into Livestock and products research.

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. Four research institutes and explain their research activities.

7.0 REFERENCES/FURTHER READINGS

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UNIT 3 AGRICULTURAL SYSTEM

CONTENTS

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Main Content
 - 3.1 Shifting Cultivation
 - 3.2 Land Rotation
 - 3.3 Mixed Farming
 - 3.4 Bush Fallow
 - 3.5 Continuous Cropping
 - 3.6 Monocropping (Sole Cropping)
 - 3.7 Cropping Rotation
 - 3.7.1 Inter-planting
 - 3.7.2 Inter-cropping
 - 3.7.3 Advantages of Crop Rotation
 - 3.7.4 Plan of a Rotation
 - 3.8 Mixed Farming
- 4.0 Conclusion
- 5.0 Summary
- 6.0 Tutor-Marked Assignment
- 7.0 References/Further Readings

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 proceeding crops and livestock 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 do the following:

- understand the various agricultural systems in Nigeria;
- describe accurately any three of the methods of farming;
- understand the strengths and weakness of traditional farming system; and
- practice one of the following system in your own garden at home or farm.

3.0 MAIN CONTENT

3.1 Shifting Cultivation

The most common system of agriculture used in Nigeria traditional villages is the shifting cultivation. Under this system the farmer clears a piece of land of its natural vegetation 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 bushes and the land regains its richness through the leaves that fall and decays on the soil. This system was practicable in the older days because the population was small and the farmer plants only for himself and his family. Nowadays, because of the increase in Nigeria population, shifting cultivation is not only undesirable but also impracticable.

3.2 Land Rotation

A modified form of shifting cultivation is called land rotation. Under this system, a farmer clears land use 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 after some years to the original plot. 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 conditions is different for grass land areas as the grass does not drop enough litter to restore the fertility of the soil rapidly.

Another factors which makes shifting cultivation and land rotation undesirable in the grassland areas is the frequents destruction of humus or bush fire. This is due to the method of disposing the 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 the first bums the humus of the soil and in addition destroys some of the nutrient, elements 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 1

Mention the two traditional agricultural systems we have just discussed.

SELF-ASSESSMENT EXERCISE 2

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 ensure against crop failure and to use fully the fertility of the soil it has even been argue by some people that under the traditional methods of farming, a mixed cropping is more economical, for they held that a 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 combinations of plants for intercrop planting are 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, taking advantage of both the nutrient reserved-that the increased are available. Examples of typical combinations for inter-cropping with local crops are: Tomatoes and green, hot pepper and okra, egg plant and spinach/greens, sorghum or millet, cowpeas/millet or cowpea/cotton, guinea corn/cowpea/groundnuts, maize/cassava/Barbara groundnuts. With modem farming methods, mixed cropping has the following disadvantages:

- a. The fellilizer mixture suitable for one of the crops may not be suitable for the other crops. This may reduce the yields of the other crops.
- b. A plot containing different crops of varying heights and distances apart cannot be easily adapted to mechanization.

3.4 Bush Fallow

When the farmers observe 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. There, they will recapture the nutrient element 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 where there is land hunger 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 organized in a crop rotation system but it often leads to soil exhaustion, erosion and low productivity.

3.6 Monocropping (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 eggs in one basket. The farmer will be exposed to the danger poor harvest in case of adverse climatic condition or invasion of pest and diseases and will depend on other farmers for other food crops that he does not produce.

3.7 Cropping 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 lands rotation and shifting cultivation in all advanced countries. Even in the 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 crop require different amounts of plant food. Some use much and are known as exhaustive crops e.g. Maize, Yam, and Cassava, other use leaves e.g. Vegetable such as: Tomatoes, and

pumpkins. Others can actually add nutrients to the soil e.g. legumes. Every year, a different kind of crop is planted in order to prevent plant food becoming exhausted.

The crops should be arranged in such a way that an increase in the yield of one result 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 roots that go deep into the soil and therefore feed deep, other 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 the crops in the rotation. As far as possible, the crops that are 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 of establishment stumping especially can be very expensive, particularly in the forest zones.

3.7.1 Inter-planting

It is the growing of any major crop in between planting another major 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 growing in this way.

3.7.2 Inter-cropping

Is the planting of quick growing and quick manufacturing crops between slow growing and slow manufacturing crops. Melon is intercropped with Yam for example followed by refers to the planting of another crop on a plot from which the first crop was just harvested. The life cycles of both crops are short enough for them to fall within the same course in 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 utilization of plant food.
- c. Under a good system of rotation, the fertility of the soil is maintained.
- d. Labour is used much more effectively.
- e. The soil is put into maximum use without necessarily destroying.

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 the 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 start all over again.

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

Fig. 1A – 4: Year Crop Rotation Plan

An efficient rotation is one that maintains the soil structure and controls pest and diseases. This can be judged on the 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

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

Fig. 2: A Rotation with the Local Crops

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 following early maize.

He may also move in order to avoid diseased areas or areas infected with pest such as tsetse-fly. Sometime some herdsman moves in order to avoid tax agents. The Fulani in West Africa and the Masai in East Africa are well known examples of pastoral farmers. They are always fearless people who are not prepared to be subordinated by the local authorities and prefer to be aloof. They provide for their families from the sales of slaughter male animals and skin. Usually their problems are:

To be able to move in such a way that the animals do not trespass into farms.

The risk of not having sufficient grazing areas since the kind is in great demand for crop farming.

The risk of not finding a good place to pitch their camps during a particular season.

Finding areas free from tsetse flies. They normally have wet and dry seasons camps to his semi-permanent wet season camp he returns his sick flock and the young ones.

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 through out the year and he can operate economically. He can feed his animals - cattle, pigs, chickens with his farm products :specially at times when such crop are attracting low price in the market. Also the need to have a source of manure in order to maintain an effective rotation, made some people to combine crop production with animal husbandry and so started the mixed farming. This system has another advantage of the farm yard manure being used to enrich the soil and also the use of farm by-product like straws, groundnut, haulons cowpea tops as livestock feed. In some communities the animals not only supply manure but also serve as a means of transport and provided labour for ploughing.

SELF-ASSESSMENT EXERCISE 3

By means of definitions, differentiate between crop rotation, mixed cropping and bush fallowing.

SELF-ASSESSMENT EXERCISE 4

List five traditional agricultural systems.

4.0 CONCLUSION

It was said from various highlight of this units that traditional agriculture and pastoralism in the forest and savannah zones have proved from time immemorial the most effective response by man to his environment in ensuring his survival and prosperity in these areas.

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, mixed farming to mention but few.

ANSWER TO SELF-ASSESSMENT EXERCISE 3

Crop Rotation: Is the method of farming in which the same piece of land is kept under cultivation every year in such a way that the crops fallow in a definite order to cycle planned in such a way to restore nutrients removed from the soil.

Mixed Farming: This is the planting of more than one type of crop on a lot of land at the same time. Yams, maize, cassava and okra often go together while maize, cassava and okra are planted on the same plot.

Bush Fallowing: This is arresting period to permit the natural build up of fertility in the soil after apiece of land has been cropped for some years.

ANSWER TO SELF-ASSESSMENT EXERCISE 4

The five traditional agricultural systems include:

- a. Shifting cultivation
- b. Crop rotation
- c. Mixed farming
- d. Pastoral farming
- e. Mono-cropping.

6.0 TUTOR-MARKED ASSIGNMENT

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

Write a short not on the following:

- a. Shifting cultivation
- b. Mixed farming
- c. Pastoral farming

7.0 REFERENCES/FURTHER READINGS

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UNIT 4 AGRICULTURAL EXTENSION SERVICE

CONTENTS

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Main Content
 - 3.1 Definition
 - 3.2 The Concept of Agricultural Extension
 - 3.3 Dissemination of Information
 - 3.4 The Principal Actors are
 - 3.5 Rate of Adoption
- 4.0 Conclusion
- 5.0 Summary
- 6.0 Tutor-Marked Assignment
- 7.0 References/Further Readings

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 with the other aspects of agriculture such as crops! livestock, forestry and others, science of agriculture, agricultural education and the role of government.

2.0 OBJECTIVES

By the end of this unit you must be able to learn the following:

- that there is a bearing between Agricultural Extension and the five functional components of agricultural systems namely production, supply, and credit marketing research and regulation; and
- that Extension helps the farmer to adopt improved practices for agricultural development.

3.0 MAIN CONTENT

3.1 Definition

Agricultural extension is information out of school educational service for training and influencing farmers (and their families) to adopt improved practices in crops and live-stocks production, management

conservation and marketing. Concern is not only with teaching and securing adoption of a particular improvement practices, but with changing the outlook of the farmer to the point where he will be receptive to, and on his own initiative 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 family.
2. Asks the farmer to adopt improved practices in the following:
 - a. Increasing his agricultural production.
 - b. Management.
 - c. Conservation.
 - d. Marketing.
3. Makes his become receptive to and continuously seek means of improving his farm business and home.

Specifically, agricultural extension officer transmit research findings from research institutes or Universities to farmers and obtain feed back from farmers to the researchers for further research, analysis and establishment of facts.

SELF-ASSESSMENT EXERCISE 1

- i. Give a clear definition of Agricultural Extension.
- ii. What do you understand by the term Research Findings?

These duties are carried out through a systematic educational approach under the atmosphere of mutual trust and respect. Figure 8.1 shows the path-way of information view the extension service.

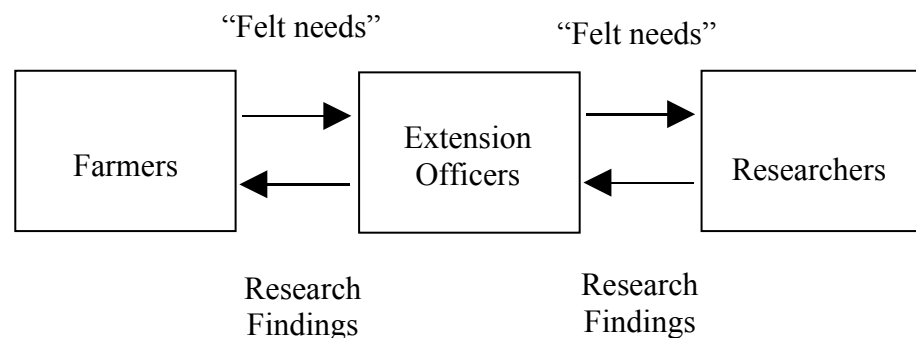


Fig. 8.1: Pathway of Agricultural Extension Services

3.3 Dissemination of Information

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

- 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.

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

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

Information about rural institutions that are relevant to the farmers needs such as financial institutions, market, cooperation etc.

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

3.4 The Principal Actors

They 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 determinates the extension services framework through the development of manpower, recruitment of extension officers, provision of resources (funds, transportation, communication etc) for effectiveness of the services.

3.5 Rate of Adoption

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

i. Economic Factor

This includes the capital outlay required by the farmer in order to practice the new techniques, and 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 risk arising from adoption of innovation. Farmer's practices such as taking insurance on farming business, whose benefits are not easily perceived by farmers, are not readily accepted. 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 characterized by million 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 the existing ideas, belief or norms of the target community. Those which seem to contradict the beneficiaries customs or ideas are usually rejected by would-be-adaptors. An example of this is production of pig in a predominantly Islamic community.

vi. Socio-economic Status of the 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 the Farmers

Farmers rate of adoption of innovation, sometimes depend on the previous educational background of the farmers. 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 the agricultural extension officers. Problems of role and personality conflicts often arise between the agricultural and co-operative extension officers on the field. This tends to negatively influence farmers rate of adoption of new farm techniques.

ix. Reliability of the 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 on a return visit reduces farmer confidence in him/her.

x. Extension Officer Approach

The approach of communicating with the farmers is very relevant to their acceptability. Thus, extension offices need to understand each situation based on the socio-cultural characteristics of the target group. Mutual respect and trust is paramount to success of extension service. Farmers tend to be less interested in the innovation introduced to them disrespectfully. The methodology of imparting the information is also essential. In this, regard, the use of audio-visual, motion picture (video), demonstration plots etc tend to facilitate farmers understanding 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 extension officers involvement in fraud are observed on the field. Thus, farmers – 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 adequately provides 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 services 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, with 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 new policy implemented negatively affect the farmers business. A farmer who has suffered this in the past is often hesitant accepting new techniques.

Government policy may encourage importation of maize meet increased demand of poultry Industry. 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 the local demands exceeds 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) of planting material which depend on fertilizers and irrigation for areas that are prone to drought. 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 the crops and livestock production.

SELF-ASSESSMENT EXERCISE 2

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

4.0 CONCLUSION

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

5.0 SUMMARY

From the concept of agricultural extension, it was clearly explained that agriculture extension the center point for the five components of agricultural systems namely production supply Id credits, marketing, research and regulation which forms the nerve center of agricultural development.

ANSWER TO SELF-ASSESSMENT EXERCISE 1

Agricultural extension service is a voluntary out-of-school adult education created to increase the production capacity and thus the standard of living of the rural populace. It is either established by the government or non-governmental organization to disseminate useful formation relating to discipline in focus, to the people, concerned. Specifically agricultural extension officer transmit research findings from research institutes or Universities to farmers and obtain feed back from farmers to the researchers for further research, analysis and establishment of facts.

Research findings are the outcome of Researchers which are called facts from the scientific view or discovered meant purposely to be transmitted or disseminated to the farmers purposely to enhance their agricultural practices.

ANSWER TO SELF-ASSESSMENT EXERCISE 2

The ten factors include:

- a. Economic factor
- b. Complexity of the innovation.

- c. Visibility of Returns.
- d. Divisibility of innovation.
- e. Compatibility of the innovation.
- f. Socio economic status of the farmers.
- g. Educational level of the farmers.
- h. Role conflict.
- i. Reliability of the extension officer.
- j. Extension Officer's approach.

6.0 TUTOR-MARKED ASSIGNMENT

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

7.0 REFERENCES/FURTHER READINGS

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Aweto, R.A. (1996). *Agricultural Cooperatives*, Christmas Publication, Ibadan.

UNIT 5 IMPORTANCE OF AGRICULTURE EXTENSION

CONTENTS

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Main Content
 - 3.1 Importance of Agriculture Extension Services
 - 3.2 Rate of Learning and Adoption
 - 3.2.1 Farmers Speed of Learning
 - 3.2.2 Innovators
 - 3.2.3 Early Adaptors
 - 3.2.4 The Majority
 - 3.3 Stages of Learning and Adoption
 - 3.4 The Act of Dissemination
 - 3.5 Methods of Dissemination
 - 3.5.1 Mass Method
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- 6.0 Tutor-Marked Assignment
- 7.0 References/Further Readings

1.0 INTRODUCTION

In our last unit, which was unit 4, the introductory aspect to Agriculture extension service was made with a detailed explanation. In this unit we are going to examine the importance of agricultural extension completed with the various stages of adoption methods of dissemination.

2.0 OBJECTIVES

At this end of this unit, you shall be able to understand the importance of agriculture extension.

- the various learning method;
- the stages of adoption; and
- the methods of dissemination.

3.0 MAIN CONTENT

3.1 Importance of Agriculture Extension Services

1. Contribution to Economic Growth

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

2. Educational Services to the Farmers

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

3. Rural Development

It helps in the organization of the rural population of activities other than agricultural production in the communities. Activities may extend to social and cultural activities, which get their education and training gained in extension. Health services such as immunization of children can gain from the extension services.

4. Leadership Training

Through the extension education and training many farmers acquired leadership training which helps them in playing importance roles in their communities.

5. Lay the roles of an agent of transfer of knowledge from government research centres stations, universities and other areas to the farmer.
6. It helps the fanner to manage his farming better and look on his fanning as a business and not for subsistence. The fanner learns to use economic factors in decision-making.

3.2 Rate of Learning and Adoption

3.2.1 Farmers 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 from farmer 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.

3.2.2 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 of them 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 of the innovator's motives in adopting new methods.

3.2.3 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 result demonstration. Usually this group of farmers includes local leaders and others who are respected in the community.

3.2.4 The Majority

If the rest of the farmers adopt a new idea, they will be 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 1

Explain the importance of Extension Service.

3.2 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 practice, they must first learn of its extension. They may then have to learn some new skills. Five stages have been identified in the process of accepting new ideas.

i. Awareness

A farmer learns of the existence of the ideas but not much about it, hence the farmer 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 decide 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 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 it from the researcher to the extension agent.
3. **The Channel:** This is the way the message is transmitted in the means 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 as they consider all the four elements carefully, as they all contribute to effectiveness. As earlier stated the duty of extension work is to encourage farmers to adopt innovations of proven value.

SELF-ASSESSMENT EXERCISE 2

- 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 method of disseminating information could be classified as follows:

3.5.1 Mass Method

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

3.5.2 Group Methods

These are employed advance people's awareness and infests to the point where they express their willingness to try and experiment with the new innovation. These methods teach farmers in groups and are mainly in the form of practical demonstrations. The first is called method demonstration. Which teaches the famers how to do particular job e.g. how to spray or plant? The second is result demonstration, which is used to teach the farmers the result that could accrue from doing something in

a certain way e.g. the effects of a 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 organizing a gathering of farmers with similar interest for the purpose of teaching them some techniques about their interest.

3.5.3 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 farmer and his family, sending circular letters about important events individually and conducting tours of farmers' fields and discussing major problems directly with individual farmers.

4.0 CONCLUSION

The channels influence different groups 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

The face-to-face contact by the extension agents is known to be a very effective way of selling innovations to farmers. The farmers desire the extension agent to talk to them, to demonstrate to them. Adoption of innovation depends more on adoption process. The constant factor there is opinion leaders who influence a lot of the traditional farmers.

ANSWER TO SELF-ASSESSMENT EXERCISE 1

The important of Agricultural Extension Service include:

1. Contributions to the economic growth.
2. Educational Services to the farmers.
3. Rural Development.
4. Leadership training acquired.
5. Transfer of knowledge to the farmers.
6. Acquiring management techniques.

ANSWER TO SELF-ASSESSMENT EXERCISE 2

- i. The stages of learning and adoption of an innovation include:
- Awareness
 - Interest
 - Evaluation
 - Trial
 - Adoption.

6.0 TUTOR-MARKED ASSIGNMENT

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

7.0 REFERENCES/FURTHER READINGS

Anyanwu *et al* (1998). *A Textbook of Agriculture for Schools and Colleges*.

Guide to Extension Training (1985). Food and Agriculture Organization of the United Nations, Publication.

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

UNIT 1 IMPORTANCE OF AGRICULTURAL PRODUCTION

CONTENTS

1.0	Introduction
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3.1	Importance of Agriculture
3.1.1	Food
3.1.2	Employment Opportunities
3.1.3	Raw Materials
3.1.4	Formation of Capital
3.1.5	Foreign Exchange
3.1.6	Shelter and Clothing
3.1.7	Rural Development
3.2	Livestock Production
3.2.1	Economic Importance
3.3	Crop Production
3.3.1	Economic Importance
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3.5	Forest Production
3.5.1	Direct Benefits
3.5.2	Indirect Benefits
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6.0	Tutor-Marked Assignment
7.0	References/Further Readings

1.0 INTRODUCTION

You will remember that we enumerated the importance of agriculture in Unit 1 and revealed that 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

productions and the combinations of both fishery and forestry productions for agricultural development.

2.0 OBJECTIVES

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

- understand the importance of agriculture;
- identify crops of agricultural importance in Nigeria; and
- understand the contributions of both crops and livestock production to the Nigeria Economy.

3.0 MAIN CONTENT

3.1 Importance of Agriculture

3.1.1 Food

This is the prime necessity of life and agriculture is the only sector that provides food for the teeming population. The food can be in form of crops 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.

3.1.2 Employment Opportunity

About 80% of the Nigerian population is employed in agricultural sector and it provides job opportunities for all categories of works. Agricultural sector absorbs sizeable proportion of the population in farming business ranging from the peasant farmer, farm labourers, agricultural officers, extension officers, researchers and mostly industrial workers.

3.1.3 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.

3.1.4 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 the farmers. The sale of agricultural products provides farmers with income for investment in agricultural production.

3.1.5 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.

3.1.6 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.

3.1.7 Rural Development

The government usually targets the 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

Will you consider the importance of agriculture as an economic importance? If yes, state your reasons.

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 cooperative so as to adopt modern techniques of livestock husbandry because it is both labour and capital intensive and cooperative action will enhance their ability to pay for modern livestock production technologies.

The basic livestock production includes:

- a. Poultry production which comprises of all the domesticated birds of chickens, ducks, turkeys, geese, swans, guineas, pigeons, pleasant, camaries and ostriches.
- b. Swine Production
- c. Horses Production
- d. Rabbitry
- 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 a very important reason for these farmers especially in increasing the standard of living. Money is being realized from the sales of the animals or its products such as meat, eggs, hides and skin, milk production. Most farmers use the income to raise capital for the production of agricultural practices.

c. Prestige

For many years in this country, some people have kept animals purposely for prestige purposes. They had herds of them and would neither sell them for money nor kill them for food. They were happy to be recognized with having a large number of animals. In this country, this idea was uppermost in the minds of chiefs and other natural ruler some year ago.

d. Sport (Pleasure)

Few people breed animals for pleasure or for spots. Horses are usually breed for spots while some good looking for an exhibitions.

e. Labour (Work)

Some animals are breed purposely to supply labour on the farm. Good examples of these are cow 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 and detectives. These animals are trained purposely to provide the essential services even with our law enforcement agency.

g. Laboratory Animals

With the recent development in scientific study few 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 Crops Production

Mainly the peasant farmers' carry out crop production in Nigeria with the traditional methods and this has really affected production both on the food and tree crops. Pests and diseases have really ravaged the crops especially during the past harvesting periods. Lack of good storage facilities has contributed in no small ways.

3.3.1 Economic Importance

1. Vegetable crops are grown principally for their leaves vegetables, which are consumed, raw or cooked. They are good sources of vitamins.
2. The grain crops or cereals constitute a major source of starch/carbohydrate to our people. Grains from the staple food for most Nigerians and farm animals.
3. The root crops like the grain crops are good source of carbohydrate and are widely eaten all over the country. It should be noted however, that although the 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 the sales and the profit accumulated to form capital formation for the farming enterprises.
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 such cocoa, rubber, iroko, timber oil palm, coffee, kola nut, etc.

5. Most of these cash crops mainly supply the local industries as raw materials. Such include the rubber supplying latex for the manufacture of tyres and tubes. The palm oil is used for soap making, timbers for the timber industries.

SELF-ASSESSMENT EXERCISE 2

Give the economic importance of livestock production.

3.4 Fish Production

Fishes are obtained by fishermen using several devices such as traps, nets, etc. to catch them. Because fishermen cannot predict their catch and because of the risks involved, as well as many other considerations artificial methods of growing fish has 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 within and outside season. 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 the necessary proteins to people where enough animals are not raised to supply enough meat.
2. It provides a high 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 got from other sources.
4. Intensive fish culture can increase the income of the fanner. Use of industrial by products can make fish fanning very profitable.
5. Through fish culture, the danger posed by standing waters in dams, ponds etc can be prevented by keeping the water clean and getting rid of the vegetation.

3.5 Forest Production

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. The trees create a special environment which affects the forest. Depending on the nature of the trees we may have

evergreen forests or deciduous or depending on the zones we 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 namely:

3.5.1 Direct Benefits

These deal with the produce from the forest and the employment opportunities it offers. The major produce 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 easily available for use. Timber is used mainly as a 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 materials 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 from the desiccation and prevent erosion.

4.0 CONCLUSION

It could be seen that the importance of Agricultural production could not be over-emphasized. Bearing in mind the importance of agricultural contributions to the socio economic development of Nigeria.

5.0 SUMMARY

The units has provided an opportunity to understand the contributions of agriculture from the various facets animals, crops, forestry and fishery to the economic development of Nigeria especially the vast majority in the rural areas.

ANSWER TO SELF-ASSESSMENT EXERCISE 1

Yes. The reasons are as follows which is the importance of agriculture.

1. Provision for food for the growing population and the farm animals.
2. Raw materials for the growing industry
3. Foreign exchange earning for Nigeria
4. Job opportunities for all the categories of workers.
5. Formation of capital
6. Provision for shelter and clothing
7. It gives way for the rural development.

ANSWER TO SELF-ASSESSMENT EXERCISE 2

The economic importance includes:

1. Food for man as meat, egg, milk.
2. Financial income for the farmers.
3. For prestige
4. For sports especially house
5. For labour activities
6. For security
7. Experiment in the laboratory.

6.0 TUTOR-MARKED ASSIGNMENT

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

7.0 REFERENCES/FURTHER READINGS

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UNIT 2 ENVIRONMENTAL FACTORS AFFECTING AGRICULTURAL PRODUCTION

CONTENTS

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Main Content
 - 3.1 Environmental Factors
 - 3.2 Climatic Factors
 - 3.2.1 Temperature
 - 3.3 Relative Humidity
 - 3.4 Day Length
 - 3.4.1 Short-day Plants
 - 3.4.2 Long-day Plants
 - 3.4.3 Day Neutral Plants
 - 3.5 Rainfall
 - 3.6 Air Movement
 - 3.7 Solar Radiation
 - 3.8 Soil Factors (Edaphic)
 - 3.9 Biotic Factors
- 4.0 Conclusion
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- 7.0 References/Further Readings

1.0 INTRODUCTION

This unit will focus mainly on the environment 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 Nigeria 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 characterized by high temperature and heavy rainfall throughout the year.

2.0 OBJECTIVES

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

- understand the main climatic factors affecting agriculture;
- identify the various factors suitable for the growth of crops; and

- appreciate the position of Nigeria on the tropical region.

3.0 MAIN CONTENT

3.1 Environmental Factors

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

3.2 Climatic 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.

3.2.1 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 in 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. Tomatoe is a lover of hot days and cooler nights. Also with the increase in altitude, the temperature becomes cooler and this is the cause of excellent performance of tea and Arabica coffee on Mambila Plateau. 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 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.

3.3 Relative Humidity

This is the amount of moisture in the atmosphere. The effects of low relative humidity can cause heat stress while high humidity reduces evapo-transpiration. These 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 could disorganize 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 evapo-transpiration balance is in jeopardy similarly in hot humid areas of the country evaporation takes place slowly thus the rate of heat loss in both plants and animals. All these have some serious effects on agricultural productivity in Nigeria.

3.4 Day Length

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

3.4.1 Short-day Plant

These are plants that short 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.

3.4.2 Long-day Plant

These are plants that will start flowering when the 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.

3.4.3 Day Neutral Plants

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

3.5 Rainfall

Rainfall has the greatest control over agricultural production activities in Nigeria. The types, of crops 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 because more unevenly distributed. Associated with this change is the gradual transition from the rainforest vegetation through wood land to savanna vegetation. The wettest parts of Ice 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 cropping per year. The crops with short life span specially small grains are suited for this zone. Cashew could 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, cultivates soils tend to be infertile because of 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. 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 in Nigeria. 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, the requirement for stored and supplementary feed supplies. In all the southern part of the country experiences and average of 7 months of rainfall and about 5 months of fairly dry to dry season while in the northern part the opposite is the case.

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

3.6 Air Movement

This is air in motion and the rate affects evaporation of transpired water droplets from plant leaves. As moderate temperature the more rapid air movements the more effective in reducing heat load of animals when moisture is present on the skin. It also influences the amount of radiant energy the 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. Adequate free movement of air depresses as incidence of diseases e.g. Black pod diseases of cocoa.

3.7 Solar Radiation

Solar Radiation is very important in agriculture because it is the source of energy used by plants during photosynthesis. The amount of this energy receives on the earth surface (isolation) carries 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 necessary for the maturity and germination of seed. Lack of solar radiation leads to etiolating when 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, and
- iii. the length of day.

SELF-ASSESSMENT EXERCISE 1

- i. Explain the term environment.
- ii. Mention three environmental production.

3.8 Soil Factors (Edaphic)

The soil is the home of the 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 plants roots. Without the soil therefore, there cannot be any 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 acid (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 toxicity effects.

3.9 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

The climatic factors influence the 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 lead to a bumper harvest.

5.0 SUMMARY

These environmental factors discussed above in this Unit affecting agricultural practices determine production and yield result during the season especially in both crop and animal productions.

ANSWER TO SELF-ASSESSMENT EXERCISE 1

- i. Environment is simply defined as the surrounding. Everything is influenced by the environment in which it exists. Environment affects the growth, behaviour, the mood and everything about the living organism.

- ii. The three environmental factors that affect agricultural production are:
 - a. Climatic factor.
 - b. Soil factors
 - c. Biotic factors.

ANSWER TO SELF-ASSESSMENT EXERCISE 2

- i. Rainfall is very important in agricultural production and it determines the distribution of agricultural products. In the southern part of Nigeria, the rainfall is heavy and as a result, tree crops such as cocoa, oil palm thrives there while sorghum, millet that requires little or no rainfall perform better in the northern part. The tuber crops are also grown in the southern parts because of rainfall and edaphic factors.
- ii. The environmental factors affecting agricultural production in Nigeria are:
 - 1. Climate factors which include:
 - a. Temperature
 - b. Rainfall
 - c. Wind
 - d. Solar Radiation (sunlight)
 - e. Relative Humidity.
 - 2. Biotic factors which include pests diseases and soil micro organisms.
 - 3. Edaphic Factors – The soil ph; soil texture, soil structure.

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 READINGS

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Media Law and Ethics.

UNIT 3 TYPES OF SOIL

CONTENTS

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Main Content
 - 3.1 Definition
 - 3.2 Physical Characteristics of the Soil
 - 3.2.1 Soil Texture
 - 3.2.2 Soil Structure
 - 3.3 Importance of Soil Structure
 - 3.4 Major Component of the Soil
 - 3.4.1 Inorganic Matter
 - 3.4.2 Organic Matter
 - 3.4.3 Soil Air
 - 3.4.4 Soil Water
 - 3.4.5 Available Water to Plant
 - 3.5 Chemical Characteristics of the Soil
 - 3.6 Types and Properties of Soil
 - 3.6.1 Sandy Soil
 - 3.6.2 Clay Soil
 - 3.6.3 Loamy Soil
 - 3.7 Special Categories of Soil
- 4.0 Conclusion
- 5.0 Summary
- 6.0 Tutor-Marked Assignment
- 7.0 References/Further Readings

1.0 INTRODUCTION

This unit deals mainly with the various types. You will recollect that agricultural practices without the appropriate soil requirements will give as poor rewards to the farmers especially during your practical aspects as soil reforms of plants nutrients with an efficient management will definitely lead to bumper harvest. This is because the soil itself is the basis of farming.

2.0 OBJECTIVES

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

- identify the various types of soil;
- describe accurately the characteristic of each of the soil; and
- understand the nature and 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 inert 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:

3.2.1 Soil Texture

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

- a. Sand if the diameter is between .002-.02mm.
- b. Silt if the diameter is between .02 – 0.002mm
- c. Clay if the diameter is less than 0.002mm.

3.2.2 Soil Structure

If soil particles are left on their own as ordinary grains 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 the soil can support good growth of crops. Because of the fact that the bounding of soil to another, the shapes of these aggregates also differ.

3.3 Importance of Soil Structure to Farmers

It is important that you should 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 spaces 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 reaching '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. Included in this are the activities of soil micro-organism that helps in the decomposition of organic matters.

SELF-ASSESSMENT EXERCISE 1

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

3.4 Major Components of the Soil

The major components of the soil include:

3.4.1 Inorganic Matter

The inorganic materials include sands 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 helps in the anchorage of plants and it is the home for soil organisms which may improve plants growth. It can also hold air for planting use as well as helping in moderating soil temperature but the porosity of the soil can be affected by its mineral content.

3.4.2 Organic Matter

Organic materials which are made up of plant and animals is about 5% of the total volume of the soil. It may be the decayed plants and animals products leading to the formation of humus while 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 and evaporation and also acting on the habit for soil micro-organism like bacteria, fungi, etc.

3.4.3 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 needed for the respiration of the root. It is also required for seed germination and needed in the Nitrogen and Carbon cycles. Oxygen is necessary for growth and development while carbon dioxide and sulphur dioxide react with water to form weak acids which aid weathering of rocks.

3.4.4 Soil Water

This is the amount of water in the soil and available to plant and it is about 25% by 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, climate and plants when all the pores are filled with water it is said to have attained its field capacity when water has drained out of the large pores after one or 2 days downwards movement of soil water after rainfall. 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 the disturbance of the soil pores by ploughing the soil only when the soil is moist but not wet.
- b. Only minimum pulverization (harrowing) is permitted and to avoid the reduction of medium and large pores and increasing the small pores.
- c. Ploughing in succulent thrash/plants should be encouraged to aid microbial activities and encourage aeration.

3.4.5 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 soil some distinct chemical characteristics. For instance, if hydrogen ions (H^+) and aluminum ions (Al^{3+}) predominate in a soil, the soil is bound to be acidic but if it is hydroxyl ion (OH^-) that are common, the soil is alkaline or basic. When both hydrogen ions (H^+) and hydroxyl ions (OH^-) are equal proportion the soil is neutral. An instrument known as the PH scale is used to measure the chemical reaction of the soil is whether the soil is acidic, alkaline or neutral. The soil PH affects the available nutrients 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 of Soil Properties

There are three major types of soil properties, sand, clay, and loamy:

3.6.1 Sand Soil

It is made up of quartz that it stops. The ranges in diameter is between 2.00mm and 0.02mm, it is coarse grained and gritty. Sandy soil is well drained, loose and highly aerated. Low capillary actions with high percolation feature. Leaching is high with low plant nutrients. Therefore sandy soil is poor growth medium for plants because there is little or no nutrients required by plants for good growth.

3.6.2 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 it is high proportion of mineral ions in the collated clay forms. The particles are tightly bound together with little pore spaces. While the colour is usually higher brown.

3.6.3 Loamy Soil

This is a soil that combines the three particles of sand, silt and clay in suitable proportion and therefore is the best soil type for cropping. It is very rich in plant nutrients has the drainage of sand and loose particles. It can withstand moderate period of drought, because the percolation is low and capillary is high. The lumps of loam fall apart easily and so they are friable. Loams are classified as heavy, light or medium according to the proportion of clay. 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 browns or even black.

3.7 Special Categories of Soil

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

4.0 CONCLUSION

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

5.0 SUMMARY

The unit has been able to describe accurately the characteristic of each soil and also highlighted the importance of soil to successful farming which ascertain that if the soil is fertile and the management is up to date yield will be bountiful.

ANSWER TO SELF-ASSESSMENT EXERCISE 1

- i. a. Soil can be defined as the loose weathering material covering the surface of the earth which supported life.
- b. The physical characteristics of a good soil include:
 - Soil texture which refers to the proportion or percentage of the different sized particles that make up the sample.
 - Soil structure -this is the arrangement of individual particles of soils into aggregates or clusters separated from neighbouring aggregates by surfaces of weakness. The formation of the soil particles into definite structural pattern is brought about cementing agents.

- ii. Soil structure is very important to the farmers because:
- it determines the water and air content as well as the type and sizes of the pore spaces in the soil,
 - it also influences the chemical properties e.g. chemical composition, iron content, the level of exchange cation,
 - soil structure also influences the rate of leaching and other processes of translocation of soil particles, and
 - it also influences the biological activities.

ANSWER TO SELF-ASSESSMENT EXERCISE 2

The major components which include:

- i.
 - a. Minerals materials which includes sand, clay, silt, gravel which is about 45% of the total volume of the soil. It contains nutrients like nitrogen, calcium, magnesium, iron and hold water in the soil.
 - b. **Organic Matter:** Organic materials which are made up of plants and animals is about 5% of the total volume of the soil. It may be the decayed plant and animal products leading to the formation of humus while it is a rich source of plant nutrient,
 - 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-organism and helps in the absorption of plant nutrients.
 - d. **Soil Water:** This is the amount of water present in the soil and available to plants and it is about 25% by volume in the soil. Soil nutrients are dissolved by water and this aids root absorption.
- ii. The available water to any growing crop plant depends on the following:
 - The structure and texture of the soil.
 - The humus content of the soil.
 - The compositions of ions or cations in the soils.

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 READINGS

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UNIT 4 IDENTIFICATION OF CROPS

CONTENTS

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Main Content
 - 3.1 Classification According to Life Cycle
 - 3.1.1 Annual Crops
 - 3.1.2 Biennial Crops
 - 3.1.3 Perennial Crops
 - 3.1.4 Ephemerals
 - 3.2 Classification According to Nature of Produce
 - 3.2.1 Vegetable Crops
 - 3.2.2 The Cereal Crops
 - 3.2.3 Soil Requirements for Cereals
 - 3.2.4 Root and Stem Tubers
 - 3.2.5 Legumes
 - 3.2.6 Soil Requirements for Legumes
 - 3.2.7 Oil Crops
 - 3.2.8 Tree/Cash Crops
- 4.0 Conclusion
- 5.0 Summary
- 6.0 Tutor-Marked Assignment
- 7.0 References/Further Readings

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 the various plants so as to make a link between these plants and the suitable soil which will facilitate their growth under a suitable climatic conditions: The unit will definitely lead us to the various types of soil that accommodates the plants.

2.0 OBJECTIVES

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

- classify the crops according to nature of produce;
- identify the various types of plants; and
- identify 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. The crops are further subdivided into four groups.

3.1.1 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.

3.1.2 Biennial Crops

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

3.1.3 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 crops e.g. Cocoa, Kola, Mango, Oil Palm, Rubber, Coconut, etc.

3.1.4 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:

- (a) Annual (b) Biennial (c) Perennial

3.2 Classification According to Nature of Produce

3.2.1 Vegetable Crops

Vegetable crops are grown principally for their leafy vegetables, which 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.

3.2.2 The Cereal Crop

The cereal crops or grain crops are those members of the family Grainier which are cultivated for their seeds. They constitute a bulk of the world's food supply cereals crops at more compact and can be stored for a 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 the cereals crops are regionalized. 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 diet of large sections of communities. The cereals grains have high starch content and also contain varying amount of proteins, the embryo contains oil and vitamins occur in the outer tissue of the seeds.

3.2.3 Soil Requirements for Cereals

The cereals crops are regionalized and because of this reason the soil requirements varies with the type of region. For example:

a. Rice (*Oryza sativa*)

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

b. Maize (*Zea mays*)

This requires a wide range of well drained soils, 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 soils, sandy or gravelly soils. The good performance of maize does not depend so much on the amount of rainfall but on the distribution.

c. Guinea Corn (*Sorghum spp*) "Dawa"

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

d. Millet (*Pennisetum spp*) "Gero"

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

e. Wheat (*Triticum monococcum*)

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

3.2.4 Root and Stem Tubers

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 pests attack and are high yield. Among the most important of these root and stem crops are the cassava and yams 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 soils rich in nutrients too dry soils caused poor tuber development and too wet soils tend to make tube putrid.

3.2.5 Legumes

The legumes constitute an important part of the diet of most of the tropical communities. They are important not only in their food value to

human beings but also in the fact that they supply the pertinacious folder for tropical livestock. The legumes also replenish soil nitrogen due to the presence of nodules on their roots. Their ability to replenish soil nitrogen due to the presence of nodules on their roots. Their ability to replenish soil nitrogen gives them a key position in crops rotation.

3.2.6 Soil Requirements for Legumes

Because of the differences in the amount of rainfall the soil requirements differ.

a. Groundnut (*Arachis hypogea*)

They grow on almost any type of soil except heavy clay low in organic matter. However groundnut prefers light sandy soil for good seed folmatio11. 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.

b. Cowpea (*Vigna unguiculata*)

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

c. Soya Bean (*Glycine max*)

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

3.2.7 Oil Crops

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

a. Oil Palm (*Elaeis Guineensis*)

Oil palm does 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.

b. Cotton (*Gossypium* spp)

Requires well drained rich loamy soil and not very high organic matter to check excessive vegetative growth which reduces lint formation.

3.2.8 Tree/Cash Crops

Tree crops are crops which are plants and could 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 practice like weeding or slashing, roughing, spraying, etc. will be recurrent activities to eliminate pests that compete for light, water nutrients. Most of the plants in this category can stay for 3 -50 years yielding every year at the fruiting season of each crop. Because of their long stay at the permanent site, they require:

a. Cocoa (*Theobroma Cacao*)

Cocoa requires soil that is retentive of moisture during the dry season and soil that is well aerated. The soil should be easy to penetrate but need not necessarily be very deep but 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. For they retain more moisture during the dry season. Shallow soils with impervious layer are not good for cocoa planting for the impervious layer does not allow root penetration which may reach depth of about 7m.

b. Rubber (*Hevea Brazillensis*)

The soil requirements is swamp clay or sandy or poor soils.

SELF-ASSESSMENT EXERCISE 2

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

4.0 CONCLUSION

From this unit the classification according to the nature of produce has given a clear distribution of these crops to the different requirements of necessary soil for their growth development and product.

5.0 SUMMARY

This unit has really helped us to identify the various types of plants with their soil requirements for production. This has not only enhanced good growth but also given the farmer better farming practices.

ANSWER TO SELF-ASSESSMENT EXERCISE 1

- a. **Annual Crops:** These are crops that complete their life cycle one in a year or a growing season during which the reproductive and vegetative stages are completed e.g. maize, rice and cowpea.
- b. **Biennial Crops:** Carrot, Lettuce, Cabbage and Ginger.
- c. **Perennial Crops:** Rhizome, Cocoa, Kola, Coffee and Rubber

ANSWER TO SELF-ASSESSMENT EXERCISE 2

- i. **Root Crops:** These are food crops grown purposely for their tuber requirements and constitute the carbohydrate rich food. Majority of root crops are annual crops, e.g. Yam, Cassava, Cocoa yam, etc.

Cereals: These are grown crops that are cultivated for their seeds. They constitute a bulk of the world's food supply they belong to the family Gramineae they also have the advantage of high yield.

- ii. **The Soil Requirements:**

- a. **Maize (*Zea mays*)**

Maize requires a wide range of well drained soils, sandy loam to clayey loam which are rich in humus, and plant nutrients. The soils should be alkaline or almost neutral.

- b. **Cocoa (*Theobroma cacao*)**

Cocoa requires soil that is retentive of moisture during the dry season and soil that is well aerated. The soil should be easy to penetrate but need not necessarily be very deep but 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 for they retain more moisture during the dry season.

c. Rice (*Oryza Sativa*)

Rice requires rich loam to clayey soil retentive of water and rich in humus though rice can be grown practically on all types of soil provided there is adequate moisture supply.

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
Cowpea.

7.0 REFERENCES/FURTHER READINGS

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

Joy, D. and Wibberly, E.J. (1981). *A Tropical Agricultural Handbook*.

MODULE 4

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

UNIT 1 COMMON FOOD CROPS: CULTIVATION, HARVESTING AND IMPORTANCE

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1.0 INTRODUCTION

In the past, you have probably tried your hand preparing a stew or soup for eating pounded ram, rice or some local food but just a minute, you imagine and describe the type of soup that would have been without the

two ingredients, tomato and pepper. Definitely your description might include the fact that the soup would be very watery and tasteless.

In West Africa countries in general and in Nigeria in particular, tomatoes and pepper form a very important part of ingredients used regular 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 diet. Because of their importance they are grown in every State of this country, most especially during the early part of the dry season.

2.0 OBJECTIVES

By the time you finish studying this unit, you should be able to do the following:

- describe accurately how tomato and pepper are 'cultivated and harvested;
- explain correctly why staking is very important during the cultivation of tomatoes;
- name two diseases of each tomato and pepper and describe how they could be controlled; and
- describe 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 got local names and have such common varieties and mar globe, money maker marred, valiant pork best of all, dwarf gem and many others.

3.1.1 Improved Varieties

- a. NH Le 158-3-local indeferminate big red fruits, big red fruits, suitable for planting in both northern and southern states.
- b. NH Le 7-7-1 local indeferminate pink fruits and hi'ff,hly tolerant to diseases.
- c. Ife No.1 - Deferminate 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 -Defenninate pear shaped red fruit. Suitable for planting in the north and during dry season in the south.

3.2 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 lowers and foliage. Tomato requires high light intensity for this influences the ascorbic acid content. If the high 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.

3.3 Cultural Practices

3.3.1 Bed Fumigation

It is usual to treat nursery soil moisture with fumigant to kill pests, fungi weed, etc. in the soil. VAPAM is recommended at the rate of. 1dm³ to 20dm² of water per bed of 1m x 10m when used, wet soil heavily to a dept of 15cm and cover with palm fronds. Do not sow seeds until 9-10 days after treatment. In the absence of fumigants, apply heat removing the ash.

3.3.2 Nursery Preparation

The nursery can be prepared on the ground or alternative in boxes and baskets for ground nursery, the land is very well tilled to a depth of 38cm and the bed neatly prepared. But for nursery in baskets or shallow boxes the containers are filled with mixture.

- a. Three parts of good top soil.

Two parts of well rooted compost.

One part fine river sand. The three must be properly mixed together.

3.3.3 Sowing in the Nursery

Seeds are planted singly 2.5cm -5cm apart and 2.5cm -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 rose. The seeds will germinate in about 5 -7 days and, transplant in about 6 weeks.

3.3.4 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 such as damping off.

3.3.5 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 minimize damage to the 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 45cm -60cm apart with plants 30cm -38cm apart in the row.

3.3.6 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.

3.3.7 Fertilizer Application

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

3.3.8 Harvesting and Storage

Fruits are ready for harvesting 3 -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

tonnes to 10 tonnes per lecture depending on the variety. Tomatoes do not store well. They are best stored in the processed form. Harvesting when half ripe, helps to preserve the fruit till disposal in the market. The fruits should be stored dry and no puncture fruits should be stored along with the healthy ones.

3.3.9 Pests of Tomatoes

Tomatoes have many pests and these include mole insect's caterpillars, grasshoppers' eelworms, fruit worms, etc. These can be controlled by hand picking in the case of caterpillars, digging up crickets and also be using insecticides D.D.T. is used for pre-fruiting treatment and vefox 85 wip is used from the fruiting stage.

3.3.10 Diseases of Tomatoes

There are four major diseases of tomato namely:

- a. **Fusarium Wilt [Root Rot]:** Is a fungal disease caused by fusarium Oxysporium. This attacks the young seedling and causes it to wilt. Control is mainly by the use of resistant varieties.
- b. **Bacterial Wilt:** This is a disease which attacks solanaceous crops at almost all stages of their development causing a rapid wilting of the leaves followed by the death of the whole plant. The disease is soil-borne bacterial which attacks roots. The control is to remove all infected plants and burn them immediately to reduce the spread of the disease.
- c. **Leaf Spots and Blight:** These are wide spread during the raining season and they are viral diseases spots of various sizes and colours occur on leaves petioles and stems. The older leaves become yellow and die as the infection progress upwards to young leaves. The control is by spraying with Dithame m - 45 or coprantol of Bordeaux mixture.
- d. **Other diseases:** Other common tomato diseases are the blossom end rot, a physiological disorder brought about by unfavourable growing conditions and the 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 [Capsicum 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. 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 *C. Annum* are larger than those of *C frutescent*. The fruits vary in shaped, size, colour, flavour and hotness. The fruits usually become hotter and they ripen pepper 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 time, 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 sterilized or sprayed by Dittane m-45. Germination takes place in 6-10 days. The developing seedlings are transplanted after 4-6 weeks when they are between 10-13cm high. Newly transplants seedlings should be watered daily until the roots are firmly established in the soil. A spacing of 60-90cm apart can be maintained. Weeding of the farmland is important at least twice in the dry season and three fires in the 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 of about 2.5kg per m². 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. The birds are attracted by the bright-coloured ripened fruits and peck them off. Nematodes stunt the growth of infected plants, caused the leaves to turn yellow before the plant eventually die. Nematode can be controlled by apply a chemical called MOCAP granules at 33kg per lecher into the soil.

Viruses cause two diseases of pepper the mosaic and leaf curl. The diseases plants have winkle leaves and started growth. The diseases can be controlled by uprooting and burning infected plants. Draping off can be controlled by sterilizing the soil before planting begins. Leaf spot can be controlled by nursery with chemical called dithane on a weekly basis.

3.4.4 Harvesting and Storage

The fruits are ready for harvest 3-4 months after planting. Pick the sweet peppers preferable green by hand. Then the harvested fruits are treated with hot water for about 30 minutes after which 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 Nigeria homes and they both thrive well in loamy soil but with benefit from the application of either organic or inorganic fertilizer. Both crops are cultivated with the seed and are attacked by pests and diseases, which can be controlled by the application of management practices.

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 important of (a) Tomato (b) Pepper.
2. Name three diseases of pepper and describe how each disease can be controlled.

ANSWER TO SELF-ASSESSMENT EXERCISE 1

- i. Tomatoes will do well in a deep, free draining fertile loamy soil, which has adequate organic content. The range of the soil should be between 5 and 7.5. Temperature variations also affect the performance of tomatoes. To do well, tomatoes must be exposed a long period of sunshine when the temperature range from 12°C and 18°C.
- ii. The three diseases of tomato are:
 - Fusarium wilt
 - Bacterial wilt
 - Leaf spot and blight

The fusarium wilt can be controlled through the use of resistant varieties.

- iii. Fertilizer e.g. N.P.K. or Organic manure can be applied to tomato seedlings at the time of transplanting 87-10cm from the side of each seedling and 7cm deep. When the first fruits appear, ammonium sulphate fertilizer should also be applied.

ANSWER TO SELF-ASSESSMENT EXERCISE 2

The three diseases of tomato are:

- Fusarium wilt
- Bacterial wilt.
- Leaf spot and blight control

- a. Fusarium wilt can be controlled through the use of resistant varieties.
- b. Bacterial wilt could be controlled through the removal of all the infected varieties and burn them immediately purposely to reduce the spread of the diseases.
- c. Leaf spot can be controlled by spraying with Dithane M-45 or Coprantol or Bordeaux mixture.

7.0 REFERENCES/FURTHER READINGS

- Agbo, Fiu (1999). *Elements of Agriculture for Cooperative Colleges, Polytechnics and Universities*.
- Anyanwu, *et al* (1998). *A Textbook of Agricultural Sciences for Schools and Colleges*: 5th Edition.

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

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- 1.0 Introduction
- 2.0 Objectives
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 - 3.1.1 Cultivation
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 - 3.2 Carrot (*Daucus Carota*)
 - 3.2.1 Cultivation
 - 3.2.2 Seed Treatment
 - 3.2.3 Seed Bed Preparation
 - 3.2.4 Seed Bed Maintenance
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 - 3.2.6 Importance of Carrot
 - 3.3 Cucumber (*Cucumis Sativas*)
 - 3.3.1 Cultivation
 - 3.3.2 Germination
 - 3.3.3 Diseases Control
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 - 3.3.5 Important
 - 3.4 Lettuce (*Leactua Sativa*)
 - 3.4.1 Cultivation
 - 3.4.2 Nursery
 - 3.4.3 Germination
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 - 3.5 Related Cultural Practices
- 4.0 Conclusion
- 5.0 Summary
- 6.0 Tutor-Marked Assignment
- 7.0 References/Further Readings

1.0 INTRODUCTION

In unit 15 of this module, 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 vegetables in

every Nigerian home. Apart from these other vegetables, which are not really, 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. They (vegetables) are a common feature of vegetable salad often served at cocktail parties and other menu in big hotels. You will definitely see that they contribute to the social menu of the people.

2.0 OBJECTIVES

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

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

3.0 MAIN CONTENT

3.1 Cabbage (*Brassica Oleracea*)

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 manured 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 the young plants are formed 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 fertilizer prepared beds. Each seedling should be lifted carefully with a ball of soil around the roots to minimize the disturbance to the roots. Each cabbage plant is planted at 50cm inter 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 vegetable salads. The leaves also supply the 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 successfully cultivated in several part 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, fruit and be harvested. Carrots prefer a light, sandy soil with good supply of plant nutrients. Compacted clay soil may lead to a poor formation of roots. The seeds are usually planted in drills (shallow depressions in the soil) in December or January, about 1.2cm to 2.5cm deep. The drills are usually 10-15cm apart. The drills are located in rows, which are about 30cm apart. The germination of the seeds can be speeded 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 applied to 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 the seeds is slow as it occurs many days after the sowing. The soil around the 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. The 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. The harvesting of carrots must be timely as the roots can go woody if left too long. The carrot fly usually attacks carrots; fungi diseases such as leaf blight, bacteria and nematode diseases such as soft rot and root rot respectively. To control the spread of bacterial and fungi diseases burning should

destroy infected plants. Fumigating the soil with nonagon several weeks before planting the seeds can control nematode disease.

3.2.6 Importance

Carrots grown primarily as a food crop because of their fleshy roots. The roots of the most suitable variety for eating have a milk flavour, reasonably sweet, crisp and tender. Carrots have considerable food and nutritional value. They contain an orange colouring 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, cooked in different ways. The roots are rarely dried. However, when 'carefully roasted and ground into powder, they could also act as a substitute for coffee. They could also be used as flavourings 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 are 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 food. 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 matured and fertilized. Two

rows of seeds are sown per bed. A spacing of 10cm 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 water, which could lead to the drying of the germinating seeds. 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 soil.
- iii. Mulching is necessary for success.

Other similarities and of course, some differences will be made know 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 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 revised the relevant sections of unit 1 and this unit.

3.3.3 Diseases

The mildew fungi, causing a lot of damage, ready attack the leaves of cucumber plants. This decreases performance of the plant. To control this disease, the leaves of cucumber plants should never be wetted. Watering should be ample but restricted to the soil around the stem. Badly infected plants should be pulled up and burned, to avoid the spread of the infection. A chemical used for, controlling fungal diseases (fungicide) such as dithane could 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 the many stem roots, which are located at 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 by plucking manually. Unless diseases destroy the plants, harvesting of, fresh fruits may continue for another one month.

3.3.5 Importance

The 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 successful growing in the cold parts of Nigeria (for example, the Jos Plateau). This variety has crisp, curling, and glossy but fleshy leaves. Lettuce grows well in well-drained soils 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, as they are seldom variables. It is important to sterilize the soil in the nursery boxes to destroy harmful soil organisms such as bacteria, fungi, viruses and nematodes, which might attack the lettuce plant. Weeds also destroyed through the process of sterilization. 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 1.2-25cm deep. 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 earth around the roots. Recall the reasons for this practice? 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 the young seedling from drying out. During the dry season, the 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. Sterilizing 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 eating.

3.4.6 Importance

Like the 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 salads.

3.5 Related Cultural Practices

The table below summarizes some of the important cultivation of the cabbage, carrot, cucumber and lettuce which we 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 important of cultivation of the four vegetables cabbage, carrot, cucumber and lettuce and they 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.

ANSWER TO SELF-ASSESSMENT EXERCISE 1

Cabbage seedlings should be transplanted with a ball of soil around the roots to minimize disturbance and possible damage to the roots.

ANSWER TO SELF-ASSESSMENT EXERCISE 2

One economic importance of cabbage is that it contains vitamin C and it is used for preparing salads.

ANSWER TO SELF-ASSESSMENT EXERCISE 3

Lettuce seedlings should be mulched to prevent them from drying out.

6.0 TUTOR-MARKED ASSIGNMENT

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

7.0 REFERENCES/FURTHER READINGS

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

Okorie, J. U. (1983). *Agricultural Sciences for Colleges*, Essex: Longman Group.

UNIT 3 ROOTS CROPS

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1.0 INTRODUCTION

In the last two units we dealt with the vegetable crops namely tomato, pepper, cabbage, carrot and cucumber. In this unit we want to concentrate on the roots crops namely yam and cassava. These two crops have dominated the activities of the small scale farmer in the agricultural food production. You will agree with me that the two roots 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:

- recognize the main two food crops of Nigeria;
- identify the varieties of each of the two crops;
- describe the cultivation method for both crops; and
- state the economic importance of both crops.

3.0 MAIN CONTENT

3.1 Yam (Discover SPP Family)

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

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 most 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 months to mature. Tuber is generally thin skinned and the vines twine anti clockwise.

ii. *D. cayensis* (Yellow Yam)

Has leaves that are as broad as they are long and has 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 brittle vines twine anti-clockwise.

This species 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 prickles 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)

Stems are cylindrical with digitate 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 cordate 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. Esculenta (Chinese Yam)

Cines twine in clockwise direction and bear alternative, pale green relatively small cordate 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 cleaning of the land. Controlled and light burning is advisable where it's difficult to clean the site. In grassland areas, the grass is pulled from the root and it may be used as much when dry.

Locally holes are dug at intervals or be elevation of soil into heaps or mounds. If erosion or flooding is anticipated, the mounds are made bigger and built above food level. Also to check erosion heaps are tied by small neck-less or 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 minimize soil erosion.

3.3.2 Sowing

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

Planting can be with yams setts or seed yams. Seeds rate should be about 2.5 tones -5 tonnes per hectare with each yam sells weighing 0.8kg -1kg, but for seed production sells should weight 0.2kg - 0.5kg each. The sells 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 the vine cuttings but this may require a long time of management before it can produce ware 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 the 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.

This is the provision of some support for the 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 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 Fertilization Application

Apply 10, 10:20 mixed fertilizer at the rate of 260kg - 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 for it contains too much water so that it is eaten or sold for money. This early harvest provides during the period of scarcity. The process of early harvesting while tuber is still growing is call detuberisation of topping and obtains most in the 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 the action of 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 tonnes - 17 tonnes per hectare in case of sole crop depending on the type of soil, variety of the yam and other environmental factors. But where yam is grown under mixed cropping, yield varies between 5 tonnes – 12 tonnes.

3.3.7 Pests of Yam

These are the primary pests of yam and one of the most important is the yam beetle (*Heteroligus* sp.) These species have their breeding areas around rivers banks and low lying river-rine areas. In the case of *Heteroligus rneles* breeding usually starts in November to December. The eggs hatch in these areas and there are three larval 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 the vegetable crops namely tomato, pepper, cabbage, carrot and cucumber. You have also learnt about the roots crops namely yam and cassava. 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, we have recognized the main two food crops of Nigeria; identified the varieties of each of the two crops; described the cultivation method for both crops; and stated the economic importance of both crops.

6.0 TUTOR-MARKED ASSIGNMENT

- 1 a. Why should lettuce seedlings be mulched?

- b. State two economic importance of cucumber.
- 2 a. Why should the soil used for preparing nursery beds be sterilized.
- b. State two economic importance of carrots.
- 3. Compare and contrast in a tabular form the cultivation of carrots and cucumber.

7.0 REFERENCES/FURTHER READINGS

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