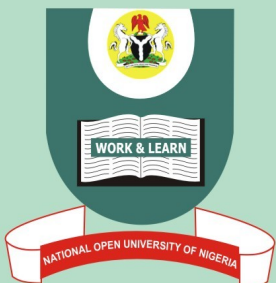


HCM 107: AGRICULTURE, NUTRITION AND HEALTH



NATIONAL OPEN UNIVERSITY OF NIGERIA

HCM 107
AGRICULTURE, NUTRITION AND HEALTH

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Introduction

HCM 107: Agriculture, Nutrition and Health is a one semester, two units, 100 level (year one) course. The course is designed for undergraduate students of Human Resources Management.

This course will expose you to an understanding of many of the concepts in animal nutrition and health, it will assist you to be able to compare them with human nutrition and health. The knowledge gained will also assist us to be able to manage our farm business effectively.

The course will consist of sixteen (16) units which include:

- Course Guide
- Meaning and concept of Agriculture
- History and importance of Agricultural development
- Farming systems
- Cropping systems
- Concepts of nutrition
- Carbohydrates
- Proteins
- Lipids and water
- Minerals and vitamins
- Balanced rations and malnutrition
- Concept of health
- Pests and parasites and
- Diseases of farm animals.

This course guide tells you briefly what the course is all about, what course materials you will be using and how you can work your way through these materials. It suggests some general guidelines for the amount of time you might be spending in order to successfully complete

each unit of the course. It also gives you some guidance on your tutor-marked assignments, details of which will be made available in the assignment file. There are regular tutorial classes that are linked to the course. You are advised to attend these sessions.

What You Will Learn in This Course

HCM 107: Agriculture, Nutrition and Health consist of three major components:

- The general agriculture component
- Animal nutrition component and
- Animal health component

The first six units will introduce you to general agriculture. Issues discussed in unit one includes: Meaning, scope and types of agriculture. Unit two will also look at the history of agriculture and the contribution of agriculture to national development. In the same unit, we will also compare traditional agriculture characterized by subsistence farming with modern or commercial agriculture. Units three and four will highlight the problems of and solutions to agricultural development respectively. Units five and six will expose you to agricultural systems practiced in Nigeria. While unit five will look at the farming systems aspect of the agricultural systems, unit six will discuss the cropping systems aspect of it. The meaning, advantages and disadvantages of each system will be discussed.

Food nutrients will cover the major parts of our discussion under animal nutrition. The essential food nutrients that we need to study include carbohydrates, proteins, lipids, water, mineral salts and vitamins. Their sources, importance and effects of their deficiencies among other things will be discussed. The last part of animal nutrition will look at types of balanced rations and effects and causes of malnutrition.

Course Aims

The aim of the course is to give you an understanding of the meaning of the various concepts of agriculture, nutrition and health. This will be achieved by trying to:

- Introduce you to the definition and meaning of the concepts of agriculture, nutrition and health
- Describe the various agricultural practices commonly used by farmers in Nigeria.
- Describe the various classification of food nutrients used in feeding farm animals.

- Outline the methods employed in classifying parasites and diseases of farm animals.
- Explain the similarities that exist between the nutrition and health of human beings and those of farm animals.

Course Objectives

In order to achieve the aims set out, there are sets of overall objectives. Each unit also has specific objectives. The unit objectives are always included at the beginning of a unit. You need to read them before you start working through the unit. You may also want to refer to them during your study of the unit to check on your progress, you should always look at the unit objectives after completing a unit. In doing so you will be sure that you have followed the instruction in the unit.

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

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

- Define the concept of agriculture
- Identify the contribution of agriculture to the Nigerian economy
- Outline the problems of agricultural development in Nigeria
- Suggest solutions to the problems of agricultural development in Nigeria
- Describe the agricultural systems practiced in Nigeria
- Define the concept of nutrition
- Classify food nutrients used in feeding farm animals into groups
- State the importance of each group of food nutrients in the body of farm animals
- Identify the causes of malnutrition
- Differentiate between pests and parasites of farm animals
- Give one example each of bacteria, viral, protozoa and fungal diseases of farm animals
- Explain the characteristics and economic importance of one ectoparasite and one endoparasite of farm animals.
- Explain how to control parasite and diseases of farm animals.

Course Requirements

To complete this course you are required to read the study units, read suggested books and other materials that will help you achieve the objective. Each unit contains tutor-marked assignments and at intervals

in the course you are required to submit assignment for assessment purpose. There will be a final examination at the end of the course.

During the first reading, you are expected to spend a minimum of two hours on each unit of this course. During the period of two hours you are expected to read through the text of the unit and also answer the self assessment exercises and questions. As a two unit course, it is expected that the lecture contact hours will be eight (8). In addition to eight (8) hours of lectures with the course facilitator, tutorial classes will also be organized for students to discuss the technical areas of this course. In addition to the tutorial classes. I would also advice that you form discussion group with your course mates to discuss some of these questions. Discussion group of between three to five people will be ideal.

The Course Material

You will be provided with the following materials for this course:

1. Course Guide

The material you are reading now is called course guide which introduce you to this course.

2. Study Units

The textbooks prepared for this course by National Open University of Nigeria is called Study Guide. You will be given a copy of the book for your personal use.

3. Textbooks

At the end of each unit, there is a list of recommended textbooks which though not compulsory, for you to acquire or read, are necessary as supplements to the course materials.

4. Other Materials

In addition to the above materials, it is very essential for you to collect your assignment file.

Study Units

There are fifteen study units in this course divided into three modules as follows:

Module 1

Unit 1	Meaning and Concept of Agriculture
Unit 2	History and Importance of Agriculture
Unit 3	Problems of Agricultural Development
Unit 4	Solutions to the Problems of Agricultural Development
Unit 5	Agricultural Systems-Farming Systems
Unit 6	Agricultural Systems-Cropping Systems

Module 2

Unit 1	Concept of Nutrition
Unit 2	Food Nutrients - Carbohydrates
Unit 3	Food Nutrients - Proteins
Unit 4	Food Nutrients – Lipids and Water
Unit 5	Food Nutrients-Minerals and Vitamins
Unit 6	Balanced Rations and Malnutrition

Module 3

Unit 1	Concept of Health
Unit 2	Pests and Parasites of Farm Animals
Unit 3	Management and Control of Pests, Parasites and Diseases of Farm Animals

The first six units in module 1 give the general perspective of agriculture. Some of the issues discussed include:

- Meaning
- Scope and types of agriculture
- Historical development of agriculture
- Importance of agriculture and problems of and
- Solutions to problems of agriculture.

Other areas include:

- The meaning
- Advantages and
- Disadvantages of some common agricultural systems practiced in Nigeria.

The next six units (unit 7 – 12) in module 2 explain the concept of nutrition. The food nutrients treated include:

- Carbohydrates
- Proteins

- Lipids
- Water
- Mineral and
- Vitamins.

Their sources, importance and deficiencies among others were highlighted. The last of this component explains balanced rations, meaning of malnutrition and causes of malnutrition.

This was followed with three other units (unit 13 – 15) in module 3 which tend to describe concept of health. In unit 13, you will learn about the meaning of health, disease and infection. You will also learn about the classification of disease. Unit 14 presents information about pests and parasites of farm animals. The unit differentiates between disease, pests and parasites. The characteristics and economic importance of some common ectoparasites and endoparasites of farm animals are treated. The last unit highlights how parasites and disease can be prevented and eradicated among farm animals.

Each unit includes a table of contents, introduction, specific objectives, reading material (main content), conclusion, summaries of key issues and ideas, tutor-marked assignments and references and further reading. At intervals in each unit, you will be provided with a number of exercises or self-assessment questions. These are to help you test yourself on the material you have just covered or to apply it in some way. The value of these self-test is to help you evaluate your progress and to re-enforce your understanding of the material. At least one tutor-marked assignment will be provided at the end of each unit. The exercises and the tutor-marked assignment will help you in achieving the stated learning objectives of the individual unit and of the course.

Textbooks and References

For detailed information about the areas covered in this course, you are advised to consult more recent editions of the following recommended books.

Akinsanmi O. (1975). *Certificate Agricultural Sciences*. London: Longman Group Ltd.

Akinyosoye V.O. and Babatude G.M. (1986). *Model Questions and Answers and Objective Tests in Agricultural Science*. Ibadan: Heinemann Educational Books (nig) Ltd.

Anyanwu A.C., Anyanwu B.O. and Anyanwu V.A. (1986). *Agricultural Science for School Certificate (Fourth Edition)*. Onitsha: Africana- Fep Publishers Ltd.

Ene-obong H.N. (2001). *Eating Right (A Nutrition Guide)* Calabar: The University of Calabar Press.

Erebor O. (1998). *Comprehensive Agricultural Science for Senior Secondary Schools*. Lagos: Johnson Publishers Ltd.

Ononamadu E.O., Ibrahim M.J. and Fakehinde P.B. (1999). *Basic Agricultural Science for Colleges of Education*. Okene: Consolidated Paper Mills Ltd.

Assessment

There are two components of assessment for this course

- i. Tutor-Marked Assignment (TMA)
- ii. End of course examination

Tutor-Marked Assignment

The TMA is the continuous assessment component of this course. It accounts for 30 percent of the total score. You will be given about six TMAs to answer. At least four must be answered from where the facilitator will pick the best three for you. You must submit all your TMAs before you are allowed to sit for the end of course examination. The TMAs would be given to you by your facilitator and returned to him or her after you have done the assignments.

Final Examination and Grading

This examination concludes the assessment for the course. It constitutes 70 percent of the whole course. You will be informed of the time for the examination through your study centre manager.

Summary

HCM 107: Agriculture, Nutrition and health is designed to provide background information on agriculture, nutrition and health for students of Human Resources Management. By the time you complete studying this course, you will be able to answer the following questions:

- What is agriculture?
- What are the areas covered by agriculture
- How many types of agriculture exists
- Highlight the importance of agriculture to the Nigerian economy
- What are the problems facing agricultural development in Nigeria? Suggest solutions to them
- Give the meaning, advantages and disadvantages of the following agricultural systems:
 - Three examples of farming systems
 - Three examples of cropping systems
- What are the causes of food and nutrition problems? Suggest solutions to them
- Explain the importance of the following food nutrition in farm animals- carbohydrates, proteins, lipids, water, minerals and vitamins
- Define balanced rations and malnutrition
- Explain the following concept: Health, Disease, Infection, Pests, Parasites.
- Give one example each of bacteria, virus, protozoa and fungus disease and state the symptoms and control measure for each of them
- List the characteristics and economic importance of one ectoparasites and one endo-parasite of farm animal
- Explain how to control the outbreak of disease among farm animals

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MODULE 1

Unit 1	Meaning and Concept of Agriculture
Unit 2	History and Importance of Agriculture
Unit 3	Problems of Agricultural Development
Unit 4	Solutions to the Problems of Agricultural Development
Unit 5	Agricultural Systems-Farming Systems
Unit 6	Agricultural Systems-Cropping Systems

UNIT 1 MEANING AND CONCEPT OF AGRICULTURE

CONTENTS

1.0	Introduction
2.0	Objectives
3.0	Main Content
3.1	Meaning of Agriculture
3.2	Scope of Agriculture
3.2.1	Crop Husbandry
3.2.2	Animal Husbandry
3.2.3	Other Areas
3.3	Types of Agriculture
4.0	Conclusion
5.0	Summary
6.0	Tutor-Marked Assignment
7.0	References/Further Readings

1.0 INTRODUCTION

I believe you have gone through the course guide before reading through this book. If not you are advised to read through it so that you will have an idea of what the course is all about. This unit will introduce you to the course. The areas covered in this unit include the meaning of agriculture, scope of agriculture and types of agriculture.

2.0 OBJECTIVES

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

- define agriculture
- list at least five different fields of Agriculture
- state the functions of at least five fields of agriculture
- explain four types of farming practiced in Nigeria.

3.0 MAIN CONTENT

3.1 Meaning of Agriculture

Originally the term agriculture is derived from two latin words “Ager” and “Cultura”. Ager means land and cultura means cultivation i.e. tilling the soil and preparing it for planting of crops. Putting the two words together i.e. land and cultivation, agriculture could be regarded as land cultivation.

In modern day farming, this definition is no longer acceptable as agriculture means much more than land cultivation. Modern agriculture therefore could be defined as the production of crops and rearing of animals for the purpose of producing food for man’s use and raw materials for industries.

Generally speaking modern agriculture involves the following activities:

- Cultivation of the land for the production of crops
- Rearing of farm animals for the production of food and raw materials
- Partial processing of farm products
- Preservation and storage of farm products, and
- Marketing of agricultural products.

From the above definition, it implies that modern agriculture does not end in the production of food for man alone. In modern day farming, farmers also cultivate land for the production of crops for feeding livestock. Similarly, farmers also grow cotton not for food but to supply raw materials for the textile industry. The conversion of raw cassava tuber into garri and groundnut into groundnut oil and groundnut cake comes under the term processing.

A farmer’s job therefore includes the production of large quantities of farm products, preserving them against wastage and selling them to make profit which he adds to his capital or uses in obtaining other necessities of life.

3.2 Scope of Agriculture

The scope of agriculture is as wide as human endeavour, because there is no part of human activity that is not touched by agriculture.

The discussion of the areas of specialization in agriculture will give us an insight into the scope of agriculture.

These areas of specialization will be classified into three. All the areas related to plant activities will be grouped under crop husbandry, those relating to animal activities will be grouped under animal husbandry and others that cannot fit into these two groups will be classified as other areas.

3.2.1 Crop Husbandry

(i) Agronomy

This is the study of crop production practices and soil management. Agronomists study plant life and soil and their complex relationships. Agronomists attempt to develop techniques that will increase the yield of field crops, improve their quality, and enhance production efficiency and profitability, while conserving the fertility of the soil.

Agronomic research has resulted in important new strains of disease-resistant plants and in the development of such practices as the selective breeding of crops and the use of chemical fertilizer.

(ii) Horticulture

This is the science and art of growing fruit, vegetables, flowers, shrubs and trees. Horticulture originally meant the practice of gardening and, by extension now means the cultivation of plants once grown in gardens. In contrast, the term agriculture by derivation, refer to more open forms of culture such as the production of grains and grasses, known as agronomic crops. There is therefore no clear cut distinction between crop science and horticulture.

(iii) Pomology

This is the study of fruits especially tree fruits.

(iv) Olericulture

The production of vegetable crops.

(v) Floriculture

The production of flowers.

(vi) Soil Science

The study of soil management which includes:

- Proper tillage
- Maintenance of organic matter
- Maintenance of proper nutrient supply
- Control of soil pollution
- Maintenance of correct soil acidity
- Control of erosion

(vii) Crop Science

This is the branch of agriculture that involves the production of crops. It is regarded as an aspect of agronomy that deals with crop production and management only.

(viii) Crop Protection

This is another branch under crop husbandry that studies crop pests and diseases and their control.

(ix) Entomology

Entomology is the study of insect pests. This is an important aspect of agriculture as about 20% of the total loss of agricultural products is attributed to insect pests.

(x) Forestry

This is another important branch of agriculture that is concerned with the management of forest trees. It is also called silviculture.

(xi) Plant Pathology

This is the field of agriculture that deals with plant diseases. Those who specialize in this field of study are called plant pathologist.

(xii) Plant Breeding

Plant breeders are concerned with the raising of hybrid or improved varieties of crops. Their areas of concern among others include:

- Improvement in the size of seed or fruit
- Colour of seeds/fruits
- Resistance to pests and diseases

- Resistance to drought and other harsh weather condition
- Reduction in the height of plant etc.

3.2.2 Animal Husbandry

(i) Animal Science

This is the branch of agriculture that deals with the production of farm animals. Some of the farm animals include:

- Cattle
- Sheep
- Goats
- Pigs
- Rabbits
- Chicken
- Turkey
- Ducks etc.

(ii) Agricultural Biochemistry and Nutrition

These concern themselves with the formulation and production of animal feeds. This branch of agriculture formulates feeds for different categories of animals. For example for chicken, we have broiler starter and broiler finisher for broiler category and chick mash, grower mash and layer mash for layer category.

(iii) Animal Health

This is the branch of agriculture that deals with the study of farm animal disease and pest and their control. It is sometimes called animal pathology.

(iv) Animal Breeding

Like their counterpart in plant breeding, animal breeding is concerned with the development of improved or hybrid stock of farm animals.

(v) Fishery

This branch of agriculture involves the breeding rearing and production of aquatic animals.

3.2.3 Other Areas

(i) Agricultural Economics

This area is concerned with the application of economic principles for the purpose of resource allocation in the agricultural industry.

(ii) Agricultural Extension

Agricultural extension is the art and science of communicating agricultural information to the local farmers. The experts in this field achieve this by persuading the farmers of the value about change and to transmit the result of research to the farmers.

(iii) Agricultural Education

This branch of agriculture involves training of agricultural manpower personnel in the education sector. While agricultural extension is directed at training of farmers on their farms, agricultural education focuses on the training of students under the classroom settings.

(iv) Agricultural Engineering

This is another important area of specialization in agriculture. It involves the study of farm machineries and their maintenance.

(v) Agricultural Biology

This branch of agriculture looks at the diseases and pests that attack farm crops and tries to devise various storage programmes. It involves the use of life science for the improvement of agricultural practices.

All these branches of agriculture mentioned above show the extent or scope of agriculture.

3.3 Types of Agriculture

Agriculture can be broadly divided into two main types namely:

- (i) Crop farming, and
- (ii) Animal farming

- **Crop Farming**

Just as we discussed under the scope of agriculture, crop farming is an area which involves the production of things of plant origin on the farm.

Crop farming can further be sub-divided into the following types of farming:

- Food crop farming
- Cash crop farming
- Fruits and nuts farming
- Fiber farming, and
- Wood farming

i. Food Crop Farming

This is the oldest form of agriculture. It involves growing of edible crops. Majority of food crops belong to annual crops. The major aim of farmers growing food crops is to produce food crops for family consumption. Any excess are however taken to the market to raise capital for other necessities of life. The major type of crops that belong to this group of farming include:- maize, sorghum, millet, cassava, yams, rice etc.

ii Cash Crop Farming

Cash crop farming involves the cultivation of crops which are produced for the purpose of selling them to earn money. Unlike food crops, cash crops are grown mainly to provide raw materials for our agro- industries and not for eating. Cash crops farming are an important aspect of agriculture as this sector is responsible for export commodities and subsequently earns foreign exchange for the country. Examples of cash crops include:

- Cotton
- Cocoa
- Rubber
- Coffee
- Tea
- Soyabeans etc.

iii Fruits and Nuts

Examples of fruits and nuts crops include:

- Pawpaw
- Pineapple
- Banana
- Mango
- Cashew

- Groundnut
- Bambara nut etc.

This type of farming deals with the cultivation of crops whose emphasis is on the production of fruits and nuts. The practices of orchard belong to this type of farming.

iv Fiber Farming

The production of fiber used to be a popular form of agriculture some years back. However, with the introduction of synthetic materials and the use of biotechnology, there is less need of agriculture for fiber production. Cotton production is the most popular fiber crop in agriculture. Some few areas are still known to grow jute and other fiber crops.

v Wood Farming

Wood farming is normally referred to as forestry or silviculture. Wood farming brings about the production of forest trees for the supply of fire wood, timber for construction works, paper industries etc.

• Animal Farming

Animal farming is concerned with raising of farm animal for man's use. Animal farming can further be sub divided into the followings:

- Livestock farming
- Dairy farming
- Poultry farming
- Fishing

i Livestock Farming

The main purpose of this type of farming is the rearing of farm animals for meat production. This is done to improve the protein intake of man. The skin of some of these animals provides hide and skin for the leather industries. Some of the animals in the category include:

- Cattle
- Sheep
- Goats
- Pigs
- Rabbits etc.

ii Dairy Farming

The main purpose of this type of agriculture is to produce milk for man's use. Secondary functions include provision of meat and hide and skin. Animals in this category include:

- Cattle
- Goats etc.

iii Poultry Farming

This type of farming involves the rearing of domestic birds such as chickens, turkeys, ducks, geese etc for the purpose of egg and meat production.

iv Fish Farming

Fish farming is now gradually becoming popular in agricultural business. All other aquatic animals are classified under fish farming.

4.0 CONCLUSION

In this unit we have discussed the meaning of agriculture, scope of agriculture and the types of agriculture. From our discussion it can be concluded that the agricultural profession is as old as mankind. Modern agriculture is more than production of crop and rearing of animals. Other areas like provision of raw materials, partial processing and marketing of agricultural products have been introduced into modern Agricultural practices.

Finally the agricultural profession is as wide and complex as Humanity itself.

5.0 SUMMARY

A summary of the major points in this unit is as follows:

- i. Agriculture is originally derived from two latin words- "Ager" meaning field and "cultura" meaning cultivation.
- ii. Modern agriculture must encompass the following activities:
 - Crop production
 - Rearing of farm animals
 - Partial processing of farm products by agro- industries
 - Preservation and storage of farm products, and

- Marketing of agricultural products.
- iii. The scope of agriculture is divided into three major areas- crop husbandry, animal husbandry, and other areas of specialization.
- iv. Crop husbandry includes:
 - Agronomy
 - Crop Science
 - Soil Science
 - Horticulture
 - Entomology
 - Crop Production
 - Pomology
 - Olericulture
 - Floriculture
 - Forestry
 - Plant Pathology
 - Plant Breeding.
- v. Animal husbandry include:
 - Animal Science
 - Agricultural Biochemistry and Nutrition
 - Animal Health
 - Animal Breeding and
 - Fishery
- Other areas of specialization include:
 - Agricultural Economic
 - Agricultural Extension
 - Agricultural Education
 - Agricultural Engineering
 - Agricultural Biology
- vi. Agriculture can be grouped into two major types:
 - Crop Farming and
 - Animal Farming
- vii. Crop Farming activities include:
 - Food crop farming

- Cash crop farming
- fruits and nuts farming
- fiber farming and
- Wood farming.

ix. Animal Farming activities include:

- livestock farming
- dairy farming
- poultry farming and
- fish farming

6.0 TUTOR-MARKED ASSIGNMENT

1. Define Agriculture.
2. List six branches of Agriculture.

7.0 REFERENCES/FURTHER READINGS

Anyanwu A.C. and Anyanwu B.O. (1987). *Junior Secondary School Agriculture*. Onitsha: Africana- Fep Publishers Ltd.

Falusi A.O. and Adeleye I.O.A. (1986). *Agricultural Science for the Junior Secondary school* (Book1) Ibadan: Onibonoje Press.

STAN (1990). *Agricultural Science for Junior Secondary Schools* (Book1). Lagos: Longman Nigeria Ltd.

UNIT 2 HISTORY AND IMPORTANCE OF AGRICULTURE

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- 1.0 Introduction
- 2.0 Objectives
- 3.0 Main Content
 - 3.1 History of Agriculture
 - 3.1.1 Hunting and Gathering
 - 3.1.2 Subsistence Agriculture
 - 3.1.3 Cash Crop Farming
 - 3.1.4 Commercial Farming
 - 3.2 Differences between Subsistence and Commercial Farming
 - 3.3 Importance of Agriculture
- 4.0 Conclusion
- 5.0 Summary
- 6.0 Tutor Marked Assignment
- 7.0 References/Further Readings

1.0 INTRODUCTION

In unit 1, we discussed the meaning of agriculture, scope of agriculture and types of agriculture.

In this unit our attention will be focused on the history of agriculture. History of agriculture will be discussed under four sub-headings:

- hunting and gathering
- subsistence agriculture
- cash crop farming and
- commercial agriculture.

Finally, the importance of agriculture to the Nigeria economy will be highlighted.

2.0 OBJECTIVES

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

- explain the history of agriculture under the following stages of agricultural development:
 - hunting and gathering
 - subsistence agriculture

- cash crop farming
- commercial agriculture
- state four differences between subsistence and commercial agriculture
- list five importance of agriculture to the economy of Nigeria.

3.0 MAIN CONTENT

3.1 History of Agriculture

The history of agriculture follows the same pattern with the development of mankind. The history of agriculture follows the gradual development of agriculture. Through the ages, four distinct stages of agricultural development can be identified. The first stage is the hunting and gathering of fruits. This stage is followed by the subsistence stage of agriculture. The third stage is the stage of cash crop production and the present modern stage is called commercial agriculture.

3.1.1 Hunting and Gathering

The early man was a wanderer; he lived by hunting wild animals and gathering wild fruits. These activities were carried out on daily basis. There was no attempt to either cultivate the land or domesticate the animals. The implements used for these activities were stone, bones, bow and arrows etc. This period was generally referred to as the Stone Age.

3.1.2 Subsistence Agriculture

Agriculture was actually discovered at this stage of development. The seeds of the wild fruits that were gathered by early men were thrown away after the fruits were eaten. It was later discovered by chance that some of these seeds that fell on good soil germinated and grew. This gave them an idea of planting the seeds and settling down in a place to look after the crops. Similarly, the captured pregnant animals also gave birth to young ones. This also gave them the ideas of taming animals. Settled life, this started gradually as men began to exploit the soil for crop production and taming animals for domestic use.

Dogs, horses, goats, sheep, cattle were among the first domesticated animals, while millet, wheat, oats, barley and some vegetables and fruits were also domesticated.

Subsistence agriculture involves the production of crops and rearing of animals for the use of the farmer and his family only.

Erebor (1998) identified the following as the major characteristic of subsistence agriculture.

- Labour is supplied only by the farmer and his family
- Small area of land is used
- Crude implements like hoe, cutlass, basket etc are used
- The product from the farm are not for sale
- Little capital is required
- The yield is also very low

3.1.3 Cash Crop Farming

Cash crop farming is an advanced stage of agricultural development when compared with the stage of subsistence farming. As man advanced in his social life it became necessary for him to produce crops that would surpass the level for family consumption. These excess crops were sold to procure other essentials of life to improve the standard of living of the family. Through the instrument of money, man was able to purchase simple farm tools, build modern houses, and purchase household equipment and other necessities of life. In addition to food crops, man also cultivated cash crops such as cocoa, cotton, coffee, rubber, groundnuts and citrus. The era of cash crop production marked the beginning of industrialization. These cash crops are exported to developed countries for processing into finished and consumable products.

3.1.4 Commercial Agriculture

Commercial Agriculture marked the beginning of mechanized farming. This is the most advanced form of agriculture. Farmers at this stage no longer produce for the family alone. Both crop production and animal rearing are now commercialized, that is why in the United States of America today, less than 10% of the population who are farmers feed over 100 million people.

However for commercial agriculture to thrive well there must be availability of large land, availability of enough capital to purchase land, improved plant and animal materials, availability of farm machines, availability of processing machines, availability of farm labour, availability of storage facilities and other essential amenities.

Similarly, Erebor (1998) identified the characteristics of commercial agriculture as follows:

- It is very expensive to practice

- Large area of farm land is required
- Requires the use of farm machines
- Requires manual, mechanized and specialized labour
- Requires marketing of agricultural products
- It requires proper keeping of the farm records
- Output is high and hence returns is also high
- It involves researches into the various aspects of production

The major advantages of commercial agriculture over other stages of agriculture include the followings:

- It allows large production of output. It also creates employment for people and there is an improved quality of crops and livestock. Because of large scale production farmers can afford to sell their products at reduced cost. Through commercial farming, social amenities like water, access road, electricity, health and education can be provided for the immediate farm settlement.

The following disadvantages are often associated with commercial farming:

- It requires, the use of modern farming equipment and therefore expensive to operate. It also requires land which may not be available since large areas of land are involved it exposes the land to erosion and leaching. The farm is also faced with problems of marketing, pests and diseases, storage etc.

In conclusion as civilization advances, the level of development of commercial agriculture advances. More and more complex machines in the field of crop and livestock production are being discovered daily. More researches in the area of hybrid and other fields of agriculture are on going. Therefore, there is no limit to the development of agriculture and the history of the development of agriculture will continue as civilization continues to advance.

3.2 Differences between Subsistence and Commercial Farming

Subsistence farming represents traditional method of farming, while commercial farming represents modern method of farming.

Ononamadu, Ibrahim and Fakehinde (1999) present in a tabular form, the differences between subsistence and commercial farming as follows:

Subsistence Farming	Commercial Farming
1. Involves small scale production	1.It involves large scale production
2. Small farm size is needed	2. Requires very large farm size
3. Use of simple farm tools	3.Use of complex farm machineries and implements
4. Poor storage facilities	4. Good and improved storage facilities
5. Low capital investment	5. High capital investment
6. Mixed cropping system adopted	6.Monocropping and plantation are practiced
7. Mixed farming is common	7. Specialized animal or crop husbandry is practiced
8. Poor processing facilities involved	8. Modern processing equipment used
9. No mechanization involved	9. Highly mechanized
10. Manual labour for farm work and transportation of farm produce	10. Combines the use of manual and mechanized labour
11. Farm work is a way of life	11. Farm work is for business
12. Commonly practiced in developing countries	12.Common in developed countries
13. Standard of living under this system is poor	13 Standards of Living under this system is high.

3.3 Importance of Agriculture

The importance of agriculture means the role agriculture is playing in the survival of an individual and the development of the economy of the nation. The following are some of the major roles that agriculture plays in the economy of Nigeria:

(i) Provision of Food for Man

Agriculture is primarily the most important source of food for all Nigerians and indeed for the whole world. Without food, the nation will starve and the average life span of an individual is shortened. There will be malnourishment and disease will set in.

This important function will continue as long as there is life. Through the years, man has sought various way of perfecting the quality and quantity of food available through experimentation, breeding and improved farming techniques.

(ii) Provision of Food for Animals

Agriculture grows crops. Some of these crops are fed to domestic animals which in turn produce animal protein like meat, eggs, fish etc for human consumption. Protein is a very important component of man's food. Apart from the provision of concentrates for farm animals, agriculture now produces pasture and forage crops to prevent ruminant animals trekking for a long distance looking for grasses. With this function, man does not need to depend entirely on wild animals for the supply of animal proteins.

(iii) Employment of Labour

Apart from being the source of food supply, it is generally known all over the world especially among the less developed countries that agriculture is an important source of employment of labour.

In Nigeria, in spite of the rapid growth of the other sectors, agriculture still retains its leading position as the largest provider of employment for the working population. It is estimated that about 70 percent of the labour force is employed in the agricultural sector while about 90 percent of the rural population depends largely on agriculture. Women and children are directly or indirectly employed to produce or process groundnut, palm oil, cocoa, cotton and rubber latex. Many others are employed to work in agro based industries.

(iv) Provision of Raw Materials for Industries

The role of agriculture as a source of raw materials for manufacturing industries cannot be over emphasized. In Nigeria efforts have been made over the years to establish and expand our local manufacturing industries. As a matter of fact it is in the interest of our economy that agriculture should be able to adequately meet the needs for our local industries. Examples of agricultural raw materials utilized and the products manufactured include:

- Palm oil is used for the manufacture of soap
- Oil seeds used for the manufacture of oils and oil cakes
- Seeds and oil cakes used for the manufacture of livestock feeds
- Sugarcane used for refined sugar
- Tobacco leaf for cigarettes
- Cotton lint for the manufacture of textile fabrics
- Cocoa for the manufacture of beverages
- Ripe fruits for the manufacture of canned fruits and juice
- Raw rubber for the manufacture of tyres and tubes

- Wood pulp for paper manufacturing.

(v) Foreign Exchange Earner

Primary producing countries depend largely on agricultural exports for their foreign exchange earnings which they use to finance their imports. Economic developments in most countries have been financed mainly with the earnings from agriculture. Such was the case with Nigeria before the impact of petroleum on our economy became so prominent.

In 1962 for example, agriculture accounted for about 82% of the total value of the export for the country. In 1976 during the oil boom the contribution of agriculture to the foreign exchange earning dropped to only about 4 percent. However with the intensification of various government and private efforts towards improving agriculture, the figure for 2007 was about 20 percent.

(vi) Contribution to National Income

Revenue realized from the sale of agricultural products form the major source of income for farmers. Other people that are engaged in the processing and marketing of these agricultural products earn their living from them. All these personal incomes from agriculture form part of the Gross Domestic Product (GDP) for the country. For example at current prices, the share of agriculture in the Gross Domestic Products has varied from 36.5% in 1973/74 to 24.4% in 1977/78. Even though there is decline over the years, it is worth noting that agriculture has made remarkable contributions to the growth of the national income.

(vii) Rural Development

Agriculture has contributed immensely to the growth and development of rural areas. Agriculture is synonymous with rural development. On the part of the farmers, through the income generated through farming, they have embarked on community development and self-help projects. Many rural communities have used their earnings from agriculture to provide amenities like primary schools, secondary schools, boreholes, bridges, hospitals, post-offices, etc.

On the part of government, in order to evacuate important agricultural products from rural areas, government embarks upon the construction of roads and railways. Large markets are also established in rural areas with agricultural potentials. Some rural villages are well known because of the location of important markets for agricultural products.

(vii) Provision of Shelter and Clothing

Agriculture also contributes substantially to the nation's shelter and clothing needs. The trees from which some of the crops are cultivated can be made into timbers and used for building and furniture, while crops such as cotton provide lint for the manufacture of textile fabrics for clothes.

SELF-ASSESSMENT EXERCISE

Agriculture may be regarded as the nerve centre of the nation. Discuss this statement.

4.0 CONCLUSION

In unit 2, we have discussed the history of agriculture. We have also differentiated between subsistence and commercial farming as well as the importance of agriculture to the Nigerian economy. From the various discussions, it can be concluded that agriculture is as old as human existence and that agriculture is contributing and will continue to contribute to the economy of Nigeria and the whole world in general.

5.0 SUMMARY

In this unit we have learnt that:

- The history of agriculture can be discussed following the historical development of agriculture
- Historical development of agriculture can be grouped into four:
 - Hunting and gathering
 - Subsistence agriculture
 - Cash crop farming
 - Commercial farming
- In hunting and gathering attempt was made to domesticate food crops and animals.
- Subsistence agriculture involved farming for family use only.
- Cash crop farming involves the production of non-edible crops for the supply of raw materials to the industries.
- Commercial agriculture involves the production of crops and livestock on a large scale.
- While subsistence agriculture involves small scale production for family use, commercial agriculture involves large scale production for industries and the larger consumption of society.

- Agriculture is important to the economy because of the following reasons:
 - Supply of food for human consumption
 - Supply of feeds for livestock
 - Employment of labour
 - Provision of raw materials for industries
 - Foreign exchange earner
 - Contribution to national income
 - Contribution to rural development
 - Provision of shelter and clothing.

6.0 TUTOR-MARKED ASSIGNMENT

1. What is agriculture?
2. State the differences between subsistence and commercial agriculture

7.0 REFERENCES/FURTHER READINGS

- Akinyosoye V.O. and Babatunde G.M. (1986). *Questions and Answers and Objective Tests in Agricultural Science*. Ibadan: Heinemann Educational Books (Nig) Ltd.
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UNIT 3 PROBLEMS OF AGRICULTURAL DEVELOPMENT

CONTENTS

- 1.0 Introduction
- 2.0 Objectives
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 - 3.1.1 Problems of Land Tenure
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 - 3.1.19 Inefficient Farmers Organizations
- 4.0 Conclusion
- 5.0 Summary
- 6.0 Tutor-Marked Assignment
- 7.0 References/Further Readings

1.0 INTRODUCTION

In unit 2, you read about the historical development of agriculture. We also differentiated between subsistence and commercial agriculture. In the concluding part of the unit, we highlighted the importance of agriculture to include some of the following:

- Provision of food
- Feed
- Employment
- Raw materials
- Income

- Foreign exchange
- Shelter and
- Clothing etc.

This unit will be devoted to discussing the problems of agricultural development in Nigeria.

2.0 OBJECTIVES

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

- list at least ten (10) problems facing agricultural development in Nigeria
- explain in details any five of the problems listed above.

3.0 MAIN CONTENT

3.1 Problems of Agricultural Development

Erebor (1998) identified seventeen problems facing the development of agriculture in Nigeria as follows:

- Land tenure
- Amenities
- Finance
- Transportation
- Communication facilities
- Processing and farm machines
- Government policies
- Marketing systems
- Pests and diseases
- Production uncertainty
- Farm inputs
- Attitudes towards farming
- Environmental degradation

Other problems that can be added include:

- Customs
- Poverty
- Farmer's organization

3.1.1 Problem of Land Tenure

Land tenure is the system of land ownership. In Nigeria the major parts of the land either belong to individuals or communities. This method of the land ownership does not encourage commercial agriculture, as the land is owned through inheritance. This method of land ownership leads to land fragmentation. This method often leads to communal clashes and destruction of life and properties. Farmers who have the capital to make the best use of the land may not belong to the group that owns the land. Even when such people are given access to land, they are often afraid to put in their best on the land as the land owners can demand it from them at anytime. At times the land owners often dictate what the landless farmers should plant on the land. Increase in population has also increased the various alternatives which land can be put, this further puts pressure on the available land.

3.1.2 Lack of Basic Infrastructural Amenities

Agriculture is synonymous with rural economy. Most of the rural areas where over 70% of agricultural production is taking place lack social and infrastructural amenities. These basic amenities includes;- motorable roads, electricity, health facilities, standard schools, telephone services, clean water supply etc. These social and infrastructural amenities are needed to improve the standard of living of local farmers and this increase agricultural production. Good roads will ease movement of workers and transportation of their farm products to urban centre, clean water supply will reduce the rate of infection of water borne diseases, and health facilities will ensure prompt treatment of illness in the rural areas. This will ensure that farmers and their family members remain strong and healthy to work on the farm. Lack of basic amenities often lead to rural urban migration. This will also lead to reduction in the working population in the villages and eventual reduction in farm output. Presently, in Nigeria majority of farmers remaining in the rural areas are those above 40 years of age. The young ones have gone out in search of jobs in the cities.

3.1.3 Poor Financing of Agriculture

Most of agricultural activities in Nigeria are left in the hands of peasant farmers. One of the major problem confronting rural farmers is lack of finance. The number of farmers who succeed in getting loan from credit institutions are very few compared to the teeming population of farmers. This is due to the following reasons:

- The farmers are generally very poor
- Most of them cannot secure the collateral demanded for loans, and
- Some cannot pay the high interest rates charged on loans by financial institutions.

As a result of these most of them still operate at subsistence level. Farmers need both production and consumption credits to enhance their status.

3.1.4 Poor Transportation Facilities

The major mode of transportation in Nigeria especially in the rural areas is by road. Transportation facilities in this context refer to the mode and means of transportation i.e. the condition of the road as well as the condition of the vehicles used for the transportation. We have already discussed the poor condition of basic amenities in the villages. The roads are generally rough and bad. Some of the roads are only motorable only during the dry season. With these conditions of the road, it is not surprising that vehicles plying them break down frequently. The vehicles also lack spare parts.

All these transportation problems often lead to high cost of bringing farm products from rural areas to urban centres. It also increases the perishability of farm products. Middlemen often take advantage of these transportation problems to increase the prices of the products and at times hoard them to create artificial scarcity.

3.1.5 Poor Communication

The means of communication include radio, television, telephone, telex, fax etc. Communication is essential for agricultural development. They are needed to pass useful information about agriculture and other related matters to farmers. Our communication system in Nigeria is still very poor. Television and telephone services are not available in the villages and where available most farmers cannot afford to buy them.

3.1.6 Lack of Storage Facilities

Our rural farmers depend largely on local methods of storing their agricultural products. Local methods like barns, cribs and rhumbus are not very efficient in storing large quantities of agricultural products for a long time. They cannot be used to store fresh products.

Modern storage facilities like silos, cold rooms, refrigerators etc are lacking in the rural farming communities. These poor storage facilities can lead to perish-ability of farm products, and pests and disease attacks. Other problems of poor storage include reduction in quality and quantity of farm products, glut during harvests and famine outside harvest periods.

3.1.7 Lack of Processing Facilities

Processing of agricultural products is one of the major conditions that must exist for agricultural development to occur. Both the processing machines and the spare parts are presently lacking in the rural areas of Nigeria. Even when available their prices are beyond the reach of local farmers. Some of the machines also require experts to operate them as they are highly technical in nature. Maintenance of the existing machines is difficult and expensive. Maintenance is difficult due to non-availability of exports as well as spare parts.

3.1.8 Illiteracy Level of the Farmers

Most farmers in Nigeria can neither read nor write. Most of the farmers in Nigeria are not educated enough in the technicalities relating to agricultural production. Many of them do not know of new developments in agriculture. It is only when a person knows of the existence of something that he can think of its use. If a farmer knows of the existence of fertilizer and does not know how to use it, he is not much better than those who do not know about it.

The results of the illiteracy of farmers according to Erebor (1998) are:

- Reluctance of the farmers to change
- Farmers are superstitious in their beliefs
- Suspicious of new innovation
- Unscientific in mind and in thinking, and
- Generally uncooperative, hostile and unaccommodating

3.1.9 Poor Extension Services

An extension service is the process through which farmers receive information in modern farming from the relevant government agencies. This is necessary to keep the farmers informed of the latest development in the field of agriculture. The extension services delivery system in Nigeria is very poor. The numbers of extension workers in Nigeria are very few compared to the number of farmers. The few available ones have no mobility to visit the farmers. Many of them are not prepared to live in rural areas where farmers reside. Those that are ready to stay in

the rural areas are not adequately remunerated. All these factors combine to bring about poor extension activities in Nigeria.

3.1.10 Poor Farm Tools and Machineries

Most Nigerian farmers still depend on the use of crude farm implements and so remain at subsistence level. Some of the available modern farm tools are not adapted to function under our soil condition. Some of the machines are very expensive, some require experts to operate and most of them cannot be used on fragmented land.

As a result of these problems, farmers still depend on their energy and crude implements. This leads to low yield, short life span of farmers, time wasting and low farmer's income.

3.1.11 Unstable Government Policies and Programmes

In order to promote the development of agriculture, governments at times establish some agricultural programmes or announce some policies. These programmes like the land use decree, operation feed the nation, marketing boards, green revolution, farm settlement schemes, directorate of food, road and rural infrastructure etc. Lack continuity as some of them will cease to exist as soon as the initiator leaves office. Some policies have negative effects on farmers e.g. importation of rice often reduces demand for local rice. Inconsistencies in government policies like the granting of subsidies and removal of subsidies on farm inputs: have negative effects on agricultural development.

3.1.12 Poor Marketing System

An efficient marketing system is one of the conditions for the development of agriculture. The Nigerian marketing system for agricultural products is generally poor. Some rural areas are not motor able throughout the year and where motor-able, the roads are generally bad. Vehicles for carrying the products are few and the available few are in bad condition which leads to their breakdown. As a result of this the volume of trade is generally low for agricultural products. The journey of two hours may take six hours. Due to lack of competition, farmers are forced to sell their farm products at very low prices. The abolition of agricultural marketing boards left farmers at the mercy of middlemen.

3.1.13 Problems of Pests and Diseases

Pests and diseases have serious effects on agricultural production. Some of the effects of pests and diseases on agricultural development include:

- Increase in the cost of production
- Reduction in the quality of farm produce
- Reduction in the income of farmers, and
- Reduction in the quantity of farm produce

3.1.14 Production Uncertainty

Agricultural production unlike industrial production is subject to the vagaries of the weather, crops depend on rainfall to grow. Shortage of rainfall leads to drought while excessive rain leads to flooding. Long period break of rainfall also have adverse effects on the crops. High humidity has effect on drying process and excessive sunshine can lead to wilting of crops. Nigerian farmers depend on natural weather conditions for their operations as a result of this, any adverse weather condition will have serious effect on their output.

3.1.15 Wrong Attitude to Farming

Farming is looked upon by many as an occupation for the poor people. The youths therefore will not like to belong to this category of people in the society. They prefer to take up white-collar jobs that would enable them to put on nice clothes and sit in air conditioned offices. As such they move out of the villages in large number in search of white collar jobs in the cities. Those youths those ventures to remain in the village to farm are being looked upon as low class. This poor or negative attitude of the general society towards farming has serious impact on farming as those who remain in farming are old people. Old farmers are known for their reluctance to accept new innovation which implies that agricultural development will remain slow.

3.1.16 Problem of Environmental Degradation

There are some environmental problems that affect agricultural development. Such problems include pollution, soil erosion, bush burning, deforestation etc. Environmental pollution is a very serious problem in the oil producing areas of Nigeria. Oil spillage is injurious to the growth of crops. Erosion menace is another serious environmental problem. Erosion is the gradual wearing away of the soil surface by either rain or wind. This leads to soil depletion, which increases the cost of farm production. Similarly, bush burning can destroy useful crops on

the farm and cause oxidation of some important elements. Deforestation can reduce the activities of micro-organisms in the soil.

3.1.17 Custom of the People

Traditional beliefs and custom affect the development of agriculture in Nigeria. For example the consumption and production of certain food stuff is forbidden in some communities for no reason other than superstitious beliefs. Some communities believe that children who eat or demand for eggs will become thieves in the later part of their life. At times customs dictate what crop farmers can plant and what animal they can rear.

Social customs on the practice of agriculture influence the people's acceptance of any innovation. Some localities are highly spiritual and they express a high degree of unwillingness to respond to any change.

3.1.18 Poverty Level of Farmers

Success in agriculture requires considerable capital investment. Majority of the problems highlighted above are hinged on the poverty level of farmers. Most farmers operate within the vicious cycle of poverty. Low farm outputs leading to low incomes result in low savings which give rise leading to low investment that in turn leads to low output and the circle continues.

There is the need to acquire enough land to make farming an economic venture. The improved planting materials and improved breeds of livestock can only be acquired with money. Modern farming requires power and equipment that are very expensive. Poverty therefore, prevents farmers from going into commercial farming. Indeed farmers will remain poor unless there is government intervention.

3.1.19 Inefficient Farmers Organizations

Various farmers' organizations are established to assist the farmers in different areas of farming. For example, marketing cooperatives are established to help the farmers solve their marketing problems, thrift and credit societies also help the farmers to solve their financial problems. Other organizations include:

- Group farming cooperatives
- Consumer cooperatives etc

However, due to administrative and financial problems these organizations are not effective in performing their functions.

4.0 CONCLUSION

In unit 3, we have discussed the problems of agricultural development with reference to Nigeria. From our discussions, it is obvious that agriculture in Nigeria is facing a great deal of problems. As a result of these problems, agriculture is yet to reach the desired level of development and growth. It is recommended that government should become more involved in agriculture if a potential food crisis is to be converted.

5.0 SUMMARY

In this unit, we have learnt about the following problems of agricultural development:

- Problem of land tenure
- Lack of basic infrastructural amenities
- Poor financing of agriculture
- Poor transportation facilities
- Poor communication
- Lack of storage facilities
- Lack of processing facilities
- Illiteracy level of the farmers
- Poor extension services
- Poor farm tools and machineries
- Unstable government policies and programmes
- Poor marketing system
- Problem of pest and diseases
- Production uncertainty
- Inadequate agricultural inputs
- Wrong attitude to farming
- Problem of environmental degradation
- Custom of the farmers
- Poverty level of farmers
- Inefficient farmer's organizations

6.0 TUTOR-MARKED ASSIGNMENT

1. Discuss ten (10) problems of agricultural development in Nigeria.
2. Discuss briefly the ways in which the following factors contribute to the problems of agricultural development in Nigeria:
 - (a) Finance
 - (b) Farm input
 - (c) Transportation
 - (d) Storage and processing facilities

7.0 REFERENCES/FURTHER READINGS

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UNIT 4 SOLUTIONS TO THE PROBLEMS OF AGRICULTURAL DEVELOPMENT

CONTENTS

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Main Content
 - 3.1 Solutions to the Problems of Agricultural Development
 - 3.1.1 Land Use Decree
 - 3.1.2 Provision of Infrastructural Facilities
 - 3.1.3 Formation of Cooperative Societies
 - 3.1.4 Provision of Credit Facilities
 - 3.1.5 Establishment of Efficient Communication System
 - 3.1.6 Efficient Transportation System
 - 3.1.7 Provision of Storage Facilities
 - 3.1.8 Mass Literacy Programmes
 - 3.1.9 Promotion of Agricultural Education
 - 3.1.10 Extension Education
 - 3.1.11 Establishment of Demonstration Farms and Film Shows
 - 3.1.12 Establishment of More Research Institutes
 - 3.1.13 Provision of Subsidies on Farm Inputs
 - 3.1.14 Establishment of Tractor Hiring Centres
 - 3.1.15 Improving Veterinary Services
 - 3.1.16 Establishment of Young Farmers Club
- 4.0 Conclusion
- 5.0 Summary
- 6.0 Tutor-Marked Assignment
- 7.0 References/Further Readings

1.0 INTRODUCTION

The last unit discussed the problems of agricultural development. In discussing the unit we highlighted about twenty (20) problems affecting the development of agriculture with particular reference to Nigeria. Some of the problems highlighted include:- land tenure system, infrastructural amenities, finances, transportation, communication, storage facilities, processing facilities, illiteracy level of farmers, extension services, tools and farm machines, government policies and programmes, marketing systems, pests and diseases, production uncertainties, farm inputs, attitudes towards farming, environmental degradation, customs, poverty and farmers organizations. In this unit we shall discuss the solutions to the above problems.

2.0 OBJECTIVES

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

- list at least eight (8) solutions to the problems of agricultural development
- explain in details any five (5) of the solutions listed above.

3.0 MAIN CONTENT

3.1 Solutions to the Problems of Agricultural Development

The Nigeria government and other developing countries of the world have realized the importance of agriculture in their overall economic development and are taking steps to eliminate these problems. The following are some of the steps been taken by the Nigerian government and other agencies connected with the development of agriculture.

3.1.1 Land Use Decree

The decree was promulgated in 1978 and amended by an Act in 1990. Land use decree vested all land ownership in the hand of government rather than individuals; the decree was promulgated to assist prospective and genuine landless farmers. With this decree the problem of land tenure is expected to be over. What is left to be done now is the enforcement of the law in the rural areas. At present the law is only effective in the urban centres where land is demanded for building purposes and not for agricultural purposes.

3.1.2 Provision of Infrastructural Facilities

One of the major problems of agricultural development identified was lack of infrastructural amenities especially in the rural areas.

Government should provide good access roads to the areas of food production to facilitate the transportation of the farm products to the urban areas. The farming communities should have electricity, water, health care facilities, schools and recreational centres to make life more pleasant for the farmers and thus prevent or reduce drift to the urban centres.

3.1.3 Formation of Cooperative Societies

Cooperative society is a voluntary organization, formed, owned and organized by farmers for their mutual benefits. Government should therefore encourage the farmers to form themselves into cooperative

bodies that can carry out farming on a large scale. By this they will be better organized, better financed and more credit-worthy to financial institutions than individual farmers. Cooperative department under the ministry of commerce and industry should be made more functional to assist the farmers. Apart from issuing certificates of registration to farmers, they should be able to supervise and nurture the societies into maturity.

3.1.4 Provision of Credit Facilities

The establishment of the Nigerian Agricultural and Rural Development Bank (NARDB) to cater for farmers credit needs is a step in the right direction. Government should ensure that the rural farmers benefit from the credit facilities of this bank. Government should also ensure that the loan facilities are not diverted to other sectors. Government should also assist farmers in obtaining loans by requesting the commercial banks and other financial institutions to grant loans to the farmers without demanding for the usual collateral. The government can even guarantee their loans. Agricultural credit is essential to increase the investment level of farmers and the amount granted should be substantial enough to make meaningful impact on the life of farmers.

3.1.5 Establishment of Efficient Communication System

We have already discussed the importance of communication on the development of agriculture. Efficient communication systems will combine with extension services in the dissemination of information on modern agricultural techniques to farmers. In this regard government can establish radio and television stations in the rural areas. In addition substantial time should be allotted to agricultural programmes. News papers and magazines should be established by the ministries of agriculture and agricultural development projects (ADPs). All these measures will ensure efficient dissemination of agricultural information to the grassroots.

3.1.6 Efficient Transportation System

The services of government transportation corporations should not be limited to urban centres only the rural dwellers should also benefit from their services. Government can also assist the farmers to transport their perishable product such as meat, eggs, vegetables, milk etc to the markets by providing them with refrigerated vehicles which are too expensive to be purchased or maintained by individual farmers.

3.1.7 Provision of Storage Facilities

Government should assist farmers in building storage facilities for their surplus produce, buy these surplus produce, store them scientifically and market them during lean seasons. Government can also build cold rooms in the rural areas with generating sets attached to them. This will assist in the storage of fresh and perishable produce. Government should also establish processing centres in the villages to take care of agricultural products. Government can buy the raw materials from the farmers for processing. Alternatively, government can allow the farmers the use of the machines at a reduced price. If processing machines for crops like cassava and rice are established for farmers, it will encourage them to produce more.

3.1.8 Mass Literacy Programmes

In order to minimize the level of illiteracy among farmers, government should establish adult education centres in the villages. The centres should be well equipped to encourage farmers to attend. Such programmes will afford the farmers the opportunity to go to school without necessarily disrupting their farming activities. Through the programme farmers will now be able to read and write on their own. Education can help to minimize the effects of some of the customs and the superstitious practices of the local farmers on agricultural production.

3.1.9 Promotion of Agricultural Education

The teaching of agricultural science in all primary and post primary schools all over the country must be encouraged or even enforced. Agriculture has been made a school subject and many schools such as secondary schools and teacher training colleges now offer it in public examinations. This will create an awareness of the significance of agriculture in national economy. More faculties of agriculture in the universities and more colleges of agriculture should be established to train people in the different fields of agriculture. Scholarship should be provided for those who want to specialize in the field of agriculture. To attract students into the field of agriculture, loans should be approved for them on completion of their courses to establish agricultural enterprises like fish farms, poultry, farm settlement, orchards etc.

3.1.10 Extension Education

Government should establish well organized and functional agricultural extension services to carry the results of agricultural researches to our farmers. Functional extension services will ensure that farmers are

organized and occasionally, films and slides on different aspects of modernized agriculture should be shown to them. Through extension services farmers are taught to adopt better agricultural practices and minimize loss of soil fertility through erosion and leaching.

3.1.11 Establishment of Demonstration Farms and Film Shows

Government, through the ministries of agriculture and natural resources should, establish demonstration farms at strategic location all over the country. These experimented and demonstration farms are meant to serve as parameters for the farmers to meet and even surpass.

Agricultural shows should be organized from time to time and farmers should be encouraged to attend to display their product. Prizes should be awarded to deserving farmers to encourage them. Through the extension workers, government teaches the farmers on their own farms and even help them to carryout some of the operations in the farm.

3.1.12 Establishment of More Research Institutes

Government should establish more research institutes to cater for all aspects of agricultural production. The existing agricultural research institutes should be expanded so that they can carry out the necessary researches and develop new varieties of seeds and breeds or strains of livestock that will yield better results.

3.1.13 Provision of Subsidies on Farm Inputs

Government should assist in the production and introduction of improved seeds and more productive, disease resistant animals for use by farmers.

Agricultural subsidies should be given to the farmers by selling the necessary farm inputs such as fertilizers, insecticides, fungicides and animal drug to them at heavily subsidized rates. Subsidies involve selling at much lower rates than the actual cost of purchase or production in order to encourage a large number of the farmers who are poor to buy and use them. The same thing applies to farm tools and implements.

3.1.14 Establishment of Tractor Hiring Centres

Government should establish tractor hiring centres that will service the needs of farmers, particularly the large-scale ones. By so doing, farmers can mechanize their farms without necessarily buying the tractors and other heavy machineries and equipment themselves.

When such tractor-hiring units are established, government must ensure that they have in stock a good consignment of spare parts of various types to keep the machines in operation. Personnel that are also technically competent in the maintenances of these machines must be employed in reasonable numbers at these centres.

3.1.15 Improving Veterinary Services

The veterinary division of the Ministry of Agriculture should be made more functional and effective to give attention to the farmers' livestock. Veterinary units should be equipped enough to carryout artificial insemination of the various classes of female livestock with the imported semen or semen from improved males of local breed. This will upgrade the local stock without going into the expenses of buying and maintaining these expensive male breeds.

Government through veterinary division must enforce quarantine regulation within the country and at the borders to ensure that disease are not imported carelessly into the country.

3.1.16 Establishment of Young Farmers Club

Young farmers club is one of the voluntary organizations among secondary school students, presently only few secondary schools have functional young farmers club. The club is necessary to create awareness among the young ones, on the importance of agriculture to the economy. The presence of young farmers club will help to change the negative impressions that the youths have bout farming and will equally help to change the people's bad attitude towards agriculture. Through thees clubs, many youths have embraced agriculture. Government should therefore enforce the establishment of the clubs among secondary schools. The existing ones should be assisted to function properly.

Government can provide farm inputs and financial assistance to them to establish both crop farm and livestock production in their schools.

4.0 CONCLUSION

In this unit we have learnt about the solutions to the problems of agricultural development in Nigeria. It can be concluded from our various discussions, that if government can address these various suggestions, air agricultural sector will attain the desired level of development. Secondly, apart from government, all other agencies that are connected with agricultural development e.g. Banks; Non-

governmental organizations etc. have major roles to play in solving the problems of agricultural development in Nigeria.

5.0 SUMMARY

In this unit 4, we have suggested the following solutions to the problems of agricultural development in Nigeria:

- Enforcement of land use decree in rural areas
- Provision of infrastructural facilities
- Formation of cooperative societies
- Provision of credit facilities
- Establishment of efficient communication system
- Efficient transportation system
- Provision of storage facilities
- Mass literacy programmes for farmers
- Promotion of agricultural education
- Extension education programme
- Establishment of demonstration farms and agricultural shows
- Establishment of more research institutes
- Provision of subsidies on farm inputs
- Establishment of tractors-hiring centres
- Improving veterinary services, and
- Establishment of young farmers club

6.0 TUTOR-MARKED ASSIGNMENT

In what ways can government assist in the development of agriculture in Nigeria?

7.0 REFERENCES/FURTHER READINGS

- Akinyosoye V.O and Babatunde G.M. (1986). *Model Questions and Answers and Objective Tests in Agricultural Science*. Ibadan: Heinemann Educational Books (Nig) Ltd.
- Anyanwu A.C., Anyanwu B.O. and Anyanwu V.A. (1986). *Agriculture for School Certificate (Fourth Edition)*. Onitsha: Africana-Fep Publishers Ltd.
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UNIT 5 AGRICULTURAL SYSTEMS (FARMING SYSTEMS

CONTENTS

- 1.0 Introductions
- 2.0 Objectives
- 3.0 Main Content
 - 3.1 Agricultural Systems
 - 3.2 Farming Systems
 - 3.2.1 Shifting Cultivation
 - 3.2.2 Bush Fallowing or Land Rotation
 - 3.2.3 Mixed Farming or Alternate Husbandry
 - 3.2.4 Nomadic Pastoral Farming
 - 3.2.5 Ranching
 - 3.2.6 Ley Farming
- 4.0 Conclusion
- 5.0 Summary
- 6.0 Tutor-Marked Assignment
- 7.0 References/Further Readings

1.0 INTRODUCTION

In unit 4, we discussed what government and other agencies can do to solve the problems of agricultural development in Nigeria. Some of the suggested solutions include:

- Enforcement of land use decree in rural areas
- Provision of infrastructural facilities
- Formation of cooperative societies
- Provision of credit facilities
- Efficient communication system
- Efficient transportation system
- Provision of storage facilities
- Mass literacy programmes
- Promotion of agricultural education.

Others include:

- Extension services
- Demonstration farms and research institutes
- Subsidies on farm inputs
- Tractor-hiring centres
- Veterinary services and establishment of young farmers club.

In this unit, we shall discuss an aspect of agricultural system called farming system.

2.0 OBJECTIVES

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

- explain the meaning of agricultural systems
- list at least five (5) farming systems
- define the following farming systems:
 - shifting Cultivation
 - bush Fallowing or Alternate Husbandry
 - nomadic Pastoral Farming
 - ranching
 - ley Farming
- mention at least one advantage and one disadvantage of each system

3.0 MAIN CONTENT

3.1 Agricultural Systems

Agricultural systems are the different ways in which farmers cultivate crops and rear animals for use by man. In different parts of the world and at various times in man's history, different systems of farming have been used. In these systems, the aim of the farmer 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 production.

The system of farming adopted in an area should be the one best suited for the area. Certain factors determine the farming or cropping systems of an area. These factors may be one or combination of the following:

- Economic factor
- Cultural factor
- Environmental factor
- Level of technology etc

Broadly, man's activities in agriculture can be grouped into two main systems:

- Farming Systems, and
- Cropping Systems

However, this classification is not rigid as some people use the two terms inter-changeably. There should be no argument about this classification, what is important is for you to understand the individual system.

3.2 Farming Systems

Gradually and over many years ago, a number of different farming systems have been evolved. Some of these systems are practiced among farmers in certain small communities while other systems have wider applications. The main farming systems in Nigeria include:

- Shifting Cultivation
- Bush Fallowing or Land Rotation
- Mixed Farming or Alternate Husbandry
- Nomadic Pastoral Farming
- Ranching
- Ley Farming

3.2.1 Shifting Cultivation

This is a system of farming in which the farmer clears a piece of land of its natural vegetation and plants his crops and after some few years when the land is no longer fertile, he leaves it for another piece of land without any intention of coming back to it. The system is associated with unlimited supply of land and low population density. It happens to be the earliest system of agriculture. It is often called hoe tillage system.

Nowadays, because of the increase in Nigeria's population and the need for the farmers to feed the non-farming population, shifting cultivation is not only undesirable but also impracticable.

Advantages of Shifting Cultivation

- The system helps the soil to return to its natural state without the use of fertilizer
- It is cheap to operate-involves the use of crude implements
- It checks pests and diseases

Disadvantages of Shifting Cultivation

- The system wastes land requires large area of land
- The system also wastes money, time and energy in clearing and cultivating new areas
- It exposes new land to soil erosion

- It can not be practiced in high population density area
- The system does not allow the growing of permanent crops
- The system encourages burning of virgin land thereby reducing microbial activities.

3.2.2 Fallowing or Land Rotation

When man established a permanent home, he was forced to modify shifting cultivation. The pressure of the expanding population forced him to assume ownership of different plots of land. As the growth of population continued, shifting cultivation had to be modified into bush fallow or plants fallow.

Bush fallow involves growing crops on a piece of land until it is no longer fertile. The land is then allowed to lie fallow for some years to regain its fertility before it is used again. Meanwhile the farmers clear other areas in succession to make new farms. This is why it is often referred to as land rotation.

If perennial legume crops like pigeon pea is planted in place of natural grasses, the system is called plant fallow.

Advantages of Bush Fallowing

- The system allows land to regain its natural fertility without the addition of fertilizer
- The system helps to check some plant diseases because when farmlands are left to fallow the disease organisms lose their host and die.
- The system is cheap- requires the use of crude implements like hoe and cutlass.

Disadvantages of Bush Fallowing

- The system cannot be practiced where there is thick population
- Exposes land to soil erosion
- Valuable forest resources are destroyed through extensive land clearance.
- Time, money and energy are wasted in preparing new land.

3.2.3 Mixed Farming or Alternate Husbandry

Mixed farming involves growing crops and keeping animals in the same system of farming. In these system animals such as cattle, sheep and goat may be kept in one portion of the land, while crops like maize,

sorghum and cowpea are cultivated in another portion of the land. The system is referred to as alternate husbandry if the portion used for rearing animals last season is used for crop cultivation this season and the portion for crop production used for animal rearing in alternation. The operator of this system must take adequate precaution so that the animals do not destroy the growing crops.

Advantages of Mixed Farming

- Fertility of the soil is maintained by using the droppings from farm animals
- It forms a good source of balanced diet
- Animals can be used to plough the land for crop cultivation
- It guides against failure of the farm
- The by-products from the farm are properly utilized for animal feed.

Disadvantages of Mixed Farming

- It can result in soil erosion if there is overstocking of the animals
- Management of the system may not be efficient
- The system may not necessarily increase agricultural production in commercial quantity
- Either the animals or crop production may succeed at the expense of the other

3.2.4 Nomadic Pastoral Farming

This is the system of farming whereby only grazing livestock are kept. The herdsman moves about with his flock. He has no permanent settlement. The flock may be cattle, sheep, goat or combination of these.

His aim is to feed his flock, to fatten well and breed well. He may also move in order to avoid disease areas or areas infested with pest like tsetse fly.

Advantages of Nomadic Farming

- It is a cheap means of producing meat and milk
- Not much labour is involved as in other systems
- Animals grow in their natural habitat

Disadvantages of Nomadic Farming

- It is unprofitable in terms of milk production
- It takes more from the soil than it gives
- The animals loss weight as a result of long trekking
- Diseases are easily transmitted or contacted
- There is no controlled mating or selection
- Overgrazing can lead to soil erosion

3.2.5 Livestock Ranching

Livestock ranching or settled pastoral farming is a development of nomadic grazing. This is a settled form of livestock farming where the major or perhaps the sole source of farm income is the keeping of grazing livestock.

The land is used all the time so efforts must be made to maintain the fertility of the land and prevent overgrazing. This can be done through the practice of paddock system i.e. the system of fencing and dividing the grazing land into sections. Provision must also be made to maintain water supply for the stock and care should be taken to maintain and improve breeds.

Advantages of Ranching

- Animals are easily identified
- The animals are generally well fed and protected
- Disease control is easier
- Controlled mating and selection of cattle from breeding can easily be done

Disadvantages of Ranching

- Labour requirement is high
- The cost of establishing a ranch is much

3.2.6 Ley Farming

Ley farming is a system of combining pastures with crop production in alternation. After an arable crop is harvested, the land is put under pasture and grazed for one or more seasons before it is again ploughed for the planting of arable crops. The major difference between ley farming and planting fallow is that in ley farming the plant is specifically for grazing. In ley farming there is also a specific period of alternation between the pasture and the arable crop.

The planted pasture is usually a mixture of grasses and legumes with different grazing characteristics.

Advantages of Ley Farming

- The livestock are fed well
- There is no scarcity of feed
- Excess pasture from the ley can be processed into hay and silage
- The soil is occupied throughout the year
- The arable crops also derive manure from the pasture

Disadvantages of Ley Farming

- Overgrazing can lead to soil erosion
- Overgrazing can also lead to nutrients deficiencies

4.0 CONCLUSION

In this unit you have learnt about the farming systems practiced in different parts of Nigeria. Some of these systems emanated as a result of advancement in civilization. The systems will continue to be modified as man advances in technological development.

5.0 SUMMARY

The main points in this unit include the followings:

- Agricultural systems are classified into two groups:
 - farming system
 - cropping system
- Examples of farming system include:
 - Shifting cultivation
 - Bush fallowing
 - Mixed farming
 - Nomadic pastoral farming
 - Livestock ranching
 - Ley farming
- There are advantages and disadvantages attached to each system
- The system adopted by individual farmers will depend on a number of factors like economic, social, cultural and environmental, and the level of technology.

6.0 TUTOR-MARKED ASSIGNMENT

Discuss the meaning, advantages and disadvantages of any two of the following systems:

- a. Bush Fallowing
 - b. Mixed Farming
 - c. Nomadic Farming
 - d. Ley Farming
-
2. (a) What is agricultural system?
 - (b) Describe two farming systems commonly practiced in Nigeria.

7.0 REFERENCES/FURTHER READINGS

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UNIT 6 AGRICULTURAL SYSTEMS (CROPPING SYSTEMS)

CONTENTS

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Main Content
 - 3.1 Cropping Systems
 - 3.1.1 Mono-Cropping or Sole Cropping
 - 3.1.2 Mixed Cropping
 - 3.1.3 Crop Rotation
 - 3.1.4 Continuous Cropping or Monoculture
 - 3.1.5 Multiple Cropping
 - 3.1.6 Interplanting
 - 3.1.7 Inter Cropping & Catch Cropping
 - 3.1.8 Relay Cropping
- 4.0 Conclusion
- 5.0 Summary
- 6.0 Tutor-Marked Assignment
- 7.0 References/Further Readings

1.0 INTRODUCTION

In the last unit, we discussed the essential farming systems practiced in Nigeria. The major ones discussed include:

- Shifting cultivation
- Bush fallowing
- Mixed farming
- Nomadic pastoral farming
- Livestock ranching
- Ley farming.

Emphases were laid on their advantages and disadvantages.

In this unit, we shall discuss the cropping systems commonly practiced in Nigeria.

2.0 OBJECTIVES

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

- explain the meaning of cropping system
- list at least five cropping systems practiced in Nigeria

- give the definition of at least five of the following systems:
 - Mono-Cropping
 - Mixed Cropping
 - Continuous Cropping
 - Multiple Cropping
 - Crop Rotation
 - Inter Planting
 - Inter Cropping, and
 - Relay Cropping
- mention one advantage and one disadvantage of at least four of the cropping systems.

3.0 MAIN CONTENT

3.1 Cropping System

Cropping system may be regarded as the various patterns which the farmer adopts in planting his crops in the farm. They involve the ways the farmer arranges his various crops in the farm. The following systems are involved:

- Mono-Cropping
- Crop Rotation
- Continuous Cropping or Monoculture
- Multiple Cropping
- Inter Planting, and
- Relay Cropping

3.1.1 Mono-Cropping or Sole Cropping

Mono-cropping or sole cropping may be regarded as the practice of planting one crop at a time in a plot and harvesting it before another crop is planted on the same plot.

Mono cropping is usually associated with mechanized agriculture in which cereal crops are planted. In Nigeria, crops like cowpea, groundnut, yam etc. are also grown under sole cropping especially on experimental farm. Some people consider monoculture i.e. the growing of perennial crops like cocoa as mono-cropping.

Advantages of Mono-Cropping

- The farmers can become experts in the operations involved in the production of that crop
- Farm mechanization is possible
- The system improves yield and quality of crop
- Pest control is easy under this cropping system

Disadvantages of Mono-Cropping:

- Mono-cropping can result in the loss of revenue in case of crop failure affecting the particular crop.
- It builds up pests, weeds and diseases. This is because the host plant is available all the year round.
- Constant fertilizer application to replenish the soil of the nutrients taken up by the plant is necessary.
- The operator of this system will have to depend on other farmers for other food crops which he does not produce.

3.1.2 Mixed Cropping

Mixed cropping means planting more than one type of crop on the same plot of land at the same time. Yam and sorghum can be grown in this way. Other examples include:

- Millet and guinea corn
- Yams okro and pepper
- Cocoa and bananas etc.

This is the most popular cropping system adopted by rural farmers in Nigeria.

Advantages of Mixed Cropping

- It makes very effective use of the available soil nutrients during a growing season.
- Pests and diseases cannot easily spread as when a single crop is grown.
- If legumes are included, they will raise the nitrogen status of the soil
- It guides against total crop failure. If one crop fails the second one may survive.
- The mixtures ensure efficient coverage of the soil to guide against soil erosion and also suppress weeds.

Disadvantages of Mixed Cropping

- The yields of individual crops are not as high as when planted alone.
- The use of combined harvester and other post planting mechanical devices may be impossible.
- There is difficulty in pest and disease control especially when the crops mature at different times or do not belong to the same family.
- Labour cost per hectare is increased.
- The young crops may be trampled under foot during the harvesting of older crops.
- The fertilizer mixture suitable for one of the crops may not be suitable for other crops.

3.1.3 Crop Rotation

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

Principles of Crop Rotation

Crop rotation means a fixed sequence of growing different crops on a particular piece of land at different times. This definition suggests that before starting a rotation, it is necessary to decide the order in which the crops will follow. The following are the principles guiding the pattern of rotation:

- Shallow rooted crops should not follow each other in the rotation e.g. cereal crops should not follow each other.
- Similarly, deep rooted crops should not follow each other e.g. tuber crops should not follow each other.
- Crops that are likely to be affected by the same disease should not follow each other.
- Crops that will require the same soil nutrients should not follow each other.
- Crops that leave residual substance in the soil which may adversely affect next crops should not be considered in the sequence.

Plan of a Rotation

The number of crops involved in the rotation usually denotes the type of rotation. For example, where four different crops are grown in sequence over a period of four years, the rotation is called a four year crop rotation.

Four Year Crop Rotation

YEAR	PLOT A	PLOT B	PLOT C	PLOT D
YEAR I	MAIZE	COWPEA	YAM	GROUNDNUT
YEAR II	COWPEA	YAM	GROUNDNUT	MAIZE
YEAR III	YAM	GROUND NUT	MAIZE	COWPEA
YEAR IV	GROUN DNUT	MAIZE	COWPEA	YAM

Advantages of Crop Rotation

- It facilitates the control of weeds, pests and diseases.
- It makes for effective utilization of plant nutrients
- Under a very good system of rotation, the fertility of the soil is maintained
- There is efficient utilization of labour.
- Soil is put into maximum use without necessarily destroying it.
- The system gives reasonable output when compared with the cost of production.

Disadvantages of Crop Rotation

- The system is complex and not all farmers can practice it.
- The practice of intercropping, interplanting and fallowing is difficult under this system.
- There is gradual decrease of crop yield as a result of continuous cropping.
- Farm mechanization may be difficult if the available land for this system is small.

3.1.4 Continuous Cropping or Monoculture

This is the growing of the same crop on the same piece of land continuously from year to year. This may apply to both annual crops like yam, cassava, maize and rice and perennial crops like cocoa, rubber, palm oil tree and sugar cane.

The practice of growing perennial crops on a piece of farm land is referred to as permanent or plantation agriculture because they remain on the farm land for many years. Most of these crops are known as cash crops because their products enter into national or international markets.

Advantages of continuous cropping are the same as in mono-cropping

Disadvantages of continuous cropping are also the same as in mono-cropping.

3.1.5 Multiple Cropping

This is the practice of growing different crops on separate plots of land. The system is similar to that of mixed cropping in that more than one crop are planted on a piece of land at the same time. The difference is that in mixed cropping while all the crops involved are planted on the same row or heap, in multiple cropping each crop is allowed to stand on separate rows or plots.

For example, the first plot or row on a piece of farm land can be cowpea, the second row or plot can be groundnut and the third row or plot can be maize. If properly operated the system has the same advantages with crop rotation. The major difference between this system and crop rotation is that in multiple cropping there is no attempt to follow any definite pattern of planting.

Advantages of multiple cropping are the same as mixed cropping

Disadvantages of multiple cropping are the same as mixed cropping

3.1.6 Inter-Planting

It involves the growing of one major crop in between another major crop in the same piece of land.

In this system, the crop planted first is harvested first, leaving the latter crop on the plot. For example, yam is planted and later cassava is interplanted with it. While yam is harvested cassava still remains.

Advantages of interplanting are the same as mixed cropping.

Disadvantages of interplanting are the same as mixed cropping.

3.1.7 Intercropping or Catch Cropping

This is the planting of quick growing and quick maturing crops in between slow growing and slow maturing crops. i.e. the first crop planted is harvested last.

For example, yam is planted first and later intercropped with okro and maize, okro and maize are harvested before yam.

In plantation agriculture, intercropping is popularly called catch cropping. Example is the growing of maize, millet, sorghum or cowpeas in cocoa, rubber or oil-palm plantations. The idea is that farmers will have something to rely on while waiting for the plantation crops to mature for harvesting.

Advantages of intercropping are the same as mixed cropping.

Disadvantages of inter cropping are the same as mixed cropping.

3.1.8 Relay Cropping

This occurs when one sole crop is planted and harvested or about to be harvested before another sole crop is planted in the same piece of land. Up to three different sets of sole crops may be planted in this way on a piece of land within one year provided the soil fertility can sustain it and there is enough rainfall. Vegetables are very suitable for this system of cropping.

Advantages of relay cropping

- There is maximum utilization of soil nutrients
- Farmers are fully engaged throughout the growing season i.e. full utilization of Labour.

Disadvantages of relay cropping

- Can lead to depletion of soil nutrients
- Require the addition of fertilizer and other farm inputs.

4.0 CONCLUSION

In this unit 6, you have learnt about the cropping systems practiced in different parts of Nigeria. Just as we conclude in unit 5, all these cropping systems will continue to undergo modifications as agricultural development continues.

SELF-ASSESSMENT EXERCISE

- (a) What is crop rotation?
- (b) Design a four year crop rotation for your college farm
- (c) What are the principles guiding your design?

5.0 SUMMARY

A summary of the major points in this unit:

1. The cropping systems discussed in this unit include:
 - Mono-cropping
 - Mixed cropping
 - Crop rotation
 - Continuous cropping or monoculture
 - Multiple cropping
 - interplanting
 - Intercropping or catch cropping and
 - Relay cropping.
2. Mixed cropping, Interplanting, intercropping and multiple cropping are similar in principle- i.e. involve planting of more than one crop at the same time on the same piece of land.
3. Mixed cropping, interplanting, intercropping and multiple cropping share the same advantages and disadvantages
4. Continuous cropping is known as monoculture under plantation agriculture
5. Intercropping is known as catch cropping under plantation agriculture
6. There are advantages and disadvantages attached to each system

6.0 TUTOR-MARKED ASSIGNMENT

Discuss the meaning, advantages and disadvantages of any two of the following cropping systems:

- Monoculture
- Mixed cropping
- Monocropping
- Relay cropping

7.0 REFERENCES/FURTHER READINGS

- Anyanwu A.C. Anyanwu B.O. and Anyanwu V.A. (1986). *Agriculture for School Certificate (Fourth Edition)*. Onitsha: Africana-Fep Publishers Ltd.
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MODULE 2

Unit 1	Concept of Nutrition
Unit 2	Food Nutrients - Carbohydrates
Unit 3	Food Nutrients - Proteins
Unit 4	Food Nutrients – Lipids and Water
Unit 5	Food Nutrients-Minerals and Vitamins
Unit 6	Balanced Rations and Malnutrition

UNIT 1 CONCEPT OF NUTRITION

CONTENTS

1.0	Introduction
2.0	Objectives
3.0	Main Content
3.1	Meaning of Nutrition
3.2	Food Stuff
3.3	Causes of Food and Nutritional Problems
3.4	Solution to Food and Nutritional Problems
4.0	Conclusion
5.0	Summary
6.0	Tutor-Marked Assignment
7.0	References/Further Readings

1.0 INTRODUCTION

In unit 6, we discussed the concluding part of agricultural systems which is cropping systems. Some of the cropping systems discussed include:

- Mono-cropping
- Mixed cropping
- Crop rotation
- Continuous cropping
- Multiple cropping
- Interplanting
- Intercropping and
- Relay cropping.

Their meanings, advantages and disadvantages were highlighted. In this unit, we will look at the concept of nutrition. Under the concept of nutrition we will discuss the meaning of nutrition, classify food stuff, highlight the causes of food and nutrition problems and suggest solutions to them.

2.0 OBJECTIVES

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

- define nutrition
- classify food stuff
- list some of the causes of nutritional problems
- suggest at least four solutions to nutritional problems.

3.0 MAIN CONTENT

3.1 Meaning of Nutrition

Ene-obong (2001) defined food as any substance-liquid or solid, which when consumed is capable of performing one or more of the following functions:

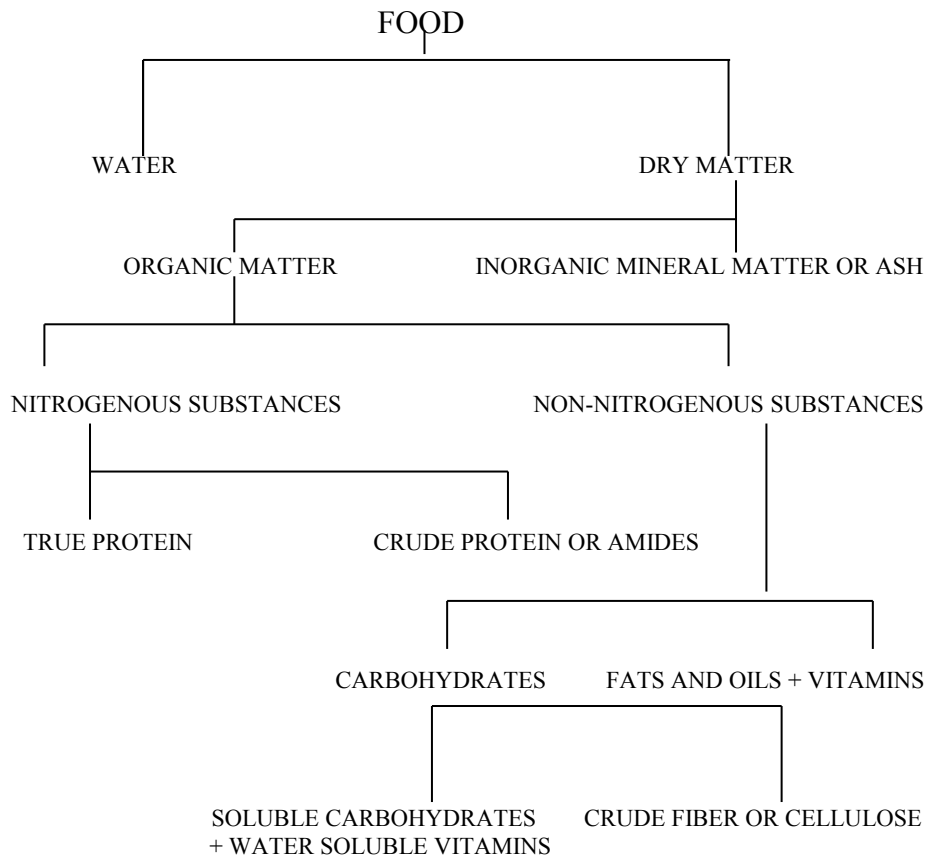
- Provide the body with energy to work
- Provide the materials that are used for growth, repair, maintenance, reproduction etc.
- Protect the body against disease, and regulate body processes.

Food is therefore the first necessity of life and the most important factor in relation to the building and maintenance of life.

The study of the use of food in the body and the interpretation of the relationship between food and the functioning of the living organism is what we refer to as nutrition. In other words, nutrition is defined as the science of feeding and the scientific investigations into the food supplied or fed. The materials in food that perform the functions of energy provision, growth, repairs and regulation of body functions are known as nutrients.

3.2 Food Stuffs

Food stuffs vary in composition and nutrient contents. Succulent foods are rich in water, while grains are regarded as dry food. Food may also be classified based on their nutrient contents e.g. carbohydrates, proteins, fats, minerals and vitamins. Whatever the methods of classification, food stuffs must generally provide all the nutrient requirements and it is essential to study how best these allowances can be met by a combination of suitable foodstuffs.



The feeding stuffs of domestic animals may be taken to consist of some of the following groups of feeds:

- Energy feeds
- Plant and animal by-products
- Food additives, and
- Forage

This classification is based on the nutrient composition of the feed, the use of the feed and the bulkiness.

(i) Energy Feeds

The feeds that belong to this group are the:

- Roots and tubers such as cassava, yam and potatoes
- Cereals such as maize, sorghum, millet and rice
- Other seeds of energy origin that do not belong to the above groups e.g. cowpea, Soya-beans, groundnut etc.

Roots and tubers are high in energy content but low in protein content. Yams are usually consumed by human beings and therefore generally

not grown for livestock feeding. Cassava and potatoes are produced both for livestock and human consumption. The dry matter content of roots and tubers is very small. They supply very little vitamins and are low in calcium but have a fair amount of phosphorus. They are highly digestible, and can be processed and made into meals.

Cereals are very important in the feeding of livestock especially non-ruminants. Human beings also compete with livestock for cereals. Cereals are high energy feeds with appreciable amount of protein. Their fiber content is low and most of them lack essential amino-acids, minerals and vitamins.

Legumes in addition to being used extensively as forages provide seeds which have high protein content. Legume seeds are generally deficient in methionine which is one of the essential amino-acid. The meals got after extracting the oil are very good feeding stuffs for livestock.

ii Plant and Animal By-Products

Plant and animal by-products are normally referred to as concentrates. They are feeds prepared from cereals and other materials used in feeding farm animals. Concentrates consist of the followings: carbohydrate products such as processed wheat, maize, millet, sorghum, plant proteins such as groundnut cake, cotton seed cake, Soya-beans cake etc. roots and tubers processed into pellets etc. animal protein such as fish meal, bone meal, blood meal and miscellaneous by-products such as wheat bran, rice bran, maize bran, brewers yeast and grains.

Plant and animal by-products are used to feed livestock to supply all the necessary requirements of the body for the optimum growth and production of meat, milk, egg, wool, hides and skins etc.

iii Forages

Forages are characterized by the relative large amount of crude fiber. That their dry matter contains forages constitute complete food for ruminant farm animal as long as they are not grown on soils that are deficient in essential nutrients.

Forages consist of the following: plant legumes such as centrosema, pueraria, stylosanthes, calapogonium etc., grasses such as guinea grass, elephant grass etc., roughages like hay, straws, dry grasses and haulms from maize, sorghum, rice, millet, groundnut etc.

iv Food Additives

Most feeding stuffs are deficient in the essential amino-acids, vitamins and mineral nutrients. It may not be possible to supplement all the require nutrients through the feeds. It becomes necessary therefore to look for other sources of making up for the deficiencies. This can be done through the addition of food supplements called food additives. Compounds of animal feeds normally add vitamins, minerals, amino-acids and growth stimulating compounds to the rations.

Examples of food additives include:

- Antibiotics
- Hormones
- Synthetic and natural vitamins
- Salts
- Proteins
- Amino acids like lysine
- Pre-mix
- Anti-oxidants
- Grits
- Anti-fungal
- Drugs etc

3.3 Causes of Food and Nutritional Problems

Food and nutritional problems arise as a result of the following factors:

(i) Storage Problems

One of the major problems affecting food quality is lack of adequate storage facilities. This problem results in reduction in the food values of some stored grains e.g. the loss of protein, carbohydrates, vitamins and mineral contents. Loss in quality of food also results in change in colour, taste, appearance, shape, size, smell, flavour, and the presence of impurities etc., and thus the inability to meet consumer needs.

When food stuffs are kept for sometimes after harvest, they are attacked by insects, mice, rats, rodents, birds, bacteria, fungal etc. The varying quantities of water or moisture are also reduced by the process of drying.

Moulds, which are tiny plants also attack crops in storage. Moulds make the crop to develop foul odour and change the colour of the food they attack.

ii. Micro-Organisms Attack

Micro organisms such as bacteria, virus, fungi etc attack food stuffs both on farmland and during storage. These micro-organisms attack crop plants and their products causing deformities and reduction in their sizes. Micro-organisms also cause a lot of damages to our livestock and their products especially milk and eggs. Contamination of food products by micro-organisms is responsible for the transmission of majority of human diseases.

iii. Insect Pests

Food spoilage also results from insect attack. Insects such as grasshoppers, locust, beetles, larvae or caterpillars etc attack mostly growing crops and their products. Beetles attack mostly tuber of crops, while grasshoppers, locust and caterpillars attack the leaves of vegetables and crops.

Insect pests like weevils attack foodstuffs especially during storage reducing both the quality and the quantity. Grains are mostly affected by weevils. Insects such as tsetsefly, housefly etc transmit diseases to domestic animals thereby reducing the quality of their products. They also cause reduction in the weight of the affected animal.

iv. Rodents Attack

Rodents such as rats, mice, grasscutter, squirrels etc. attack food crops both before harvest and after harvest. Rodent attacks result in material losses and loss in quality of food. Rodents may not be a serious problem in livestock farming.

v. Physical and Mechanical Damages

Damages can occur to food stuffs as a result of handling and transportation. Physical and mechanical damages can occur through desiccation, bruises, breakages, milling, gain of moisture etc.

vi. Illiteracy Level of the People

Illiteracy level of the people is very high and this has negative effect on the food and nutrition needs of the society. Even when the foods are available, some illiterate people are not aware of the right combination of the food items to eat. Apart from eating balance diet, different categories of people require different combinations of food, working adult, pregnant women, children and infants require different combinations and quantities of food items.

vii. Poverty Level of the People

Substantial percentages of Nigerians are living below the poverty line. This is a critical situation because even when people know what to eat they cannot afford them. This is the reason why some people depend on the same type of food for many days. In rural villages some people depend wholly on cassava and yam for more than one month.

viii. Socio-Cultural Factors

Culture and social life of the people also contribute to food and nutrition problems. In some villages it is a taboo to eat new yam before the celebration of New Year festival. Some villages have established some relationship with some animals, as such they do not kill or eat such animals. Some people believe that serving egg to children will make them to steal. On religious grounds, Moslems do not rear or eat pig. There are other crops and animals that are forbidden based on cultural beliefs.

SELF-ASSESSMENT EXERCISE

List and discuss any five major problems facing food and nutrition in Nigeria.

3.4 Solutions to Food and Nutritional Problems**A. Controlling Agents of Food Deterioration**

Food deterioration is caused by micro-organisms. These micro-organisms are living things that require oxygen, optimum temperature, moisture and other medium to survive. Activities of these organisms can be controlled by making one or more of these conditions unbearable for them.

For example, when food is stored in air tight container, all metabolic activities will cease after sometime. There after no micro-organism can survive in the food container again. Similarly, if moisture content of any food is reduced to 10%, the food will be protected from deterioration. If the temperature of any food item is too high or too low, no micro-organism can survive and the food will remain preserved. Chemicals are also used to control agents of food deterioration e.g. organic acids, fumigants, insecticides etc. They are mostly effective when used along with any of the above methods.

B. Storing of Grains

Grains constitute the major part of staple food in Nigeria. Examples of cereal grains found in Nigeria are maize, sorghum, millet, wheat, rice etc., while legume grains include cowpea, groundnut, Soya-beans, Bambara nut etc. Different methods are available for preserving these grains depending on the quantity, state of harvest, content and many other factors.

The modern way of storing large quantities of grains is through the use of silos. These are elevated cylindrical containers usually made from metal (aluminium). Dried grains can be stored in sacks and placed on an elevated platform. The sacks are placed under shelter to prevent rain from soaking the grains. Smoke or chemicals can be used to keep away insects from attacking the grains. Grains can also be stored in baskets and placed on top of platforms. This is done to keep off rodents from attacking them.

Rhumbuses are local constructions used mainly in the northern part of Nigeria for storing dried cereals. The body is made up of clay, while the roof tops are covered with thatched grasses. Other methods like barns, pots cribs etc are all local and crude means of preserving agricultural products.

C. Root and Tuber Storage

Roots and tubers like yam and cassava contain large quantity of water. They are usually exposed to the atmosphere to attain some levels of dryness before storage. Roots and tubers can be stored in the barn but there must be free flow of air to cool the tubers. Sprouts should be removed as they appear and any rotten ones should also be removed.

Trenches of varying sizes can be dug for storing tubers such as yam and cassava. The size will depend on the quantity of products stored. This method if properly carried out can store tubers for up to three months.

D. Reduction of Spoilage

Reduction of spoilage can be achieved through careful handling, harvesting, packing and transportation of farm products. Rough handling during packaging, harvesting, and transportation quicken spoilage of fruits and vegetables.

During harvests, fruits such as oranges, mangoes, bananas, apples, guavas etc should not be allowed to fall on the ground because the impact with the ground during the fall will initiate spoilages in them. Fruits that are carefully plucked last longer than those rough handled during different stages.

E. Food Processing

Food processing facilitates storage of agricultural products for a very long period of time thereby making them available all year round.

Some cereals can be processed by removing the grains from the stalk e.g. threshing sorghum, millet, rice etc. Some require shelling like maize. After threshing, shelling and winnowing they can undergo further processing like parboiling in the case of rice, milling in the case of all the cereals etc.

Tubers such as cassava can be processed into chips, flour and gari to enable them to be stored longer. Cocoa is usually fermented, dried and ground into paste before packing as beverage.

F. Storage of Fruits and Vegetables

Fruits and vegetables can be packed in perforated boxes or cartons to protect them from compression under pressure. It will also allow proper ventilation.

Refrigeration and freezing can be used to preserve processed foods, fruits and vegetables. This involves keeping the food items very cold below room temperature. Under this condition the micro-organisms which cause food spoilage are kept inactive as long as the food items remain cold.

Pasteurization is the process of heating food items in order to destroy most micro-organisms present in them. Milk may be preserved through this process before storing it in a refrigerator to preserve the fresh taste. Fruits may be preserved by processing them into canned foods. Canning of food involves treating the food materials and then storage in air tight tin cans. This process can keep food items for about six months without spoilage.

SELF-ASSESSMENT EXERCISE

Explain in details any five steps that could be taken to reduce food and nutrition problems in Nigeria.

4.0 CONCLUSION

In this unit, you have learnt about the meaning of nutrition, categories of food stuff, causes of food and nutrition problems and solutions to the problems identified. From our discussions, it was discovered that there are many problems facing food and nutrition in Nigeria. The solutions discussed in this unit must be properly addressed before we can make progress on the quality of our food and nutrition in Nigeria.

5.0 SUMMARY

The main points in this unit include the followings:

- (a) Food is any substance eaten to make the body system function normally.
- (b) Nutrition is the study of the use of food in the body i.e. the science of feeding.
- (c) Food stuffs can be classified into four groups:
 - Energy feeds
 - Plant and animal by-products
 - Food additives, and
 - Forage
- (d) Food and nutrition problems occur as a result of the following factors:
 - Storage problems
 - Micro-organism attack
 - Insect pest
 - Rodents attack
 - Physical and mechanical damages
 - Illiteracy level of the people
 - Poverty level of the people
 - Socio-cultural factors
- (e) Solutions to the problems of food and nutrition include the followings:
 - Controlling agents of food deterioration
 - Storing of grains
 - Trenches for tubers
 - Careful handling during harvesting, packaging and transportation

- Food processing
- Refrigeration
- Pasteurization
- Canning

6.0 TUTOR-MARKED ASSIGNMENT

1. Define the following concepts:
 - i. Food
 - ii. Nutrition
2. Discuss four groups of feeding stuffs used in farm animal

7.0 REFERENCES/FURTHER READINGS

- Akinsanmi O. (1975). *Certificate Agricultural Sciences*. London: Longman Group Ltd.
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UNIT 2 FOOD NUTRIENTS - CARBOHYDRATES

CONTENTS

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Main Content
 - 3.1 Carbohydrates
 - 3.1.1 Classification of Carbohydrates
 - 3.1.2 Functions of Carbohydrates
 - 3.1.3 Effects of Carbohydrate's Deficiency/Excess
 - 3.1.4 Test for Carbohydrate
- 4.0 Conclusion
- 5.0 Summary
- 6.0 Tutor Marked Assignment
- 7.0 References/Further Readings

1.0 INTRODUCTION

In the last unit, we discussed the meaning of food, nutrition and nutrients. We also classified food stuffs into four major groups. We equally highlighted the problems of food and nutrition in Nigeria and finally, we discussed the solution to these problems highlighted. In this unit, attempt will be made to explain one of the constituents of food nutrition which is carbohydrate.

2.0 OBJECTIVES

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

- list the chemical compositions of carbohydrates
- classify carbohydrate into groups
- list at least five sources of carbohydrates
- list at least two functions of carbohydrates
- state the deficiency of carbohydrates.

3.0 MAIN CONTENT

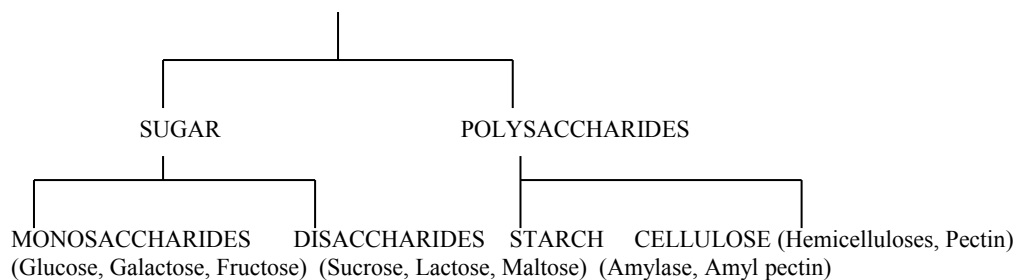
3.1 Carbohydrates

Carbohydrates are compounds containing carbon, hydrogen and oxygen combines in such a way that there are always twice as many atoms of hydrogen as that of oxygen (e.g. C₆ H₁₂ O₆ as in glucose). In order words the ratio of hydrogen to oxygen in carbohydrate is 2:1.

The major sources of carbohydrates include cereals e.g. maize, sorghum, millet, rice, wheat etc; roots and tubers e.g. yam, cassava, cocoyam, potatoes etc, legumes e.g. cowpea, groundnut, bambara nut, Soya-beans, pigeon peas etc, and starch fruits like plantain and banana.

3.1.1 Classification of Carbohydrates

CARBOHYDRATES



Carbohydrates may be classified as monosaccharide, disaccharides or polysaccharides by the number of sugar units they contain. Monosaccharide contains 1 sugar unit, disaccharides contain 2 and polysaccharides contain 3 or more.

Polysaccharides are often referred to as complex carbohydrates because they contain long chains of sugar units whereas monosaccharide and disaccharides are simple carbohydrates. The difference is important to nutritionist because complex carbohydrates take longer to metabolize since their sugar units are processed one-by-one off the ends of the chains. Simple carbohydrates are metabolized quickly, and this raises blood sugar levels more quickly resulting in rapid increase in blood insulin levels compared to complex carbohydrates.

Monosaccharide and disaccharides are usually called sugar while polysaccharides are divided into starch and cellulose.

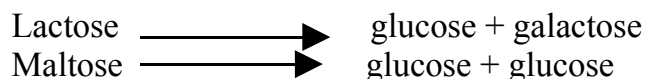
Monosaccharide

These are the simple sugars called reducing sugars. They include glucose, fructose (fruit sugar) and galactose. Monosaccharides are generally represented by the formula $C_6H_{12}O_6$.

Disaccharides

Disaccharides are the complex sugars. They have the molecular formula $C_{12}H_{22}O_{11}$. Examples of disaccharides include lactose (milk sugar), maltose (malt sugar) and sucrose (cane sugar). Lactose has two sugar or monosaccharide units – glucose and galactose. Sucrose is a combination of glucose and fructose while maltose has two glucose units.

Sucrose \longrightarrow glucose + fructose



Starches

These are the most abundant carbohydrates in man's diet. Some are digestible others are not digestible. The indigestible starches are also called resistant starches. Digestible starches are subject to enzymes digestion. Enzymes break them down into simple sugars especially glucose.

Starches can be classified as:

- Rapidly digested starch: this group of starch is found in raw cereals. Their digestion is slow but complete. The starch is converted to glucose after about 2 hours of enzyme actions on them.
- Resistant starch: These groups of starch are resistant to digestion.

Starch is stored in the form of granules in various parts of the plant and used as food by both the plants and animals that fed on them. Considerable quantities of starch are stored in the tubers of yam, cocoyam and cassava and in grains such as maize, sorghum, millet and rice.

The presence of starch in any foodstuff can be detected by applying two or three drops of iodine solution to the cut surface of the food material. Only starchy food turns the solution to deep-blue colour.

Cellulose

Cellulose belongs to another class of carbohydrates. Cellulose is formed through the process of polymerization of starch by plants. Cellulose is a white solid, insoluble in water and in alcohol. It is present in all cell-walls of plants. It is present in the pure form in cotton wool. All animals can digest starch, but not all animals can digest cellulose. Other polysaccharides that are of cell wall origin are hemi-cellulose and pectin.

Cellulose may or may not be fermentable in the large intestine. The non-fermentable polysaccharides passes through the alimentary canal unchanged. Fermentable ones can be acted upon by colonic micro flora to produce short-chain fatty acids, which can be used by the host animal.

3.1.2 Functions of Carbohydrates

- They are mainly used to provide energy needed for body processes.
- They also assist in body building and maintenance especially when protein is in short supply in the animal body.
- Similarly, carbohydrates have been found helpful during milk production.
- The central nervous system is entirely dependent on carbohydrate especially glucose.
- Carbohydrates when in excess can be converted to fat and the fatty acids produced contribute to the energy balance of the host.
- Carbohydrates like cellulose help to form softer bulky stools and speed up transit time through the digestive system.
- Cellulose and some other polysaccharides have been associated with provision of protection against colon and rectal cancer.

3.1.3 Effects of Carbohydrate's Deficiency/Excess

If carbohydrate is in short supply or lacking in the body, it can lead to the following problems:

- Emaciation: the animal will look bony and unattractive.
- The animal will be generally weak and dull.
- Such animal can easily be attacked by disease. It will lack resistance to disease attack.
- However, excess carbohydrate in human body is also bad as this can lead to diabetes i.e. too much of sugar in the blood. It has the same effect with shortage of carbohydrate in the body.

3.1.4 Test for Carbohydrates

(a) Iodine

A simple test for the presence of carbohydrate in food is done through the use of iodine solution. To carry out the test, the food item is cut and a solution of iodine is added on the cut surface. If the portion turns deep-blue, that confirms the presence of carbohydrate in the food material.

B. Fehling's Solution

i. Test for simple sugars

A test for simple sugars or monosaccharide such as glucose, fructose and galactose require preparing solution of the sugar. Add Fehling's solutions (A+B) to the sugar solution. Heat the combination for few

minutes. The presence of sugar will turn the blue colour solution to brick-red colour.

ii. Test for complex sugars and Polysaccharides

Complex sugars or disaccharides and polysaccharides require the process of hydrolysis before Fehling's solution can act on them. This is done by adding diluted hydrochloric acid to the sugar solution and later neutralizes it with sodium hydroxide. This process is capable of converting the carbohydrate into simple sugar. In the absence of hydrolysis, long boiling of the complex sugar can convert it to simple sugar. After the process of hydrolysis, Fehling's solutions can be added to the sugar solution and heat is applied until the solution changes colour to brick-red.

4.0 CONCLUSION

In this unit, you have learnt the meaning of carbohydrate, the components of carbohydrate and the sources of carbohydrate. We also discussed the classes of carbohydrates, functions of carbohydrates and the effects of shortage and excess of carbohydrate in the body. It was then concluded that carbohydrate is essential in the animal body but the excess or shortage of it will cause a lot of damages to the health of animals.

5.0 SUMMARY

You have learnt in this unit that:

- Carbohydrates are made up of carbon, hydrogen and oxygen.
- They include simple sugars such as glucose, fructose and galactose, disaccharides such as maltose, complex sugars such as starches, glycogen and cellulose.
- Very little quantities of carbohydrate occur in the animals' body as glycogen.
- The plant body is largely made up of carbohydrates which constitute at least 75% of the dry weight.
- They are products of photosynthesis in plants.
- Their primary dietary function is to supply energy to the animal, since they make up the largest fraction of the animal's food.
- They also provide the building store for other nutrients.
- Excess of carbohydrates in the animal is converted into fat and stored.
- Carbohydrates comprise two major fractions, the nitrogen-free extract which contains the solution sugars and starches and are

readily digested and the second fraction is the crude fiber which is largely cellulose, lignin, hemi-cellulose and is poorly digested.

- During digestion, carbohydrates are hydrolyzed into simple sugars mostly glucose before they are absorbed.
- Some of the main sources of carbohydrates in animal diets are maize, sorghum, millet, wheat, cassava, yam etc.

6.0 TUTOR-MARKED ASSIGNMENT

1. Discuss the nature and functions of carbohydrate in animal rations and give five examples of the feeding stuffs that are very rich in carbohydrate.
2. (a) Write short notes on the following classes of carbohydrate giving at least one example in each case:
 - i. Monosaccharides
 - ii. Disaccharides
 - iii. Polysaccharides(b) How do you test for the presence of starch in food?

7.0 REFERENCES/FURTHER READINGS

- Akinsanmi O. (1975). *Certificate Agricultural Sciences*. London: Longman Group Ltd.
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UNIT 3 FOOD NUTRIENTS - PROTEINS

CONTENTS

1.0	Introduction
2.0	Objectives
3.0	Main Content
3.1	Proteins
3.1.1	Sources of Proteins
3.1.2	Protein Quality
3.1.3	Classification of Protein
3.1.4	Proteins and Amino-Acids
3.1.5	Functions of Proteins
3.1.6	Deficiency of Proteins
3.1.7	Test for Protein Food
4.0	Conclusion
5.0	Summary
6.0	Tutor-Marked Assignment
7.0	References/Further Readings

1.0 INTRODUCTION

In unit 8, we learnt about food nutrient called carbohydrate. We discussed the chemical components of carbohydrate, sources of carbohydrate and the various classes of carbohydrates with their examples. We further discussed the functions of carbohydrate, the effects of shortage or excess of carbohydrate in the body and finally, how to test for the presence of carbohydrate in food items. In this unit, we are going to discuss another food nutrient called protein.

2.0 OBJECTIVES

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

- list the chemical compositions of protein
- list at least five sources of protein
- classify proteins into groups
- list at least five functions of proteins in the body
- state the deficiency of proteins in the body.

3.0 MAIN CONTENT

3.1 Proteins

Proteins are complex organic compounds which consist of carbon, hydrogen, nitrogen and oxygen. In addition some also contain sulphur and phosphorus.

The process of protein synthesis is started by plants, which cause simple sugars to react with nitrogen obtained from nitrates absorbed from the soil by the plants. Most of the proteins synthesis occurs in the green leaves, where the energy necessary is obtained from sunlight. In other parts of the plant the energy for protein synthesis is obtained by respiration. The elements sulphur and phosphorus which occur in some proteins are also obtained from the soil in form of sulphates and phosphates. Protein molecules are formed in plants by young amino-acid molecules together.

3.1.1 Sources of Proteins

Proteins can be obtained from animal and plant sources. Animal sources include all edible flesh of animal, all types of fish, eggs, milk, cheese, snail, larvae and insects. Plant proteins can be obtained from all legumes such as cowpea, groundnut, soybeans, bambara nut, and pigeon peas. Some little quantities of proteins can be obtained from cereal crops such as maize, sorghum, millet, rice, wheat etc.

3.1.2 Protein Quality

Protein quality refers to how adequate the amount of amino-acids supplied by the foodstuff's. Not all the proteins are of good quality in terms of the amino-acids contained in them.

Foods from animal sources supply all the essential amino-acids. These are complete proteins. Food from plant sources are incomplete proteins, because they are low in or lack one or more of the essential amino-acids. For example, legumes do not contain sufficient amounts of sulphur amino-acids (cystine and methionine) but have abundant lysine. Cereals do not have sufficient amount of lysine but contain enough sulphur amino – acids. This is why in nutrition it is advisable to practice a combination of legumes and cereal in a meal. For example, eating beans and rice together or at different meals over the course of the day, provides excellent quality protein. Plant sources supply all or much of the protein in the diets of vegetarians, who eat no meat. In addition, plant foods, which are often less expensive and lower in fat than meat, are an important supplementary source of protein for many non-vegetarians around the world.

The amino-acids needed for the formation of one unit of muscle must be present in the correct quantity and quality otherwise the tissue is not formed at all. This knowledge has to be borne in mind in meeting up the dietary amino-acids requirements of an animal.

Generally, the quality of protein food depends on two major factors. First is the amount of essential amino-acids contained in it. If one of the essential amino-acids is lacking or insufficient, the protein cannot be fully utilized for the synthesis of new tissues. Second is the capacity of the protein to be broken down by the enzymes of the intestinal tract (Digestibility).

Protein digestibility depends on a number of factors- the type of protein (plant or animal), the state of the protein, and the presence of substances that are capable of altering digestion and the enzymatic reactions of individuals to protein food.

3.1.3 Classification of Protein

There are four major groups of protein food. They include:

- simple proteins
- fibrous proteins
- conjugate proteins and
- derived proteins.

The simple proteins are the simplest form of proteins and they are mainly amino-acids.

Fibrous proteins are insoluble elastic proteins found in cartilage as collagen, in muscle as myosin, in hair and feather as keratin and in blood as fibrin.

The conjugate proteins are complex compounds of proteins and other compounds e.g. chromo-protein is a conjugate of proteins and various pigments.

The derived proteins cover all the proteins derived as a result of alteration of the naturally occurring proteins.

3.1.4 Proteins and Amino-Acids

Amino-acids are the building blocks of proteins. When proteins are eaten and digested they are broken down into their amino acids, which are absorbed and used to build muscles, bones, blood, hair, feathers, horns, enzymes and hormones. They can also be used for the provision of energy. The amino acids are the forms in which proteins are used in animal body, they are not stored but any excess of the body requirement may be broken down by a process called deamination or may be transferred to another compound by a process called transamination. Both of these processes take place in the liver and kidney. Urea for example is produced during deamination.

The most essential factor of proteins is the amino-acids. The usefulness of a protein material is measured in terms of the amino acids it can supply. The animal body however synthesizes some of the amino acids and the amino acids needed for building up the substances in the body have to be supplied from outside the body and this is through the diet.

Amino acids are therefore grouped into two-essential and non-essential. They are essential in the diet if they cannot be synthesized in the body and non-essential if they are not needed to be included in the diet since they are synthesized by the body. Much will depend again on the quantity synthesized. This will determine whether the amino acids are non-essential for both maintenance and production or for maintenance alone.

Amino acids being essential or non-essential depend on the species and the physiological stages of the animals. For example in human beings about twenty (20) amino acids have been identified. Of these eight (8) are said to be essential for adults and nine (9) essential for growing children.

The essential amino acids include:

- histidine (for children)
- isoleucine
- leucine
- lysine
- methionine
- phenylalanine
- threonine
- tryptophan
- valine.

The non-essential or dispensible amino acids include:

- Alanine
- Arginine
- Asparagines
- aspartic acid
- cystine
- cysteine
- glutamic acid
- glycine, praline
- serine and
- tyrosine.

In ruminant animals a lot of amino acids are synthesized in the reticulo-rumen and most of the amino acids are non-essential for these group of livestock. One amino acid essential in one specie of livestock may not be essential in another. This is why it is necessary to know each animal's requirement in order to supply the adequate food.

The protein needs of the body can be estimated using the body weight. For example, an adult human being needs about 1g of protein per kilogram body weight. Infants' need about 1.5g per kilogram body weight. In addition to the normal adult requirement, pregnant women need an extra 6g of protein.

3.1.5 Functions of Proteins

- Proteins are essential in the formation of oxygen-carrying pigment of the blood, and collagen antibodies in the chemical units of hereditary transmission.
- Proteins also help in tissue formation.
- Proteins are also essential in cell membrane.
- They help in the repairs of worn-out cells.
- Proteins help in egg, milk and blood production.
- Proteins are very essential in the growth of young ones.
- They are also essential in the formation of some enzymes.
- Proteins are necessary for hormone formation.
- Proteins are used for the production of energy when other energy sources are in short supply.
- Protein is the only source of amino acids supply to the body.
- Enzymes and hormones which are protein in nature are used for metabolic regulations.
- Antibodies which are complex proteins assist in body defense mechanisms.

3.1.6 Deficiency of Proteins

Short or lack of proteins in the body will lead to any of the following problems:

- Reproductive failures in female animals.
- Emaciation and kwashiorkor- the affected animal will appear lean and weak.
- Retarded growth of the affected animal
- Reduction or failure in the formation of enzymes, blood and hormones.
- In severe cases death may occur.

3.1.7 Test for Protein Food

The presence of protein in any given food can be detected by either of these tests:

i. Biuret test

Mix the food item containing protein thoroughly with solution of 5% sodium hydroxide. Then add 2 or 3 drops of 1% copper sulphate solution. Purple (violet) coloration shows the presence of proteins. Complex proteins like peptones give a rose colour.

ii. Xanthoproteic Test

This test is carried out by putting a small quantity of the food material in a test tube. If the food material is solid, it should be well crushed with pestle and mortar. Add a few drops of concentrated nitric acid. Heat the test tube gently until the liquid boils. Pour off the excess acid. After the test tube has cooled, add a few drops of ammonium hydroxide. The changes of colour from yellow to orange confirms the presence of protein.

SELF-ASSESSMENT EXERCISE

1. List five essential and five non-essential amino acids found in the human body.
2. Give the protein requirements in gramme per body weight of the followings:
 - (a) Adult man
 - (b) Children
 - (c) Pregnant women

4.0 CONCLUSION

You have noted the chemical compositions of protein food, sources of protein and the two major groups of amino acids- essential and non-essential. It can be concluded from our discussions that animal proteins belong to first class proteins while plant proteins belong to second class proteins and that there is no alternative to protein food in the body.

5.0 SUMMARY

In this unit, you have studied the class of food nutrients called proteins. In this regard you have learnt that:

- Proteins are made up of carbon, hydrogen, oxygen and nitrogen primarily, plus phosphorus and sulphur in some cases.
- Protein contains approximately 16% nitrogen.
- Proteins are built-up from molecules of amino acids and about 9 of these are called essential amino acids while the remaining 11 or 12 are called the non-essential amino acids.
- Essential amino acids cannot be synthesized in the body, while the non-essential can be synthesized in the body.
- Amino acids are called building blocks for proteins.
- Proteins are colloidal when dissolved in water in which they are partly but not completely soluble.
- They are components of every cell of the animal or plant body where they perform several important functions.
- The qualities of the different proteins vary and the proteins from animal sources are better in quality than those from plant sources.
- Proteins are essential for the growing cells for their maintenance and for production and reproduction of new offsprings.
- They are components of enzymes, hormones, catalysts, antibodies and the protoplasm of cells.
- They also supply energy to the animal like carbohydrates and lipids, although their primary role is not for energy but for body building
- They replace the worn out cells and tissues
- The main sources of proteins from animals include meat, fish, egg, milk and from plants they include cowpea, groundnut, soybeans Bambara nut.

6.0 TUTOR-MARKED ASSIGNMENT

1. Discuss the nature and functions of proteins in animal ration and give five examples of the feeding stuffs that are very rich in protein.
- 2 (a) Write short notes on the following:
 - (i) Protein quality
 - (ii) Essential amino acids
 - (iii) Non-essential amino acids
- (b) How do you test for the presence of protein in food items?

7.0 REFERENCES/FURTHER READINGS

- Akinsanmi O. (1975). *Certificate Agricultural Sciences*. London: Longman Group Ltd.
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UNIT 4 FOOD NUTRIENTS – LIPIDS AND WATER

CONTENTS

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1.0 INTRODUCTION

In unit 9, we learnt about proteins and we highlighted the chemical composition of protein, animal and plant sources of proteins, classes of proteins and protein quality. Other areas discussed in the unit include essential and non-essential amino acids, functions of proteins, and effects of protein deficiency in the body and how to test for the presence of protein in any food item. In this unit, we will continue our discussions of food nutrients and two of such nutrients will be mentioned. The first aspect of the unit will discuss lipids while the second part will be devoted to water.

2.0 OBJECTIVES

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

- list the chemical components of lipids
- list at least five sources of lipids
- classify lipids into groups
- list at least two functions of lipids in the body
- test for the presence of lipids in food materials
- give at least five functions of water

- list two effects of water shortage in the body.

3.0 MAIN CONTENT

3.1 Lipids or Fats and Oil

Like the carbohydrates, lipids belong to the energy producing group of foods. They are produced by plants from simple sugars whose molecules contain only carbon, hydrogen and oxygen. But unlike carbohydrates, fat molecules consist of glycerol and fatty acid molecules.

Fats are found both in animals and plants. Fats from plants are generally called oils. Animal fat is stored in the body around the intestines and under the skin.

If an animal eats more food than its needs for energy production and body-building, the body stores the excess as fat. The animal then gains weight. If it eats too little the stored fat is used for energy production therefore, the animal gets thin. If it makes just enough of what the body needs, the weight will remain constant.

3.1.1 Sources of Fats

Fat in diet can be obtained from the following sources content:

- Groundnut oil (99.9)
- Palm oil (98.9)
- Margarine (81.0)
- Butter (77.3)
- Pork (77.0)
- African mango-ogbono (68.9)
- Melon seed (52.0)
- Fluted groundnut (50.9)
- Bemiseed (46.5)
- Pumpkin (46.2)
- Cashew nut (43.0)
- Meat (40.5)
- African oil beans- Ugba (39.9)
- Coconut (36.0)
- Locust bean seed –iru (31.2)
- Milk (26.3)
- African walnut (23.7)
- Groundnut cake (22.9)
- Cocoa (20.8).

3.1.2 Classification of Lipids

Lipids can be classified into three groups:

- Simple lipids such as fats and oils
- Compound lipids such as phospholipids and lipoproteins
- Derived lipids such as fatty acids and sterols

3.1.3 Classification of fatty Acids

Fatty acids can be classified using different method:

- According to the bonds present
- According to the length of the carbon chain
- According to whether they can be synthesized in the body.

(i) Classification Based on the Kinds of Bonds

There are four basic kinds of fatty acids-saturated, polyunsaturated, monounsaturated and trans fatty acids.

Each has a different effect on the blood cholesterol levels. In general saturated and trans-fatty acids tend to increase one risk of heart attack and other cardiovascular diseases.

Poly unsaturated and monounsaturated fatty acids are believed to lower those risks. Saturated fats i.e. fats with high percentage of saturated fatty acids are solid at room temperature and come primarily from animals. For example saturated fats are found in meat, poultry, skin, lard and non-skin dairy foods such as butter, cheese and milk. Some plant fats also contain high percentage of saturated fats e.g. coconut, palm oil and cocoa butter. Saturated fats raise the level of a substance called low density lipoprotein cholesterol in the blood. Higher levels of these types of cholesterol are associated with a higher risk of cardiovascular disease.

Unsaturated fats are typically liquid at room temperature and come mainly from plants. Both polyunsaturated and monounsaturated fats tend to lower the level of low-density lipoprotein cholesterol.

Polyunsaturated fats may also lower the levels of high density lipoprotein cholesterol. This can help to protect against heart diseases. Monounsaturated fats tend not to lower the level of high density lipoprotein cholesterol.

Many vegetable oil including sunflower oils are rich in polyunsaturated fats as well as fatty fish like salmon.

Monounsaturated fats are found in avocados, olive oil, olive and most nuts and nut oils. Both types of unsaturated fats are considered healthier choices than saturated Tran's fats.

Saturated fats have all of their carbon atoms bonded to hydrogen atoms. Fatty acids have between 12 to 18 carbon atoms. Long chain fatty acids are found mainly in animals and most vegetable fats.

Unsaturated fats have some of their carbon atoms double-bonded in place of hydrogen atom. Monounsaturated fats have one double-bond and polies unsaturated have many double-bonds.

Tran's fats are saturated fats which are typically created from unsaturated fat by adding the extra hydrogen atoms.

(ii) Classification Based on the Length of Carbon Chain

According to the length of the carbon chain fatty acids can be classified into the followings:

- (a) Short chain fatty acids. These groups have ten (10) or less carbon atoms and are found mainly in milk fat.
- (b) Long chain fatty acids have between 12 to 18 carbon atoms. Long chain fatty acids are found mainly in animal and most vegetable fats.
- (c) Extra-long chain fatty acids have 20 or more carbon atoms and are found in fish oils.

(iii) Classification Based on Fatty Acid Synthesis

Fatty acids are also designated essential or non-essential. Recent findings have shown that linoelic acid and linoleic acid which form the starting point in human metabolism for the respective families cannot be produced in the body and need to be obtained from external sources i.e. through food or supplements. They are therefore considered essential fatty acids.

3.1.4 Functions of Lipids

- Lipids provide the richest and highest amount of energy
- They also help to build up fat
- Lipids help in body temperature regulation
- Lipids also insulate the body

- They are the sources of fat soluble vitamins e.g vitamins A,D,E and K
- Lipids comprise a large component of membrane of cells and organs.
- Lipids protect vital internal organs like kidney, heart and liver
- Lipids improve the flavor of foods, making them more palatable
- They are the major sources of essential fatty acids
- They add satiety value to food.

3.1.5 Test for Lipid Food

To determine the presence of lipids in any given food substance, either of the following tests can be performed:

- (a) Crush thoroughly some pieces of the food material using a pestle and mortar. Place some of the crushed material in a test tube and add some quantities of either petrol or ether. Shake well so that the fat dissolves in the liquid. Pour some of the solution on a piece of filter paper. When the paper has dried, a grease spot remains. This shows that the original substance contains fat.
- (b) Add a few drops of osmic acid to a cross section of the specimen. Black colouration confirms the presences of fat or oil.

SELF-ASSESSMENT EXERCISE

- (a) Give five functions of lipids in animal body
- (b) How can you test for the presence of lipids in food stuff?

3.2 Water

The body requires water. Water is an essential part of any diet. The quantity present in most food stuffs vary from 10% to 95%.

It is possible to survive longer without food than without water. The bodies of most animals contain 55-65% water. Animals take it directly or as a component of foodstuff. The water content of some body fluids and tissue are as follows:

- Saliva and sweat (99.5%)
- Blood (79.0%), lung (79.0%)
- Muscle (76.0%), skin (72.0%)
- Fat (30.0%) and
- Bone (20.0%)

Plants take it directly from the soil through the root hairs, and convey it to other parts of the organism where it can constitute part of the protoplasm. It may also be used either for food synthesis or to transport food materials in solution to other parts of the plant.

3.2.1 Sources of Water

There are three major sources of water available to animals:

- (a) **Liquid:** This source includes drinkable water, tea, coffee, milk, juices, soups etc, drinkable water can be obtained from rainfall, well, borehole, rivers, ponds, seas, oceans etc.
- (b) **Solid foods:** All foods contain water but the water content of individual food items varies.
- (c) **Metabolic water:** Similarly, the water formed during the metabolism of different foods also varies.

3.2.2 Functions of Water

- It helps in the regulation of animal body temperature.
- Assists in enzyme and hormone formation and distribution.
- Essential for the digestion of food.
- It helps in the turgidity of muscles and cells of the body.
- Since water is a universal solvent, it therefore dissolves solid substances in the body.
- Helps in the excretion of waste products in the body.
- It is the main constituent of all body fluids.
- It accounts for about 65% of the total body weight and 79% of blood components.
- In addition, water is essential for other activities like washing and cleaning of tools, equipment, farm animals and dipping of animals.

3.2.3 Deficiency of Water

Shortage of water in the body can result into any of the followings:

- Restlessness of the animal.
- Dehydration and reduction in body weight.
- Stoppage of certain functions in the body.
- Reduces animals activities like egg-laying and milk production.
- Gasping for breath and eventually death if it is acute.

3.2.4 Estimation of Water Percentage in Food Material

- **Dry Matter**

Dry matter is the materials left after all the available water in a foodstuff have been expelled. It contains both organic matter and inorganic mineral matters.

- **Organic Matter**

Organic matter is the fraction of dry matter content of a foodstuff which is completely burnt off when subjected to very high temperature.

- **Percentage Water Content Estimated**

Water is expelled from a known weight of food by heating the food stuff up to the temperature of 100 ° c. The heating will continue until a constant weight is obtained. If it is completely desiccated and then weighed, the difference between the original weight and the water of the dry matter represent the weight of the water expelled.

$$\% \text{ water content} = \frac{\text{wt. of water expelled} \times 100}{\text{Original wt. of food stuff}}$$

SELF-ASSESSMENT EXERCISE

If a foodstuff weighed 10kg and after heating it to a constant weight, the weight reduced to 8kg, calculate the percentage water content in the food.

4.0 CONCLUSION

In this unit, you have learnt about two important food nutrients- lipids and water. In respect of lipids or fats and oils, we discussed the sources of lipids, classification of lipids and fatty acids, functions of lipids and tests for the presence of fats and oils in food materials.

Concerning water, we learnt about the sources of water, functions of water in the body, effects of water shortage in the body and estimation of percentage water content in foodstuffs. The unit concludes that no life can survive without water.

5.0 SUMMARY

The main points in this unit are that fats and oils or lipids:

- Are made up of carbon, hydrogen and oxygen.
- Are not soluble in water but soluble in organic solvent like diethyl ether, benzene etc.
- Are very rich in energy and produce about 2.25 times more energy than carbohydrates or proteins.
- Are made up of fatty acids and glycerols which esterify together, but some complex lipids are not composed of these.
- Are both saturated and unsaturated and some of the unsaturated fatty acids are called essential fatty acids.
- Are found in various parts of the animal and plant bodies and some seeds are very rich in them. These are called oil seeds e.g. groundnut.
- Supply energy for the daily activities of animal.
- Provide heat and insulation for the animals since a good fraction of fat is found underneath the skin.
- Protect some delicate internal organs and tissues from physical damage.
- Aid in the absorption of fat-soluble vitamins such as vitamins A, D, E and K.
- The major sources of water in the body include liquid, solid food and metabolic water.
- Water is a universal solvent including activities in plant and animal bodies.
- No life can survive long without water.

6.0 TUTOR-MARKED ASSIGNMENT

1.
 - (a) Discuss the various classes of fatty acids
 - (b) Name five foodstuffs that are very rich in fats and oils
2.
 - (a) Define
 - (i) Dry matter
 - (ii) Organic matter
 - (b) List five important functions of water in the body.

7.0 REFERENCES/FURTHER READINGS

- Akinsanmi O. (1975). *Certificate Agricultural Sciences*. London: Longman Group Ltd.
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UNIT 5 FOOD NUTRIENTS-MINERALS AND VITAMINS

CONTENTS

- 1.0 Introductions
- 2.0 Objectives
- 3.0 Main Content
 - 3.1 Minerals
 - 3.2 Vitamins
- 4.0 Conclusion
- 5.0 Summary
- 6.0 Tutor-Marked Assignment
- 7.0 References/Further Readings

1.0 INTRODUCTION

In unit 4, we discussed two groups of food nutrients – lipids and water. In that unit we learnt about the sources of lipids, classification of lipids, classification of fatty acids, functions of lipids and test for the presence of fat in food stuff. We also discussed the sources of water, functions of water, and effects of water shortage in the body and the estimation of percentage water content in food material.

In this unit, we shall discuss the last two groups of food nutrients i.e. minerals and vitamins.

2.0 OBJECTIVES

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

- list four minerals and sources
- list four minerals and their functions
- state the deficiency symptoms of the minerals
- list four vitamins and their sources
- state the functions of at least four vitamins
- state the deficiency symptoms of four vitamins.

3.0 MAIN CONTENT

3.1 Minerals

All animals require certain inorganic elements called minerals. The mineral requirements are divided into two groups. They are:

- (i) Macro- minerals like calcium, phosphorous, potassium, sodium, chlorine, sulphur and magnesium. They are called macro-minerals because they are required in large quantities.
- (ii) Micro –minerals like iron, zinc, copper, manganese, iodine, cobalt, molybdenum, fluorine, bromine, barium, strontium etc.

The sources, functions and deficiency symptoms of some of these minerals are presented below:

1. Calcium (Ca)

- Sources - Milk, limestone, bone meal, oyster shell, rock, calcium phosphate etc.
- Functions – Essential for bone and teeth formation.
Coagulation of blood
Essential for egg production
- Deficiency - Can cause rickets
Soft beak
Retarded growth
Shell-less eggs, thin egg shell and reduces egg production
Osteomalacia

2. Phosphorus (P)

- Sources - Milk, cereal grains, fish and meat, bone by-products, dicalcium phosphate, oyster shell, limestone etc.
- Functions - Excitement of heart and muscles
Essential for bone and teeth formation
Formation of egg shell
Contribute to acid-base balance
- Deficiency - Rickets and stunted growth
Osteomalacia and low milk yield
Stiff joints
Muscular weakness
Low fertility

3. Potassium (K)

- Sources - Citrus, pine-apple, yam, potato, banana etc.
Functions - Helps in the activity of heart muscle
Essential for osmo-regulation
Maintain acid-base balance
Deficiency - Severe paralysis
Retarded growth
Tetany

4. Sodium (Na)

- Sources- Fish, meat, bone by-products, common salt etc.
Functions- Helps in acid-base balance
Helps in growth
Helps in nervous co-ordination
Deficiency - Retardation of growth
Reduced egg production
Loss of appetite
Nervous problem

5. Chlorine (Cl)

- Sources - Fish, meat, bone by-products, salt lickets
Functions - Constituent of hydrochloric acid in the stomach
Helps in the digestion of proteins
Increases the palatability of food
Deficiency - Decline in appetite
Reduction in growth
Feather pecking in chicken
Cannibalism
Reduced weight

6. Sulphur (S)

- Sources - Elemental sulphur, salt licks, fish meal, potassium sulphate, sodium sulphate, protein feeds etc.
Functions - Constituent of protein and amino acids e.g cystine and methionine.
Deficiency - Poor growth
Reduction in the synthesis of amino acids like cystine, cysteine and methionine.

7. Magnesium (Mg)

- Sources – Wheat bran, cotton seed cake,
Salt licks, magnesium oxide,
Magnesium carbonate, forage grasses,
Concentrates, roughages etc.
- Functions - Helps in nervous co-ordination
Helps in the activation of enzymes
Essential for carbohydrate metabolism
Helps in bone formation
- Deficiency - Tetany and hypomagnesaemia tetany
Death
Grass staggers

8. Iron (Fe)

- Sources - Green leafy materials, yeast, salt licks, blood meal,
iron II chloride, iron dextran injection etc
- Functions- Constituent of the ferritin in the haemoglobin of the
red blood cell.
Found in myoglobin and cytochrome
- Deficiency - Anaemia

9. Copper (Cu)

- Sources - Plant seeds, seed by-products, copper salts, copper
II chloride etc
- Functions - Helps in iron absorption
Constituent of haemoglobin in the red blood cell
Also found in myoglobin
- Deficiency- Anaemia
Reduction in haemoglobin synthesis
Poor growth
Gastro-intestinal problems
Loss of pigment in the hair
Bone disorder

10. Cobalt (Co)

- Sources - Cobalt salts, salt licks, cobalt oxide, vitamin B12
- Functions- It activates some enzymes
Helps in vitamin B12 synthesis
- Deficiency- vitamin B12 deficiency
Emaciation
Listlessness

11. Iodine (I)

Sources- Fish meal, sea weed, iodized salt etc.
Functions- Constituent of thyroxin
Essential for growth
Deficiency- Goiter-endemic goiter or big neck
Reproductive failure

12. Manganese (Mn)

Sources - Rice, wheat offals, manganese salts etc.
Functions- Bone structure production
Enzyme inhibition
Deficiency- Poor growth
Lameness
Perosis or slipped tendon
Reduced hatchability in chicken
Thin egg shell
Frequent abortion
Leg deformities

13. Zinc (Zn)

Sources- Yeast, rice bran, maize, zinc salts e.g. Zinc carbonate and zinc sulphate etc.
Functions- Essential in enzyme and co-enzyme formation
Component of insulin
Deficiency- Skin lesions
Low efficiency of feed conversion
Poor growth
Poor feathering

14. Molybdenum (Mo)

Sources - Molybdenum salts
Function- Prevents copper availability
Deficiency- Poor growth
Poor live weight

15. Fluorine (F)

Sources- Drinking water, vegetables, salt licks etc
Functions- Prevents tooth decay
Essential in bone and teeth formation
Deficiency- Tooth decay

3.2 Vitamins

Vitamins are small complex organic materials present in food stuff and required in small quantities by animals. They are classified into two major groups:

- Fat soluble vitamins e.g. vitamins A, D, E, and K
- Water soluble vitamins e.g. B and C

Fat Soluble Vitamins

1. Vitamin A (Retinol)

- Sources - Fish oil, cod liver oil, green vegetables, yellow maize, palm oil, carrot, synthetic vitamin A etc.
- Functions- Proper night vision
Helps in epithelia cell formation
Maintain the surface of cornea in eyes
- Deficiency- Night blindness
Rough coat and scaly skin
Low fertility
Abortion in pregnant animals

2. Vitamin D (Ergicalciferol)

- Sources- Synthesized in the skin, sunlight,
Sun dry feeds e.g. hay, fish oil, fish meal, bone meal etc.
- Functions- Essential for bone and teeth formation
Formation of egg shell
Necessary for calcium and phosphorus deposition
- Deficiency- Rickets
Osteomalacia
Soft shell
Shell-less eggs

3. Vitamin K (phyloquinone)

- Sources- Fish meal, green leafy materials etc
- Functions- Essential for blood clotting and coagulation
- Deficiency- Haemorrhage
Inability of blood clotting to take place

4. Vitamin E (Tocopherols)

- Sources- Green leafy materials, selenium salts, cereal grain, synthetic alpha-tocopherol etc
- Functions- Essential for reproduction in animals
- Deficiency- Abortion in female animals
Sterility in male and female animals

Water Soluble Vitamins

5. Vitamin B1 (Thiamine)

- Sources- Yeast, cereal grains etc.
- Functions- Acts as co-enzymes
- Deficiency- Beri-beri
Loss of appetite

6. Vitamin B2 (Riboflavine)

- Sources- Yeast, milk, green leafy materials etc.
- Functions- Acts as co-enzymes in certain food metabolism
- Deficiency- Loss of appetite
Serious diarrhea
Curled toe paralysis
Decreased hatchability of eggs

7. Vitamin B3 (Niacin)

- Sources- Fish, meat, cereals, legumes, yeast, liver, tryptophan etc.
- Function- Co-enzymes and carbohydrate oxidation
- Deficiency- Poor growth
Black tongue
Dermatitis
Pellagra

8. Vitamin B6 (Pyridoxine)

- Sources- Yeast, liver, milk, cereal, banana etc.
- Functions- Haemoglobin synthesis
Production of antibodies
Breakdown of amino acids
Fatty acids synthesis
- Deficiency- Slow growth rate
Anaemia
Convulsion

Poor egg production
Reduced hatchability

9. Vitamin- pantothenic acid

Sources- Animal feeds, cereals, liver, egg, yolk, yeast, grasses etc.
Functions- Necessary for energy release from carbohydrate, Protein and fat
Deficiency- Poor growth
Dermatitis
Reduced gait

10. Vitamin- Biotin

Sources- Egg yolk, soybean, liver, cereal, legumes, nuts yeast, vegetables etc.
Functions- Component of many co-enzymes
Important in energy metabolism
For protein synthesis
Deficiency- No serious deficiency reported

11. Vitamin – folic acid

Sources- Mushrooms, spinach, legumes, liver, orange juice, yeast, can be synthesized etc.
Functions- Essential in nervous co-ordination
Involved in amino acid and nucleic acid metabolism
Deficiency- Anaemia
Poor growth

12. Vitamin B12 – (Cobalamine)

Sources- Egg, yeast, liver, meat, meat products, fish etc.
Functions- Act as co-enzyme
Formation of red blood cell
Involved in nucleic acid metabolism
Deficiency- Anaemia
Poor growth or growth failure

13. Vitamin C- (Ascorbic Acid)

Sources- Citrus orange, tangerine, fruits, vegetables etc.
Functions- Gum formation around the teeth
Formation of connective tissues

	Anti oxidant
	Synthesis of many body compounds
	Helps in the absorption of non-heme iron
	Necessary for plate metabolism
Deficiency-	Scurvy
	Bleeding gum
	Not essential in farm animals

SELF-ASSESSMENT EXERCISE

1. Give the chemical formulae of six mineral elements found in animals body.
2. Give the full names of any five vitamins found in the body.

Hints

Q1	Mineral Elements	Chemical formula
	a. Iron	Fe
	b. Calcium	Ca

Q2	Vitamins	Name
	a. Vitamin C	Ascorbic acid
	b. Vitamin K	Phylloquinone

4.0 CONCLUSION

In this unit, you have learnt about the two major groups of minerals found in the body. We have already highlighted the sources of these minerals, their functions and the effects of their shortages in the body. Similarly, vitamins were grouped into two classes and their various sources, functions and deficiencies were also discussed. From the various discussions it can be concluded that minerals and vitamins perform vital roles in the body and therefore, no life can survive without them in the body.

5.0 SUMMARY

The main points in this unit include the following:

(A) Minerals

- Minerals are inorganic elements and they are the main constituents of the ash left after a feed stuff has been burnt over furnace.

- The mineral content of a plant or animal is therefore, found in the ash fraction.
- The minerals of this ash fraction are usually divided into two groups on the basis of their concentration.
- The first group is the major minerals e.g. calcium, phosphorus, sodium, chlorine etc. while the other group is called trace or micro minerals e.g. zinc, molybdenum, copper, cobalt, manganese, iron etc.
- Both are very important for the well-being of animals.
- They are largely soluble in water.
- They function in the formation and maintenance of the skeletal frame work of animals.
- They are also vital in cellular activities and are involved in oxygen transport.
- They are generally involved in the chemical reactions going on in the body tissues and are also connected with fluid balance.
- They also regulate acid-base balance of the entire body.
- They activate enzyme systems.

(B) Vitamins

- Like proteins, fats and carbohydrates, the vitamins are also organic in nature.
- They are called accessory food factors needed in small amounts
- Two main groups are recognized, the fat soluble vitamins e.g. A, D, E, and K and the water soluble vitamins e.g. B and C.
- They are also found nearly in all plants and animals where they perform a number of functions.
- Vitamins contain the usual carbon, hydrogen and oxygen but also several other components which vary from one vitamin to another.
- They are connected with all the metabolic processes in plant and animal bodies and deficiencies of one or more of these vitamins cause a lot of metabolic problems.
- Some of their functions include:
 - prevention of night blindness (vitamin A)
 - prevention of rickets (vitamin D)
 - prevention of anaemia (folic acid)
 - sterility (Vitamin E) and
 - scurvy (Vitamin C).
- Good sources of vitamins are:
 - Yeast

- Liver
- Vegetables
- Egg
- Meat
- Milk
- Fruits etc.

6.0 TUTOR-MARKED ASSIGNMENT

1. Discuss the sources, functions and deficiency symptoms of any five minerals found in the body.
2. (a) Name two fat soluble vitamins and two water soluble vitamins
(b) Discuss the sources, functions and deficiency symptoms of the four vitamins mentioned above.
3. Write short notes on the followings:
 - (a) Macro- minerals
 - (b) Micro or trace minerals
 - (c) Fat soluble vitamins
 - (d) Water soluble vitamins

7.0 REFERENCES/FURTHER READING

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UNIT 6 BALANCED RATIONS AND MALNUTRITION

CONTENTS

- 1.0 Introduction
- 2.0 Objective
- 3.0 Main Content
 - 3.1 Balanced Rations
 - 3.1.1 What is Balanced Rations?
 - 3.1.2 Categories of Balanced Rations
 - 3.2 Malnutrition
 - 3.2.1 Causes of Malnutrition
- 4.0 Conclusion
- 5.0 Summary
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1.0 INTRODUCTION

In unit 5, we discussed the last two groups of food nutrients- minerals and vitamins. Under the minerals we grouped them into macro-minerals and micro-minerals. We then highlighted the sources, functions and deficiencies of each of the minerals. We similarly grouped vitamins into fat soluble vitamins and water soluble vitamins. The sources, functions and deficiencies of each of the vitamins were also highlighted. In this unit, effort will be made to discuss the concept of balanced rations and malnutrition.

2.0 OBJECTIVES

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

- define balanced diet
- explain the meaning of maintenance ration
- explain the meaning of production ration
- define malnutrition
- list at least four causes of malnutrition.

3.0 MAIN CONTENT

3.1 Balanced Rations

A ration can be defined as the feed given to the animal at anytime. It ranges from a simple combination of two ingredients to complex formulations containing several different ingredients.

A ration is therefore, made up of one or more feeding stuffs carefully mixed and it supplies to the animal the nutrients it needs.

3.1.1 What is Balanced Ration

Balanced ration is a feeding stuff which consists of all the essential nutrients needed by animals in the right proportion e.g. carbohydrate, protein, lipids, mineral salts, vitamins and water.

When a ration has been so formulated to contain all the nutrients needed for a particular class of species of farm animals in their correct quantities and proportions, that ration is said to be balanced for that specific purpose.

To get a balanced ration, two or more ingredients are mixed in the right proportions and quantities in such a way that each ingredient is supplying specific nutrients which the others are not supplying at the correct levels. In other words, they are all complementing one another in nutrient supplies.

The right proportion of feeding stuff will depend on a number of factors which include:

- Amount of feed ingredients available
- Form of the nutrients available
- Species of the animal
- Stage of life of the animal
- Purpose of production etc.

If the proportion is not maintained the balance of nutrients is offset. The proper amount of the nutrients has to be provided otherwise the ration fails to provide the required quantity of nutrients needed.

The correct form of nutrients is necessary since some nutrients may be in a form that is not available to the animals. In this case the animal suffers from a deficiency where as the ration has the nutrients.

The stage of life of the animal is another important factor to be considered, in that one has to remember that young animals need greater quantities of water and proteins for example than old animals.

One also has to bear in mind the purpose of keeping the animal whose ration one is preparing. An animal kept for egg production needs fairly different nutrients from an animal prepared for greater meat yield.

Likewise, an animal kept for milk production needs different feed ingredients combination than other types of farm animals.

In formulating balanced diet, the nutrient values of the feeding stuff must be known. In addition the feeding standards which are the nutrient requirements of the animal must also be known. From the knowledge of these two, the deficient nutrients are determined. By changing one quantity of feeding stuff and substituting some others, the deficiencies are corrected. The other deficiencies that cannot be corrected by mere adjustment can be done by supplying the particular deficient nutrient in supplements such as vitamin, mineral or protein supplements.

In the final adjustment a safety margin is allowed. The safety margin may be regarded as an allowance in the nutrients above the minimum requirements. This allowance is needed for the following reasons:

- It enables the animal to counteract the variations in the nutritive value
- Variations in the composition of feed, and
- Variations in the ability of the animal to digest, absorb and utilize the feed.

3.1.2 Categories of Balanced Rations

Balanced rations are of two categories namely:

- i. Maintenance ration, and
- ii. Production ration.

(i) Maintenance Ration

This is the type of ration given to the animal in order for it to keep a particular shape, weight and size. There will be no increase or decrease in size and functions of the animal.

In other words, maintenance ration supplies the animal with just the quantity of nutrients that are enough to enable the animal carry on with vital body activities. Without losing or gaining another substance the species, the environment and the activity of the animal influence the maintenance requirements of the livestock. The maintenance requirements for a dairy cow are not the same as that of the cow meant for only meat and the maintenance requirements for cattle in the tropics are not the same as those of cattle in the temperate regions.

For example, the daily maintenance requirement of a matured cow weighing 363.5kg is given to be 227g digestible proteins, 2.7kg total digestible nutrient, 6g calcium, 6g phosphorus and 32g carotene.

(ii) Production Ration

Production ration is the quantity of ration that can supply the required nutrients above the maintenance ration to enable the animal produce the form of animal product for which the livestock is kept. The production ration can be for meat, milk, wool and egg production. In other words, production ration is the ration given above the maintenance ration so that the animal can increase in weight, size and improve in function.

There are two notable production rations, they are flushing and steaming up rations. Flushing is given to the animal in order to increase fertility e.g. broiler ration, layers' ration, lactation ration etc. while steaming up helps to prepare pregnant animal for parturition.

Those factors that influence the maintenance ration also influence the production ration. For each pound of milk, a cow of weight 454.5kg needs 17.2g digestible protein, 127.1g total digestible nutrient, 1g of calcium and 0.7g of phosphorus above the maintenance requirement.

SELF-ASSESSMENT EXERCISE

Explain the following terms:

- (a) A ration
- (b) Maintenance ration
- (c) Production ration

3.2 Malnutrition

Malnutrition is a general term for a medical condition caused by an improper or insufficient diet. It most often refers to under nutrition resulting from inadequate consumption, poor absorption or excessive loss of nutrients. The term can also encompass over nutrition resulting from overeating or excessive intake of specific nutrients. An individual will experience malnutrition if the appropriate amount of or quality of nutrients comprising a healthy diet are not consumed for an extended period of time. Those nutrients in want are said to be deficient. Nutritional deficiency is indicated by specific symptoms when particular nutrients are absent or unavailable in the diet. Many deficiencies are known to produce the same general symptoms, for example slow growth, low production, susceptibility to disease and high mortality rate.

Malnutrition influences infection and causes disease. The mechanism by which nutrition affects health is very complex. Inadequate dietary intake can cause weight loss or failure of growth in children, lowered nutritional reserves, lowered immunity and causes mucosal damage. In these circumstances, disease incidences, severity and duration are potentially increased. The disease process itself results into loss of nutrients, loss of appetite, mal-absorption and altered metabolism. These factors eventually lead to inadequate dietary intake and the cycle repeats itself.

Under-nutrition which is the consumption of insufficient amount of nutrients for body need can result in nutritional problems such as: protein-energy malnutrition and micro-nutrient malnutrition. Protein energy malnutrition refers to inadequate availability or absorption of energy and proteins in the body. Micro-nutrient malnutrition refers to inadequate availability of some essential nutrients such as vitamins and trace elements that are required by the body in small quantities. Micro nutrient deficiencies lead to a variety of disease and impair normal functioning of the body.

The general effects of under-nutrition in the body include:

- Stunted growth
- Reduced intelligence
- Reduction in the various cognition abilities
- Reduced sociability
- Reduced leadership and assertiveness
- Reduced activity and energy
- Reduced muscle growth and strength
- Poorer overall health

Over nutrition which is the consumption of excessive amount of one or more nutrients can lead to obesity, hyper vitaminosis A, and degenerative disease such as cancer, diabetes mellitus, cardiovascular disease etc.

Obesity or the state of being excessively fat is a form of malnutrition that can contribute to many health problems including high blood pressure, heart disease, stroke, diabetes mellitus and arthritis. It is broadly defined as having a body weight more than 20 percent above one's ideal weight.

3.2.1 Causes of Malnutrition

Malnutrition could be caused by any of the following factors:

- Poverty
- Overpopulation
- Fasting/ religious practices
- Digestive disease
- Bulimia nervosa
- Famine
- Mal-absorption
- Depression
- Untreated diabetes mellitus
- Alcoholism and other forms of drug addiction
- Over-consumption of fat and sugar
- Industrial food processing
- Socialism
- Lack of economic freedom
- Anorexia nervosa.

The nature, quantity and quality of food consumed depend to some extent on the income or purchasing power of individuals. Low-income families may not be able to purchase growth promoting food items like meat, fish, egg and milk. This will lead to over dependence on starchy foods which can lead to malnutrition.

It is a well-known fact that the more the number of people in an area or household, the less the amount of resources available to the individual in it. The number of people in an area or within the household will affect the quantity and quality of food consumed. Food resources will be more equitably distributed as the number decreases.

Some individuals opt to be vegetarians on religious grounds e.g. Hindus and Buddhist will eat no flesh of animal. Vegetarians may suffer from malnutrition if they lack the proper knowledge of ways of combining plant foods in order to obtain an adequate diet.

Fasting is common to most religions. Muslims usually observe the Ramadan fast for four weeks. During this period, they neither eat food nor drink water between sunrise and sundown. Such a fast may impair the health of people who before the fast had been on inadequate diet probably due to low purchasing power. However, occasional fasts have not been known to do any harm to healthy individuals.

Infections and disease conditions are known to influence food intake of individuals. Disease can cause loss of appetite and decrease food intake. The anxiety of illness, the loneliness experienced if one eats from a tray alone, the lack of activity and a modified diet are likely to interfere with food intake.

Adolescents worry a lot about their body weight. The result is that many teenagers who are not obese consider themselves so, and there is an exaggerated interest in weight reduction especially among girls often leading to inadequate and sometimes bizarre dietary intake, this may sometime lead to a condition known as anorexia nervosa. Anorexia nervosa is an eating disorder characterized by extreme intentional dieting and weight loss. It requires professional treatment, if untreated, it can be life threatening. This disorder occurs most often in young women in developed countries.

An eating disorder called bulimia nervosa can also cause nutritional problems. This illness involves eating huge quantities of food at one sitting and then usually purging the food from one's body by self induced vomiting or other means.

Famine occurs as a result of lack of rainfall (drought), excessive rainfall (flooding), disease outbreak or war. The result is lack of food which leads to starvation.

SELF-ASSESSMENT EXERCISE

1. List five effects of under-nutrition in the body.
2.
 - (a) what is obesity?
 - (b) List four health problems associated with obesity.

4.0 CONCLUSION

In this unit you have learnt about balanced ration and malnutrition. Balanced diet is of two types- maintenance ration and production ration. We also learnt that malnutrition are of two types- under-nutrition and over-nutrition. We also highlighted the causes of malnutrition. In conclusion, we can see from our discussion that over-feeding is as bad as under-feeding. We should feed according to our feeding requirement which varies from one person to the other.

5.0 SUMMARY

The summary that could be drawn from this unit includes:

- Ration refers to the feed given to animal at a time.
- Balanced ration contains all the essential nutrients needed by animal in the right proportion.
- The essential nutrients include-carbohydrate, protein, lipids, water, minerals and vitamins.
- The right proportion of feeds varies among the animals depending on a number of factors.
- There are two categories of balanced rations: maintenance rations and production rations.
- Maintenance ration is needed to maintain the normal activities of the body- no increase and no decrease.
- Production ration is the quantity of feed required to enable the animal produce the livestock product for which the animal is kept.
- Production ration can be classified into flushing and steaming-up rations.
- Malnutrition can be as a result of under-nutrition or over-nutrition.
- Malnutrition is a condition of improper or insufficient diet.
- Some of the causes of malnutrition include- poverty, over-population, fasting and other religious practices, digestive disease, anorexia nervosa, bulimia nervosa, famine, malabsorption, depression, untreated diabetes mellitus, alcoholism, over consumption of fat and sugar etc.

6.0 TUTOR-MARKED ASSIGNMENT

1.
 - (a) What do you understand by the term balanced ration?
 - (b) Why does the relative importance of the major nutrients in balanced diets vary with the class and age of animal?
2.
 - (a) What do you understand by malnutrition?
 - (b) What are the effects of malnutrition on farm animals?
3. List ten (10) causes of malnutrition and discuss any five of them in full.

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MODULE 3

Unit 1	Concept of Health
Unit 2	Pests and Parasites of Farm Animals
Unit 3	Management and Control of Pests, Parasites and Diseases of Farm Animals

UNIT 1 CONCEPT OF HEALTH

CONTENTS

1.0	Introduction
2.0	Objectives
3.0	Main Content
3.1	Meaning of Health
3.2	Meaning of Disease
3.3	Meaning of Infection
3.3.1	Mode of Animal Infection
3.3.2	Factors Influencing Infections
3.4	Classification of Diseases
4.0	Conclusion
5.0	Summary
6.0	Tutor-Marked Assignment
7.0	References/Further Readings

1.0 INTRODUCTION

Unit 6 concludes all our discussions on nutrition. In that unit, we looked at balanced rations and malnutrition. Under the balanced rations we discussed maintenance ration and production ration. We further explained the meaning of malnutrition and highlighted the causes of malnutrition. This unit will introduce us to the general principles of health. The areas covered include:

- The meaning of health
- Diseases and infections and
- The classification of diseases.

2.0 OBJECTIVES

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

- define health, disease and infection
- classify diseases into five groups
- describe the effect of one disease caused by each of the following groups of pathogens- bacteria, virus and protozoa.

3.0 MAIN CONTENT

3.1 Meaning of Health

Health is a general physical condition of the body or mind especially in terms of the presence or absence of illness, injuries or impairments. Health may also be seen as the extent of an individual's continuing physical, emotional, mental and social ability to cope with his environment.

In the light of the above definition, health could be described as good or bad. Bad health can be defined as the presence of disease while good health may mean its absence particularly the absence of continuing disease, because the person afflicted with a sudden attack of seasickness, for example, may not be thought of as having lost his good health as a result of such mishap.

3.2 Meaning of Disease

Disease may be described as a departure from normal state of health. Disease is said to occur in an animal when there is any interference with the body processes which will make its body fail to function in a normal manner. This will result in a state of ill health that will prevent the animal from giving its highest performance which may be measured in terms of work done in case of work animals or increase in weight in a fixed interval of time, milk production, wool or egg production.

Absolute health is often not in existence, but if an animal can perform its physiological activities adequately then it is said to be healthy or in good healthy condition.

Diseases are very important economic factor in livestock development. Gains in any livestock business will depend on how far the diseases associated with the types of livestock in the business are prevented or controlled.

The losses recorded from diseases are numerous. There is poor growth as a result of disease, poor food utilization, poor yield of animal products and the mortality of the stock. Another aspect of loss is in the cost of medication, labour involved in the prevention and control of the disease. Disease also reduces the availability of animal protein for man's use.

3.3 Concept of Infection

Infection is the term used to designate the establishment of parasite within a host. It is the entering of the disease producing organisms into the animal to produce disease.

The entering of pathogens i.e. disease producing organism into animal will depend on three major factors:

- (a) Population of the pathogens- the more the number of the pathogens within the animal host, the more the chances of infection.
- (b) The resistance of the animal to pathogens. The ability of the animal to fight back when there is invasion of pathogens will determine whether the organism will produce disease or not. Resistance to disease may be inherited or acquired. It may be acquired through vaccination, good feeding, proper rest and sleep etc.
- (c) Virulence of the organism i.e. the capability of the organism to produce the disease. This ability will influence the severity of the disease. The virulence will reduce if the pathogens are kept under unfavorable environmental conditions like dryness, sunlight, high or low temperature etc.

3.3.1 Mode of Animal Infection

Animals get infected by pathogenic organisms through any of the following means:

- (a) Contact with infected animal- External spread through contact with infected animals.
- (b) Contaminated water and feeds- Disease can easily spread through eating of contaminated feed and drinking of contaminated water. This is made possible by keeping both the healthy animal as well as infected ones together.
- (c) Droppings and excretas- Eggs of parasites and even the pathogens are at times passed out of the animal host through their droppings or excretas. When healthy animals come in contact with those waste materials, they get infected.
- (d) Animal carriers- Farm workers and other visitors may be responsible for the spread of disease in farm animals by transferring the pathogen from one pen to the other.

3.3.2 Factors Influencing Infections

Some of the factors influencing the adaptation of parasites to the host include the following:

- Some parasites possess cuticle or chitinous coat which serves as a barrier to damage by host secretions and environmental effects.
- Parasites may secrete various substances which may protect them against host attack.
- The formations of cysts also ensure protection for many parasites or their intermediate stages.
- There are various modifications in the body structure of many parasites which appear to be adaptive mechanisms e.g. limbs, hooks, suckers etc.
- The mouth parts of some insect pests are adapted for their mode of obtaining nutrients.
- Some parasites release toxins that paralyze the host. These are said to be mechanism for ensuring continuous attachment and full engorgement by the parasite.
- Many parasites produce large amounts of ova or intermediate stages. This is regarded as another means of parasites increasing the chance of propagation in the host.

3.4 Classification of Diseases

Various classifications of animal diseases exist in the literature. Several authorities have classified diseases on different basis. Some scientists classify animal diseases based on:

- Causal agent or pathogens (Etiology)
- Pathology
- Symptoms and interruption of physiological process

However, classification based on pathogens is the most popular among them. Under this method we have diseases caused by bacteria, virus, fungi, protozoa, parasites bigger than protozoa etc.

(i) Bacteria

Bacteria are microscopic organism living within or outside the hosts. They possess nucleus and cytoplasm. A bacteria is a plant and reproduces through the binary fusions in which the cell divide into cells after growing to a certain size

Some bacteria are pathogenic in nature causing serious damage or even death of the hosts. It must also be noted that not all bacteria are pathogens. Some perform useful functions like cheese making, compost making, nitrogen fixation etc.

According to their shapes, bacteria can be grouped into three:

- a. Those that are spherical in shape are called cocci e.g. streptococcus, staphylococcus, diplococcus.
- b. Those that are cylindrical in shape are called bacilli e.g. streptobacillus, anthrax, tetanus etc.
- c. The third group are either curved or spiral in shape and are called spirilla e.g. pirillum rubrum, spirillum undulatum, cholera, typhoid etc.

Examples of Bacteria Diseases of Farm Animals

Disease	Farm Animal	Symptoms	Prevention and Control
Tuberculosis	Cattle, Sheep Goats, Pigs	Acute dry cough Swelling of the Lymph node Death Loss in weight Difficulty in breathing	Vaccination Isolate affected one Destroy the affected animals
Anthrax	Cattle	Sudden death High fever Discharge of blood from all openings Emaciation	Vaccination Good sanitation Isolation of infected animals
Brucellosis	Cattle, Sheep, Pigs	Abortion in pregnant animal Swelling of the scrotum in ram Loss of appetite High fever Infertility in male Lameness Diarrhea and dysentery	Vaccination Isolation of infected animals Good sanitation
Fowl pox	Poultry	Sores in wattle Sore mouth Eyes may also develop sores	Vaccination Isolation of the infected ones

(ii) Viruses

Viruses are small particles which cannot be seen even with powerful microscope. They are regarded as organism because they are capable of self-reproduction on the host organism. Scientists have not developed curative measures to control the attack of virus disease. Viruses are recognized by the nature of the disease which they cause.

Examples of Virus Disease of Farm Animals

Disease	Farm Animal	Symptoms	Prevention and Control
Rinderpest	Cattle, Sheep, Goats, Pigs	Mucous discharge High fever Loss of appetite Offensive diarrhea High mortality	Vaccination Destruction of affected animals Isolation of infected animals
Foot and Mouth Disease	Cattle, Goats, Pigs	Rise in temperature Loss of appetite Lameness Salivation Inflammation of teat and udder	Quarantine Segregation Good sanitation Vaccination Burn and bury the affected animals
Newcastle diseases	Poultry	Difficulty in breathing Paralysis Sudden death Stretching of neck Prostration Cycling movement Loss of appetite	Good sanitation Vaccination Burn and bury infected animals

(iii) Protozoa

Protozoa are microscopic one-celled animals. The protozoa multiply repeatedly in the host body and causes rupture of certain parts of the host body. They have the insects as their carries. They do a lot of harm to livestock in the tropics.

Examples of Protozoa Disease of farm Animals

Diseases	Farm Animal	Symptoms	Prevention and Control
Trypanosomiasis	Cattle, Sheep, Goats, Pigs	Anemia Loss of condition Great weakness Nervousness Paralysis Loss of appetite Frequent sleeping Abortion Death	Keep resistant varieties Good sanitation Use chemical treatment Use insecticides against tsetse fly
Coccidiosis	Poultry, Rabbits	Bloody diarrhea Weakness Emaciation Anaemia Dullness Loss of appetite Rough feather Crowding together Dropping of wings Death or high mortality	Vaccination Frequent change of litter materials Good sanitation Use of drugs Maintain dry litters always Use of coccidiostat
Babesiosis	Ruminants	Red urine Anaemia Death Loss of appetite	Tick control Dipping Good sanitation

(iv) Fungi

Fungi are simple plants with no chlorophyll and other specialized organs of plant like roots, stems and leaves. They live as parasites or saprophytes.

The saprophytes obtain their foods from dead organic matter. The parasites are regarded as pathogens feeding on living organisms. Fungi develop through the means of spores which perform the function of seeds. The spores will germinate to produce mycelia which can penetrate the host to cause a new infection.

Fungi can be classified into:

- (a) Phycomycetes e.g. phytophthora sp.
- (b) Ascomycetes - the two most important group in this class are the aspergillus and penicillium.
- (c) Basidiomycetes - this class includes the large fungi species found growing in the field and wood. The two major groups in this class are the hymenomycetes and gasteromycetes. The common mushroom and toadstools belong to the hymenomycetes.
- (d) Fungi imperfecti – all fungi that cannot be grouped into any of the three classes above fall into this class.

Apart from the above classification, it is also possible to group fungi according to the mode of dispersal and development. Thus we have soil-borne fungus, water-borne fungus and wind-borne fungus.

Examples of Fungi Disease of Farm Animals

Disease	Farm Animal	Symptoms	Prevention and Control
Aspergillosis	Poultry	High fever Loss of weight Loss of appetite Difficulty in breathing Whistling noises Grasping for breath Irritation of the skin	Use disinfectant Clean hatchery Avoid mouldy feed and litters good sanitation Isolate affected animals
Ringworm	Ruminants	Skin lesions Skin irritation Emaciation Loss of appetite Rough hides and skins Restlessness Presence of ring-shaped patches in the skin	Chemical treatment with sulphur, iodine and Vaseline Use disinfectant Dipping of the animal in fungicide is good

4.0 CONCLUSION

In this unit, we have discussed the concept of health. Under this section, we explained the meanings of health, disease and infection. We further classified animal diseases based on causal agent or pathogens into: bacteria, virus, fungi, protozoa and other parasites. It was then

concluded that disease ranks highest in deciding the profitability of livestock management.

5.0 SUMMARY

In this unit we have learnt that:

- Disease is a departure from normal state of health.
- Disease in farm management results into poor growth, poor food utilization, poor yield of animal products and high mortality rate.
- Infection is the establishment of parasite within a host.
- The establishment of pathogens in a host will depend on the population of the pathogens, the resistance of the animal against the pathogens and virulence of the pathogens.
- Sources of animal infection include:
 - contact with the infected animal
 - contaminated water and feeds
 - droppings and excretes and
 - animal carries.
- Disease can be classified based on pathogens, pathology and symptoms.
- Based on pathogens disease can be classified into bacteria, virus, protozoa, fungi.
- Examples of viral disease include:
 - foot and mouth disease
 - rinderpest
 - newcastle disease.
- Examples of bacteria diseases include:
 - Tuberculosis
 - Anthrax
 - Brucellosis
 - fowl pox etc
- Examples of protozoa disease include:
 - Typanosomiasis
 - Coccidiosis
 - babesiasis etc.

- Examples of fungi disease included:
 - ringworm and
 - aspergillosis.
- The general symptoms of disease infection include:
 - Dullness
 - loss of appetite
 - loss of weight
 - weakness
 - emaciation
 - reduction in yield of the animal production and
 - death.

6.0 TUTOR-MARKED ASSIGNMENT

1. (a) Define the following terms:
 - i. Health
 - ii. Disease
 - iii. Infection(b) List six (6) important causes of animal disease.
2. (a) Write an account of a disease of a named farm animal you have studied.
(b) Indicate the sources of infection, the symptoms or damage caused, prevention and treatment
3. State the causal organism and three symptoms of each of the following livestock diseases:
 - (a) Brucellosis
 - (b) Tuberculosis
 - (c) Aspergillosis
 - (d) Coccidiosis
4. (a) Name the causative agent of each of the following livestock diseases
 - i. Foot and mouth
 - ii. Rinderpest
 - iii. Newcastle(b) Name three animals that can be affected by each of the diseases listed.

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UNIT 2 PESTS AND PARASITES OF FARM ANIMALS

CONTENTS

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Main Content
 - 3.1 Differences between Diseases, Parasites and Pests
 - 3.2 Examples of Endoparasites of Farm Animals
 - 3.2.1 Characteristics and Destructive Nature of Tapeworm
 - 3.2.2 Characteristics of Destructive Nature of Liver-fluke
 - 3.2.3 Characteristics and Destructive Nature of Roundworm
 - 3.3 Examples of Ectoparasites of Farm Animals
 - 3.3.1 Characteristics and Destructive Nature of Ticks
 - 3.3.2 Characteristics and Destructive Nature of Louse
- 4.0 Conclusion
- 5.0 Summary
- 6.0 Tutor Marked Assignment
- 7.0 References/Further Readings

1.0 INTRODUCTION

In the last unit, we discussed the concept of health. The items discussed under this concept are the meaning of health, diseases and infection. Diseases of farm animals were classified based on pathogens into bacteria, virus, protozoa, fungi and other bigger parasites. Examples of bacteria, virus, protozoa and fungi diseases were also discussed under the following headings-farm animals affected, symptoms of infection, and prevention and control measures. This unit is devoted to pests and parasites of farm animals. The parasites will be grouped into two and discussed under endoparasites and ectoparasites.

2.0 OBJECTIVES

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

- differentiate between diseases, parasites and pests
- classify parasites
- give two examples each of endoparasites and ectoparasites
- give four characteristics of one endoparasite and one ectoparasite
- list two economic importance of one endoparasite and one ectoparasite.

3.0 MAIN CONTENT

3.1 Differences between Disease, Parasites and Pests

Disease is an unfavorable physiological and anatomical condition caused by continuous irritation of the host by pathogens. This normally results in abnormal cellular activity expressed in characteristic symptoms. This expressed condition is harmful to the animal, its products and reduces its economic value.

The word parasite in Greek, literally means 'situated beside' and was used for 'hangers on' or people who ate at other people's table. A parasite is therefore usually defined as an organism which grows on host animal from which it extracts all its food requirements.

The distinguishing features of parasites are:

- Metabolic dependence of the parasite for a whole or part of its existence on the host.
- Higher reproductive potential of the parasite than the host.

A pest is any animal which causes damage to crops or livestock. Unlike parasites, they do not live permanently on the host. Common pests include:

- Insects
- Birds and
- Animals.

3.2 Examples of Endoparasites of Farm Animals

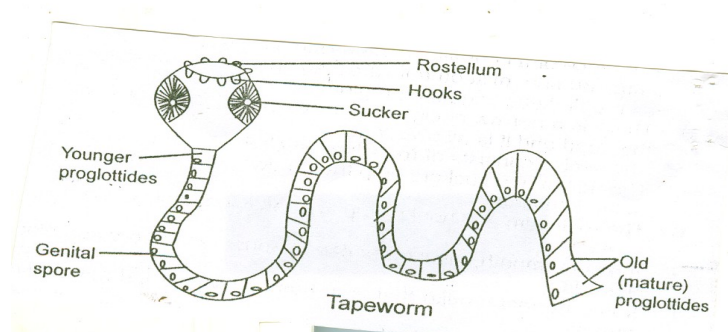
The common endoparasites of farm animals include the followings:

- Tapeworm – Taenia solium (Pork Tapeworm) and Taenia saginata (Beef Tapeworm)
- Liver fluke-Fasciola hepatica
- Roundworm-Ascaris limbricoides

3.2.1 Characteristics and Destructive Nature of Tapeworm

(a) Characteristics of Tapeworm

- Erebor (1998) identified the followings characteristics of tapeworm:
 - (i) The head of tapeworm is called scolex and shaped like a knob.
 - (ii) The scolex consists of suckers, hooks and rostellum.
 - (iii) The hooks and suckers help to cling to the walls of the host is intestine.
 - (iv) The rostellum and hooks also help in attaching the scolex to the gut walls.
 - (v) the head is attached to a large number of segments called proglottides.
 - (vi) It has no mouth, alimentary canal, anus, respiratory and blood vessels.
 - (vii) It has both male and female sex organs (hermaphrodite).
 - (viii) Excretion is through flame cells.
 - (ix) It is a two-host parasite with man as the primary host and pig or cow as the secondary host.
 - (x) Matured proglottides of the worm contain numerous fertilized eggs.
 - (xi) Fertilized eggs pass out with the faeces of the host and develop into embryos.
 - (xii) When swallowed by the secondary host the embryo form bladder worm and remains inactive.
 - (xiii) Bladder worm later develops into young tapeworm in the primary host.



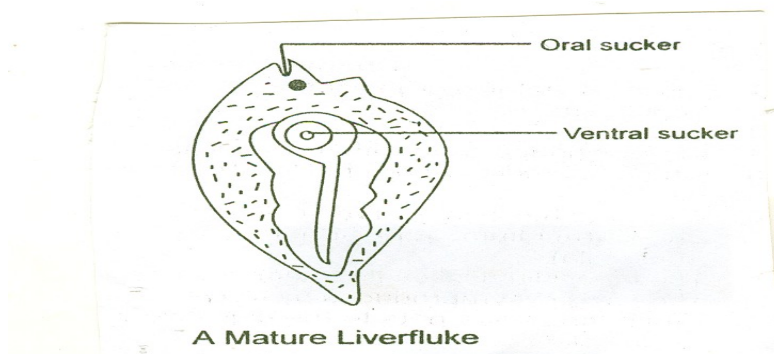
(b) Destructive nature of Tapeworm:

- a) Causes serious shortage of blood i.e. anaemia
- b) Causes abdominal pain and discomfort
- c) The presence in the body can lead to vomiting and indigestion.
- d) There is loss of weight or emaciation
- e) The infected animal shows general weakness
- f) There is also disorder in the nervous system.

3.2.2 Characteristics and Destructive nature of Liver-fluke

(a) Characteristics of Liverfluke:

- i. Liverfluke is about 2cm long.
- ii. Liverfluke is brown in colour.
- iii. It is a flat leaf-like organism.
- iv. Liverfluke has both male and female sex organs in one body i.e. hermaphrodite.
- v. The eggs pass out with faeces and hatch into larvae called miracidia.
- vi. The miracidium gets attached to a watersnail which is the secondary host.
- vii. The miracidium forms sporocyst which later changes to rediae.
- viii. When the rediae gets to the digestive system, it forms a small worm called cercae.
- ix. When the cercae gets out of snail, it swim inside water until when animal drinks it along with water.
- x. It may also encyst on vegetation where it will be picked up by grazing animals.
- xi. There, it will penetrate the animals body and finally settle in the bile duct as liverfluke.

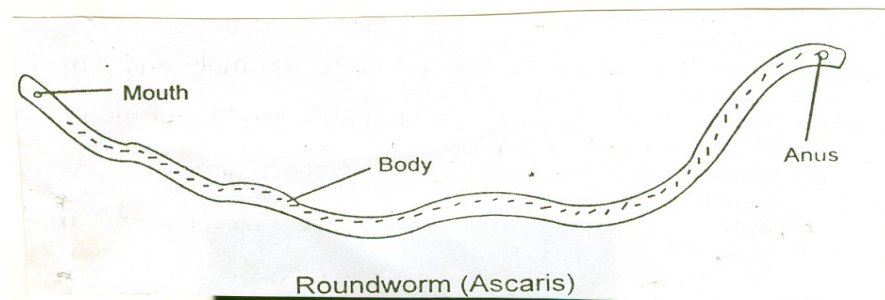
**(b) Economic importance of Liver-fluke:**

- i. It causes a disease called bilharzias or schistosomiasis.
- ii. It also results to liver problems leading to drowsiness.
- iii. It causes death.
- iv. It affects the digestion of food in animals.
- v. The excretory product of the fluke can be poisonous to the animal.

3.2.3 Characteristics and Destructive Nature of Roundworm

(a) Characteristics of Roundworm:

- i. Roundworm exists as male or female.
- ii. They possess mouth and anus.
- iii. The body is smooth and covered by thick and tough cuticle.
- iv. The male and female worms mate to produce fertilized eggs.
- v. The eggs may be deposited on grazing land, water or even in the animal feeds.
- vi. The animal may pick up the eggs from any of the above sources.
- vii. The egg develops into larva.
- viii. The larva may later find its way to the mouth and may later be swallowed into the intestine.
- ix. The larva then develops into a matured roundworm.

**(b) Destructive nature of Roundworm:**

- i. It reduces the blood of the host thereby leading to anaemia
- ii. It is responsible for retarded growth.
- iii. Responsible for many respiratory problems in farm animals.
- iv. Leads to indigestion of food in the alimentary canal.
- v. Constipation will also be very frequent.
- vi. There is loss of appetite in affected animal.
- vii. The animals shows general weakness.
- viii. Many organs may be destroyed during worm migration.
- ix. Death of the host may occur under severe infestation.

SELF-ASSESSMENT EXERCISE 1

Describe the life cycle of a named endoparasite in a named animal and comment on the damages it causes to the host.

3.3 Examples of Ectoparasites of Farm Animals

The common ectoparasites of farm animals include the followings:

(a) Ticks

- E.g. One – host ticks – *boophilus decoloratus*
 Two – host ticks – *rhhipicephalus evertsi*
 Three – host ticks – *ixodes ricinus*

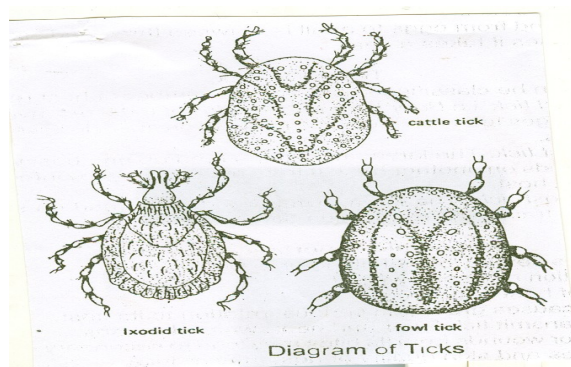
(b) Louse

Erebor (1998) presented the characteristics and destructive nature of these two ectoparasites as follows:

3.3.1 Characteristics and Destructive nature of Ticks

(a) Characteristics of Ticks:

- i. It is an arthropod belonging to the class of arachnida
- ii. They are of two types – the soft tick (*argasidae*) and the hard tick (*ixodidae*).
- iii. Ticks have four pairs of jointed walking legs.
- iv. The mouth parts of the soft- tick are hidden in a groove called *camerostome*.
- v. The body of the soft ticks is covered by a small projection called *mammillae*.
- vi. Adult ticks are night feeders and hide themselves during the day.
- vii. The body of the hard ticks is covered with a chitinous plate called *scutum*.
- viii. The mouth part and capitulum project to form a false head or *rostrum*.
- ix. The male and female ticks are different from each other.
- x. The male tick is small and does not suck blood, but the female is large and sucks blood.
- xi. The scutum covering the body of the male hard tick is relatively much larger than that of the female.
- xii. After mating, the female tick engorges blood very rapidly and drops off the host.
- xiii. The eggs can be laid any where in batches.
- xiv. The eggs later hatch to larvae, the larvae develops into nymphs and later into adults.
- xv. The development of the eggs into adult ticks takes about three to six months.



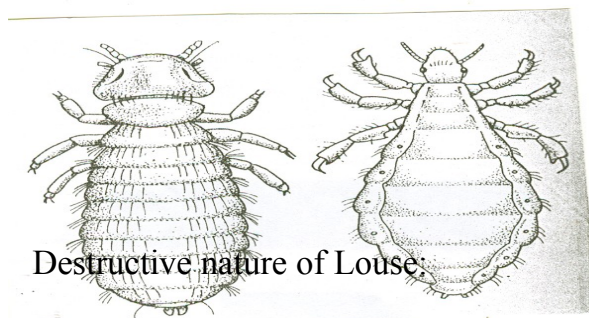
(b) Destructive nature of Ticks:

- i. Ticks remove appreciable quantities of blood from animals.
- ii. Their bites cause serious skin irritation.
- iii. The wounds produced by the bites may become infested by bacteria.
- iv. The most significant injury inflicted by ticks is the transmission to valuable domestic animals such serious diseases as babesiasis or theileriasis.
- v. Death of host may occur.
- vi. There is loss of weight or emaciation.
- vii. The hides and skin quality of host may reduce.

3.3.2 Characteristics and Destructive nature of Louse

(a) Characteristics of Louse:

- i. Lice belong to the arthropoda and the insect class.
- ii. Like other insects, the body is divided into head thorax and abdomen.
- iii. Like other insects, it has three pairs of jointed walking legs.
- iv. The mouth part is adapted for biting and sucking.
- v. The body is flat and has no wing.
- vi. It lays eggs called nits.
- vii. The eggs hatch into nymphs and the nymphs develop into adults.
- viii. Adult lice are transmitted from one host to another through contact.
- ix. The life cycle from eggs to adults lasts for about three to four weeks.



(b) Destructive nature of Louse:

- i. It sucks large volume of blood thereby leading to anaemia or excessive loss of blood.
- ii. Its bites can cause severe irritation.
- iii. Heavy lice infestation can lead to restlessness.
- iv. The productivity of the animal will automatically reduce.
- v. Scratching of the bites can result into sores.
- vi. The sores may create room for pathogens to attack the animal.
- vii. Loss of weight or emaciation.
- viii. Heavy lice infestation can cause death in poultry.

SELF-ASSESSMENT EXERCISE 2

1. Which of the following livestock parasites possess progloihides?
 - A. Liver Fluke
 - B. Roundworm
 - C. Tapeworm
 - D. Trypanosome
 - E. Tick
2. The water-snail is important in the lifecycle of
 - A. Roundworm
 - B. Tapeworm.
 - C. Liver-Fluke
 - D. Coccidium
 - E. Tick.
3. In what ways can ectoparasites be harmful to farm animals?

4.0 CONCLUSION

In this unit, we discussed pests and parasites of farm animals. Under the unit, we differentiated between diseases, parasites and pests. We equally grouped parasites into endoparasites and ectoparasites. The characteristics and destructive nature of some common parasites were highlighted. It can be concluded from our various submissions in this unit that parasites are responsible for a lot of damages that happen to animal health.

5.0 SUMMARY

In this unit, we have learnt that:

- i. Parasites live within the host while pests live outside the host.
- ii. Parasites can be grouped into two endoparasites and ectoparasites
- iii. Endoparasites live within the organs of the host while ectoparasites live on the skin of the host.
- iv. Examples of endoparasites are tapeworm, liverfluke and roundworm
- v. Examples of ectoparasites are ticks and louse.
- vi. Cattle and pigs are the secondary hosts of tapeworm while man is the primary host.
- vii. Cattle and sheep are the major hosts of liver fluke while fresh-water snail is the secondary host.
- viii. Pig is the primary host of roundworm.
- ix. Ticks can be grouped into soft body ticks and hard body ticks.
- x. Ticks can also be classified according to the number of host-one host, two host and three hosts ticks.
- xi. Lice can be found in the body of any farm animal most especially poultry and pigs.
- xii. The general damages that parasites cause to host farm animals include the following:
 - The animal continues to eat but does not grow because the parasites consume the nutrients already digested by the host.
 - Growth is retarded and milk yield is considerably reduced in lactating animals.
 - The animal becomes rough in appearance and lean.
 - Resistance to disease from secondary infections is lowered.
 - Cost of production is increased and milk and meat quality are lowered.
 - Severe cases may result in the death of the animal.

6.0 TUTOR-MARKED ASSIGNMENT

1.
 - (a) Write an account of the life history of an endoparasite of a named livestock. Draw attention to the features which make it a successful parasite.
 - (b) What are the effects of the adult parasite on the host?
2.
 - (a) Describe the structure and life history of a named ectoparasite.
 - (b) Explain how this parasite is transmitted from one host to another.
 - (c) List four destructive features of the parasite.

7.0 REFERENCES/FURTHER READINGS

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UNIT 3 MANAGEMENT AND CONTROL OF PESTS, PARASITES AND DISEASES OF FARM ANIMALS

CONTENTS

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Main Content
 - 3.1 Management Methods of Prevention of Pests, Parasites and Diseases
 - 3.2 General Methods of Controlling Pests and Parasites of Farm Animals
 - 3.3 General Control Measures of Animal Diseases
- 4.0 Conclusion
- 5.0 Summary
- 6.0 Tutor-Marked Assignment
- 7.0 References/Further Readings

1.0 INTRODUCTION

Remember that this is the last unit of discussion on animal health. In unit 2, we differentiated between diseases, parasites and pests. We also looked at common parasites of farm animals. We discussed this under the ectoparasites and endoparasites. The characteristics and destructive nature of these common parasites were highlighted. In this last unit, the general prevention and control of pests, parasites and diseases will be highlighted. This will be control of pests and parasites and control of diseases.

2.0 OBJECTIVES

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

- list at least two management practices that can be adopted to prevent the spread of parasites and diseases
- list at least five general ways of controlling the spread of parasites and pests
- list four methods that can be adopted to control the outbreak of diseases of farm animals.

3.0 MAIN CONTENT

3.1 Management Methods of Prevention of Pests, Parasites and Diseases

Prevention is better than cure, so farmers should always aim at preventing disease outbreaks in their farm rather than curing them. Proper livestock management plays an important part in preventing the effects of pests, parasites and diseases on the host animals. Such management practices include the followings;

- (a) Disinfecting premises by regularly changing the bedding materials, sweeping stock houses and spraying with insecticides and acaricides. These measures will destroy some parasitic arthropods, arachnids and their life stages.
- (b) Dipping and spraying stock with appropriate insecticides at regular intervals. This will destroy the ectoparasites such as ticks, lice and fleas
- (c) Deworming livestock with drugs e.g. piperazine wormer, which will keep the endoparasites in check.
- (d) Good and balanced nutrition, which involves providing food at the right time, not only in the right quantity but also in the right quality with respect to carbohydrates, proteins, lipids, water, mineral salts and vitamins. Animals suffering from malnutrition easily succumb to the attack of disease organisms, while well fed animals will resist attack more successfully.
- (e) Observation of good management practice to prevent the spread and attack of pests, parasites and diseases among the flock. This can be achieved in several ways:
 - i. All bushes around the livestock house should be cleared and the environment kept clean.
 - ii. Farm workers should make it a point of duty to clean livestock equipment especially feeders and drinkers every morning. This will help to reduce the spread of diseases through contamination of equipment.
 - iii. Isolate sick and unproductive animals.
 - iv. Keep only animals of the same age and breed together.
 - v. Avoid overcrowding of the animals.
 - vi. Maintain good record of all the animals in order to know their susceptibility and resistance to diseases.

- (f) Before purchasing any livestock, the parental background should be sought. The parent stock should be free from all inheritable diseases.
- (g) Footbath containing disinfectant should be provided at the entrance of livestock pen. Anybody entering the house should make it a point of duty to bath their shoes with the disinfectant.
- (h) Try as much as possible to disallow visitors from entering animal pen. The same visitors must have entered one or two other poultry houses before entering your own. This can encourage the spread of diseases from one flock to another.
- (i) Always seek the help of veterinary officers in your area anytime there is outbreak of disease. He will help you to diagnose the cause of the disease and he will also render expert advice on the possible remedies.

SELF-ASSESSMENT EXERCISE 1

List five (5) essential routine management practices that a stockman should carryout to prevent the spread of diseases.

3.2 General Methods of Controlling Pests and Parasites of Farm Animals

Control of pests and parasites involves the keeping away of the pests and parasites from their hosts. The intermediate hosts of the parasites have to be killed or removed from the vicinity of the hosts if there is to be any control. The host should be made strong to resist some of the attacks. The carriers or agents of transmitting parasites should be kept away from the farm animals.

To achieve all these, different methods have to be adopted. The methods will depend on whether the parasites are endoparasites or ectoparasites and also whether or not they have intermediate host. This implies that the means of transmission will influence the method of control. For the endoparasites which have intermediate host the control measures are centered on the vectors. The same treatment goes for some ectoparasites or pests. Further more the treatment will depend on whether they are arthropods or not. The following methods are used for some of the arthropods vectors, parasites and pests.

- (a) Clearing of the breeding places. Bushy surroundings should be cleared and other medium that harbor pests and parasites should be removed. This is very essential for insect pests like tsetse fly.
- (b) Application of chemicals on the host e.g. the application of certain compound on the host, will be capable of preventing the vectors or pests from getting access to it.
- (c) Application of chemicals to kill the parasites. Ectoparasites like ticks and lice are controlled in this way. The chemicals are applied to the host either by dipping the host animal in the mixture containing the chemical or by applying the chemical through dusting or dressing on the host animal. Some of the chemicals commonly used include DDT, arsenic compounds etc.
- (d) Applying the chemicals directly on the vectors. Here the habitat of the vector is located. The vector may be sprayed with the chemical. Their breeding places may be sprayed with the chemicals too. In some cases it may be necessary to fumigate the area with chemical. The chemical may be painted or smeared where the organisms are suspected to be present. Such is the case in lice in which perches are painted with DDT. Most of these treatments are repeated in such a way that the vectors are treated at the time they are most vulnerable to the chemicals, especially in their reproductive stages.
- (e) Biological control. This method is effective for some ectoparasites. For example, cattle egret can be introduced to pick out the ticks from cattle's skin. Other animals may be introduced to feed on some of the pests of farm animals e.g using ducks and geese to eat up the snails that serve as secondary host for liver fluke.
- (f) Immunity. Natural or acquired immunity may be possessed by the animals by selecting the animals that are immuned naturally to a prevalent parasitic disease. Immunity against such disease may help to reduce the havoc caused by the disease and this will also help to reduce its incidence. For example, Ndama cattle have natural immunity against trypanosomiasis.
- (g) Adequate nutrition. The importance of nutrition in disease control has been stressed under management practices. Good nutrition helps the animals build up resistance to the invading organism. If the body is strong enough the disease may not manifest at all, with good feeding the blood parasites may not succeed in breaking the body resistance against other diseases.

- (h) Control of non-arthropod vectors. For non-arthropod vectors, the control measure will vary according to the species. In the case of the snails which is an intermediate host of liver fluke, the snails can be killed by using some chemicals like cooper sulphate. The cutting of the vegetation can also help. Other measures include draining pools so that snails will not have comfortable environment. Flock is also prevented from grazing near rivers and streams.
- (i) Other methods of controlling parasites and pests include paying attention to good sanitation. The environment should be clean and free from materials that may harbour pathogenic organisms or may help vectors spread. Animals should be removed from faeces since the eggs of the parasitic worms pass out of the host through the faeces. Isolation of the affected animal and quarantine are also effective.
- (j) Management practices. All the management methods of preventing pests, parasites and diseases are also recommended under the method of controlling pests and parasites of farm animals.

SELF-ASSESSMENT EXERCISE 2

1. An effective way of ensuring in-built resistance to disease in calves is to:
 - (a) Vaccinate calves at weaning
 - (b) Allow calves access to colostrums
 - (c) Ensure regular veterinary check-up
 - (d) Observe proper quarantine
 - (e) Give balanced ration
2. The Ndama cattle are well adapted to West Africa mainly because the breed:
 - (a) Can withstand a long period of drought
 - (b) Is resistant to trypanosomiasis
 - (c) Can feed well in poor quality forages
 - (d) Can withstand high humidity
 - (e) Is tolerant to poor management

3.3 General Control Measures of Animal Diseases

Management practices and control of pests and parasites are generally designed to prevent the outbreak of diseases among the livestock. When

there is outbreak however, some measures may be necessary to curtail the spread in addition to those measures discussed above.

- (a) Administration of drugs. Various drugs are now available in the market to treat various diseases of farm animals. There are antibiotics against bacteria diseases of farm animals. The drugs may be taken orally by farm animals; some are added to their feeds and some to the drinking water. Examples of common antibiotics of farm animals include- terramycin, tylan, furazolidon, flozaid, furagali etc.
- (b) Use of vaccination. Vaccination is the most effective way of controlling viral diseases. Routine vaccination will give farm animals especially poultry immunity against the out break of diseases. There are vaccines against newcastle disease, fowl pox, fowl typhoid, fowl cholera etc.

4.0 SUMMARY

In this unit, we have learnt about the following ways of preventing and controlling pests, parasites and diseases of farm animals:

- Provide good and adequate balanced diet
- Keep resistant breeds of farm animals
- Animals must be quarantined before being allowed to join others
- Maintenance of clean environment
- Farm animals should be allowed to graze in paddocks with rich nutritive forages
- Vaccinate animals against diseases
- Isolate sick and unproductive animals
- Provide clean feed and water
- Wash the feeding and watering troughs regularly
- Keep animals of the same age and breed together
- Call the veterinary officer for routine check-up
- Deworm animals for internal parasites regularly
- Provide dipping services against ectoparasites
- Carryout regular checking, observation and treatment of diseases
- Avoid over crowding of the animals
- Restrict visitors from entering animals houses
- Maintain good record of all the animals in order to know their susceptibility and resistance to diseases.

5.0 TUTOR-MARKED ASSIGNMENT

1. Explain how knowledge of the life history of a pest can be of use when trying to prevent or control it.
2. Suggest the methods which can be used to prevent and control the following parasites:
 - i. A named endoparasite of farm animals
 - ii. A named ectoparasite of farm animals

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- Akinsanmi O. (1975). *Certificate Agricultural Sciences*. London: Longman Group Ltd.
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