

**THE UNITED REPUBLIC OF TANZANIA
MINISTRY OF EDUCATION AND CULTURE**



Field Support Programme For Second Year
Diploma In Secondary Education

**SELF STUDY MODULE
AGRICULTURE SCIENCE**

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INTRODUCTION

Agriculture is an industry in which the knowledge of different natural and physical sciences as well as economics, administration and sociology are applied in order to promote production of food, fibre, shelter and fuel for human use. It is the science of growing, managing, harvesting, processing, storing and marketing of products. It also involve raising and management of livestock and other natural resources and environmental management notably forests, bees and fish.

The aim of this self-instructional module for Diploma in secondary education is to Promote the acquisition of professional knowledge, skills and attitude in the field of agriculture, and to develop and promote self-confidence and an inquiry mind to the student teacher and thus enable him/her to expand the scope of acquisition, improvement and upgrading of mental, practical, productive life skills needed to meet the need of the demand-driven world of science and technology both in academic and pedagogy. When used properly, the rational mind will enhance fundamental principles, theories and practices of Agriculture to develop team work spirit self wage, employment and improvement in production of goods and services.

The module is organized into six topics which are Crop Science, Livestock Science, Soil Science, Agricultural Economics, Agricultural Mechanization, Natural Resources and Environmental Management.

In this modern world explosion of knowledge you are expected to seek knowledge from a varied sources, such as libraries, digital libraries, reading periodicals and surfing in internet in order to make you up to date. However, the Ministry of Education and Vocational Training (MoEVT) in collaboration with the Tanzania Institute of Education (TIE) will from time to time provide guides and other textual materials as teaching and learning resources. It is your responsibility as agricultural teacher, to be well acquainted to books relevant to the science and practice of agriculture, so that you can advice on the best use of books and other textual materials available at school or other sources for the best learning theoretically and practically.

As you read this module you will be able to assess yourself in each topic and get ready to do the final examination of National Examination Council of Tanzania [NECTA]. At the same time, you will be teaching your students in form I – 4 and prescribe tests and project work in the classroom.

It is expected that you will work hard within the time allocated to cover this content adequately to gain competence, desired in the field of Agriculture.

HOW TO USE THE MODULE

This module is designed for Agricultural Science. It will orient you to practical and theoretical aspects in the field support programme in your second year Diploma in secondary education. The module requires you to adhere to instructional Objectives and targeted competences so that the intended goals will be realized. You are required to keep records of all activities you are going to do practically and theoretically in each sub-topic when teaching for the sixteen weeks, in a diary and portfolio. You are advised to read student-teachers guide for more information. also you will be required to prepare more activities for your students to compliment the given one in this module.

In addition you have to write a report on your teaching practice as your independent study which will be graded for evaluation purpose.

TOPIC ONE: CROP SCIENCE

1.1 Brief Explanation

Welcome to topic one. During the college-based phase, you discussed on the knowledge, skills and attitudes acquired in crop science. The themes which follow under this topic are as follows: Principles of crop Production, Weed and Weed control. Importance of pests and diseases. Categories and control measures of pests and diseases. Other are grain storage, which encompass crop hygiene, pest control measures, and common method of grain storage. The knowledge you learnt and practicals you performed in this topic has made you acquire several competences and enabled you to be active participant in the study of crop science and production.

1.2 Competence to be developed

At the end of this topic you are expected to develop the following competences:-

- (i) To design supervise and practice activities relevant to crop production depending on circumstances and situations.
- (ii) To develop skills of estimating plant population in a given area.
- (iii) To identify noxious weeds and non-noxious weeds and their detrimental effects in crop production.

1.3 Activities:

Guide your students in performing the following activities

- (i) Construct different types of seed beds by use of hand hoe, ridger and other advanced machines.
- (ii) Prune perennial crops by use of simple tools
- (iii) Desuk plants eg. Tomato plant.
- (iv) Apply vegetative propagation by any of these – cutting, layering or grafting.
- (v) Prepare compost manure by the process of composting.
- (vi) Collect and preserve weed species found in the school vicinity.
- (vii) Calculate plant population in a hectare of maize given the recommended spacing.
- (viii) Calibrate a knapsack sprayer before spraying a field against insect pest like African bollworm OR calibrate the sprayer before hand application of 2, 4D Amine herbicide to a plot of wheat farm.
- (ix) Collect seeds, plants species to establish a genebank or crop museum/botanic garden or establish a Mali hai Club.
- (x) Establish a vegetable garden and employ biological pest and disease control measures eg. Inter planting with Marigold weed (flowers).
- (xi) Establish means of identifying different plant diseases.
- (xii) Device a Format for Teaching a Practical lesson on “Germination Test of small seeds”

1.4 Evaluation

1. So far you have developed various competences in this topic. Identify competences you met and what you have not.
2. Visit your area, collect and identify different species of weeds, label their common names, Botanical names, and scientific names.
3. In the school compound identify different types of trees, label their common names and botanical names.
4. According to activities performed in 1:3 explain various ways supervising your students in performing the mentioned activities groups.

TOPIC TWO:
INTRODUCTION TO LIVESTOCK
SCIENCE AND PRODUCTION

2.1 Brief explanation

Welcome to topic two. This topic intends to equip you to gain the following concepts and principles of livestock production. These includes:-

The importance of livestock industry in Tanzania, Factors limiting livestock industry in Tanzania, selection of suitable stock (breed) types, classes of livestock, Principles of livestock improvement with emphasis to livestock breeding. Among these, swine production, poultry production, cattle management, Goat and sheep rearing. Animal Nutrition, breeding and improvement will be emphasized.

2.2 Competences to be developed

- (i) To describe the role of livestock industry in Tanzania and factors limiting the industry.
- (ii) To organize and supervise group work to identify select, and describe, the suitable livestock breed by considering climatological factor's of an area.
- (iii) To demonstrate Handling skills in treatment of livestock animals regarding general rules and regulations.
- (iv) Incorporate and practice other managerial activities relevant to livestock science depending on Environment and circumstances.

2.3 Activities

- (i) Guide your students to visit one of livestock industry and find out problems facing the industry and later discussing solutions towards problems identified.
- (ii) Explain how you can construct livestock equipments, and structures using locally available materials.
- (iii) With your students visiting livestock breeding stations and observe how breeding is conducted Naturally or artificially.
- (iv) Involving students in practical activities eg:- milking, test for mastitis using strip-cup, spraying, visiting the abortor, hay making dehorning, identification of animals, culling practices, docking, deworming, foot trimming, formulating animal feeds using Pearson's square method, Estimating the liveweight of livestock animals by using the formula, below $\frac{L \times G^2}{300}$

300

Where: L = Stands for length of the Animals

G = Girth of the animal and 300 it constant.

- (v) Guide your students to show step by step how to preserve animal products using traditional methods/improved techniques.
- (vi) Explain how to establish and manage pastures, utilize and conserve forage materials by use of integrated traditional and modern techniques. lead a

2.4 Evaluation:

Livestock industry in Tanzania is still in dilemma.

1. Practical and theory aspects are essential in learning. Ask yourself how you can guide students intergrate Theory and practices of livestock science in their daily life?
2. Show how to manage livestock as regards to selection, principles, systems, practices, daily routines, equipment, housing, nutritional status, feeding, compounding ration, fodder conservations, livestock breeding and livestock records keeping.

**TOPIC THREE:
INTRODUCTION TO SOIL SCIENCE**

3.1 Brief Explanation

Welcome to topic three. In the course of your study you learnt that Soil is a thin layer of the earth's crust which has several components namely mineral matter organic matter, inorganic matter, water, soil air and living organisms in the soil.

In addition in the study of soil [pedology] you studied physical properties of soil, chemical properties and soil biology.

It should be known that soil is dynamic matrix, and for that matter you need to study the concept of soil composition, properties of soil, soil biology, study soil formation and classification, plant nutrition soil fertility and soil conservation. The knowledge of soil science will enable you to assess potentiality of soil to support agriculture productivity.

The subject matter is also composed of many practical lessons which will require laboratory procedures. Examples are sampling and preparation of soil samples, Particle size Analysis, Soil Consistence, Bulk Density, Particle Density, and Cation Exchange-Capacity of soil by Ammonium Acetate [NH₄OA_c] saturation. Some of these practicals can be done at tertiary level where laboratories are well equipped with apparatus and personnel while the rest can be done in the field where the soil is sampled. However, where the laboratories are not established the nearest school/college with such laboratories equipments can be consulted as an alternative strategy.

3.2 Competences to be developed

- (i) Identifying different types of soils in your school environment and advice the school management how to use in agriculture.
- (ii) Planning for the laboratory experiments lead and supervise your students to classify, identify, characterize, perceive and sieve soil samples.
- (iii) Computing exchangeable cations.

- a) C.E.C. cation exchange capacity
 - b) Total exchangeable base
 - c) Exchangeable cations.
- (iv) Applying different teaching technique lead and guide your students to intergrate the existing relationship between soils and soil formation factors eg: climate, organism, relief, parent materials and time. S = F (C, O, R, P, T).
- (v) Guiding and supervise students to practice cultural, mechanical, chemical, physical and biological practices related to soil science.

3.3 Activities

- (i) Practice the application of the following things in your school garden or farm. Cultural, physical, chemical, and biological practice related to soil science eg. Application of mulching, fertilizer application land tillage, terraces etc.
- (ii) Explore more relevant and appropriate soil science practical activities to compliment the goal desired.

$$\text{Percentage base saturation} = \frac{\sum \text{EB} \times 100}{\text{C.E.C}}$$

Where EB = exchangeable cations eg. H⁺ and Al³⁺

C.E.C. = total cation exchange capacity; bottle expressed in mills equivalent per 100g soil.

3.4 Evaluation

1. Soil is a dynamic matrix; Explain how you can analyse and assess on

the following:

- a) Soil and its components
- b) Physical chemical and biological properties of a soil
- c) Soil classification and formation
- d) Plant Nutrition and soil fertility

TOPIC FOUR:
AGRICULTURAL ECONOMICS

4.1 Brief Explanation

Welcome to topic four. You have already learnt that, Economics is an applied social science which deals with production, distribution and consumption of goods and services. You also know that the study of the costs and benefits is involved in Agricultural production activities done mainly in the rural areas. For this reason, Agriculture economic is also called Rural Economy. Thus, this module will guide you revise through tasks on Meaning, of Economics, factors of production, price theories, prices, production economics, farm records, farm planning, Risk and uncertainly in Agriculture production, Marketing and International trade.

4.2 Competences to be developed

- (i) Demonstrating the use of participatory methods and techniques to:
 - a) Analyse, plan, manage and assess feasible and non feasible projects in a school vicinity and in their day to day life.
 - b) Prepare enterprise budgets, inventory and balance sheet the their project/enterprise.
- (ii) Designing and organizing field study activities which will enable learners to comprehend Agricultural economics.

4.3 Activities

- (i) Guide your students on how to write a report on constraints, achievement and challenges of a certain project.
- (ii) Lead your students to visit a co-operative society, or a market place in order to observe how exchange of goods take place.
- (iii) Plan for the role play teaching technique in the classroom to demonstrate how buying and selling is done in the school compound.

4.4 Evaluation

1. After all competences acquired, assess if you can do the following:-
 - Applying different teaching techniques to enable your student to identify, plan, implement and evaluate Agricultural project or enterprise.
2. Up to this point can your student prepare enterprise budgets/inventory and balance sheet?.
3. What can you comment on Agricultural Economics in Tanzania as far as development of commercial subsistence Agriculture is concerned.

**TOPIC FIVE:
AGRICULTURE MECHANIZATION**

5.1 Brief Explanation

Welcome to topic five which is about Agricultural Mechanization. As experienced during college-based course,

This topic equipped you with knowledge, skills and attitudes related to the following concepts:- introduction to agricultural mechanization, Human power and basic tools, animal power and other sources of power. Tillage machinery, Planting equipments and Crop protection equipments. Harvesting equipments, Farm workshop and structures, Soil and water conservation and lastly Processing of Agricultural products.

You are advised to read various textual materials available in libraries, and visiting the web for surfing in the internet to access complementary materials. Application of teaching and learning strategies such as field trips, guest speakers and demonstration are encouraged to meet the need of your students.

5.2 Competences to be developed

- (i) Integrating the concept of agriculture mechanization in agriculture production.
- (ii) Converting different types of power, use/apply them in Agricultural activities eg. Solar power, animal power and wind power use and apply them in agriculture activities.
- (iii) Mobilizing students in small groups to design, use and maintain farm implements in Agriculture.
- (iv) Applying of principles of agriculture mechanization to agriculture practices.

5.3 Activities

- (i) Supervise your students to operate and apply appropriate commands to Animal power and man Machine/Equipment/Tools by an assistance of an expert.
- (ii) Analyse methods to harness different source of power and apply them in Agricultural practices.

5.4 Self - Evaluation:

1. Can I manipulate and harness Animal power and other sources of power in agricultural activities in a daily life?
2. Explain the significance of Agro-mechanics in Agriculture?
3. Can I design and construct simple Agriculture Equipments/tools using local available materials eg. Planters, seed drill, wheelbarrow and harness yoke.

TOPIC SIX:
NATURAL RESOURCES AND ENVIRONMENTAL MANAGEMENT

6.1 Brief Explanation:

Welcome to topic six. Natural resources are Natural potentials which are supplied by nature and they require mankind to develop them and utilize them sustainably. This means human beings should not harvest them beyond maximum sustainable yield some of Natural resources are fishes and fish products, bees and bee products, forest products, minerals and natural habitats.

You are supposed to teach the role and importance of natural resources to the economy of Tanzania with regard to Environmental degradation.

It has been reported that environmental pollution has reduced most of Natural resources eg. Fishes, bees, forests, wildlife in their natural habitats. It's the duty of the agriculture student in collaboration with the community to keep the school environment green and teach pupils to harvest natural resources within the recommended limits stated by environmentalists. In the college you also discussed the concepts of environmental management, environmental degradation, activities that bring about degradation, environmental pollution, destruction of ozone layer and global warming.

6.2 Competences to be developed

- (i) Demonstrating practices and apply sustainable environment management principles in your school.
- (ii) Ability to socialize, interact and share ideas and theoretical concepts with community around so as to intergrate their ideas and concepts taught in the school /college.
- (iii) To demonstrate to students enemies of natural resources, environmental management in the field/farm.
- (iv) Ability to mobilize, organize and guide students to demonstrate the role play in safety measures to be taken in workshop as life saving strategy (precautions).

6.3 Activities to the Student

- (i) Prepare a lesson for your students on the anatomy, physiology and reproduction of fishes and show clearly the materials used for teaching and learning.
- (ii) Guide your students to collect seeds from indigenous trees, ask them to observe and name them in both common and scientifically.
- (iii) Visit a fishing ground, use a checklist to interview the fishermen on the challenges they face during harvesting and marketing of the catch.
- (iv) Describe various methods used to preserve fresh fish and insects e.g. bees in the laboratory.
- (v) Use a gauze to catch varieties of bees kill them and preserve them in a glazed cage well labeled.
- (vi) Explain the procedures used to estimate the age of a tree by counting the annual concentric rings of the vascular bundles.
- (vii) Describe how you plan and establish tree nursery by applying principles of forest management.
- (viii) Guide your students to design and construct a modern or traditional hives with an assistance of the community around.

6.4 Evaluation:

1. Within the confines of the limited Teaching/Learning resources can you teach the subject/topic of Natural resources confidently? If not comment on the alternatives.
2. Ichthyology is a study in marine biology. Mention the 2 major fish groups and explain natural environment (habitats)
3. Explain problems facing forestry industry.
4. Explain the roles of fish farming play in the domestic economy,
5. What are the wood preservatives you have come across in the area around the school?
6. Outline and explain the safety precautions to be taken during honey harvesting.
7. Evaluate the Role and potential of Natural resources and environmental management in your area.
8. Evaluate and analyse the significance and roles of natural resources and environmental management to the economy of Tanzania.

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