THE REPUBLIC OF UGANDA

Ministry of Education and Sports

HOME-STUDY LEARNING

SENIOR 5

AGRICULTURE

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FOREWORD

Following the outbreak of the COVID-19 pandemic, government of Uganda closed all schools and other educational institutions to minimize the spread of the coronavirus. This has affected more than 36,314 primary schools, 3129 secondary schools, 430,778 teachers and 12,777,390 learners.

The COVID-19 outbreak and subsequent closure of all has had drastically impacted on learning especially curriculum coverage, loss of interest in education and learner readiness in case schools open. This could result in massive rates of learner dropouts due to unwanted pregnancies and lack of school fees among others.

To mitigate the impact of the pandemic on the education system in Uganda, the Ministry of Education and Sports (MoES) constituted a Sector Response Taskforce (SRT) to strengthen the sector's preparedness and response measures. The SRT and National Curriculum Development Centre developed print home-study materials, radio and television scripts for some selected subjects for all learners from Pre-Primary to Advanced Level. The materials will enhance continued learning and learning for progression during this period of the lockdown, and will still be relevant when schools resume.

The materials focused on critical competences in all subjects in the curricula to enable the learners to achieve without the teachers' guidance. Therefore effort should be made for all learners to access and use these materials during the lockdown. Similarly, teachers are advised to get these materials in order to plan appropriately for further learning when schools resume, while parents/guardians need to ensure that their children access copies of these materials and use them appropriately.
I recognise the effort of National Curriculum Development Centre in responding to this emergency through appropriate guidance and the timely development of these home study materials. I recommend them for use by all learners during the lockdown.

Alex Kakooza
Permanent Secretary
Ministry of Education and Sports

ACKNOWLEDGEMENTS

National Curriculum Development Centre (NCDC) would like to express its appreciation to all those who worked tirelessly towards the production of home–study materials for Pre-Primary, Primary and Secondary Levels of Education during the COVID-19 lockdown in Uganda.

The Centre appreciates the contribution from all those who guided the development of these materials to make sure they are of quality; Development partners - SESIL, Save the Children and UNICEF; all the Panel members of the various subjects; sister institutions - UNEB and DES for their valuable contributions.

NCDC takes the responsibility for any shortcomings that might be identified in this publication and welcomes suggestions for improvement. The comments and suggestions may be communicated to NCDC through P.O. Box 7002 Kampala or email admin@ncdc.go.ug or by visiting our website at http://ncdc.go.ug/node/13.

Grace K. Baguma
Director,
National Curriculum Development Centre

ABOUT THIS BOOKLET

Dear learner, you are welcome to this home-study package. This content focuses on critical competences in the syllabus.

The content is organised into lesson units. Each unit has lesson activities, summary notes and assessment activities. Some lessons have projects that you need to carry out at home during this period. You are free to use other reference materials to get more information for specific topics.

Seek guidance from people at home who are knowledgeable to clarify in case of a challenge. The knowledge you can acquire from this content can be supplemented with other learning options that may be offered on radio, television, newspaper learning programmes. More learning materials can also be accessed by visiting our website at www.ncdc.go.ug or ncdc-go-ug.digital/. You can access the website using an internet enabled computer or mobile phone.

We encourage you to present your work to your class teacher when schools resume so that your teacher is able to know what you learned during the time you have been away from school. This will form part of your assessment. Your teacher will also assess the assignments you will have done and do corrections where you might not have done it right.

The content has been developed with full awareness of the home learning environment without direct supervision of the teacher. The methods, examples and activities used in the materials have been carefully selected to facilitate continuity of learning.

You are therefore in charge of your own learning. You need to give yourself favourable time for learning. This material can as well be used beyond the home-study situation. Keep it for reference anytime.

Develop your learning timetable to ca ter for continuity of learning and other responsibilities given to you at home.

Enjoy learning

AGRICULTURE

TERM ONE

TOPIC: VARIATION

Lesson 1: Causes and process of variation in plants and animals

Learning outcome: By the end of this lesson, you should be able to explain the causes and process of variation in plants and animals.

Materials: Different plant species e.g. vegetables, spices, fruit crops, root and stem tubers, medicinal plants, cash crops, and weeds; animals, such as cattle, goats, pigs, goats, sheep, and dogs; as well as poultry.

Introduction:

At the beginning of term 1, you are expected to have learnt about cytology specifically cell components and their roles in plants, animals, and genetics, specifically the roles of heredity in producing desired varieties of plants and animals. Now you're going to learn about variation.

Observe any **two** or **three species** of the same plants and animals in your home environment or community. What do you observe when you look at different plants or animals of the same species? Do they have the same color, size, height, shape, yield or any other characteristics?

You should realize that the different plants or animals of the same species or even offspring of the same parents show considerable differences. These differences are called **Variation.**

Basically variation occurs due to **environmental** and **genetic** causes.

Environmental factors often result in the changes in the phenotype but not the genotype. However, environment factors can influence the development of genetically determined traits to full potential. For example, a plant can have the genotype for high yield but it can only bear a specific yield if grown in a fertile soil. On the other hand, genetic causes are due to chromosomes and gene mutation.

Activity 1(a)

Move around your community and observe branches and leaves of one of the following: moringa/caliandra/blackwalnut/cassia/neem tree/tick berry/cassava or any plant with pinnate leaf arrangement.

(i) Investigate the number of leaflets from the lower and upper most part of the branch.

(ii) What is the difference in size of the branches for the lower and upper part of that plant?

(iii) Explain three factors in your environment that contribute to the characteristics (traits) of each plant.

Write answers in your exercise book.

Activity 1(b)

Study the text below and write answers to the questions in your exercise book.

Genetically, organisms vary due to mutation, gene reshuffling, epistasis, and polygenic inheritance.

(a) Mutations

A mutation is a sudden or spontaneous change in the gene or chromosome of an organism. Mutations are of two categories; chromosomal mutations and gene mutations.

(i) Chromosome mutations. This is a sudden permanent change in the chromosome. This change is due to **changes in the number and structure of chromosomes.**

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- Changes in chromosomes number

  From your studies of cytology before schools were closed due to COVID - 19, you should have learnt that, cells of organisms have a definite number and type of chromosomes depending on the species. However, variation may occur when the daughter cells produced in meiosis or mitosis have one chromosome more or less than the parent cells, hence a condition called **aneuploidy**. The loss of a chromosome number may lead to infertile individuals among other effects.

  Likewise, the gamete and somatic cells of organisms may have multiples of haploid number of chromosomes of that organisms hence a condition called **polyploidy or hybrid vigor** e.*g. If an organism has diploid number of 16; Then, we have 2n = 16, n = 8. Polyploidy implies = 3n (triploid) =3x8 = 24 or 4n (tetraploid) 4x8 = 32 etc.*

- Changes in chromosome structure.

  How can you know that the chromosome structure has changed? You can be able to tell this if there is a general breaking and rejoining of the chromosomes. This involves deletion, inversion, duplication, and translocation.

(ii) Gene mutations

When there is a sudden change in nucleotide sequence of the DNA molecule, it is called ***gene mutation.***

Gene mutation also occurs by deletion, insertion, inversion, and substitution.

In ***deletion,*** there is removal of one or more base pairs from a gene.

During ***insertion,*** there is addition of extra bases into the coding sequences of chromosomes.

In ***inversion,*** the base sequence of a gene becomes reversed like AGC to CGA.

During ***substitution,*** mutation involves replacement of one base with another like a purine (Adenine/Guanine) is replaced by a purine, or a pyrimidine is replaced by a Pyrimidine (Cytosine/Thymine).

(b) **Gene reshuffling**

This refers to changes in the gene combinations that occur from time to time in a population due to meiosis and fusion of gametes. The combinations can be reversed from one generation to another. This implies that gene reshuffling is temporary and doesn't generate major genetic changes which can evolve into new species.

Did you know that **biotechnology** can be used to promote gene reshuffling? Do you know how it is done? In biotechnology, one uses biological processes to develop new and better plants and animals needed in agriculture. These processes are cloning, embryo transfer, and embryo splitting.

(c) Epistasis

This is when presence of a gene (epistatic gene) at one locus suppresses the effect of another gene (hypostatic gene) for example; a dominant gene can suppress a recessive gene. If **W** is dominant over **w** for white color and **B** is dominant over **b** for black color, then WwBb = white, Wwbb =white, wwBb = black, wwbb = brown.

(d) Polygenic inheritance

It is when numerous genes at the loci interact to result into various extents of phenotypic expression.

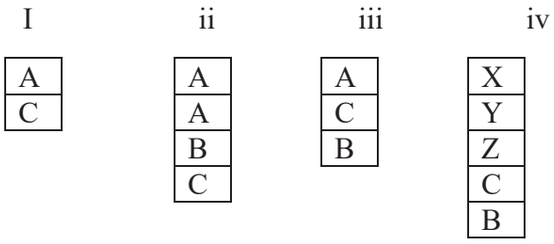
Observe the structures of the normal chromosomes **K** and **M** and the changes in the chromosomes structure below.

Normal chromosomes

K M

A		X
B	and	Y
C		Z

Changes in chromosomes structure



1. Identify each type of change in chromosome structure that leads to variation in plants and animals.
2. What is the role of mutation in agriculture?

Summary: From activity 1(**a**) and (**b**), you have learnt that variation can occur continuously or discontinuously. In continuous variation, the characteristics of organisms show a complete gradation (without clear cut differences) or breaks amongst organisms of the same species over a given character (trait) e.g. the number of leaflets and size of branches. However, in discontinuous variation, the characteristics of organisms of a population show clear cut and sharp differences over a given character for the same species. For example, some animals can be females while others males by sex and yet of the same species.

TOPIC 2: SELECTION

LESSON 2: Selection of Plants and Animals

Learning outcome: By the end of this lesson, you should be able to select plants and animals based on desired qualities.

Materials: Healthy and non-healthy looking plants and animals. These plants and animals may be vigorously growing, stunted, high yielding, big or small, tall or short or have disease signs and symptoms.

Introduction:

What do you think is selection about? Selection is the gateway to plants and animal improvement. **Selection** is the act of choosing organisms to become parents of the next generation. This is done by either natural or artificial means.

How do farmers choose the plants to grow or animals they want to rear?

You can do artificial selection using methods like individual performance, progeny testing, pedigree, collateral relatives (family), tandem, index, and total score (independent culling level).

In individual performance; you select an animal basing on its genetic potential. This considers characteristics which are highly inheritable and phenotypically recorded in both sexes.

In progeny testing; you evaluate an animal basing on performance of its offspring.

In pedigree; you select an animal basing on good performance record of its ancestors or parents.

In family; you select an animal basing on the performance of its close relatives or siblings.

In tandem; you select the desired trait at a time, improve it and then select another for improvement.

In index; you select many traits at the same time simultaneously.

In total score; you set a level of merit for each trait and all individuals below that level are rejected regardless of their other good traits.

Did you know that in artificial selection you cannot select all plants and animals for breeding? You are limited in selection because not every plant and animal has the desired qualities for selection. You can consider selection qualities like plant or animal adaptability to its environment among others.

Activity 2

Move around your home environment to observe both healthy and non-healthy appearing plants and animals as guided by materials for this lesson.

Describe their superior features that enable you to select them or their inferior features that dissuade you to select them.

Summary: In this lesson you have learnt that genetic potential, phenotypic potential and environmental factors influence selection.

TOPIC 3: GENETIC ENGINEERING

LESSON 3: Genetic Engineering in crop and livestock production

Learning outcome: By the end of this lesson, you should be able to justify the role of genetic engineering in crop and livestock production.

Materials: Improved plants and animals like crosses or upgraded livestock or poultry, such as broiler birds; exotic & traditional plant varieties & local livestock breeds.

Introduction:

If you compare the local and improved plants and animals of the same kind, you certainly realize some differences in their physical characteristics. What you observe physically is as a result of scientists directly manipulating the genes hence a technology known as **genetic engineering.**

Do you know why it's done? It's done to form new organisms of plants, animals, and insecticides to control pests and disease causing organisms.

If you're the genetic engineer, what would you target for gene manipulation? During breeding, a genetic engineer considers yield, nutrition, health, taste, among other characteristics of organisms.

Although genetic engineering has uses through modifying crops and livestock production, it also has problems. What could be the negative effects of genetic engineering?

Activity 3

Move around your environment and observe the characteristics of improved and non-improved plants and animals according to the materials given.

Explain the role of genetic engineering in crop and livestock production.

Summary: Genetic engineering plays a big role in commercial agriculture by leading to production of adequate and quality produce for market.

TOPIC 4: SOIL FERTILITY

Lesson 4: Improvement and maintenance of soil fertility.

Learning outcome: By the end of the lesson, you should be able to design activities that help to improve and maintain soil fertility.

Materials: Samples of organic mulch, farm yard and compost manure, artificial fertilizers, and ploughing tools like hoes.

Introduction

Soil fertility is the ability of the soil to sustain agricultural plant growth. Soil should be improved and maintained to provide adequate nutrients in the habitat of soil living organisms. How can you improve and maintain soil fertility? You can do it through use of good farming practices, such as addition of organic manure. Can you think of other farming practices? Did you know that soil is a major farming resource? Its physical properties, such as structure, chemical properties like pH and components like water and mineral content make it useful in agriculture.

If the soil properties are not safe guarded, then the soil loses its fertility. For you to carry out soil fertility and management, you need to design physical, chemical, and biological strategies.

Activity 4

Where do you throw household decomposable wastes? How long do they take to decompose? Have you seen plants grow nearby? If yes, how do they look different from others that grow where you don't throw? If not, move around your environment and observe plants that grow near areas where decomposable materials are thrown. Compare them with other plants where the materials are not thrown.

Also, make a project of growing a few selected vegetable plants of your choice. Properly apply ready compost or farm yard manure to some of the vegetables **(category A)**. Do not apply the manure to the rest of the plants **(category B**). Compare the differences in growth for the two categories of plants. Make a conclusion about the effect of manure on plant growth.

Note: Identify the purpose of your project. Outline the activities you must do to achieve the purpose. List all the requirements and estimate their budget. Identify the sources to support your project. Get the resources and implement towards that purpose.

Summary: In this activity, you should have designed strategies towards soil and water conservation, nutrient availability and supply in the soil, preserving the structure and biological activities of the soil.

TOPIC 5: LIVESTOCK IMPROVEMENT

Lesson 5: Selecting of livestock for rearing

Learning outcome: By the end of the lesson, you should be able to establish and explain the criteria for selecting different livestock breeds.

Materials: Examples of work, dairy, beef, and dual purpose breeds of cattle.

Introduction:

The way of developing and breeding only those animals that show the greatest merit under consideration like growth rate is called **animal selection.**

Have you ever selected an animal for rearing? How did you do it? What did you consider?

Before you select any livestock, you must consider the overall purpose for selecting it e.g. beef production. This major purpose guides you in determining the reasons (criteria) to consider while selecting an animal such as physical appearance and health status. You can only select an animal if it meets the requirement for selection.

Activity 5

Use your agricultural background to establish and explain the reasons for selecting different livestock breeds.

If you are able, carry out a community survey to find out why livestock farmers are interested in rearing particular animals like dairy, beef, and work type. You will need to carry recording materials to note the findings.

Summary: In this activity, you should have learnt that, the reasons for selecting an animal are based on the animals' best characteristics towards the required purpose. Animals below the required standard should not be selected because they are less productive for the intended purpose.

TERM TWO

TOPIC 1 CHEMICALS LIFE

Lesson 1: Characteristics of food nutrients and enzymes

Learning outcome: By the end of this lesson, you should be able to determine the characteristics of food nutrients and enzymes.

Materials: Feeds like crushed groundnuts or silver fish, maize seed or bran, water, any pasture grass and lemon/ orange/premix.

Introduction:

Organisms cannot have life without chemical elements called nutrients. Why do organisms eat?

Organisms eat food to get nutrients. A substance that provides nourishment essential for growth and maintenance of life is called a **food nutrient.** Do you know the nutrients needed for growth, maintenance, production, reproduction, and health of plants and animals? These nutrients include proteins, carbohydrates, vitamins, lipids (fats and oils), minerals, and water. The nutrients have chemical bonds which must be broken down during reactions to support the life of an organism. These reactions are catalyzed in biological systems by the working of enzymes. Therefore, a substance produced by a living organism which acts as a catalyst to bring about biochemical reaction is called an **enzyme.** Enzymes are protein in nature. They also remain unchanged at the end of the chemical reactions.

Activity 1

Observe each of the food materials given above for this lesson.

1. Write in your exercise book the major food nutrients provided by each material.
2. How do organisms benefit from these identified nutrients?
3. Describe the characteristics of proteins, carbohydrates, vitamins, lipids (fats and oils), minerals, and water.

Summary: Nutrients are essential for growth and maintenance while enzymes catalyze the utilization of food in plants and animals.

TOPIC 2: PLANT MORPHOLOGY AND PHYSIOLOGY

Lesson 2: Photosynthesis, Translocation, and Transpiration

Learning outcome: By the end of the lesson, you should be able to demonstrate the role and factors influencing photosynthesis, translocation, and transpiration.

Materials: Any growing plants.

Introduction:

When the carbon dioxide and water are synthesized into carbohydrates using sunlight energy trapped by chlorophyll, the process is called **Photosynthesis.** During this process, oxygen is also given off. Two biochemical reactions occur during photosynthesis. These are the light dependent stage which requires presence of light energy and light independent or dark stage reaction which does not require light. This light reaction produces chemical energy and reduces power which is used in the dark stage to fix carbon dioxide and produce carbohydrates.

How does translocation occur and what is its role? After synthesis, food is taken to storage centers hence **translocation** process. From the storage sites, food is translocated to the growing points for utilization to form food structures.

You have learnt that translocation occurs after photosynthesis. Then how is photosynthesis helpful to a famer? Photosynthesis helps a farmer by forming structures which are harvested.

However, external factors such as light intensity and internal factors like accumulation of stored food affect the rate of photosynthesis on the principle or law of limiting factors. A **limiting factor** is one whose value is directly related to the rate of photosynthesis. Also these factors affect the amount of food available for translocation.

What do you know about transpiration? The loss of water in form of water vapor from the aerial part of plants is called **transpiration**. This occurs in form of Stomatal, cuticular, and lenticular transpiration. Transpiration helps plants to absorb water and the excess is lost to the atmosphere. The water absorbed makes plant cell turgidity in the plant structures harvested. Environmental factors like humidity and soil water content and internal factors like number of stomata pores influence transpiration.

Osmosis is also useful. It enables plants to absorb mineral salts from the soil to build up plant structures which are harvested.

Activity 2

> Describe the role and factors that influence photosynthesis, translocation, and transpiration.

Summary: In this activity, you should have learnt that photosynthesis, translocation, and transpiration are essential for making the food harvested. Internal and environmental factors

influence photosynthetic and translocation rate while plant factors like state of the stomata as well as environment influence transpiration. The rate of photosynthesis is an indication of the productivity of a plant. The higher the photosynthetic rate, the higher the rate of translocation and the reverse is true. However, the higher the transpiration rate the lower the plant productivity.

TOPIC 3: REPRODUCTION IN PLANTS

Lesson 3: Sexual (seed) and Asexual (vegetative) reproduction

Learning outcome: By the end of this lesson, you should be able to differentiate between sexual and asexual/vegetative reproduction.

Materials: Any seeds and vegetative materials for planting e.g. cuttings, tubers, bulbs, corms and suckers.

Introduction:

How do you get new plants? Give examples. The getting of new plants of the same species is called **reproduction or propagation.**

Do you know how plants reproduce vegetatively? Fission, spore formation, budding, fragmentation, and vegetative propagation are forms of **asexual (vegetative) reproduction**. Naturally vegetative propagation can be done by various methods like use of bulbs, bulbils, corms, and crowns. Can you think of others?

You can also use artificial methods to propagate plants vegetatively like layering, grafting, tissue culture, and cuttings. Which plants in your community can be propagated by each of the vegetative methods?

The fusion of two gametes in fertilization to produce offspring is called **sexual (seed) reproduction.** The male gamete is called **pollen** while the female is the **ovule.** These gametes meet during special mechanisms called **pollination** and **fertilization** in flowers which are the organs for sexual reproduction. Pollination is the transfer of pollen grains from the anthers to the stigma of the same species. It can take place by self or cross pollination. During fertilization, the pollen grains land on the stigma of the same species and germinate due to the sugary fluid secreted by the mature stigma. A pollen tube grows from each pollen grain through the stigma. The pollen tube nucleus produces enzymes to digest the soft tissues ahead of the tube. Then the generative nucleus inside divides **mitotically** to produce two identical haploid sperm. Lastly, the pollen tube penetrates the ovule at the micropyle. The two sperms enter the embryo sac for double fertilization to take place. One of the sperms fertilizes the egg cell to form a haploid zygote cell which also divides to form the embryo. Then the other two sperms with the polar nuclei form a triploid endosperm cell which also divides to form the endosperm. When the zygote develops, it forms seeds. The seeds formed are used to produce new plants.

Observe figure 1 to look at sexual reproduction.

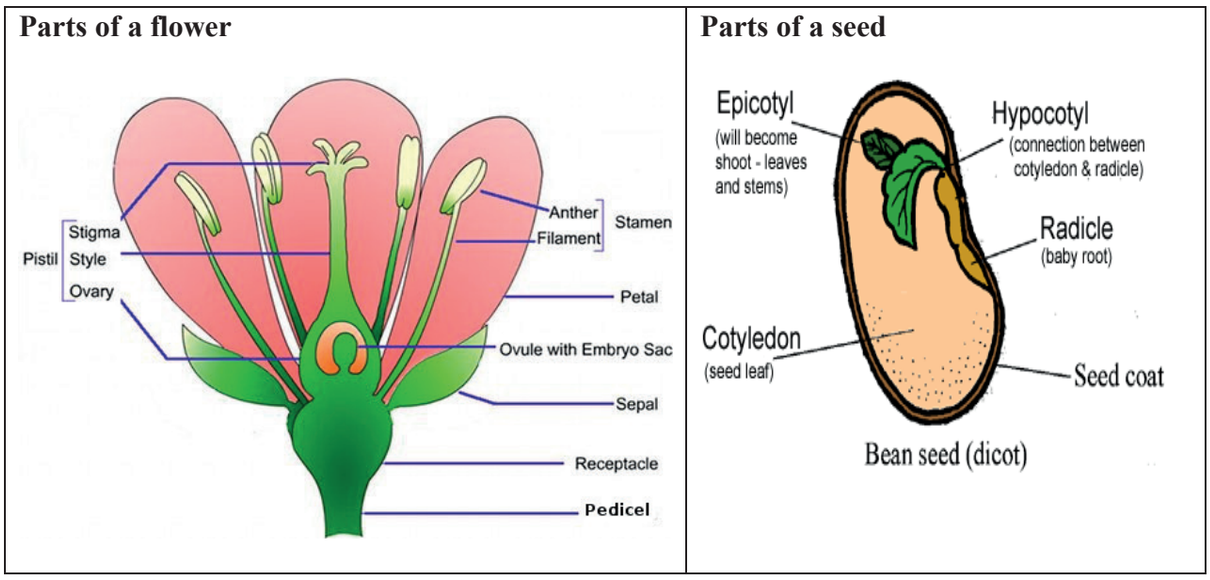


Figure 1: Sexual reproduction in plants

Study figure 1 to identify the parts of a flower that lead to seed formation.

Activity 3

In your environment, identify and observe any two plants, one propagated by seeds and another by vegetative materials.

1. Compare the two plants and state the observable features in their types of reproduction.
2. If you are able, use internet or text books or any other reliable source of information, state the differences in vegetative and seed propagation which you haven't seen by comparing these two plants.
3. Describe the qualities of a good seed and vegetative material for propagation.

Summary: The significance of seed propagation is to enable a farmer propagate plants which cannot be done by vegetative means while the reverse is true. Each propagation material requires qualities or characteristics and factors that must favor its propagation.

TOPIC 4: MICRO AND MACRO ORGANISMS

Lesson 4: Beneficial and harmful micro and macro organisms

Learning outcome: By the end of the lesson, you should be able to identify the different types of micro and macro organisms that are important in agriculture and their roles.

Materials: Earth worms, round worms, overstayed food with molds or fermenting (decomposing) plants/animals remains or legume roots with nodules.

Introduction

Organisms of agricultural importance are in large numbers. Do you know where they live? Some live in the soil, others on plants, animal cells, and organs. Can you use your naked eyes to see the organisms? Some are very small hence called **micro organisms** like viruses, protozoa, bacteria and nematodes. Can you name others in this category? Others are large in size hence called **macro organisms** like the earthworms, termites, liver flukes, lice and fleas. Can you name others in this category? Both the micro and macro-organisms can have beneficial and harmful effects in agriculture. Some improve on soil conditions or cause diseases or used as decomposers or preserve food products, among others.

Activity

1. Use the examples of materials given as a reference (overstayed food with molds or fermenting (decomposing) plants/animals remains or legume roots with nodules) to enable you identify the micro organisms and their roles.
2. Describe the positive and negative roles of the following micro and macro organism that are found in;
   (a) soil
   (b) plants
   (c) animals

Summary: In this activity, you should have learnt that micro and macro organisms influence agricultural production. Some transmit diseases to plants and animals hence affecting the quality of products. Others promote biological soil activities and the properties of soils.

TOPIC 5: FERTILIZERS

Lesson: Methods of fertilizer application

Learning outcome: By the end of the lesson, you should be able to apply organic and artificial fertilizers using an appropriate method.

Materials: Poultry droppings or Cow dung (farmyard manure) and any artificial fertilizers.

Introduction:

A fertilizer is an organic or inorganic material that is added to the soil to supplement on plant nutrients. Before you can apply a fertilizer, you need to carry out soil sampling and analysis and then follow manufacturer's instructions for use like right fertilizer, time, crop and method of application. Unlike organic fertilizers, you can use many methods to apply artificial fertilizers. Do you know how to apply these methods like fertigation, plough sole, foliar application, band placement, broad casting, among others?

Activity 5

1. Observe the materials given for this lesson and describe how you can apply each to crops.
2. Identify different examples of fertilizers and describe how you should apply each to high value crops.

Summary: It is important to consider the right method, rate of application, right crop and stage of growth. This ensures efficient utilization of the nutrients contained in a fertilizer. It also avoids a burning effect to crops.

TOPIC 6: HIGH VALUE CROPS

Lesson 6: Production of high value crops

Learning outcome: By the end of the lesson, you should be able to adopt practices involved in the production of high value crops.

Materials: Onions/garlic/pepper; pineapple/mango/goose berry; Aloevera/moringa/neem; pine/musizi/lucern/mulberry and flowers/mushrooms/upland rice.

Introduction:

What is a high value crop? It's a crop with many by-products and earns high income in the market. These crops play a vital role in society. For example, some are spices, vegetables, mendicants, fruits, trees, and popular cottage crops like up land rice. Give examples of such crops.

For you to grow high value crops you need to;

- Select the right crop to grow.
- Use the right agronomic practices like soil sampling and testing, nursery bed preparation, seedbed preparation, planting and management, and value addition.

These good practices can enable you to get high crop yields and quality products. Therefore, the general principles and practices involved in the growing of other crops are also applied to high value crops. However, you must apply these principles and practices intensively for high value returns.

Activity 6

1. Observe the materials given and classify them into different categories of high value crops.
2. Use the materials given to choose a high value crop of your choice to grow. Describe the practices you must properly follow to produce it up to marketing.

Summary: The proper use of agronomic practices in high value crops leads to good and profitable production. You need to consider good record keeping for every agronomic practice for future use.

TOPIC 7: LIVESTOCK MANAGEMENT

Lesson 7: Livestock feeding

Learning outcome: By the end of the lesson, you should be able to carry out appropriate feeding and watering practices.

Materials: Livestock feeds like grass pastures or legume pastures, dairy meal, fish meal and water.

Introduction:

Livestock feeding is the act of providing feeds to livestock. Why do you need to feed animals?

You need to feed animals for body repair, maintenance, production and reproduction. Animal feeds exist in different forms. Some are of plant origin or animal origin while others are from the factory. Different feed equipments are used to provide different amounts and quality of feeds to different livestock. During feeding, you provide specific feeds to different livestock at different times.

Activity 7

1. Refer to the materials given to enable you identify and describe the principles and practices for proper feeding of livestock.
2. Design a feeding program for layers/broilers/dairy cattle.

Summary: Proper feeding and watering of livestock promotes efficient utilization of feeds and livestock production.

TOPIC 8: POULTRY REARING

Lesson 8: Rearing and breeding of poultry

Learning outcome: By the end of the lesson, you should be able to practice poultry rearing and breeding for sale.

Materials: Poultry, any poultry feed, feed or water troughs (feeders and drinkers) for poultry and raw egg, a poultry unit in the neighborhood.

Introduction:

Poultry rearing is the keeping of domesticated birds such as chicken, turkeys, and geese. What other birds are domesticated in your community? Poultry rearing is done after selection of a good poultry breed. You can rear local or exotic breeds. Give commonly reared breeds in your community. You select the breed depending on its purpose like eggs or meat production. Each type of poultry should have features that make it fit for breeding e.g. bleached cloaca and soft abdomen in layers while large body size in broilers.

What poultry rearing practices can you use? Poultry rearing practices should be, brooding, method of rearing, housing, feeding, good sanitation, parasites, disease and control of vices, and meat and egg handling.

In brooding, you provide care to raise young chicks in a brooder from day 1 until they are taken to the rearing house. For how long must you brood layers or broiler chicks?

You can use intensive, semi intensive, and extensive methods to rear birds. Can you identify examples in each of the above mentioned rearing methods?

A good poultry rearing structure should have desirable characteristics. What are they?

You need to feed birds according to age and production intervals. Can you sketch feed and water troughs used to feed birds for commercial production?

Poultry can be attacked by common parasites like flee and diseases like new castle. These reduce productivity and increases production costs. Good hygiene and use of appropriate vaccination can be their control measures. What other methods can you use to maintain the health of birds?

Finally, eggs can be handled by collecting, cleaning, grading and packing for commercial or home consumption. Mature birds for meat are also sold off or slaughtered and dressed for consumption.

Activity 8

1. Observe layer(s) and broiler(s) in your community and describe the qualities that make them suitable for breeding.

2. Describe the practices you should perform during production of chicks, layers, and egg handling.
3. Get a raw egg and hold it between the thumb and the other four fingers. Direct it to the sun and look through it. Describe what you observe. If possible, repeat the above steps using a non-hatchable egg and one that has been incubated for one week. Write your observation.

Summary: Each poultry breed must have outstanding qualities for breeding. Use of good practices at each stage of poultry rearing is a necessity. During candling, unfertilized eggs are seen as clear and fertilized ones show uniform dark appearance. Those with dead embryos show dark spots.

TERM THREE

TOPIC 1: ECOLOGY

Lesson 1: Ecosystem

Learning outcome: By the end of the lesson, you should be able to generate energy flows, food chains, and food webs.

Materials: Plant habitat with anti-hills.

Introduction

Can you give the meaning of the term ecology? **Ecology** is the interaction of organisms with one another and with the non-living part of their environment. This interaction enables the ecological environment to be self-sustaining.

Have you ever visited a garden where there is an anthill? What will be the components of this garden? There are plants, anthill, and termites. How do these components relate to each other? The plants get energy from the sun to make food. Termites feed on plants and they also use soil to make the anthill. However, there are many other components including living and non-living organisms that you may not see. Can you think about them? This close association of organisms in an ecosystem is what we call **energy flow.** In this system the sun provides light used by the producers to photosynthesize food for consumers. The plants produce food for the consumers and when the consumers die, they are worked on by decomposers and detritivores.

A **food chain** is a linear feeding relationship of an organism eating another and is in turn being eaten. For example, grass, goat, and man. Primarily green plants produce food for the consumers which is utilized by decomposers.

An interlocking pattern with many food chains is called a **food web**. For example, the relationship between plants, wild birds, chicken, and animals. This is because many animals eat more than one kind of food.

Plants are the primary producers and end with carnivores as tertiary consumers.

Activity 1

1. Refer to the materials given to design a diagram for energy flow.
2. Move to your community and observe any plant habitat.
   (a) Make a list of organisms that you can see in that habitat.
   (b) Design diagrams for energy flows, food chains and food webs for a functional ecosystem.

Summary: In an ecosystem, energy flow is passed from one organism to another but energy passed out by the organism is lost to the environment and does not return to the cycle. Unlike a

food chain, a food web has several alternative pathways for the flow of energy to make the ecosystem more stable.

TOPIC 2: ECOLOGY

Lesson 2: Agricultural activities on a habitat

Learning outcome: By the end of the lesson, you should be able to demonstrate the changes and effect of agricultural activities on a habitat.

Materials: Degraded area due to agricultural activities like bare land after cultivation, murram road for transport of agro inputs and products.

Introduction

What are agricultural activities? These are activities which are done on land for purposes of food production. Several agricultural activities are involved in production. Each activity is done for a specific purpose. For example, land clearing for planting of crops. Can you mention other agricultural activities you or other people in your community perform on land? However, each of these activities changes and affects the habitat. Also the way each activity is done will influence the level of impact on the habitat. For example, if you use tools to clear an area for growing crops, what happens? Organisms that depended initially on it for food will have to look for food elsewhere. Some become pests. Others are chased away by the workers or due to lack of food. However, these may come back when the habitat regains its structure. The rest may even die due to unfavorable environment or can be killed by the workers on the farm.

Activity 2

1. Identify the agricultural activities and why each is done during production.
2. Survey your community to establish the effects of agricultural activities on the environment.
3. Suggest ways through which the impact of these activities on land can be reduced.
4. If you are able, watch the video on agriculture and degradation using this website, **http//www.theconsciouschallenge.org** for more learning.

Summary: All agricultural activities that involve removal of vegetation and agro chemical handling greatly affect the habitat.

TOPIC 3: AGROFORESTRY

Lesson 3: Tree nurseries and practices for agro forestry

Learning outcome: By the end of the lesson, you should be able to manage a tree nursery and practice agro forestry.

Materials: Tree seeds, seedling materials for fixed or portable beds like boxes, tins, soil, hoe, watering can, water, posts (wooden or non-wooden).

Introduction:

If you grow crops, multipurpose trees (e.g. *Calliandra, Sesbania*) and rear animals on the same piece of land for a purpose, it is called **agroforestry.** Why should one practice agroforestry and how is it practiced? It is done to produce food, fiber, and fuel while sustaining the soil. Agroforestry is based on the principles and practices of crop production such as nursery bed preparation, seed bed preparation, and field management activities. Well selected and prepared seeds should be established and managed in a well located and prepared nursery bed. The seedling should be transferred and maintained in a well prepared field. Common agroforestry practice for you to use are:

- Alley cropping- agriculture crops grown with long term trees simultaneously.
- Forest farming- cultivation of high value crops under the protection of a managed forest canopy.
- Riparian forest buffers- natural or established stream side forests made up of trees, shrubs and grass planting.
- Silvo pasture- a combination of trees with forage and livestock production.
- Agrosilvo pastoral- combination of crops, trees, and livestock.
- Agrosilvo cultural- trees and annual crops are planted.
- Aquaculture- fish and plant production
- Apiculture- rearing of bees under tree management.
- Entomoculture- raising of plants and insects on the same land management.

Good establishing of trees in the field using good management is essential for tees and crop growth. Proper harvesting practices like copping, lopping, pollarding, and shaking the tree leads to good production from tree components. Also proper spacing and use of compatible components also yields good results per unit area.

Activity 3

Use your crop management knowledge or any other reliable source of information and;

1. Describe how the following activities are done in agroforestry establishment and management
   (a) Site selection for a nursery

(b) Site preparation for a nursery
(c) Seed preparation
(d) Planting the tree nursery
(e) Managing the nursery

2. Describe the activities you must do to manage and produce trees in agro forestry.

Project

You are going to do this project in your free time. Choose a few multipurpose/agroforestry tree seeds of your own choice and use the acquired knowledge to prepare and manage a tree nursery. Depending on the space of your field, transplant, and manage a few seedlings.

Summary

The proper performance of agro forestry trees depends on proper nursery bed practices and field management. You should practice agroforestry with the aim of creating productive and sustainable land use.

TOPIC 4: FISH FARMING

Lesson 4: Selection and rearing of fish in a fish pond.

Learning outcome: By the end of the lesson, you should be able to select and rear fish in a pond.

Materials: Samples of fish like cat fish, silver fish, and Nile perch.

Introduction

What is fish and fish farming? Fish is aquatic craniate animals that lack limbs with digits. Fish farming is the rearing of fish for commercial purposes. You need to properly select fish for rearing. In fish selection, you must consider the desirable characteristics, for example, adaptability of fish to the rearing environment and fast growing. Can you think of other desirable characteristics? Fish goes through stages during its rearing. Fish eggs are hatched into **fish fry**. Fish fry are brooded into young fish called **fingerings**. The fingerings develop into **brood fish** and finally **mature** fish for marketing. Fish can be reared under controlled conditions and structures like ponds, dams, cages, tanks, raceways and hydroponics. Can you name other fish rearing conditions? How do you rear fish using these mentioned structures? The principles and practices of rearing are similar.

A pond is a shallow depression where water is confined for fish rearing as shown in **figure 1.**

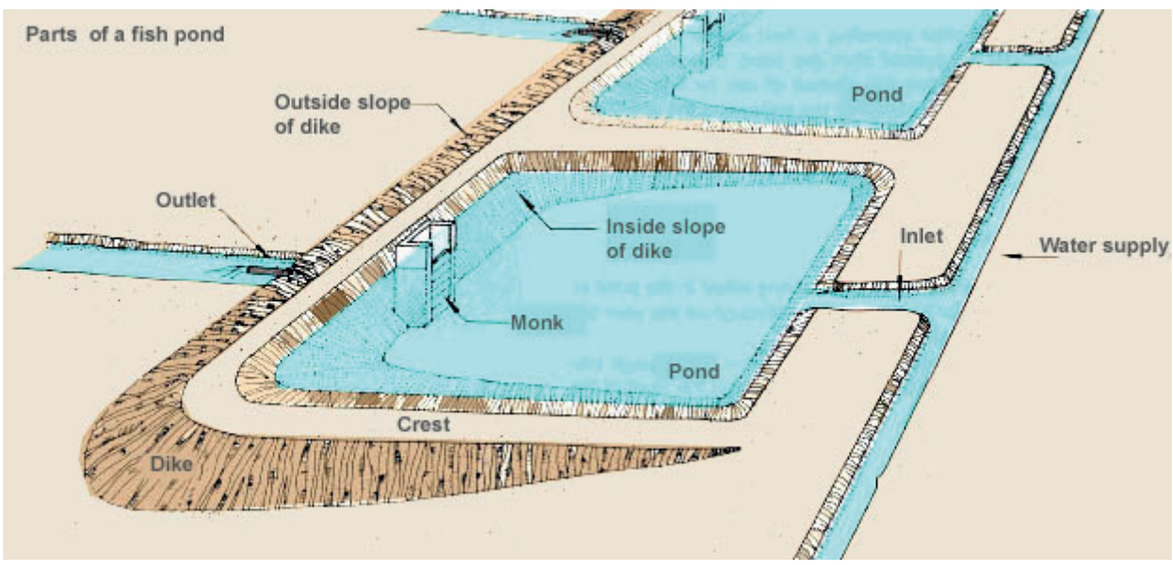


Figure 1. Components of a fish pond

Study figure 1 to identify its components and uses.

It may contain the nursery, brood, rearing, and production as rearing components. The other parts are the pond dyke, inlet, outlet and drainage pipes, its walls, and foundation.

The rearing practices such as pond stocking, fertilization, water quality, and health management, harvesting, and post-harvest fish handling are essential in fish pond production.

Activity 4

1. Describe the qualities you consider while selecting fish for stocking the pond.
2. Describe the activities you can perform under the following headings for fish pond production
   (a) Stocking the pond
   (b) Pond fertilization
   (c) Water quality management
   (d) Health management
   (e) Fish harvesting
   (f) Handling of harvested fish

Summary: The fish species for rearing should fulfill the desired qualities under captive conditions. You must properly site the pond, manage it, and fish. Also, good handling of harvested fish will enable you achieve the economic gains.

TOPIC 5: BEE KEEPING

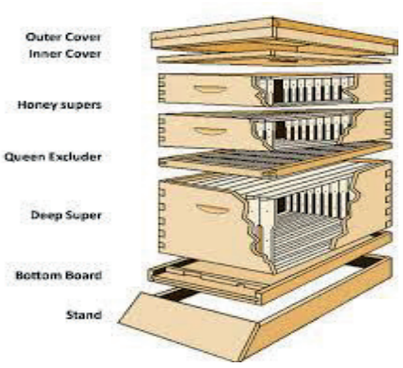
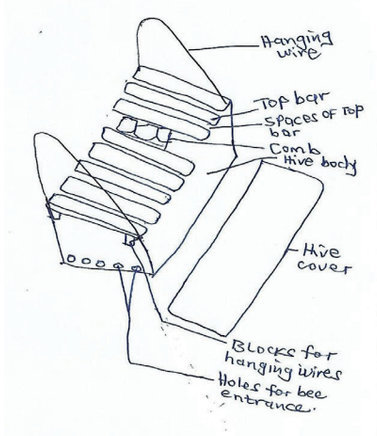
Lesson 5: Location of the apiary, stocking the hive and honey, harvesting and processing.

Learning outcome: By the end of the lesson, you should be able to locate an apiary, stock the hive, harvest, and process honey.

Materials: Apiary equipment like langstroth/top bar hive/ hive tool/ smoker/ bee suit/catcher box/honey extractor/honey strainer/honey glass jar and bee products like honey combs and honey.

Introduction:

Bee keeping (apiculture) is the rearing of bees on a commercial scale for the production of honey and its products. You can keep bees using commercial bee hive (langstroth) and modern bee hive (top bar hive). However, you can use other local structures in bee keeping. Can you mention the structures used by local farmers to keep bees? How do the bees produce honey? Bees use water and collect nectar from forage plants and are sensitive to human or livestock interference. Therefore, you need to select a good site for an apiary. How can you introduce bees in the hive for rearing? You can introduce bees in a hive in many ways like use of a catcher box and aromatic materials. After introducing the bees into the hive, you need to properly manage the hive. Good hive management will enable you to get good yields from the bee harvest. How do you harvest and handle honey? You should use proper harvesting materials, tools, and equipment and then process honey before consumption or marketing. Have you ever used or seen the following apiary handling equipment, tools, and materials in **figure 2** being used in apiary**?**

Langstroth Hive	Top Bar Hive	Hive tool
		

COVID-19 ALERT

Corona virus kills. Protect yourselves by staying home and avoiding overcrowded places.
Put on a mask and regularly clean your hands with clean water and soap or sanitiser.

Figure 2: Apiary handling equipment, tools and materials

Study the above equipment or tools and materials and give the use of each. What other materials can be used in apiary?

Activity 5

1. Describe the feature of a suitable location for apiary.
2. Describe the steps you should follow while stocking the hive.
3. How should you manage an apiary for honey production?
4. Describe the steps you must follow to harvest and process honey.

Summary: You have learnt that, proper location of an apiary eases management of the apiary. Good stocking and management promotes yield. Good harvesting practices promote yield and sustainability of the apiary. It is also important to consider quality of honey during processing for high economic gains.

TOPIC 6: LIVESTOCK MANAGEMENT AND THE ENVIRONMENT.

Lesson 6: Care for the environment while carrying out livestock rearing.

Learning outcome: By the end of this lesson, you should be able to care for the environment while rearing livestock.

Materials: Videos and degraded grounds due to cattle rearing.

Introduction:

Livestock management and environment are livestock production practices done with concerns of environmental protection.

What activities are done by man during livestock rearing?

Man can feed animals by direct grazing on land, indirect grazing from animal structures, spray pesticides to control pests on livestock, trample animals to grazing land or market centers, slaughter animals, distribute animals or their products to market centers, use animals for entertainment and stock animals on land. Can you name others?

Then, what can you find in the environment? In the environment you can find plants, farm structures, air, water, micro and micro organisms, abiotic components like soil as well as human beings.

If man does not carry out livestock rearing practices, then the environmental components will be affected. For example, pollution and soil losses among others can result in the environment.

How can you protect the environment during livestock rearing?

You can do this by use of good livestock management activities like controlled grazing among others.

Activity 6

1. Visit any area where livestock is kept or grazed or overgrazed and identify the livestock rearing effects to that environment. If you are able, you can also watch this video **https://ccafs.cgiar.org>blog>meat...**Or **https://www.ucdavis.edu>nwes>m...**to identify the impacts of livestock on the environment.
2. Design strategies which you must apply to protect the environment during livestock rearing.

Summary: The strategies designed for livestock rearing to protect the environment should aim at reducing soil losses, air pollution, crop damages, disease spread, and destruction of structures, protect human health as well as preservation of the abiotic components.

TOPIC 7: ANIMAL NUTRITION

Lesson 7: Feed formulation

Learning outcome: By the end of this lesson, you should be able to formulate, prepare, and use suitable feeds for different categories of livestock.

Materials: feeding ingredients like protein feeds, carbohydrates, minerals, and tools like calculator.

Introduction:

Feed formulation is the rationing of feed ingredients to get feeds for farm animals that can supply all the food values. Animals require a well balanced food for proper functioning of the body organs and systems. Food is needed for body repair, maintenance, production and reproduction. The feeds which you need to formulate and prepare must meet up the animal's body requirements during use. A farmer needs to formulate his own livestock feeds due to;

- Lack of certainty of the feed composition of the already prepared feeds on public market.
- High cost of the public market feeds.
- They are also often not fresh.

By preparing his or her own feeds, a farmer becomes certain of the nutrient composition of a ration, uses the locally and cheaply available feed ingredients on the farm and also provides fresh feeds to his or her animals.

Can you mention other reasons for a farmer to prepare his/her own livestock feeds?

Feed formulation requires following properly set standards. What standards must you follow when formulating feeds?

For you to formulate feeds, you should follow feeding standards for animal feeding rations. These standards help you to formulate the food values like proteins and carbohydrates for specific functions. During preparation, avoid deleterious (toxic) substances like gossypol, afflatoxin, trypsin inhibitor, fluorine, mimosine, and hydrocyanic acid.

In commercial farming, you can use many methods for feed formulation, for example, Pearson's square, graphical, linear programming, algebraic equation, computation and applications such as feed calculator. However, local farmers tend to use trial and error method.

How do you formulate feeds by Pearson's square method?

1. You begin by drawing the square.
2. Write the percentage protein of the ingredient on the left hand corners of the square and that of the ration in the center of the square.
3. Subtract diagonally across the square, disregarding the positive and minus signs.

4. The values obtained at the right hand corners of the square give the proportions of the ingredients to be mixed.

Can you investigate how other methods of feed formulation are done?

When mixing feeds, you need to consider: the type of animal, its age, nutrient requirement, cost of ingredients, palatability, wholesomeness, and availability of the ingredients.

Activity 7

1. Mention the different rations which you can prepare to feeding different categories of livestock.
2. Describe the procedure to follow when mixing feeding ingredients for a ration.
3. You are given maize bran containing 8% fish meal and 42% crude protein. Use Pearson's square to determine the portions you would mix the two feed ingredients to produce a ration of 16% crude protein.

Summary: A ration having the required nutrients should be obtained during feed formulation. Feeds to be formulated and prepared should be for the right animals. Preparing your own livestock feeds in the right way will reduce production costs and promotes productivity.

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