

New Normal Curriculum
Instructional Guide
Agriculture for Food Security
Class IX



Royal Education Council

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Agriculture for Food Security
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Foreword

Agriculture has been one of the main occupations of Bhutanese in the past, present, and likely to remain so in the foreseeable future. Large sections of Bhutanese populace live in rural areas; and depend on agriculture for livelihood. Therefore, the ultimate national aspiration of agriculture in Bhutan is largely driven by the looming desire to raise the per capita income of the Bhutanese populace, enhance self-sufficiency, and to increase the productivity of farm labour and agricultural land. Although it is perceived as the career of drudgery, agriculture is an enterprising occupation which is certainly joyful, innovative, and creative. Therefore, it is of utmost importance for our younger generations to have know-how of agriculture practices and the changes in agriculture technology both within Bhutan and around the world.

Although introduced recently, the footprint of agriculture education is currently gaining its foothold in the Bhutanese educational milieu. The dynamics of agriculture education in Bhutanese schools is taught through a separate optional subject called Agriculture for Food Security (AgFS) from classes IX-XII. The AgFS is basically inspired by the curricular intention of turning the mindset of young Bhutanese populace towards career opportunities. Besides, it is also underpinned in providing opportunities to imbibe the concepts, practices, and values of modern forms of farming, such as smart farming and sustainable agriculture practices.

The AgFS at the national level desires to mitigate unemployment and social issues; and maintain the national food security index; or create pathways for higher studies. From a classroom teaching point of view, it intends to transfer the knowledge, skills, and values of agriculture to students and help in understanding other subjects. As such, in the long run, the AgFS as a subject expects to contribute in producing adequate and quality supply of farm manager, commercial horticulturist, sustainably responsible farmers, etc.

Overall, I am confident that this instructional guide will help our teachers and learners in realising the curricular intentions of NNC for AgFS and enable learners to engage in active exploration, analysis, creation, and enjoyment in their engagement with the subject. They would understand the holistic dynamism of agriculture in society, especially how agriculture contributes to individuals, communities, and cultures; and how agriculture products are produced, processed, and distributed. Consequently, the concepts, skills, and values acquired would help them sail through everyday lives and attain the goal of self-sufficiency.

Tashi Delek

(Kinga Dakpa)

Director General





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The REC also genuinely acknowledges the retrieval and use of contents and resources, either in part or whole, from relevant websites and other forms of sources. Moreover, the REC reassures that these resources will exclusively be used for the educational or learning purposes.





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Introduction

Agriculture is the science and art of cultivating soil, growing crops and raising animals. As a mother of all culture, agriculture has formed the bases for all civilization and continues to serve as an indispensable practice for the survival of humanity. For Bhutan, agriculture has remained as one of the main occupations in the past, present, and likely to remain so in the future as well. With over 80% of the Bhutanese depending on agriculture, it forms the backbone of our economy. Even today, majority of the Bhutanese populace live in rural areas and depend on agriculture for their livelihood. Hence, an utmost priority has been placed over agriculture by the government to increase the productivity and ensure food self-sufficiency,

On the contrary, agriculture is perceived as drudgery with less reward, and not as a lucrative career opportunity. It has, therefore, become imperative to challenge the perceptions and explain the enterprising opportunities associated with agriculture. Consequently, various measures have been considered to change the perception. It includes integration of concept of agriculture in the school curriculum and teaching as a part of science subjects for decades, and subsequent introduction of *School Agriculture Program (SAP)*, by the Ministry of Education, to inculcate the values of agriculture in the minds of young Bhutanese. All these attempts have culminated into introducing *Agriculture for Food Security (AgFS)* as one of the subjects to be offered on optional basis in all the schools with classes ranging from IX to XII.

With its introduction in 2013 for class IX and subsequently for remaining classes, the AgFS curriculum has served its purpose of translating the ideas and principles of agricultural practices into teaching learning processes. Nonetheless, driven by the pressing national needs to address the contemporary issues and the changing dynamics in agriculture globally, the curriculum reform was initiated towards the fall of 2019 to augment the quality of content and instructional practices. Ever since, the curricular intention has been focused towards inclusion of competency based teaching and assessment with astounding considerations and shifts made along with adoption of the intentions of New Normal Curriculum (NNC) – from ‘What?’ to ‘How?’ in 2020.

While the NNC for AgFS explicitly spells out the curricular intentions and expectations in the form of expected competencies to be achieved at each key stage and classes tied with the scope specific objectives, it was found crucial to have a clear guideline on how to carry out actual instructional practices. Cognizant of the issue, an Instructional Guide (IG) was developed to help guide the teachers and learners carryout instructional practices without compromising the curricular intentions. It is also expected to help teachers become more resourceful facilitators while learners become an autodidact and consistent learner even in the absence of teacher. The suggestive instructions are put under contact and noncontact for clarity and is linked with the scope, objective and assessments.

1. Crop Production

Competency

- Apply the understanding of soil science to explain that soil is one of the important elements for the crop productions.
- Apply the understanding of soil management to conserve soil in your locality.
- Use the understanding of soil testing and perform soil testing.

1.1 Study of Soil

1.1.1 Physical and Chemical Properties of Soil

(Scope: A soil's physical and chemical properties affect plant growth and soil management. Some important physical and chemical properties of soil are mineral content, texture, structure, porosity, organic matter content, cation exchange capacity, color, depth, fertility, and pH.)

Objective(s):

- Explain physical and chemical properties of soil.

Learning Experiences:

Contact:

The teacher may carry out the instructional practices on physical and chemical properties of the soil through following activities:

- The learner explores information on physical and chemical properties of the soil.
- Based on the information gathered, the learner carries out an activity to investigate the texture, structure, porosity, organic matter content, color, depth, fertility, and pH of the soil to explain the physical and chemical properties.
- The learner submits the activity's finding in form of the report.

Non-contact:

The teacher may carry out the instructional practices on physical and chemical properties of the soil through following activities:

- The teacher may provide the weblink <https://www.youtube.com/watch?v=ko-GJDbnXE8>/or relevant material (downloaded digital content, articles, etc.) that explains the physical and chemical properties of the soil.
- The learner explores information on physical and chemical properties of the soil.
- Based on the information gathered, the learner carries out an activity to investigate the texture, structure, porosity, organic matter content, colour, depth, fertility, and pH of the soil to explain the physical and chemical properties.
- The learner submits the findings in the form of a report via Google Classroom or other media platforms.

Assessment:

**Contact:**

- Assess learner's information management and comprehension skills, and ability to explain the physical and chemical properties of the soil using a rubric.

Non-contact:

- Use a rubric to assess a learner's conceptual understanding of the physical and chemical properties of soil. Provide necessary intervention based on the learner's achievement assessed using a rubric.
- For recording and reporting, refer to the new normal curriculum framework in AgFs (NNCFS- 2021).

Resources:

- REC repository
- AgFs Textbook for Class XI (2019), REC
- New normal curriculum framework in AgFs (NNCFAgFS- 2021)
- <https://www.youtube.com/watch?v=ko-GJDbnXE8/>

1.1.2 Soil Types

(Scope: Depending upon their textures, colours, physical and chemical properties soils are generally classified as brown soil, red and black soil, alluvial soils and acidic soils.)

1.1.3 Soil Testing

(Scope: Soil test may refer to the analysis of soil sample to determine nutrient content, composition, and other characteristics such as the acidity or pH level. A soil test can determine fertility, nutrient deficiencies, or potential toxicities from excessive fertility and inhibitions from the presence of non- essential trace minerals.)

Objective(s):

- Determine the soil nutrient content through soil testing.

Learning Experiences:**Contact:**

The teacher may carry out the instructional practices on soil types and testing through following activities:

- Teacher may ask the learner to view the information on soil types and soil tests from the web link (<https://www.youtube.com/watch?v=WbceKZ7rmhk>) or from (books, videos, articles, online content, etc.)



- The learner gathers information from the video and relevant sources.
- The learner carries out an activity to determine the soil nutrient content through soil testing and study the suitability of different types of soil for cultivation of crops.
- Based on the information gathered from the activity, the learner designs solutions to improve soil quality to enhance crop production.

Non-contact:

- The teacher may provide the weblink <https://www.youtube.com/watch?v=WbceKZ7rmhk> or from (books, videos, articles, online content, etc.) that explains soil types and testing.
- Based on the information gathered, the learner carries out the activity to study the alternative methods of soil testing to determine the nutrient content in the soil.
- Based on the finding, the learner designs solutions to improve soil quality and upload the report through Google Classroom or any other relevant media platforms.

Assessment:**Contact:**

- Assess the learner's ability to test soil nutrient content, analyse and interpret the gathered information on the relationships between the soils and crops and figure out the solutions using a rating scale. Provide necessary intervention based on the achievement.

Non-contact:

- Assess the learner's ability to suggest alternative methods of soil testing, analyze and interpret the gathered information on the relationships between the soils and crops and suggest the solutions shared via Google Classroom using any assessment tools. Provide necessary feedbacks and follow up.
- For recording and reporting, refer to the new normal curriculum framework in AgFs (NNCFS- 2021).

Resources:

- REC repository
 - AgFs Textbook for Class XI (2020), REC
 - New Normal Curriculum Framework in AgFs (NNCFAgFS- 2021).
 - <https://www.youtube.com/watch?v=WbceKZ7rmhk>
- 1.1.4 Soil Management

(Scope: Soil management practices are tools the farmer can use to prevent soil degradation and build organic matter. These practices include: crop rotation, reduced tillage, mulching,



managing soil nutrient, and water management, reduce pesticide use, cover cropping and cross-slope farming.)

Objectives

- i. Design techniques/solutions to conserve soil.

Learning Experiences:**Contact:**

The teacher may conduct instructional practices on sustainable soil management through the following activities. The teacher may provide learning resources (e.g., books, videos, articles, online content, etc.) on sustainable soil management.

- The learner notes information on different methods of soil management and assesses the suitability of the methods in their locality.
- Based on the conceptual understanding and information gathered, the learner designs suitable techniques to conserve soil in the locality.
- The learner explains the purposes, process and impact of the technique on the soil conservation.

Non-contact:

- The teacher provides learning resources (books, videos, articles, online content, etc.) on soil management via relevant media platforms.
- The learner examines all information on the methods of soil management and designs technique that is suitable to the locality.
- The learner explains the purpose, process and advantage of the technique on the soil conservation and shares through relevant media.

Assessment:**Contact:**

- Assess learner's conceptual understanding and relevancy of the designed technique on soil conservation using a rubric. Provide feedback based on the learner's performance.

Non-contact:

- Assess conceptual understanding and relevancy of the designed techniques on the soil conservation using a relevant assessment tool. Provide necessary feedback.
- For recording and reporting, refer to the new normal curriculum framework in science (NNCFS- 2021).

Resources:

- REC repository
- AgFS Textbook for Class IX (2020), REC
- New Normal Curriculum Framework in science (NNCF AgFS- 2021)

1.2 Growing of Vegetables I

Competencies:

- . Use the understanding of best practices of growing vegetables to grow vegetables.
- a. Apply the understanding of pest and diseases to explain that poorly managed agriculture garden is prone to common pest and diseases.

1.2.1 Vegetables and their Importance

(*Scope:* Vegetables are an important source of nutrients (minerals and vitamins) for us. Generally, vegetables can be categorized by their edible parts; 1) roots/tubers, 2) leave and/or stems and 3) flowers or fruits.)

Objective(s):

- i. Explain three categories of vegetables.

Contact:

Teacher may carry out the instructional practice on vegetables and their importance through following activities;

- The learner may gather information from learning resources (online content, articles, hand out etc.) or the web link https://www.youtube.com/watch?v=TvczZs6_KM4
- Based on the information gathered, the learner may explain different categories of vegetables found in Bhutan through chart displayed in the classroom.

Non-contact:

Teacher may carry out the instructional practice on vegetables and their importance through following activities;

- The learner may gather information from learning resources (online content, articles, hand out etc.) or from the web link https://www.youtube.com/watch?v=TvczZs6_KM4
- Based on the information gathered, the learner may explain different categories of vegetables found in Bhutan by making notes.
- The learner submits the report through Google Classroom or any media platforms.

Assessment:

Contact:

- Assess the learner's ability to comprehend, identify the types of vegetables found in Bhutan using relevant assessment tools.

Non-contact:

- Assess the learner's ability to comprehend, identify the types of vegetables found in Bhutan as submitted by learners using relevant assessment tools.
- For recording and reporting, refer to the new Normal Curriculum Framework in AgFS (NNCF AgFS- 2021).

Resources:

- REC repository
- AgFS Textbook for Class IX (2020), REC
- New Normal Curriculum Framework in AgFS (NNCF AgFS- 2021).
- <https://www.youtube.com/watch?v=M8MUJ-sQAQc>

1.2.2 Procedure for Growing Vegetable and Cultivation

(*Scope:* The basic needs of vegetable production include water, soil, sunlight and air. While planning what to grow and when to grow vegetables, farmers need to be well versed on AEZs and plan accordingly.)

(*Scope:* The principles of vegetable cultivation includes planning the garden, site selection, enhancing soil nutrients, choosing the crops, nursery, transplantation, and post transplantation care and management practices.)

(*Scope:* Both the quality and quantity of crops can be enhanced if grown in a controlled environment and nursery. Different crops has different ways of growing)

1.2.3 Cultivation Practices of Vegetables(cabbage, beans, and potato)

(*Scope:* Appropriate conditions of soil, temperature, water and selection of variety are fundamental to enhance crop production. Soil improvement is essential before crop production through adding organic matters and fertilizers.)

(*Scope:* Bhutan has various agro-ecological zones with different crop production and different growing seasons and need to grow one crop from cabbage, beans and potato using its cultivation practices.)

Objective(s):

- Explain the procedures of growing cabbage, beans and potato.



Learning Experiences

Contact:

Teacher may carry out the instructional practices to explain the procedures of growing cabbage, beans and potato through following activities:

- Teacher may provide weblink <https://myknowledgebase.in/7-steps-for-successful-agricultural-practice-by-farmers/> or (text book, journals, internet, and guest speaker, etc.) and other relevant materials.
- Based on the gathered information, the learner may formulate or design a plan to establish a vegetable garden to grow cabbage, beans and potato through field practices in-cooperating modern vegetable cultivation practices.
- The learner evaluates and compiles the reports of best cultivation practices.

Non-contact:

Teacher may carry out the instructional practices to explain the procedures of growing cabbage, beans and potato through following activities:

- Teacher may provide materials like (text book, journals, internet, and guest speaker, etc.) or weblink <https://myknowledgebase.in/7-steps-for-successful-agricultural-practice-by-farmers/> and other relevant materials.
- Based on the gathered information, the learner may formulate or design a plan to establish a vegetable garden to grow cabbage, beans and potato through field practices in-cooperating modern vegetable cultivation practices.
- The learner evaluates and compiles the reports of best vegetable cultivation practices and submit evidence via Google Classroom.

Assessment:

Contact:

Assess learner's ability to gather the information, explain and evaluate the process and establishment of best vegetable growing practices using applicable assessment tools. Provide necessary feedback and follow up.

Non-contact:

Assess learner's ability to gather the information, explain and evaluate the process and establishment of best vegetable growing practices using applicable assessment tools. Provide necessary feedback and follow up.

Resources:

- REC repository
- AgFS Textbook for Class IX (2019), REC

- <https://myknowledgebase.in/7-steps-for-successful-agricultural-practice-by-farmers/>
- New Normal Curriculum Framework in AgFs (NNCF AgFS- 2021)

1.2.4 Common Pests and Diseases of Vegetable Crops

(*Scope:* In agriculture, the most challenging issue is pest and disease control. Some of the common pests of vegetable crops are cut worm, caterpillar, cabbage moth, bean pod moth, blight and aphids)

(*Scope:* The common disease of vegetables includes club root affecting roots and it is a soil borne disease. Bacterial wilt is another major disease especially affecting tomatoes.)

Objective(s):

- Identify common pests and diseases of vegetables found in Bhutan.
- Solve common pests and diseases of vegetables cultivation.

Learning Experiences:

Contact:

The teacher may carry out the instructional practices to identify common pests and diseases of vegetables found in Bhutan and how to solve common pests and diseases problems of cultivation through following activities:

- The learner may gather information from web link <https://www.youtube.com/watch?v=9rWYR51urXI&t=3s> or learning resources (books, videos, articles, online content, etc.) to identify common pests and diseases of vegetables found in Bhutan and solution for common pests and diseases.
- Based on the information gathered, the learner identifies the common pest and diseases from local plants and find the solution for the problems.
- The learner presents the information through group discussion/report writing/gallery walk/exhibition, etc.

Non-contact:

- The teacher may carry out the instructional practices to identify common pests and diseases of vegetables found in Bhutan and how to solve common pests and diseases problems of cultivation through following activities:
- The learner may gather information from web link <https://www.youtube.com/watch?v=9rWYR51urXI&t=3s> or learning resources (books, videos, articles, online content, etc.) to identify common pests and diseases of vegetables found in Bhutan and solution for common pests and diseases
- Based on the information gathered, the learner identifies the common pest and diseases from local plants and find solution for the problems through online group discussion.

Assessment:

**Contact:**

- Assess the learner's ability to identify and interprets common pests and diseases of vegetables and their ability to solve the problems using any relevant assessment tools. Provide necessary feedback and follow up.

Non-contact:

- Assess the learner's ability to identify and interprets common pests and diseases of vegetables and their ability to solve the problems using any relevant assessment tools. Provide necessary feedback and follow up.
- For recording and reporting, refer to the New Normal Curriculum Framework in AgFS (NNCFAgFS- 2021).

Resources:

- REC repository
- AgFS Textbook for Class IX (2020), REC
- <https://www.youtube.com/watch?v=9rWYR51urXI&t=3s>
- New Normal Curriculum Framework in AgFS (NNCFAgFS- 2021).

1.3 Growing of Fruits I

Competencies:

- a. Use the understanding and skills of growing fruit trees for how the pruning, training of trees and proper soil management resulting in higher productivity.
- b. Apply the understanding of basic horticulture management practices to grow any fruit from the given list.
- c. Use the concepts and skills of horticulture to lay out orchards of any fruits and vegetables found in your locality

1.3.1 Categories of Fruits (pome, stone, walnut and strawberry)

(Scope: Fruits are important in everyday life, as fruits are rich in carbohydrates, vitamins and minerals. There are different types of fruits like apple, peach, apricot, plum, walnut and strawberry.)

Objective(s):

- i. Identify different types of fruits found in Bhutan.
- ii. Explain the importance of fruit for healthy life.

Learning Experiences:**Contact:**

The teacher may carry out the instructional practices on identifying the different types of fruits and its importance for healthy life through following activities:

- The learner may gather information from learning resources (books, videos, articles, online content, etc.) on different types of fruits grown in Bhutan, the cultivation practices in their locality and significance of fruits for healthy life.
- Based on the information gathered, the learner constructs an explanation on different types of fruits grown in Bhutan, the cultivation practices in their locality and significance of fruits for healthy life
- The learner presents the information through group discussion/report writing /gallery walk/exhibition, etc.

Non-contact:

Teacher may carry out the instructional practices on identifying the different types of fruits and its importance for healthy life through following activities:

- The learner may gather information from learning resources (books, videos, articles, online content, etc.) on different types of fruits grown in Bhutan, the cultivation practices in their locality and significance of fruits for healthy life.
- Based on the information gathered, the learner constructs an explanation on different types of fruits grown in Bhutan, the cultivation practices in their locality and significance of fruits for healthy life.
- The learner presents the information through report writing/online discussion/presentation, etc.

Assessment:

Contact:

- Assess the learner's ability to identify different types of fruits grown in Bhutan, and explain the importance of fruits in their daily life using any relevant assessment tools. Provide necessary feedback and follow up.

Non-contact:

- Assess the learner's ability to identify different types of fruits grown in Bhutan, and explain the importance of fruits in their daily life using any relevant assessment tools. Provide necessary feedback and follow up.
- For recording and reporting, refer to the New Normal Curriculum Framework in AgFS (NNCFAgFS- 2021).

Resources:

- REC repository

- AgFS Textbook for Class IX (2020), REC
- New Normal Curriculum Framework in AgFS (NNCF AgFS- 2021)

1.3.2 Stone Fruits: Peach (*Prunus persica*)

(Scope: Peach originated from Persia and China is considered as good sources of iron and phosphorus.)

1.3.3 Walnut (*Juglans regia* L.)

(Scope: Walnut is widely grown in Bhutan, both as native forest trees, and as introductions in the past from Tibet and Kashmir. It is considered high value and low weight commodities, in that they are not so perishable and are relatively resistant to transport damage.)

1.3.4 Strawberry (*Fragaria* spp.)

(Scope: Strawberry belongs to the Rosaceae family and it was lately introduced in Bhutan. It is most often eaten fresh or used as garnishing the desserts, flavouring dairy products and making jams.)

Objective(s):

- Categorize fruits found in Bhutan into pome, stone, walnut and berries.
- Explain the procedure of growing pome, stone, walnut and berries.

Contact:

Teacher may carry out the instructional practice on category of fruits found in Bhutan and procedures of growing fruits such as pome, stone, walnut and berries, through following activities;

- The learner may gather information from learning resources (online content, articles, hand out etc.) or from the web link <https://www.youtube.com/watch?v=ArhxoFmvCHE>, <https://www.youtube.com/watch?v=M8MUJ-sQAQc>
- Based on the information gathered, the learner may explain different categories of fruits found in Bhutan.
- Based on the information gathered, the learner prepares a plan and layout to demonstrate the procedures of growing fruits (pome/stone/walnut/ berries) or any locally available fruits.

Non-contact:

Teacher may carry out the instructional practice on category of fruits found in Bhutan and procedures of growing fruits such as pome, stone, walnut and berries, through following activities;

- The learner may gather information from learning resources (online content, articles, hand out etc.) or from the web link <https://www.youtube.com/watch?v=ArhxoFmvCHE>, <https://www.youtube.com/watch?v=M8MUJ-sQAQc>
- Based on the information gathered, the learner may explain different categories of fruits found in Bhutan.
- Based on the information gathered, the learner prepares a plan and layout to demonstrate the procedures of growing fruits (pome/stone/walnut/ berries) or any locally available fruits.
The learner submits the report through Google Classroom or any media platforms.

Assessment:**Contact:**

- Assess the learner's ability to comprehend, identify, types of fruit found in Bhutan and demonstrate skill of growing fruits using relevant assessment tools.

Non-contact:

- Assess the learner's ability to comprehend, identify types of fruit found in Bhutan and demonstrate skill of growing fruits using relevant assessment tools.
- For recording and reporting, refer to the new Normal Curriculum Framework in AgFS (NNCFAgFS- 2021).

Resources:

- REC repository
- AgFS Textbook for Class IX (2020), REC
- New Normal Curriculum Framework in AgFS (NNCFAgFS- 2021).
- <https://www.youtube.com/watch?v=ArhxoFmvCHE>
- <https://www.youtube.com/watch?v=M8MUJ-sQAQc>

1.3.5 Procedure and Management of Fruits

(Scope: Establishment of an orchard is a long-term investment and requires proper planning, selection of suitable sites, planting system, varieties and nursery plants, necessary inputs, post-harvest practices and horticulture management practices to ensure optimum productions.)

Objective(s):

- i. Design horticulture gardens using the concept and principles of horticulture management practices.

Learning Experiences

Contact:

Teacher may carry out the instructional practice on designing model of horticulture garden using the concept and principles of management practices through the following order by providing resources (e.g., hands out, videos, articles, online content, inviting guest speaker etc.)

- Based on the information gathered, learners prepare basic scientific methods of pruning, the training, the grafting, the air layering and the cutting for root stock preparations using reliable resources and experts on procedure and management of fruits.
- Learner carry out hand on experiment for aforementioned process with local fruit trees/model and explains the importance of implementing proper horticulture management practices.

Non-contact:

Teacher may carry out the instructional practice on designing model horticulture garden using the concept and principles of management practices through the following order by providing resources (e.g., hands out, videos, articles, online content) via Google Classroom

- Based on the information gathered, learners prepare basic scientific methods of pruning, the training, the grafting, the air layering and the cutting for root stock preparations using reliable resources and experts on procedure and management of fruits.
- Learner may carry hand on experiment for aforementioned process with local fruit trees/model and explains the importance of implementing proper horticulture management practices.

Assessment:**Contact:**

- Assess learner's ability to transfer conceptual knowledge into developing a model/design basic horticulture garden using a checklist/rubric or any assessment tools. Provide necessary feedback and follow up.

Non-contact:

- Assess learner's ability to transfer conceptual knowledge into developing a model/design basic horticulture garden using a checklist/rubric and any assessment tools based on the submitted evidences. Provide necessary feedback and follow up.
- For recording and reporting, refer to the new Normal Curriculum Framework in AgFS (NNCFAgFS- 2021).

Resources:

- REC repository

- AgFS Textbook for Class IX (2020), REC
- New Normal Curriculum Framework in AgFS (NNCFAgFS- 2021)

1.3.6 Procedure and Management of Fruits

(Scope: Establishment of an orchard is a long-term investment and requires proper planning, selection of suitable sites, planting system, varieties and nursery plants, necessary inputs, post-harvest practices, and horticulture management practices to ensure optimum productions.)

Objective(s):

- i. Design horticulture garden using the concept and principles of horticulture management practices.

Learning Experiences:

Contact:

The teacher may carry out the instructional practice on designing a model of horticulture garden using the concept and principles of management practices through the following activities:

- The learner may gather information from reliable sources (hands out, videos, articles, online content, guest speaker, etc.)
- Based on the information gathered, the learner may discuss basic scientific methods of fruit tree management such as pruning, training, grafting, air layering, and cutting for rootstock preparations in groups.
- The learner may design a horticulture garden to demonstrate the basic scientific methods of fruit tree management.

Non-contact:

The teacher may carry out the instructional practice on designing a model of horticulture garden using the concept and principles of management practices through the following activities:

- The learner may gather information from reliable sources (hands out, videos, articles, online content, guest speaker, etc.)
- Based on the information gathered, the learner may conduct online discussions on the basic scientific methods of fruit tree management such as pruning, training, grafting, air layering, and cutting for rootstock preparations in groups.
- The learner may design a horticulture garden or a model to demonstrate the basic scientific methods of fruit tree management and submit through Google Classroom or any other media platforms.

Assessment:

Contact:

- Assess the learner's comprehension and interpretation skills and ability to transfer conceptual knowledge in designing a horticulture garden and demonstration of the basic scientific methods of fruit tree management using any relevant assessment tools. Provide necessary feedback and follow-up.

Non-contact:

- Assess the learner's comprehension and interpretation skills and ability to transfer conceptual knowledge in designing a horticulture garden or a model to demonstrate the basic scientific methods of fruit tree management using any relevant assessment tools. Provide necessary feedback and follow-up
- For recording and reporting, refer to the new Normal Curriculum Framework in AgFS (NNCFAgFS- 2021).

Resources:

- REC repository
- AgFS Textbook for Class IX (2020), REC.
- New Normal Curriculum Framework in AgFS (NNCFAgFS- 2021).

2. Livestock Production

2.1 Starting a Poultry Farming

Competencies:

- Apply the understanding of each breed in selecting the best breeds for productive poultry farming.
- Apply the understanding and skills of proper housing of poultry birds to manage poultry farming.
- Use the understanding and skills of feeding practices to adopt better feeding practice besides commercially formulated feeds.

2.1.1 Poultry Breeds and its Production System in Bhutan

(Scope: Poultry includes chicken, duck, turkey, pigeon, quail, geese, ostrich, swan and other game birds reared for eggs, meat and feather)

(Scope: Chickens in Bhutan can be classified into two groups: native/local and exotic/commercial breeds. Example of native breeds is YuebjhaNarp (Black), and whereas Hy-line is an exotic breed.)

(Scope: Three types of production system is practiced in Bhutan; traditional scavenging system/free range system, semi-intensive system and intensive system)

Objective(s):

- Explain poultry breeds based on its production system in Bhutan.

Learning Experiences:**Contact:**

The teacher may carry out the instructional practices on poultry breed and production system through the following activities:

- The learner may search for information on poultry breeds and its production system from reliable sources (books, journals, online resources, guest speakers, field trips, projects, etc).
- Based on the information gathered, the learner prepares a note/write-up/presentation on the following topics using relevant digital tools.
 1. Differences between native and exotic breeds of poultry
 2. Examples of native and exotic breeds of poultry
 3. Types of production system. (compare and contrast)
- The learner explains the note/write-up/presentation through different relevant activities (class presentation, gallery walk, exhibition, Google Classroom, other relevant media platforms, etc.)

Non-contact:

The teacher may provide the web link <https://cutt.ly/hl86oon> or relevant materials (book, articles, journal, online resources, etc.)

- Based on the information gathered, the learner prepares a note/write-up/presentation on the following topics using relevant digital tools.
 1. Differences between native and exotic breeds of poultry
 2. Examples of native and exotic breeds of poultry
 3. Types of production system. (compare and contrast)
- The learner uploads the notes/ write-up/presentation through Google Classroom or through any other relevant media platforms.

Assessment:**Contact:**

- Assess learner's conceptual understanding of the poultry breeds and its production system, using appropriate assessment tools. Provide necessary feedback and follow up.

Non-contact:

- Assess learner's conceptual understanding of the poultry breeds and its production system based on note/write-up/presentation submitted through Google Classroom or any appropriate media platforms using relevant assessment tools. Provide necessary feedback and follow up.
- For recording and reporting, refer to the New Normal Curriculum framework in AgFS (NNCFAgFS- 2021).

Resources:

- REC repository
- Agriculture for Food Security Textbook for Class IX (2019), REC
- New normal curriculum framework in Agriculture for Food Security (NNCFAgFS- 2021).
- <https://cutt.ly/hl86oon>

2.1.2 Management of Pullets

(Scope: The first 18 weeks of a chick's life, is the most critical and will affect future production. Pullet management is essential for the success and profits of the future laying flock. The overall aim of pullet development is to reach a target body weight with high uniformity. Management of layers. Management in terms of feeding balanced diet feed and providing artificial lights greater than 15 hours per day significantly affect layers productivity)

Objective(s):

- i. Explain the strategies of managing pullets for future layers.

Learning Experiences:**Contact:**

The teacher may carry out the instructional practices on management of pullets for future layers through the following activities:

- The teacher may provide the web link <https://cutt.ly/I1869od> or the learner may search information on management of pullets from reliable sources (books, journals, online resources, guest speakers, field trips, project, etc.)
- Based on the information gathered, the learner may construct an explanation on the strategies of managing pullets for future layers through group discussion/peer discussion.
- The learner may explain the strategies of managing pullets for future layers through presentation/debate/gallery walk, exhibition, Google Classroom, other relevant media platforms, etc.

Non-contact:

The teacher may carry out the instructional practices on management of pullets for future layers through the following activities.

- The teacher may provide the web link <https://cutt.ly/I1869od> or the learner may search information on management of pullets from reliable sources (books, articles, journals, online resources, etc.)
- Based on the information gathered, the learner may construct an explanation on the strategies of managing pullets for future layers.
- The learner may upload explanations on strategies of managing pullets through the Google Classroom or through any other relevant media platforms.

Assessment:**Contact:**

- Assess learner's conceptual understanding, information gathering skill, comprehension, interpretation and communication skills using appropriate assessment tools. Provide necessary feedback and follow up.

Non-contact:

- Assess learner's conceptual understanding, information gathering skill, comprehension, interpretation and communication skills using appropriate assessment tools. Provide necessary feedback and follow up.
- For recording and reporting, refer to the New Normal Curriculum framework in AgFS (NNCFAgFS- 2021).

Resources:

- REC repository
- Agriculture for Food Security Textbook for Class IX (2019), REC
- New normal curriculum framework in Agriculture for Food Security (NNCFAgFS- 2021)
- <https://cutt.ly/I1869od>

2.1.3 Poultry Housing and it's Equipment

(Scope: Poultry houses should protect the chickens against the harsh weather conditions. Houses should be constructed as per the standard measurements to provide enough space for the birds. It should also include amenities like feeders, drinkers both commercially available or improvised ones, and perch for resting)

Objective(s):

- Develop an illustrative model of poultry house including the placement of poultry equipment.

Learning Experiences:**Contact:**

The teacher may carry out an instructional practices on poultry houses and its equipment through the following activities:

- The teacher may provide the web link <https://cutt.ly/jl4qzh4> or the learner may search information on poultry houses and its equipment and design of poultry farms from reliable sources (books, videos, online resources, journals, guest speakers, field trips, projects, etc.)
- Based on the information gathered, the learner designs an illustrative model of poultry farm in the group.
- The learner may explain the model of poultry farm through presentation/gallery walk/exhibition, etc.

Non-contact:

The teacher may provide the web link <https://cutt.ly/jl4qzh4> or the learner may search information on poultry houses and its equipment and design of poultry farms from reliable sources (books, articles, journals, online resources, etc.)

- Based on the information gathered, the learner designs an illustrative model of poultry farm.
- The learner uploads the illustrative model of poultry farm through Google Classroom or any other relevant media platforms.

Assessment:**Contact:**

- Assess learner's information gathering skill, comprehension, designing, modelling and communication skills using appropriate assessment tools. Provide necessary feedback and follow up.

Non-contact:

- Assess learner's information gathering skill, comprehension, designing, modelling and communication skills using appropriate assessment tools. Provide necessary feedback and follow up.
- For recording and reporting, refer to the New Normal Curriculum framework in AgFS (NNCFAgFS- 2021).

Resources:

- REC repository
- Agriculture for Food Security Textbook for Class IX (2019), REC
- New Normal Curriculum Framework in Agriculture for Food Security (NNCFAgFS- 2021)
- <https://cutt.ly/jl4qzh4>

2.1.4 Feeding of Poultry Birds

(Scope: Chickens require balanced nutrients to feed for best physical condition. Chickens find their own feed from the surrounding. This will provide a good mixture of feed (quality) but usually not enough (quantity) for them to perform well (egg and meat production). Feeding practice significantly affects the chick performance and productivity. Commercially formulated feeds that are specific for chick starter, grower and layers are also available in the commercial feed store to supplement the locally available feeds)

Objective(s):

- Evaluate the impact of feeding practice on chicken performance and productivity.

Learning Experiences:**Contact:**

The teacher may carry out the instructional practices on the impact of feeding practice on chicken performance and productivity through following activities:

- The teacher may provide the web link <https://bit.ly/30ozTZ7> and <https://cutt.ly/E14q4Zx> or the learner may search information on impact of feeding practice on chicken performance and productivity from reliable sources (books, online resources, journals, guest speakers, field trips, project, etc.)
- Based on the information gathered, the learner may evaluate the feeding practices and its impact on chicken performance and productivity through a group discussion.
- The learner explains the impact of feeding practices on chicken performance and productivity based on the evaluation carried out from the group discussion through different relevant activities (class presentation, gallery walk, exhibition, etc.)

Non-contact:

The teacher may carry out the instructional practices on impact of feeding practice on chicken performance and productivity through following activities:

- The teacher may provide the web link <https://bit.ly/30ozTZ7> and <https://cutt.ly/E14q4Zx> or the learner may search information on impact of feeding practice on chicken performance and productivity from reliable sources (books, articles, online resources, journals, etc.)
- Based on the information gathered, the learner may evaluate the feeding practices and its impact on chicken performance and productivity.
- The learner explains the impact of feeding practices on chicken performance and productivity through presentation or video recording and submit it via Google Classroom or any other relevant media platforms.

Assessment:**Contact:**

- Assess learner's information gathering skill, comprehension, analysis, interpretation, evaluation, and communication skills using appropriate assessment tools. Provide necessary feedback and follow up.

Non-contact:

- Assess learner's information gathering skill, comprehension, analysis, interpretation, evaluation, and communication skills using appropriate assessment tools. Provide necessary feedback and follow up.
- For recording and reporting, refer to the New Normal Curriculum framework in AgFS (NNCFAgFS- 2021)

Resources:

- REC repository
- Agriculture for Food Security Textbook for Class IX (2019), REC
- For recording and reporting, refer to the New Normal Curriculum framework in AgFS (NNCFAgFS- 2021)
- <https://cutt.ly/E14q4Zx>
- <https://bit.ly/30ozTZ7>

2.2 Starting a Pig Farming**Competencies**

- a. Use the understanding skills of exotic breeds of pigs in Bhutan to select the best breeds for the better pig farm production.
- b. Apply the understanding and skills from pig breeding to breed the best pig for effective pig farming.
- c. Outline the common diseases in pig including parasitic infection in developing a management strategy towards risk reduction and elimination.

2.2.1 Exotic Pig Breeds in Bhutan

(Scope: The exotic breeds are imported from abroad for cross breeding with our local pigs. Pig breeds such as large White, Landrace, Duroc, Saddleback and Large Black are commonly

raised for farming. The productivity and performance among pig breeds are dependent on various factors such as feeding and other management practice)

Objective(s):

- Compare the performance among pig breeds raised in Bhutan in terms of productivity and profitability.

Learning Experiences:

Contact:

The teacher may carry out the instructional practices to compare the performance among pig breeds in terms of productivity and profitability through the following activities:

- The teacher may provide the web <https://cutt.ly/Jl4wkqU> link and <https://cutt.ly/C17saWr> or the learner may search information from reliable sources (books, journals, guest speakers, field trips, projects, etc.)
- Based on the information gathered, the learner may construct a comparative explanation on performance of different pig breeds in terms of productivity and profitability through group discussion.
- The learner may explain the comparative performance of different pig breeds in terms of productivity and profitability through presentation/debate/gallery walk, exhibition, etc.

Non-contact:

The teacher may provide the web link <https://cutt.ly/Jl4wkqU> and <https://cutt.ly/C17saWr> or the learner may search information on performance among pig breeds raised in Bhutan in terms of productivity and profitability from reliable sources (books, articles, journals, other reliable sources, etc.)

- Based on the information gathered, the learner may construct a comparative explanation on performance of different pig breeds in terms of productivity and profitability.
- The learner may upload a comparative explanation on performance of different pig breeds in terms of productivity and profitability through the Google Classroom or any other relevant media platforms.

Assessment:

Contact:

- Assess learner's information gathering skill, comprehension, analysis, evaluation, and communication skills using appropriate assessment tools. Provide necessary feedback and follow up.

Non-contact:

- Assess learner's information gathering skill, comprehension, analysis, evaluation, and communication skills using appropriate assessment tools. Provide necessary feedback and follow up.
- For recording and reporting, refer to the New Normal Curriculum framework in AgFS (NNCFAgFS- 2021)

Resources:

- REC repository

- Agriculture for Food Security Textbook for Class IX (2019), REC
- For recording and reporting, refer to the New Normal Curriculum framework in AgFS (NNCFAgFS- 2021)
- <https://cutt.ly/Jl4wkqU>
- <https://cutt.ly/Cl7saWr>

2.2.2 Pig Breeding

(Scope: Breeding or mating systems are the approach taken in pairing a boar and a gilt or sow for breeding in order to maintain desired traits. The genetics of a pig plays an important role in its performance and meat quality; all pig producers should be familiar with breeding systems for pigs)

Objective(s):

- Explain procedures and conditions required for successful pig breeding.

Learning Experiences:

Contact:

The teacher may carry out the instructional practices on procedures and conditions required for successful pig breeding using the following activities:

- The teacher may provide the web link <https://bit.ly/3kOxYGG> or the learner may search information on procedures and conditions required for successful pig breeding from reliable sources (books, journals, online resources, guest speakers, field trips, project, etc.)
- Based on the information gathered, the learner prepares a note/write-up/presentation on the following topics using any relevant digital tools.
 1. Procedures required for successful pig breeding.
 2. Conditions required for successful pig breeding.
- The learner explains the note/write-up/presentation through different relevant activities (class presentation, gallery walk, exhibition, etc.)

Non-contact:

The teacher may provide the web link <https://bit.ly/3kOxYGG> or relevant materials (book, articles, journal, etc.)

- Based on the information gathered, the learner prepares a note/write-up/presentation on the following topics using relevant digital tools.
 1. Procedures required for successful pig breeding.
 2. Conditions required for successful pig breeding.
- The learner uploads the notes/write-up/presentation through Google Classroom or any other relevant media platforms.

Assessment:

Contact:

- Assess learner's information gathering skill, comprehension, analysis, and ability to explain the procedures and conditions required for successful pig breeding using appropriate assessment tools. Provide necessary feedback and follow up.

Non-contact:

- Assess learner's information gathering skill, comprehension, analysis, and ability to explain the procedures and conditions required for successful pig breeding using appropriate assessment tools. Provide necessary feedback and follow up.
- For recording and reporting, refer to the New Normal Curriculum framework in AgFS (NNCFAgFS- 2021)

Resources:

- REC repository
- Agriculture for Food Security Textbook for Class IX (2019), REC
- For recording and reporting, refer to the New Normal Curriculum Framework in AgFS (NNCFAgFS- 2021)
- <https://bit.ly/3kOxYGG>

2.2.3 Pig Breeding

(Scope: Housing conditions of pig play an important role in pig performance besides other variables such as genetics, nutrition and feeding, and health status. Essential requirements for pigs must be understood and considered before planning to construct a pig sty)

Objective(s):

- Outline the details of requirement for construction of pig sty based on purpose of farming

Learning Experiences:**Contact:**

The teacher may carry out the instructional practices on requirement for construction of pig sty using the following activities:

- The teacher may provide the web link <https://bit.ly/3kPnI0Y> or the learner may search information on requirements for construction of pig sty from reliable sources (books, journals, guest speakers, field trips, project, etc.)
- Based on the information gathered, the learner designs an illustrative model or constructs a sample pig sty.
- The learner explains the model of pig sty through different relevant activities (class presentation, gallery walk, exhibition, etc.).

Non-contact:

The teacher may carry out the instructional practices on requirement for construction of pig sty using the following activities:

- The teacher may provide the web link <https://bit.ly/3kPnI0Y> or the learner may search information on requirements for construction of pig sty from reliable sources (books, journals, guest speakers, field trips, project, etc.)
- Based on the information gathered, the learner designs an illustrative model of a pig sty showing all the requirements.

- The learner submits the model of pig sty through Google Classroom and other relevant media platforms.

Assessment:**Contact:**

- Assess learner's information gathering skill and the ability to design a pig sty showing all the requirements using appropriate assessment tools. Provide necessary feedback and follow up.

Non-contact:

- Assess learner's ability to design a pig sty showing all the requirements using appropriate assessment tools. Provide necessary feedback and follow up.
- For recording and reporting, refer to the New Normal Curriculum Framework in AgFS (NNCFAgFS- 2021)

Resources:

- REC repository
- Agriculture for Food Security Textbook for Class IX (2019), REC
- For recording and reporting, refer to the New Normal Curriculum framework in AgFS (NNCFAgFS- 2021)
- <https://bit.ly/3kPnI0Y>

2.2.4 Common Diseases of Pigs and their Management

(Scope: Classical Swine Fever (CSF), also known as hog cholera, is a contagious viral disease. Preventive measure against spread of disease and pathogens includes hygiene and sanitation, pest control and waste management including other bio-security measures)

Objective(s):

- Explain measures to avoid disease infection and spread including other bio-security measures.

Learning Experiences:**Contact:**

The teacher may carry out the instructional practices on measures to avoid disease infection and spread including other bio-security measures through the following activities:

- The teacher may provide the web link <https://cutt.ly/o14etrb> or the learner may search information on measures to avoid disease infection and spread and other bio-security measures from reliable sources (books, journals, guest speakers, field trips, project, etc.).
- Based on information gathered, the learner identifies the diseases and constructs an explanation to prevent the spread of diseases and propose bio-security measures through presentation/debate/gallery walk, etc.

Non-contact:

The teacher may carry out the instructional practices on measures to avoid disease infection and spread including other bio-security measures through the following activities:

- The teacher may provide the web link <https://cutt.ly/ol4etrb> or the learner may search information on measures to avoid disease infection and spread and other bio-security measures from reliable sources (books, journals, articles, online resources, etc.).
- Based on information gathered, the learner identifies the diseases and constructs an explanation to prevent the spread of diseases and propose bio-security measures through presentation and submit via Google Classroom or any other relevant media platforms.

Assessment:**Contact:**

- Assess learner's information gathering and comprehension skills and the ability to identify disease and propose measures to prevent the spread of disease using appropriate assessment tools. Provide necessary feedback and follow up.

Non-contact:

- Assess learner's information gathering and comprehension skills and the ability to identify disease and propose measures to prevent the spread of disease using appropriate assessment tools. Provide necessary feedback and follow up.
- For recording and reporting, refer to the New Normal Curriculum Framework in AgFS (NNCFAgFS- 2021)

Resources:

- REC repository
- Agriculture for Food Security Textbook for Class IX (2019), REC
- New Normal Curriculum Framework in Agriculture for Food Security (NNCFAgFS- 2021)
- <https://cutt.ly/ol4etrb>

3. Sustainable Agriculture Practices

Competencies:

- Apply the understanding skills and values of food and nutritional security to grow and consume a healthy diet.
- Use the understanding of food classification based on its function to classify foods found in Bhutan.
- Use the concept of AEZs of Bhutan and choose what crops can be grown accordingly.

3.1.1 Introduction to Agriculture and Agriculture practices in Bhutan

(Scope: Bhutanese agriculture is still largely based on the traditional subsistence-oriented mixed farming system that integrates cropping, livestock rearing, and use of forest products. Bhutan is divided into six Agro-Ecological Zones (AEZs) based on altitude, rainfall, and air temperature. The AEZs of the country provide abundant opportunities to the people of Bhutan to engage in diversified agriculture activities throughout the year.)

Objective(s):

- Interpret the concept of 'Food and Nutrition Security' with examples

- ii. List the crops that can be grown in each AEZs.

Learning Experiences:

Contact:

The teacher may carry out the instructional practices on introduction to agriculture for food and nutrition security through following activities:

- The teacher may let the learner explore information on agriculture one day before the lesson.
- The learner searches information on food and nutrition security and crops grown in each Agro-Ecological Zones of Bhutan from the web link <https://www.idrc.ca/en/program/agriculture-and-food-security> and <http://www.moaf.gov.bt/agro-ecological-zone-map-for-bhutan/> or relevant sources (books, articles, handouts, etc.)
- Based on the information gathered, the learner constructs an explanation on food and nutrition security and list of the crops grown in each AEZs through presentation.

Non-contact:

The teacher may provide the web link <https://www.idrc.ca/en/program/agriculture-and-food-security> / <http://www.moaf.gov.bt/agro-ecological-zone-map-for-bhutan/> or relevant materials (downloaded digital content, articles, etc.) on Food and Nutrition Security and crops grown in each AEZs.

- Based on the information gathered, the learner constructs an explanation on food and nutrition security and list of crops grown in each AEZs through modelling or illustration using animations, vocal narratives, pop-up texts, etc.
- The learner may submit the work via Google Classroom or any other media platforms.

Assessment

Contact:

- Assess learner's information management skill, comprehensiveness of AEZs mapping, ability to explain Agriculture for Nutritional Security and listing different crop production for each Zones using appropriate assessment tools and provide necessary intervention.

Non-contact:

- Ask the learner to upload the AEZs mapping and crop production for each zone in the Google Classroom.
- Use a rubric to assess learners' conceptual understanding of agriculture and national food security based on the vocal narratives, pop-up texts, and comprehension skills of the AEZs mapping. Provide necessary intervention to the learners based on the learner's achievement derived using the rubric and checklist.

Resources:

REC repository

- Agriculture for Food Security Textbook for Class IX (2019), REC.

- New Normal Curriculum Framework in AgFS (NNCFAgFS- 2021).
- Yuichi, T. (2018). Guidebook on vegetable cultivation. ARDC Bajo.
- <https://www.idrc.ca/en/program/agriculture-and-food-security>
- <http://www.moaf.gov.bt/agro-ecological-zone-map-for-bhutan/>

3.1.2 Classification of Food Based on their Main Functions

(Scope: Food can be generally categorized into three groups based on their functions as energy-giving foods, growth-promoting foods, and protective foods. These foods are used in the body of an organism to sustain growth, repair, and vital processes and to provide energy)

3.1.2 Food Guide Pyramid

(Scope: The Food Pyramid contains six groups of foods depending on the quantity needed by the body. Eating the right amount from each food group is called eating a "Balanced" Diet)

Objective(s):

- Interpret the food pyramid for a healthy life.
- Categorize different types of food based on its function.

Learning Experiences:

Contact:

The teacher may carry out the instructional practices on constituents of food and nutrients, classification of food based on their functions, and food pyramid.

- The learner searches for information on what constituents of food and nutrients, classification of food based on their functions from web link <https://www.idrc.ca/en/program/agriculture-and-food-security> or from other relevant sources (books, internets, handouts, etc.)
- Based on the information gathered, learners design a Food Pyramid for their school mess and family and may display it at a strategic location.

Non-contact:

The teacher may provide the web link <https://www.hsph.harvard.edu/nutritionsource/healthy-eating-pyramid/> / <https://www.google.com/search?q=designing+food+pyramid&oq> or relevant material (downloaded digital content, articles, etc.) that shows functions of the food and food pyramid.

- Based on the information gathered, the learner may plan and design an illustration of the Food Pyramid for their family through relevant digital tools and programming software and display at home or strategic location in the community.

Assessment:

Contact:

- Assess learner's comprehension and application skills on the classification of foods based on their main function using a checklist or any other assessment tools. Provide necessary intervention.
- Use a rubric to assess learner's conceptual understanding, and translating skills of the designed food pyramid

Non-contact:

- Ask the learner to upload the designed food pyramid in the Google Classroom and assess the learner's conceptual understanding and translating skills of the food pyramid using relevant assessment tools.
- Assess learner's comprehensiveness of food classification based on function using a checklist.

Resources:

- REC repository
- Agriculture For Food Security Textbook for Class IX (2019), REC
- New Normal Curriculum Framework in AgFS (NNCFAgFS- 2021).
- <https://www.idrc.ca/en/program/agriculture-and-food-security>
- <https://www.google.com/search?q=designing+food+pyramid&oq>

3.1.3 Introduction to Sustainable Forest

Competencies:

- a. Use the understanding, skills, and values of forest management practices in knowing how much important is to preserve and conserve forest for the ecosystem and country.
- b. Apply the understanding and skills of forest nursery management practices and start forest nurseries in their locality.

3.1.4 Forest and its Importance

(Scope; Forests have been the main source of construction materials, timber for making furniture, firewood, fodder, leaf litter farmyard manure, etc. The services derived from forest include; ecosystem and diversity, recreation, water and watershed services, forest acting as a carbon sink, and leaf litter for making farmyard manures).

Objectives:

- i. Describe the importance of forest.

Learning Experiences

Contact:

The teacher may carry out the instructional practices on forest and its importance through following activities;

- The learner explores information on what constitutes forest and its importance from the web link https://wwf.panda.org/discover/our_focus/forests_practice/importance_forests or reliable sources (journals, periodicals, newsletters, etc.) or the teacher may also invite guest speakers.
- The learner may prepare a chart to display and explain the importance of forest .

Non-contact:

The teacher may provide the web link

https://wwf.panda.org/discover/our_focus/forests_practice/importance_forests/#:~:text=The%20importance%20of%20forests%20cannot,erosion%20and%20mitigate%20climate%20change. or relevant material (downloaded digital content, articles, etc.) that discuss the forest and its importance

- Learners will prepare concept mapping on the importance of forest and submit it through Google classroom or other means for social media.

Assessment:

Contact:

- Assess learner's information management, comprehension, and analytical skills of the importance of forest and forest products to the community, ecosystem, and nation through group discussion.

**Non-contact:**

Assess learner synthesis information and interpretation skills regarding the importance of forest and submitted through Google Classroom with relevant assessment tools and provide constructive feedbacks

Resources:

- REC repository
- Agriculture For Food Security Textbook for Class IX (2019), REC
- New Normal Curriculum Framework in AgFS (NNCFAgFS- 2021)
- https://wwf.panda.org/discover/our_focus/forests_practice/importance
- https://wwf.panda.org/discover/our_focus/forests_practice/importance_forests/#:~:text=The%20importance%20of%20forests%20cannot,erosion%20and%20mitigate%20climate%20change

3.1.5 Types of Human-made Forestry

(Scope: There are many grouping of forest base on its management viz community forest, private forest, and agro-forestry)

3.1.6 Management of Forest Nursery

(Scope: Forest nursery is usually set up for producing plant nursery. Important guiding principles of forest nursery include; nursery site and size, seedbed and seed care, plantation).

Objectives:

- i. Explain the types of human-made forestry.
- ii. Outline procedures and practices of starting forest nursery

Learning Experiences:**Contact:**

The teacher may carry out the instructional practices on types of human-made forest and procedures and practices of starting forest nursery through following activities;

- The learner collects information on types of human-made forest and procedures of nursery establishment from relevant sources or from the web link <https://www.onegreenplanet.org/environment/difference-between-man-made-forest-and-natural-one/>.
- Based on the information gathered, the learner presents information on types of human made forest by designing a poster.
- The learner applies the concept of nursery establishment in planning, and establishment of a small forest nursery.

Non-contact:

- The learner gathers information on types of human-made forest and procedures of starting forest nursery from relevant sources or web link <https://www.onegreenplanet.org/environment/difference-between-man-made-forest-and-natural-one/> and <http://www.twisted-tree.net/starting-a-nursery-business>
- Using the information gathered, the learner explains the type of human made forest and procedures of establishing a forest nursery.
- The learner may also practice the concept of nursery establishment in planning, and starts growing seedlings at home.
- The learner may submit the work records through Google Classroom or any other online platform.

Assessment:**Contact:**

Assess the learner's understanding of man-made forest and the ability to translate the conceptual understanding of nursery establishment in developing a nursery using any relevant assessment tools. Provide necessary feedback.

Non-contact:

Assess the learner's understanding of man-made forest and the ability to explain or use the conceptual understanding of nursery establishment using any relevant assessment tools. Provide necessary feedback.

Resources:

REC repository

- Agriculture For Food Security Textbook for Class IX (2019), REC
- New Normal Curriculum Framework in AgFS (NNCFAgFS- 2021)
- <http://www.twisted-tree.net/starting-a-nursery-business>
- <https://www.onegreenplanet.org/environment/difference-between-man-made>
- https://wwf.panda.org/discover/our_focus/forests_practice/importance_forests/#:~:text=The%20importance%20of%20forests%20cannot,erosion%20and%20mitigate%20climate%20change

4. Agro-technology

Competencies:

- Implement the basic skills of plastic mulching and drip irrigation system as a water management strategy in the face of water scarcity issues.
- Apply the understanding and skills of controlled environment agriculture using protected farming technologies such as greenhouse, shade house and poly tunnel in providing ambient conditions for crop production.

4.1 Basic Smart Agriculture Technologies

4.1.1 Irrigation and Water Management

(Scope: Irrigation is the artificial application of water for supplementing the moisture in the soil that is deficient and does not meet the full requirements of growing crops. Using plastic mulch film as an alternative to organic mulch plays an important role in soil moisture retention besides other merits like weed control and manipulation of environmental conditions.

(Scope: Drip irrigation involves dripping water onto soil at very low rates (2-20 liters/hour) from a system of small diameter plastics pipes fitted with outlets called emitter. Drip irrigation system saves water by reducing the amount used by crops. Installing drip irrigation system along with mulching with plastic film provides better water management alternatives).

Objective (s):

- i. Explain how using plastic mulch film and drip irrigation helps in irrigation and water management.

Learning Experiences:

Contact:

The teacher may carry out instructional practices on mulch film and how drip irrigation helps irrigation and water management by carrying out following activities:

- The learner may search for information on mulch film and drip irrigation and water management from the web link <https://www.youtube.com/watch?v=BIPRSbhvAYU> or relevant sources (books, you tube videos, articles, handouts, etc.)
- The learner may construct an explanation by designing a model or carrying out an activity on mulch film and drip irrigation and water management.

Non-contact:

- Teacher may provide the web link <https://www.youtube.com/watch?v=SbYRdvEUJ70> or relevant materials (downloaded digital content, articles, youtube, etc.) that shows video lessons on the manual practices through Google Classroom or other media platforms.
- Based on the information gathered, the learner may develop a model/illustration to explain the process, feasibility and materials required through Google Classroom.

Assessment:

Contact:

- Assess learner's comprehension, interpretation, application and communication skills on mulch film and drip irrigation and water management using relevant assessment tools.
- Provide necessary feedback.

Non-contact:

- Assess learner's ability to explain the benefit of using plastic mulch film and drip irrigation and water management using relevant assessment tools.
- Provide necessary feedback.
- For recording and reporting, refer to the New Normal Curriculum Framework in AgFS (NNCFAgFS- 2021).

Resources:

- REC repository
- AgFS Textbook for Class XI (2019), REC
- New Normal Curriculum Framework in AgFS (NNCF AgFS- 2021).
- <https://www.youtube.com/watch?v=SbYRdvEUJ70>
- <https://www.youtube.com/watch?v=BIPRSbhvAYU>

4.1.2 Controlled Environment Agriculture (greenhouse or poly tunnel)

(Scope: Controlled-environment agriculture (CEA) is a technology-based approach toward food production. The aim of CEA is to provide protection and maintain optimal growing conditions throughout the development of the crop. Production takes place within an enclosed growing structure such as a green house, shade house, poly tunnel or building).

Objective(s):

- Develop greenhouse or poly tunnel to study the effect of controlling the environment in growing crops.

Learning Experiences:

Contact:

The teacher may carry out the instructional practices on designing and developing a greenhouse or poly tunnel through following activities:

- The teacher may provide the web link <https://www.youtube.com/watch?v=FPjko9DDhcU> and or relevant resources (downloaded digital content, online video, article, etc.) that explains different techniques of making greenhouse or poly tunnel.
- Based on the information gathered, the learner may construct a green house or poly tunnel using any relevant technique.

Non-contact:

The teacher may carry out the instructional practices on designing and developing a greenhouse or poly tunnel through following activities:

- The teacher may provide the web link <https://www.youtube.com/watch?v=FPjko9DDhcU> and <https://bit.ly/38jktP> or relevant resources (downloaded digital content, online video, article, etc.) that explains different techniques of making greenhouse or poly tunnel.
- Based on the information gathered, the learner may construct a green house or poly tunnel using any relevant technique.
- The learner may make a short video clip capturing the process of constructing a greenhouse or poly tunnel and submit it through Google Classroom or any relevant media platform.

Assessment:

Contact:

- Assess learner's comprehension skills and ability to construct a greenhouse or poly tunnel using relevant assessment tools.
- Provide necessary feedback.

Non-contact:

- Assess learner's comprehension skills and ability to construct a greenhouse or poly tunnel following the construction steps using relevant assessment tools.
- Provide necessary feedback.

- For recording and reporting, refer to the New Normal Curriculum Framework in AgFS (NNCFAgFS- 2021).

Resources:

- REC repository
- AgFS Textbook for Class IX (2019), REC
- New Normal Curriculum Framework in AgFS (NNCFAgFS- 2021).
- <https://bit.ly/38jktP>
- https://www.youtube.com/watch?v=6uyj_p3PVG0



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Appendix A

Weighting and Instructional Time

Strands	Core Concepts (Chapters)	Sub-core Concepts (Topics)	Weighting (%)	Time (min)
Crop Production	Basics of Soil and Water Management	<ol style="list-style-type: none"> Physical and Chemical Properties of Soil Types of Soil Soil Testing Soil Management 	9	360
	Growing of Vegetable I	<ol style="list-style-type: none"> Vegetables and their Importance Cultivation Practices of Vegetables (cabbage, beans, and potato) Common Pests and Diseases of Vegetable Crops 	10	420
	Growing of Fruits I	<ol style="list-style-type: none"> Categories of Fruits (pome, stone, walnut and strawberry) Procedure and Management of Fruits 	10	360
Livestock Production	Running a Poultry Farm	<ol style="list-style-type: none"> Poultry Breeds and its Production System in Bhutan Management of Pullets Poultry Housing and it's Equipment Feeding of Poultry Birds 	12	360
	Pig Farming	<ol style="list-style-type: none"> Exotic Pig Breeds in Bhutan Pig Breeding Common Diseases of Pigs and their Management 	10	300

Sustainable Agriculture Practices	Introduction to Sustainable Agriculture System	<ol style="list-style-type: none"> 1. Introduction to Agriculture and Agriculture Practices in Bhutan 2. Classification of Food Based on their Main Functions 3. Food Guide Pyramid 	15	600
	Forest for Agriculture	<ol style="list-style-type: none"> 1. Forest and its Importance 2. Types of Human made Forestry 3. Management of Forest Nursery 	10	360
Agro-technology	Irrigation and Water Management	<ol style="list-style-type: none"> 1. Irrigation and Water Management 	12	420
	Controlled Farming	<ol style="list-style-type: none"> 1. Controlled Environment Agriculture (green house or poly tunnel) 	12	420
Total			100	3,600

Note:

The core concept-wise weighting and the corresponding instructional hours is purported to assist classroom instructional practices and assessment of learner's performance expectations or competencies (performance or authentic assessments). At times, learning in the context of field-based learning, project-based learning, design-based learning, problem-based learning, or engaging in service learning may entail learning over an extended period of time. In such situation, the specific hours of instructional time cleaved in the table may neither suffice the need nor appear ideal. Therefore, the scale and proportion of instructional time may change as per the need of the hour so long the learning objectives are achieved as intended. At the same time, if the weighting cleaved against each sub-core concept is deemed necessary to tinker as per the need, the same can be changed by small margin or so.

Concurrently, the core concept-wise weighting is not entirely based on the length of the instructional time. The weighting is computed considering several parameters, such as length of the instructional hours and the nature of the learning objectives in terms of intricacy, complexity, and relevancy.



The duration of instruction as per REC (2019) is approximated as 40 min per period, the number of period for the duration of the instructional time cleaved against each core concept or sub-core concept may not come ideally as whole number.

