Horticultural Crops Production

Level III

Learning Guide –49

Unit of Competence: Coordinate Nursery Activities

Module Title: Coordinating Nursery Activities

LG Code: AGR HCP3 M19LO1- 49

TTLM Code: AGR HCP3 TTLM 0120V1

LO1:- Monitor Nursery Establishment

Instruction sheet 1	Learning Guide 49

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics –

- Selecting site
- Selecting fertile areas with gentle slope
- Conducting survey and nursery plot design

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, you will be able to:

- Select site
- Select fertilizer areas with gentle slope
- Conduct survey and nursery plot design

Learning Instructions

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below 3 to 6.
3. Read the information written in the information “Sheets 1-3”.
4. Accomplish the “Self-checks 1-3” **in page -5, 8, and 12,** respectively.
5. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1” **in page 13.**
6. Do the “LAP test” **in page – 14** (if you are ready).

Information Sheet-1	Selecting site

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1.1, Basic requirements for selecting nursery site

1.1.1The major factors to be considered in nursery site selection are:

1. The availability of water supply
2. The proximity of nursery to the plantation site
3. Favorable climatic, soil and land features
4. Land availability
5. Legal framework

Legal requirement for a commercial production employment practices, land ownership

Factors to be considered when locating a nursery are determined by the nature of the nursery business and the extent to which it is to be developed .In other words, it will depend up on the kind of operation s one intends to carry out. If ornamentals and vegetables are to be raised for seed production and planting stocks for tree crops are to be produced on a commercial scale, then an extensive area would be required. Essentially, a nursery should have continuous source of water and a shaded area where young plants are protected from the sever heat of the sun. A nursery location should also be protected from strong winds, because tropical winds often cause extensive damage to plants and structure if this are adequately protected. Availability of water throughout the year and its controlled supply is most essential in nursery practice. Cultivars of horticultural plants can be propagated throughout the in tropical climate, provided the water supply is assured. A nursery should have its own supply of water either from a bore hole or surface well with pumping and storage facilities. It is very unwise to depend solely up on external source for water, whether the nursery is small or big. A surface tank built close to the field nursery will serve as the reservoir. The source of supply to the tank could either be from a bore hole or deep surface well. A small scale sprinkler could be operated as well from a facility such as this or water could be fed to the field by the gravity. The protection of tender nursery from direct sunlight is most important as the heat and glare of the sun, especially during the middle of the day, can harm the plants in the nursery. If natural shade is not already available in the site selected, trees preferably of leguminous species such as Albezzia, Cassia, etc., should be planted. Cassia siamea is selected from the other species of cassia

due to its fast growing characteristics, giving reasonably good shade within a short time. Nursery plants that would benefit most from natural shade are potted plants. Compost, which the main source of organic manure for well managed nursery, will also require shade for its preparation in tropical conditions.

Trees planted at the boundaries around the nursery will protect the nursery plants from strong winds. Excessive wind causes dryness of the foliage under dry climatic conditions. Wind breaks help to prevent this and also maintain a relatively constant temperature around the plants. Two or three rows of closely spaced Eucalyptus, a row of cashew, mango or whistling pine can serve as a good wind break.

Generally, nurseries in the tropics dealing with a variety of horticultural plants would require selected variety of tree crops such as mango , citrus , etc. to serve as source of scion materials. One would thus find it ideal to plant them at the boundaries to serve as Wind breaks.

The size of land to be selected for nursery depends on –

1) Morphological characteristics of the plant species.
2) Size of the stock to be planted
3) The annual production target
4) Method of raising the seedlings
5) The degree of permanence of the site.

For intermediate nursery, the area actually occupied by the seedlings plus the access roads and storage sheds constitute the nursery area. In a permanent nursery, additional room has to be provided for crop rotation in order to maintain the organic matter and nutrient status of the soil. Where mechanical equipment is to be used, equipment maintenance and storage centers have to be provided for in the nursery

self-check-1	written test for self-evaluation

Direction; answer the following questions, pay attention in each activity and try to answer to the point.

1. List factors considered during nursery site selection?5 point
2. What are Basic requirements for selecting nursery site? 5 point

Note: **Satisfactory rating – 10 points Unsatisfactory - below 10 points**

You can ask your teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer

1. _____

Information Sheet-2	Selecting fertile areas with gentle slope

2.1. Selecting available slope and soil fertility for nursery site

2. 2.1, Aspect of slope

A poorly sited vegetable garden may produce inferior crops even though sound methods of cultivation are used. This is because the microclimate of a site is greatly influenced by its slope. Lands which slope steeply can be difficult to cultivate and erosion of the top soil can become a series problem in regions with heavy rainfall. A level site is generally suitable, but slight slop can be an advantage because it assists drainage and hence prevents water logging.

2. 2.2, Soil

Deep, fertile, light to medium loamy soils are the most suitable for vegetable production. Therefore, before buying or renting land for establishment of a vegetable garden, it is essential that the soil should be inspected in order to estimate its suitability. Information on the structure and physic-chemical content will enable the grower to take any necessary steps to improve the fertility and will serve as a guide for further cultivation. Although most vegetable crops can in practice be grown on a much wider range of soil types, it is as well to be aware of particular crop requirements when selecting a site for specialized production. For example, root crops are more suited to sandy soils and the presence of stones is particularly disadvantageous.

Tropical soils vary widely as regards texture, organic and mineral content and general fertility , but a great deal can be done to improve land if intensive methods of cultivation are practiced .These includes the regular application of organic fertilizer s, crop rotation and conservation measures. Other routine practices such as mulching, irrigation and disease and pest control will contribute to an increase in soil fertility. Generally, it is possible to correct nutrient levels and PH to suit particular crops but soil texture is more difficult to modify.

2.2.2.1. Prepare the Soil

The ideal soil should be deep, well-drained, and fertile, contain plenty of organic matter, and retain moisture well. It should also be friable (easily worked) and reasonably free of stones. Soils vary in texture (size of soil particle) from sandy (course particles) to clay (fine particles). Silts fall between sandy and clay textures, while loams are mixtures of all the above. Sandy soils tend to be low in fertility and do not hold water well. Clay soils often drain poorly, crack severely when dry, and become very sticky when wet. Sandy loam soils are ideal for producing most vegetables. Adding organic matter to almost any Southwestern soil will improve its structure. Most soils in New Mexico are low in organic matter. Adding organic matter to a sandy soil improves both its water-holding capacity and its cation exchange capacity, or the ability of the soil to retain nutrients for plant uptake. Adding organic matter to clay soils aerates these soils and improves their drainage. One of the easiest ways to add organic matter to your garden soil is to apply livestock manure at a rate of 50-100 lb/100 ft2. Use lighter rates when applying chicken manure, as it tends to be “hotter" manure (higher in nitrogen) than manure from larger livestock like cattle and horses. Fresh manure should only be applied in the fall so it has the time to break down in the soil. Heat-treated or composted manures are preferred because fresh manure can introduce weed seed into the garden. Fresh manure applied in the spring often burns young seedlings due to the high salt content of the manure. Large amounts of organic matter can be added to the soil using "green manure" crops. A green manure crop is any crop grown specifically as a source of forage that can be incorporated back into the soil as a source of organic matter. The most popular green manure crops are winter wheat, barley, oats, and rye. Seed can be obtained from most local farm feed stores and liberally scattered around the garden in late summer or early fall. Rake the seed into the soil around existing vegetables, then water. After first frost, pull up frost-damaged summer vegetables, leaving a "carpet" of green grass to develop in late fall. A little nitrogen fertilizer applied the following spring will speed growth. Approximately one month before planting your garden, the green manure crop should be thoroughly rototilled into the soil. A little extra nitrogen fertilizer will help microorganisms in the soil rapidly break down the organic matter. Most gardeners find the easiest way to add organic matter to the soil is to apply compost. Compost is often made from leaves, grass clippings, food wastes, and garden vegetable waste from the previous growing

season. A 1- to 2-inch layer of well-decomposed compost can be incorporated into the soil before planting. Most New Mexico soils tend to be alkaline, which makes some soil nutrients like phosphorous, iron, and zinc unavailable for plant uptake. Well-decomposed compost (often called humus) contains humus acid, and when added to alkaline soils, helps to make these nutrients more available for plant uptake. Compost and manures also contain a wide variety of nutrients. Because the nutrients are in an organic form, they tend to be more stable in the soil and more available for plant uptake over a relatively long time. They do not, however, occur in large quantities, thus most gardeners rely on commercial fertilizers for optimum plant growth.

Fig. 2.1 type of soil and slope of the field for nursery

self-check-2	written test for self-evaluation

Direction; answer the following questions, pay attention in each activity and try to answer to the point.

1. What is gentle slope? (5 point)
2. What are nursery soil fertility criteria ?(5 point)
3. What are Basic requirements for gentle slope? (5 point)

Note: **Satisfactory rating - 15 points Unsatisfactory - below 15points**

You can ask your teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer

1._____

Information Sheet-3	Conducting survey and nursery plot design

3.1. Nursery Design and Preparation

Good design and preparation will increase the efficiency and productivity of a nursery operation. Unnecessary deaths of seedlings can thus be avoided, which is crucial when a project requires a specified number of trees in order to be economically efficient.

Nursery design depends on the site. Some general guidelines exist that can help in the initial stages. Draw out your design so that the best overall nursery plan can be developed, and so that alternative plans can be easily formulated.

The size, orientation, and location of the nursery beds are important considerations. Beds should be 1.2 m in width for ease of weeding; their length will depend on the shape of the nursery. Orient the beds with the long dimension of the bed running from east to west. This orientation allows even exposure throughout the day for the trees on both the inside and outside of the bed. If the area is level create a slight slope to facilitate surface runoff.

The beds should be separated by walkways that are at least 45 cm wide, allowing people with wheelbarrows easy access for weeding, pruning, and other treatment. Beds should be slightly raised above the walkways, at least 15-20 cm. This allows good root penetration and easy maintenance. A slightly concave shape is recommended for the top of the bed. This controls erosion of the sides and enhances water retention.

If the nursery is permanent and the budget allows, lay a concrete pad as a base for each of the beds. The pad will deter roots from penetrating too deeply, as well as facilitate surface runoff. Another option is to line the bottom of the beds with plastic sheets. Large fruit tree plantations use plastic bags to cover the fruit during crucial

periods. When split they make excellent liners, and plantation managers are often willing to provide them free of charge.

3.2 What is site surveying?

Method of assessing and conducting analysis to collect necessary information about nursery site to design the correct plot. Practice of measuring distances on the ground so that they can accurately plotted Design is a plan of field for nursery site preparation and bed lay out. Plot is a small area of ground covered by specific vegetation.

Surveys

Control stakes are the responsibility of Surveys. The construction survey shall be performed in cooperation with the Resident Engineer and the Structure Representative.

The following are the responsibilities of Surveys:

A. Ensures statewide conformity.
B. Performs State-furnished construction staking prior to contract award as determined necessary by the Resident Engineer.
C. Performs all State-furnished construction staking that requires the use of a survey party.
D. Determines the methods and procedures to accomplish the State-furnished construction staking.
E. Checks data furnished by the Project Engineer for completeness and discrepancies.
F. Checks the conformity of planned lines and grades with existing conditions at pavement “conforms”, curb and gutter joins, inlets and outlets of drainage facilities, etc.; advises the Resident Engineer of any problems; makes minor adjustments to lines and grades under the direction of the Resident Engineer
G. Advises the Resident Engineer of all discovered design issues (problems) regarding lines and grades, and records the problems in daily Survey Party Reports.
H. Keeps the Resident Engineer informed of pertinent construction staking issues; accepts construction staking requests only from the Resident Engineer; and keeps adequate records of State-furnished construction staking efforts (work accomplished, dates, time and resources required, survey data and restacking).

I. Sets lath when normal staking is hidden by vegetation.

J. Communicates with the Structure Representative on the availability of safety-related protection equipment for work on superstructures.

3.3 Conducting survey & nursery plot design planning a nursery

1. There should be adequate store and tool shade.
2. Hardening off sheds should be near the propagation area.
3. Potting benches should be well positioned.
4. Every nursery should have a media preparation area.
5. Fencing is required to protect the nursery from animals and to minimize unauthorized entry.
6. High quality material should be used in constructing nursery structures.
7. Footbath should be placed at the entrance to all propagation site and facilities.

Nursery Design and Layout

In the design of a commercial nursery, all the nursery structures and other facilities are arranged to ensure a constant flow of activities. The layout of the nursery depends on:

- Climatic and environmental conditions.
- The type of scheme in operation.
- The type of propagation structure in use.
- The resources available.
- Other factors unique to each individual situation.

The figure below is a ground plan of a simple commercial nursery showing some of the major structures and facilities.

Figure 3.1 Nursery design and lay out

self-check-3	Written test for self-evaluation

Direction; answer the following questions, pay attention in each activity and try to answer to the point.

1. What is site surveying? (5 point)
2. What is site design? (5 point)
3. Discus on the responsibilities of Surveys? (5point)

Note: **Satisfactory rating – 15 points Unsatisfactory - below 15 points**

You can ask your teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer

2. _____

Operation sheet	**Selecting nursery site**

Objectives

After completing this practical, the trainee will able to

- ❖ Select proper site for nursery
- ❖ Familiarize with criteria's required to select for site selection

Materials

- Meter -Surveying materials -Metrological data
- Bag -Digging materials

Procedures

1. Survey the topography of the land whether undulating, slopping or plain
2. Locate suitable spot for digging pits at 2-3 places in one hectare as areas, the number of pits may be more according to the area and the topography
3. Collect the soil samples layer wise from 0-60,60-120cm,120-2 meter
4. Put samples in bags, label individual bags indicating location of pits and depth
5. Indicate the source of water (such as well or irrigation canals)
6. Take the water sample in plastic bottles from 4-5 places for testing its suitability for irrigation purposes
7. Have the soil and water sample analyze in soil testing laboratory
8. Collect the metrological data from the nearest metrological observatory for the least 5 years.
9. Depending on the metrological data and soil and water test results, select the site for nursery to be grown.

Precautions

- ✓ Soil sample and water to be tested must be taken by respective person or expert
- ✓ Be careful while interpreting the soil and water testing results, because if you make mistake here, it will lead you to make a mistake in selecting site.

LAP Test	Practical Demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions:

1. You are required to perform any of the following:
   - Prepare materials for nursery
   - Prepare land
   - Select site
2. Request your teacher for evaluation and feedback

List of Reference

1. Armson, K.A.; Carman, R.D. 1961. Forest tree nursery soil management. Ont. Dep. Lands & Forests, Timber Branch, Ottawa ON. 74 p.
2. Armson, K.A. 1966. The growth and absorption of nutrients by fertilized and unfertilized white spruce seedlings. For. Chron. 42(2):127–136.
3. Stiell, W.M. 1976. White spruce: artificial regeneration in Canada. Dep. Environ., Can. For. Serv., Ottawa ON, Inf. Rep. FMR-X-85. 275 p.
4. Duryea, M.L.; McClain, K.M. 1984. Altering seedling physiology to improve reforestation success. pp. 77–114 in M.L. Dryea and G.N. Brown (eds.). Seedling physiology and reforestation success. Martinus Nijhoff/Dr. W. Junk, The Hague.
5. Armson, K.A.; Sadreika, V. 1979. Forest tree nursery soil management and related practices – metric edition. Ont. Min. Nat. Resour., Div. For. For. Manage. Branch, Toronto ON. 179.

Horticultural Crops Production

Level III

Learning Guide –50

Unit of Competence: Coordinate Nursery Activities

Module Title: Coordinating Nursery Activities

LG Code: AGR HCP3 M19LO2- 50

TTLM Code: AGR HCP3 TTLM 0120V1

LO2:- Prepare to coordinate nursery activities

Instruction sheet	Learning Guide 50

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics –

- Identifying and clarifying activity goals and performance requirements
- Identifying and clarifying tasks
- Identifying personnel, equipment and material resource requirements
- Identifying, documenting and presenting order of activities and time allocation
- Identifying, assessing and reporting the environmental implications of the proposed work site activities
- Identifying OHS hazards, assessing and reporting risks

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, you will be able to:

- Identify and clarify activity goals and performance requirements
- Identify and clarify tasks
- Identify personnel, equipment and material resource requirements
- Identify, document and present order of activities and time allocation
- Identify, assess and report the environmental implications of the proposed work site activities
- Identify OHS hazards , assess and report risks

Learning Instructions

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below 3 to 6.
3. Read the information written in the information “Sheet 1- Sheet 6”.
4. Accomplish the “Self-check 1 Self- check 6,” **in page 20, 25, 31, 34, 43 and 46** respectively.
5. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1, Operation Sheet 2 and Operation Sheet 3” **in page 47.**
6. Do the “LAP test” **in page 47** (if you are ready).

Information Sheet-1	Identifying and clarifying activity goals and performance requirements

1.1. Activity goals and performance requirements of nursery

- It is convenient to look after the young seedlings
- It is possible to provide favorable growth conditions i.e.
- germination as well as growth
- Eliminates the problem of difficult soils
- Easy weed control
- Reduced field management costs
- Improved crop uniformity
- Higher yields
- More optimal use of Hybrid seeds
- Shorter growing season and more efficient use of land
- More accurate prediction of harvest date.

1.2. Importance of Nursery and its Role

There is a wide scope for fruit orchards, ornamental, vegetable, and landscape gardens at public places, highways and co-operative housing societies It assures the production of genetically improved quality planting material

It provides employment opportunities for technical, skilled, semi-skilled, unskilled labor

They are an important source supplying the seedlings for meeting the fruit, pulp and paper, fuel wood, timber and other demands of the industries.

Guidelines for Nursery Raising

Time of sowing/initiation of propagules production depend on how long the seedlings will take to have an optimum size of a seedling (with good rooting and about 20 cm tall) and coincidence of its ready availability at the time of initiation of monsoon areas.

The number of plants required to be produced from a nursery can be calculated as below.

Number of plants required for the season = W

Mortality in nursery = X

Transportation/culling loss = Y

Seedling required of buffer loss = Z

Total seedlings required to be produced from the nursery = W + X + Y + Z

In case of vegetative propagules, the success percentage also needs to be considered. Generally, it is assumed that the area of nursery should be 0.25% to 2.5% of the area to be planted or the area of nursery should be about 1 acre for every 30,000 seedlings. It also required daily supply of water @ 200 l per 1000 seedlings.

The nursery site should be located in the nutrient rich/medium soil, near to water source, free from soil pathogens and insects, availability of cheap and skilled labors and has good access to the main road for easy transportation. The site should be on gently sloping area and away from other tall crops: this is important for good drainage as well as to encourage air circulation. An appropriate site must be selected for the most effective, efficient, and economical design of a nursery. The purpose and target of plants to be produced will decide the site selection and its improvement. Careful observation of site conditions and an assessment of past and present climatic records are important. If desired, make a list of potential nursery sites and compare them using a decision matrix.

Components of a Good Nursery Layout

No standard blueprint for designing a plant nursery exists. On the contrary, each nursery will have a unique design based on distinct needs, resources, and requirements.

Generally a good nursery should consist of water tank/pond, water pump/pump house, seed and fertilizer store room, implement shed, germination/mother bed area; potting/container filling area, seedling raising area, worker mess/hall, office room, propagation structures, compost area, etc. A nursery is usually arranged in a series of beds with pathway between them. An open area is needed at one end, where work such as sieving of soil and filling of containers can be done. Usually a room/shelter is required for staff and the watchman, and where equipment can be securely stored. Layout should be in a way that enables operations to flow logically through the nursery so as to save labor and time. Roads and paths within the nursery should be carefully planned. The nursery facilities should be kept clean. Every effort should be made to

control weeds in and around the nursery as weeds may host insects and pathogens. The general layout of a nursery is given below in

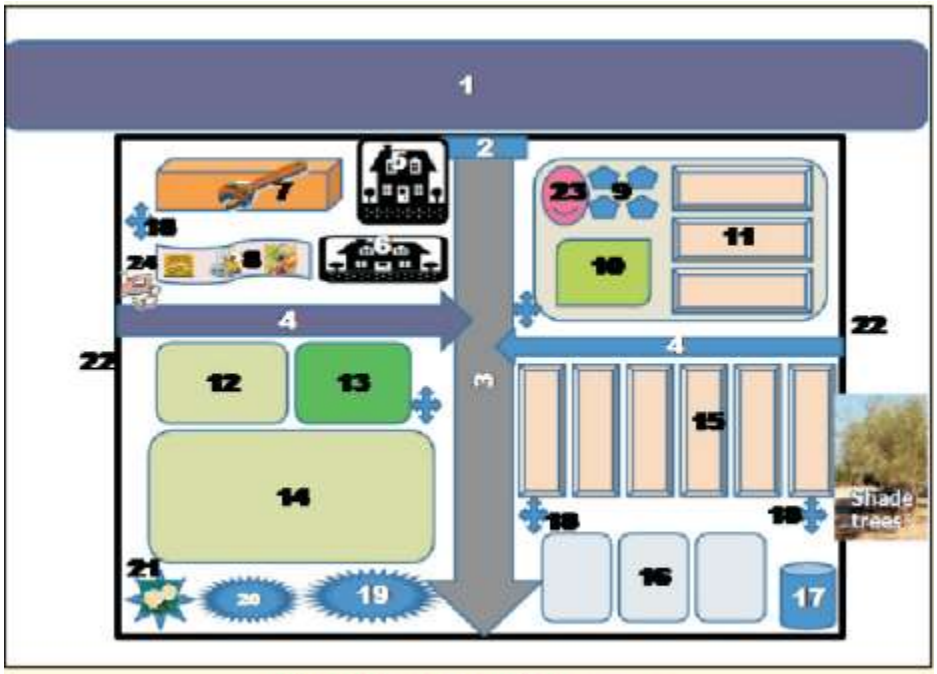

Fig. 1. General layout of nursery

Legend

1: Main road,
2: Gate,
3: Nursery road,
4: Path,
5: Office,
6: Labor shed,
7: Store rooms,
8: Vehicle shed,
9: Potted plants,
10: Saplings,
11: Seedlings,
12: Propagation/mist chamber,
13: Shade net house,
14: Poly house,
15: Seedling beds,
16: Mother beds,
17: Well/water source,
18: Water pipeline,
19: Soil dumping,
20: Compost area,
21: Mother plants,
22: Fencing,
23: Plant library,
24: Generator/Electricity room).

Self-check question-1	Written Test

Directions: Answer the following questions listed below. Illustrations may be necessary to aid some explanations/answers

1. Discuss on activity goals and performance requirements of nursery**?** (5 pts)

2. Discuss on Importance of Nursery and its Role**?** (5 pts)

Note: Satisfactory rating-10 points Unsatisfactory- below 10 points

You can ask your teacher for copy of correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer

3. _____

Information Sheet-2	Identifying and clarifying tasks

2.1. Major tasks in nursery

A nursery worker is someone who works outdoors or in a greenhouse, and whose job it is to plant, grow, water, transplant, prune, and ... They also monitor the whole process from the initial planting to harvest. ... Duties vary depending on the employment location, but tree farms are one of the major employers in this area

Handling and Moving Objects — Using hands and arms in handling, installing, positioning, and moving materials, and manipulating things.
Getting Information — observing, receiving, and otherwise obtaining information from all relevant sources
Performing General Physical Activities — performing physical activities that require considerable use of your arms and legs and moving your whole body, such as climbing, lifting, balancing, walking, stooping, and handling of materials.
Monitor Processes, Materials, or Surroundings — monitoring and reviewing information from materials, events, or the environment, to detect or assess problems.

Communicating with Supervisors, Peers, or Subordinates — providing information to supervisors, co-workers, and subordinates by telephone, in written form, e-mail, or in person.
Identifying Objects, Actions, and Events — Identifying information by categorizing, estimating, recognizing differences or similarities, and detecting changes in circumstances or events.
Making Decisions and Solving Problems — analyzing information and evaluating results to choose the best solution and solve problems.
Establishing and Maintaining Interpersonal Relationships — developing constructive and cooperative working relationships with others, and maintaining them over time.
Organizing, Planning, and Prioritizing Work — Developing specific goals and plans to prioritize, organize, and accomplish your work.
Estimating the Quantifiable Characteristics of Products, Events, or Information — Estimating sizes, distances, and quantities; or determining time, costs, resources, or materials needed to perform a work activity.
Inspecting Equipment, Structures, or Material — Inspecting equipment, structures, or materials to identify the cause of errors or other problems or defects.
Judging the Qualities of Things, Services, or People — Assessing the value, importance, or quality of things or people.
Training and Teaching Others — identifying the educational needs of others, developing formal educational or training programs or classes, and teaching or instructing others.

Developing and Building Teams — Encouraging and building mutual trust, respect, and cooperation among team members.

Documenting/Recording Information — entering, transcribing, recording, storing, or maintaining information in written or electronic/magnetic form.

Coordinating the Work and Activities of Others — getting members of a group to work together to accomplish tasks.

Communicating with Persons outside Organization — communicating with people outside the organization, representing the organization to customers, the public, government, and other external sources. This information can be exchanged in person, in writing, or by telephone or e-mail.

Guiding, Directing, and Motivating Subordinates — Providing guidance and direction to subordinates, including setting performance standards and monitoring performance.

Evaluating Information to Determine Compliance with Standards — Using relevant information and individual judgment to determine whether events or processes comply with laws, regulations, or standards

Scheduling Work and Activities — Scheduling events, programs, and activities, as well as the work of others.

Monitoring and Controlling Resources — Monitoring and controlling resources and overseeing the spending of money.

Thinking Creatively — developing, designing, or creating new applications, ideas, relationships, systems, or products, including artistic contributions.

Provide Consultation and Advice to Others — providing guidance and expert advice to management or other groups on technical, systems-, or process-related topics.

Repairing and Maintaining Mechanical Equipment — Servicing, repairing, adjusting, and testing machines, devices, moving parts, and equipment that operate primarily on the basis of mechanical (not electronic) principles.

Developing Objectives and Strategies — Establishing long-range objectives and specifying the strategies and actions to achieve them.

Analyzing Data or Information — Identifying the underlying principles, reasons, or facts of information by breaking down information or data into separate parts.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Harvest
Artichokes													
Asparagus													
Beans (lima)													
Beans (snap)													
Beets													All Winter
Broccoli													
Cabbage													
Cantaloupe													
Carrots													
Cauliflower													
Celery													
Corn (sweet)													
Cucumbers													
Eggplants													
Garlic													
Head Lettuce													
Leaf Lettuce													
Onions													
Peas													
Peppers													

Potatoes													
Pumpkins													
Radish													
Rhubarb													
Spinach													
Squash (summer)													
Squash (winter)													
Tomatoes													
Watermelons													
Legend Summer Planting Winter Planting													

Table 1. Vegetable Planting Calenda

Self-check question-2	Written Test

Directions: Answer the following questions listed below. Illustrations may be necessary to aid some explanations/answers

1. Discuss on major tasks in nursery? (10 pts)
2. Perform planting calendar form?(5pts)

Note: Satisfactory rating-15 points Unsatisfactory- below 15 points

You can ask your teacher for copy of correct answers

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer

4. _____

Information Sheet-3	Identifying personnel, equipment and material resource requirements

3.1. Personnel resource

- The personnel resource uniquely identify the person or personnel class
- Define skills and training for individuals or groups
- Define qualification tests, results and results expiration for individuals (such as licensing and certification).

3.2. The equipment resource

- Uniquely identify the equipment or equipment class
- Define a description of the equipment
- Define the capability of the equipment
- Define capability tests, results and results expiration for equipment (such as safety inspections)
- Define and track maintenance requests.

3.3. The material resource

- Uniquely define the material or material class property
- Describe the material
- Define and track material lot and sub-lot information
- Define and track material location information
- Define QA test specifications, results and results expiration for materials (such as shelf-life).

3.3.1. Materials tools and equipment's requiring for nursery preparation

3.3.2. Definition:

Materials: are substances that things can be made from such as building materials, bricks, sand, glass, and planting materials

- Plastic sheeting, Hardwood poles, Bamboo poles, Wire mesh, Assorted hails, Thatching grasses, Cement, gravel, sand, Corrugated sheeting's, etc

Tools- that hold in your hand and use for making things or repair things e.g. is an instrument such as auger, hoe, rake, axes, shovel, saw, spade, scissors, sickle, fork, pruning sheared,

Figure 2 nursery tools

Equipment's and machineries: things that are needed for particular purpose or activitv such as knapsack, motor pump etc.

1. Sprayers
2. Motor pump
3. Combine harvester
4. Seed cum fertilizer drill
5. PH meter

Figure 2 nursery equipment's and machinery

Figure 3 pruning Secateurs

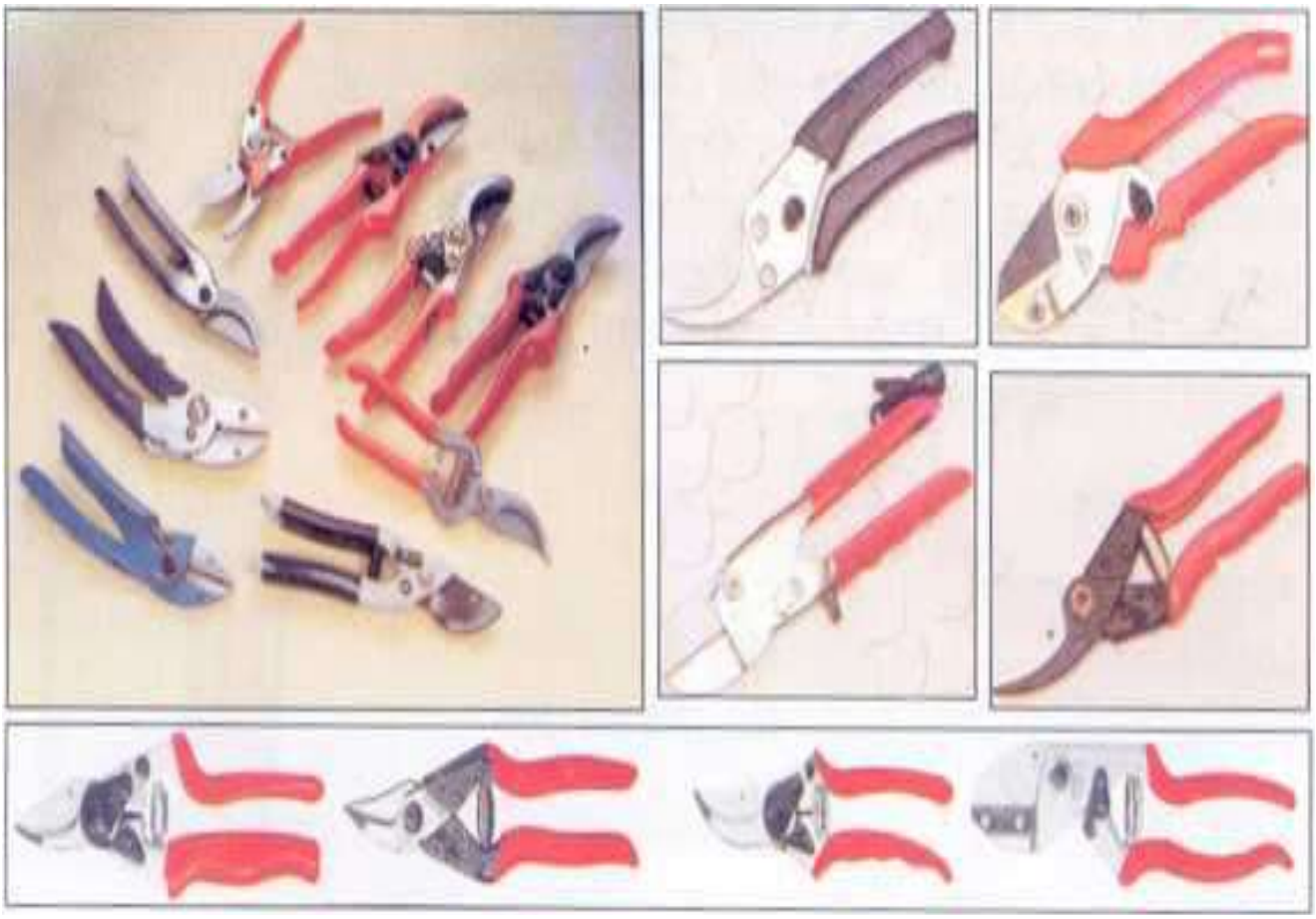

Figure 3 tools and equipment

2.1.3. Nursery Materials

⇨ The following materials are some of those often used in a nursery.

1. Polythene bags
2. Insecticides and Fungicides
3. Herbicides
4. Fertile topsoil
5. Sawdust
6. Manures and fertilizers
7. Plants

Self-Check 3	Written Test

Instructions: Answer all the questions listed below. Illustrations may be necessary to aid some explanations/answers. Write your answers in the sheet provided in the next page.

1. Define the word materials, tools and equipment's? (5 points)
2. List out materials, tools and equipment's used for nursery work? (5 points)

Note: **Satisfactory rating - 10 points** **Unsatisfactory - below 10 points**

You can ask your teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer

1. _____
   _____
2. _____
3. _____
   _____
4. _____

Information Sheet-4	Identifying, documenting and presenting order of activities and time allocation

Documenting/Recording Information it is the process of entering, transcribing, recording, storing, or maintaining information in written or electronic/magnetic form.

Coordinating the Work and Activities of Others — getting members of a group to work together to accomplish tasks.

Communicating with Persons outside Organization — communicating with people outside the organization, representing the organization to customers, the public, government, and other external sources. This information can be exchanged in person, in writing, or by telephone or e-mail.

4.1. Order of activities in nursery Establishment

Choice of site for the nursery

Design of the nursery layout

Collection, handling, storage and pre-treatment of seeds

Seed collection

Seed extraction

Seed drying

Seed storage

Seedling production

Nursery soil mixture

Nursery soil treatment

Filling the pots/pot size

Sowing of seeds

Watering plants in the Nursery

Weeding

Pricking out of seedlings

Vegetative propagation

Preparation of seedlings for the planting site

Transport of seedlings to the planting site

Transplanting

Aspect	Establishment	Rapid growth	Hardening
Definition	From germination through emergence and formation of true leaves	From emergence of true leaves to when seedling approaches target height; rapid increase in size, particularly in terminal shoot	Energy diverted from shoot to root growth; seedling reaches target height and root-collar diameter; lateral buds are set, seedling is conditioned to endure stress
Duration	Typically 14 to 21 days for germination; 4 to 8 weeks for early growth	Varies widely, typically about 10 to 20 weeks	Varies widely by species, from 1 to 4 months
Objectives	• Maximize uniform germination • Fill containers efficiently • Maximize survival • Minimize damping off	• Minimize stress • Encourage shoot growth • Maintain environmental factors near optimum levels • Monitor as seedling approaches target height and roots fully occupy container	• Stop shoot growth • Encourage root and stem diameter growth • Bring seedling into dormancy • Acclimate to natural environment • Condition to endure stress • Fortify for survival after out-planting
Special needs	• Protect from weather • Keep temps optimal • Irrigate to keep "moist, but not wet" • No or low fertilizer	• Protect from stress • Optimize temperatures • Irrigate regularly • Fertilize properly	• Induce moderate moisture stress • Decrease temperatures • Reduce photoperiod—Expose to ambient temperatures and humidity • Reduce fertilization rates and change mineral nutrient ratios
Labour	• Scout for pests and diseases • Monitor germination • Introduce beneficial microorganisms • Thin • Resow and/or transplant if	• Scout for pests and diseases • Monitor environment • Modify density of crops to encourage good development	• Scout for pests and diseases • Monitor crops and environment carefully; • Deliver crop to client in timely fashion to avoid problems with holdover stock.

Table 4.1 order of activities and time allocation in nursery site

Self-check question-4	Written Test

Directions: Answer the following questions listed below. Illustrations may be necessary to aid some explanations/answers

1. What are the Documenting/Recording Information? (5pts)

2. List order of activities in nursery Establishment? (6pts)

Note: Satisfactory rating-11 points Unsatisfactory- below 11 points

You can ask your teacher for copy of correct answers

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer

5. _____

Information Sheet-5	Identifying, assessing and reporting the environmental implications of the proposed work site activities

5.1. Environmental implications includes

- threats to flora and fauna;
- Risk of contamination of soils, water or adjoining property through fertilizers and chemicals flowing into drains and water sources.
  - Land used for a planting program for example may include : chemical residues in the soil,
  - spray drift,
  - contaminated run-off water,
  - run off from over-watering,
  - diseased plant material,
  - waste plant material, and
  - Physical damage such as soil compaction from machinery.

5.2. Environmental parameters

Altering of environmental parameters are important as the requirements of plants to meets the needs of plants and market requirements. Markets may require plants that have quality in their size, extent of foliage, color, and optimum time of selling and required numbers of blooms (flowers). So that in order to get high yield and quality plants controlling of environmental factors affecting plant growth is very important.

5.3. Environmental factors affecting plant growth

Environmental parameters may include light, temperature, humidity, wind, water and air**.** Plant growth and development are influenced by physical, chemical and biological components in the plants environment. Any factor in the plants' environment that is less than optimum, whether it is deficient or in excess, will limit plant growth.

Light

Plants respond to light of the wavelengths from 300-800 nm. Plants grown in the absence of light are said to be etiolated. Etiolated plants lack chlorophyll, are tall and spindly with long internodes and have small leaves that have failed to expand .Their

morphological expression of etiolating is related to the effect of light on auxin distribution and synthesis .There are no anatomical differences in the tissues formed in the light or dark, however, light accelerates many phases of growth while inhibiting certain aspects of internodes elongation.

Light can have an effect on the morphology of the plant. Leaves on the same plant may differ depending on whether they are sun leaves or shade leaves. Sun leaves are often thicker with extra layers of palisade parenchyma, and shorter petioles. They are also smaller in area. A plant's response to light will vary depending on the intensity, duration and wavelength of the light it receives. Light intensity refers to the concentration of light waves striking the leaf surface. Light intensity has been expressed in foot-candles by scientists and growers until recently. Watts per square meter or micro Einstein's per square centimeter are more useful and describe energy per unit area which can be related directly to power consumption for cost analysis.

Light intensity is high where there are no clouds and little moisture in the air. Water vapor in the atmosphere absorbs radiation so light intensity is lower in cloudy or humid areas. Light intensity will vary with the elevation, latitude, season and the weather conditions affecting the amount of water vapor in the air.

Photo processes in the plant vary in the intensity of the light required to initiate the reactions and the effect of the intensity on the rate of the reaction. The rate of photosynthesis drops on cloudy days. However, not all plants require high light intensities. Shade plants may require as little as 1/10 full sunlight for optimum growth and higher levels may cause sun burning, scald and in severe cases death if sufficient soil moisture is not available.

Photo periodism refers to the physiological responses of plants to variations in the duration of daylight. The shift from vegetative growth to reproductive growth is a response to the photoperiod. The length of the vegetative growth period can be extended by growing plants in photoperiods that do not induce flowering. Day length may also affect the time to first flower, the number of flowers produced and the number of fruit set. Likewise short days and cooler temperatures initiate dormancy in many temperate zone perennial plants.

The light reactions of the plant are carried on by different pigment systems that absorb specific wavelengths of light, i.e., blue, green, yellow or red light. Chlorophyll absorbs that radiant energy necessary for the photo processes of photosynthesis. Chlorophyll absorbs light in the red and blue portions of the spectrum. Phototropism, the movement or bending of stems, leaves and flowers toward light, is triggered by blue light. This process is believed to occur due to the accumulation of auxin in the shaded side promoting cell growth. Thus the bending movement toward the light source is a result of increased cell growth on the shaded side. When leaves are subjected to high levels of radiation, they may orient themselves parallel to the energy source in order to minimize the harmful effects of the intense radiation.

Although incoming light in the typical greenhouse in mid-winter often does not exceed 1000-1500 foot-candles in many locations, good growth of lettuce may be obtained at intensities as low as 500 foot-candles. Bolting results from long days and high temperatures so most varieties of greenhouse lettuce are not grown in late spring and early summer.

Early spring cucumbers, at the seedling stage, respond to supplemental light. Day length of about 12-14 hours with 1800-2000 foot candles at the plant level should be provided. Crowding should be avoided to prevent plants from becoming spindly.

Tomatoes grown in the late fall or early winter should be exposed to as much light as possible during normal daylight hours. However, artificial lights should not be used to extend the day length as tomatoes are plants which flower and fruit better if day length is twelve hours or less. If artificial lights are used, at least 500 foot candles at the leaf surface should be provided. Supplementary artificial light may only be economically feasible for tomatoes at the seedling stage where a greater number of plants can be illuminated per square foot.

Temperature

The temperature range that supports plant growth is generally from 40-97 degrees F (4.5-36 ^{0}C. Optimum temperatures for growth vary with the species and the stage of development and usually fluctuates night to day.

Several growth processes are sensitive to temperature. Among these are respiration, part of the photosynthetic process, maturation, flowering, fruit ripening and dormancy.

Photosynthetic rates are determined mainly by light intensity, CO2 levels and temperature (Temperature has little effect on photosynthetic rate from 50-86 degrees F (15-30 degrees C) until light and CO2 become saturated for the photosynthetic process. At this point, an increase in temperature from 68-86 degrees F (20-30 degrees C) results in a marked increase in the photosynthetic rate. On warm days, midday leaf temperatures may be high and inhibit photosynthetic activity. Not only are metabolic processes reduced at high leaf temperatures, but moisture stress, from increased transpiration losses, results in stomatal closure which decreases the supply of CO2 to the chloroplasts slowing photosynthesis.

Respiration rates increase rapidly as the temperature increases. Temperature is a controlling factor in establishing the compensation point of greenhouse crops, the point at which the rate of CO2 consumed in photosynthesis equals the rate of CO2 given off in respiration, because of its affect on respiration rate. As temperatures rise the level at which the compensation point occurs for a particular light level or CO2 concentration will decrease. A cessation of growth occurs when the rate of respiration increases more rapidly than the rate of photosynthesis, resulting in a depletion of food reserves.

Maintaining day/night temperatures at specific levels can increase yield and quality of crops. Optimum growth of many crops occurs when greenhouse temperatures are cooler at night than during the day. The response of plants to diurnal temperature fluctuations is referred to as thermos periodicity.

Temperature effects on flowering may be direct or inductive. The effect of temperature is direct when flower initiation occurs during the period of temperature treatment. If a specific temperature induces a change within the plant which permits flowering at another time, the effect is considered to be inductive. Vernalization is the inductive effect of cold temperatures on flower initiation. Many biennials and perennials require cold treatments to induce flowering.

Root temperatures also affect the rate of plant growth. Increasing root temperatures up to about 26 degrees C (76 degrees F) may increase top growth and the uptake of inorganic ions. This is true of many hydroponically grown crops, cucumbers in particular. Green plants require oxygen for normal growth and development. The energy released in cellular respiration, from the breakdown of carbohydrates and complex organic molecules, consumes oxygen and releases CO2. Most plants respire continuously, day and night, requiring a continuous supply of oxygen. Anaerobic respiration or fermentation occurs in the absence of oxygen. The products of this form of respiration are often deleterious to the plant and the energy released is relatively small compared to aerobic respiration. Roots also require oxygen for aerobic respiration which they obtain directly from the growing media. The absorption of salts and root extension are dependent upon the energy supplied from respiration. Poorly aerated growing Medias result in a decrease in water absorption due to a reduction in the permeability of the root cells. After extended periods of poor root aeration the roots stop growing and are more susceptible to disease.

Seeds require oxygen to germinate. Seed germination is inhibited by a lack of oxygen for prolonged periods. Often thick or oily seed coats must be removed from the seed so oxygen will be available to the embryo. Compacted or water logged soils or growing media can also create an oxygen-less environment and seeds will not germinate.

Carbon Dioxide

Carbon dioxide (CO_2) is a raw material required for photosynthesis. The atmospheric CO_2 concentration at the plant level is the most important rate determining factor for further increases in photosynthesis and yield. CO_2 concentrations may fall below the ambient air concentration .03% (300 ppm) in the greenhouse when weather conditions restrict ventilation or infiltration. A crop in a tightly closed greenhouse will soon deplete the CO_2 concentration which reduces growth and production by slowing or stopping photosynthesis. Unless replaced, the CO_2 concentration will remain at the plants compensation point, the level at which the CO_2 produced from respiration equals the amount used for photosynthesis. No growth occurs at this point.

When weather conditions permit, ventilation is an effective method of maintaining CO_2 concentrations at the normal air levels. However, plants respond favorably to higher CO_2 concentrations, making greenhouse supplementation of CO_2 an effective method of increasing plant growth. Although the CO_2 response is dependent upon light intensity, beneficial effects are obtained over a wide range of light intensities, either natural or artificial. CO_2 enrichment is of special significance in hydroponic culture as decaying organic matter in the soil, a source of CO_2, is not present.

CO_2 is commonly supplied at 800-1600 ppm via gas CO_2 generators or large tanks of liquid CO_2 depending upon the cost comparison between the two and the availability of the bottled carbon dioxide.

Air pollutants

Air pollution is an important problem for producers of greenhouse crops. The sources of air pollution are increasing as new industries and highways are built. This is a particular problem for horticultural operations near urban and industrial areas. Among the phototoxic pollutants are ozone, peroxyacel nitrates, oxides of sulfur, hydrocarbons, fluorides, carbon monoxide, herbicides, fumigants, mercury vapors (do not use mercury thermometers in greenhouses), and phototoxic gases produced from incomplete combustion of CO_2 generators. It may be necessary for greenhouse owners to move to areas where phototoxic gases are not present, or to grow species that are less sensitive to these substances.

Often leaves and flowers are first to show signs of air pollution. Unusual discolorations, spotting, twisting or turning of leaves and abortion of flowers followed by poor growth are symptoms of air pollution.

Water

Most growing plants contain about 90% water .Water is the medium for transfer within the plant and is the solvent system of the cell. Water is one of the raw materials for photosynthesis required for the production of new compounds. In soft tissues water pressure provides support and as plants lose water from their leaves they are cooled. A net loss of water will cause growth to stop and continued deficiency results in death. A

growing plant absorbs water from the soil and gives it off in transpiration. CO_2 enters the plant through a film of water that surrounds the leaf and as the film evaporates it is replenished by the plant. The transpiration loss of water in exchange for CO_2 is necessary for plant growth. Rapidly growing plants require large quantities of water, far in excess of that found in the plant for synthesis of new materials.

Moisture stress is generally detrimental to plant growth reducing both yield and quality of the crop. The degree and duration of the stress will determine how severely growth is reduced, however, growth rate may never return to the level it was before the stress (11).

The stage of growth when moisture stress occurs is also important. Moisture stress at the time of flower initiation may significantly reduce yield. Severe stress leads to premature flower, leaf and fruct drop.

Transpiration leads to moisture stress if moisture is not readily available to the roots. As moisture stress increases, stomata close and photosynthesis is reduced. Warm dry air has a high evaporative capacity, increasing the rate of transpiration. As well as, the increase in leaf temperature resulting from high light intensity raises the rate of transpiration loss.

Poor water quality can be a major problem for growers, particularly those with hydroponic systems, due to contamination from organic and inorganic substances. Even the best domestic water supplies may contain substances that affect plant growth. Therefore, a complete water analysis is recommended for greenhouse growers. Hydroponic systems require detailed elemental analysis of irrigation waters. In order to develop an appropriate recommendation for nutrient levels in solution the concentration of existing elements in the water must be known. Adjustments can then be made in the solution for the crop to be grown. Depending on the result of the water analysis, some form of water treatment may be necessary. Water treatment may simply involve the use of a filtering system for particulate debris, or may require more sophisticated methods of ion exchange or reverse osmosis in addition to filtration. In some cases all that may be necessary is the adjustment of nutrient solution, as in hard water areas where the majority of calcium and magnesium is already provided by the water source.

Nutrition

Sixteen elements are considered to be essential for growth and development in higher plants. Arnon & Stout. Considered an element essential when it is required by a plant to complete its life cycle, the action of the element is specific and no other element may be substituted for it and the element must exert its effect directly on growth or metabolism and not simply cause another element to be more readily available or antagonize a toxic effect of another element.

The essential elements are divided into two groups: the macronutrients, those required in relatively large quantities including carbon, hydrogen, oxygen, nitrogen, phosphorus, potassium, calcium, magnesium and sulfur and the micronutrients, those required in small quantities, including iron, chlorine, manganese, boron, zinc, copper and molybdenum.

Carbon, oxygen and hydrogen are obtained from the environment, specifically carbon dioxide or water. Along with chlorine, which is found in most water sources, these elements are generally not considered in the formulation of nutrient solutions.

Self-check question-5	Written Test

Directions: Answer the following questions listed below. Illustrations may be necessary to aid some explanations/answers

1. What are the Environmental implications in nursery? (5pts)

2. Discuss on environmental parameters? (5pts)

3. How plants are maintained in nursery? (5pts)

4. What are environmental factors affecting plant growth? (5pts)

5. How we can prevents plants in nursery from environmental effects? (5pts)

Note: Satisfactory rating-25 points Unsatisfactory- below 25 points

You can ask your teacher for copy of correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer

1. _____

Information Sheet-6	Identifying OHS hazards and assessing and reporting risks

6.1. How to protect nursery workers from hazards

Nursery workers plant, cultivate, and harvest trees, shrubs, or plants at garden centers, greenhouses, and agricultural fields. The proper tools, work behaviors, and training for nursery workers can keep you safe.

When you plant, thin, or weed, bring the plants to waist height by using nursery tables or carts. To tend plants at ground level, use long-handled tools. If you kneel on the ground, use kneepads or garden pads.

Choose planting and cultivating tools with handles that fit the task, your height, and your hand. Tools need comfortable, soft grips that will not slip out of your hand or press into your flesh. Use the correct size cutting tool and blade to trim or prune. Keep cutting tools sharp. Know where your hands are before you make a cut.

Hauling heavy potted plants can put a strain on your back. If you must lift a pot or plant manually, lift with your legs while keeping your back straight. Use lifting handles or a thick plastic edge around the pot to give you a good grip instead of trying to “pinch” a thin plastic edge with your thumb and forefinger. Use mechanical lifting devices such as wheelbarrows, dollies, and carts to move pots and materials (topsoil, mulch, fertilizers, etc.) around. Wheels should be large enough to roll over the uneven terrain in a garden center or field. You may operate all-terrain vehicles, tractors, and forklifts to move supplies and plants. Get training in the equipment you operate. Inspect and maintain the equipment. Know the equipment rated capacity so you do not overload it. Do not hitch a ride or allow riders unless there is a seat and seatbelt available.

Know the properties and hazards of the chemicals you use by getting training and consulting the Safety Data Sheets (SDS). Insecticides, fungicides, pesticides, and fertilizers can be harmful if you do not wear personal protective equipment (PPE). Consult the product label and/or SDS to choose appropriate gloves, coveralls, safety glasses, and respirator, if needed.

Working outdoors or year-round tending plants exposes you to the weather. Get training in heat and cold illness prevention. Wear layers of clothing appropriate to the season. Practice sun safety with long sleeves, a hat, and sunscreen. Use insect repellent and keep a first aid kit handy to treat bites and stings.

6.2. Identifying OHS Hazards

OHS hazards

Chemicals and hazardous substances, dust and pollen, incorrect manual handling, moving equipment, machinery, and vehicles, noise sharp hand tools and equipment's, slippery or uneven surfaces, soil-born microorganisms, solar radiation, wet working environment, including electricity.

Hazard identification

Hazard identification is a process used to identify all possible situations where people may be exposed to injury, illness or disease, the type of injury or illness that may result from these and the way in which work is organized and managed.

Hazard: a situation at the workplace capable of causing harm (i.e. capable of causing personal injury, occupationally related disease or death).

Risk: the chance of a hazard actually causing injury or disease. It is measured in terms of consequences and likelihood.

Risk Management: The overall process of risk identification, risk analysis, control of risks and risk evaluation.

Risk Control: that part of risk management which involves the implementation of policies, standards, procedures and physical changes to eliminate or minimize adverse risks.

Reporting Hazards and Accidents

Employees are required to report any situation or occurrence in the workplace that may present a risk or have the potential to affect the health and safety of employees or others in the workplace

OHS Requirements of tending nursery plants may include:

- ⌘ Identifying hazards
- ⌘ Assessing and reporting risks
- ⌘ Cleaning
- ⌘ Maintaining and storing tools and equipment

- Appropriate use of personal protective equipment including sun protection
- Safe operation of tools and equipment
- Safe handling
- Use and storage of chemicals and hazardous substances
- Correct manual handling
- Basic first aid
- Personal hygiene and
- Reporting problems to supervisors.

Employers are responsible for providing a healthy and safe work environment for their employees. OHS are to be in accordance with Federal and Regional Legislation and regulations, and organizational safety Policies and procedures.

6.2. Assessing *Risk*

Risk is considered to be a product of likelihood and impact, i.e. how likely something is to happen and how much of an effect it would have if it did. Stage 2 of the PRA, pest risk assessment, therefore, assesses these two elements. Pest risk is assessed by combining estimates of the probability or likelihood of an event occurring (the pest's entry, establishment and spread) and the consequences or magnitude of the impact if it does occur (the economic, environmental and social impacts that would potentially be attributable to the pest).

Risk: the chance of a hazard actually causing injury or disease. It is measured in terms of consequences and likelihood.

Risk Management: The overall process of risk identification, risk analysis, control of risks and risk evaluation.

Risk Control: that part of risk management which involves the implementation of policies, standards, procedures and physical changes to eliminate or minimize adverse risks

Self-Check- 6	Written Test

Directions*:* Answer all the questions listed below. Illustrations may be necessary to aid some explanations/answers

1. What does ***OHS hazards*** associated with tending nursery plants? [**4pt]**

2. What does mean ecologically sound management? [6pt]

Note: Satisfactory rating - 10 points and above Unsatisfactory - below 10 points

You can ask your teacher for the copy of the correct answer

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer

1. _____

Operation sheet -1	Identify, asses and report work place hazards

Objective: to identify workplace hazards and eliminate or reduce the risk

Procedure:

Step 1. Identify the hazard by carrying out a workplace risk assessment;

Step 2. Determine how employees might be at risk;

Step 3. Evaluate the risks;

Step 4. Record and review hazards at least annually, or earlier if something changes

Lab test 1	Practical demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks

Task 1. Identify workplace hazards and eliminate or reduce the risk

Reference

1. P. Ratha Krishnan, Rajwant K. Kalia,J.C. Tewari (2014). Plant Nursery Management: Principles and Practices
2. Rob Dimsey, July 1995. Seedling production using cell tray
3. Draft Indian Standard: Requirements for Good Agricultural Practices – India GAP part 1 crop base, 2008, Bureau of Indian Standards, New Delhi, Doc: FAD 22 (1949) C, p 28.

Horticultural Crops Production

Level III

Learning Guide –51

Unit of Competence: Coordinate Nursery Activities

Module Title: Coordinating Nursery Activities

LG Code: AGR HCP3 M19LO3- 51

TTLM Code: AGR HCP3 TTLM 0120V1

LO3:- Coordinate nursery activities

Instruction sheet	Learning Guide 51

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics –

- Allocating individual work tasks and roles
- Negotiating work targets and timelines
- Coordinating and timing all resources
- Organizing personnel
- Conducting work
- Monitoring and documenting personnel, activities, timelines and resource usage
- Monitoring nursery activities
- Monitoring nursery activities against timelines and performance requirements
- Identifying rectifying and reporting Potential barriers
- Recording workplace information
- Writing nursery activity report

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, you will be able to:

- Allocate individual work tasks and roles
- Negotiate work targets and timelines
- Coordinate and time all resources
- Organize personnel
- Conduct work
- Monitor and document personnel, activities, timelines and resource usage
- Monitor nursery activities
- Monitor nursery activities against timelines and performance requirements
- Identify, rectify and report Potential barriers
- Record workplace information
- Write nursery activity report

Learning Instructions

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below 3 to 6.
3. Read the information written in the information “Sheets 1-11”.
4. Accomplish the “Self-checks 1-11” **in page -58, 63, 66, 69,75,78,81,84,87,90 and 92** respectively.
5. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1” **in page 93.**
6. Do the “LAP test” **in page – 93** (if you are ready).

Information Sheet-1	Allocating individual work tasks and roles

1.1. What does a Nursery Workers do?

Nursery workers have distinct personalities. They tend to be realistic individuals, which means they're independent, stable, persistent, genuine, practical, and thrifty. They like tasks that are tactile, physical, athletic, or mechanical. Some of them are also investigative, meaning they're intellectual, introspective, and inquisitive.

Duties vary depending on the employment location, but tree farms are one of the major employers in this area. Nursery workers determine varieties and quantities of trees and shrubs and follow planting and care schedules. In the greenhouse they prepare the beds and plant the seedlings. As the plants grow and develop, workers must prune, weed, and water them. Caring for trees can also involve staking young saplings, tying and wrapping them, and packing them for transportation, as well as digging up shrubs and trees and moving them from greenhouse to field.

Most farms use some form of pest management system, so the nursery worker must develop and implement the plan. This includes identifying and controlling insects, rodents, birds, weeds, and diseases. If pesticides are used, safe handling, storage and disposal practices must be followed. Workers on organic farms must be familiar with organic farming procedures and natural pest control methods.

The horticultural industry often employs large numbers of seasonal workers, so the nursery worker may be responsible for supervising these staff in planting, transplanting, pruning, and feeding perennials, shrubs, trees, and seedlings of all types. Staff is often comprised of migrant workers who speak another language, so supervisors must find effective communication methods.

On large operations, irrigation may be controlled with computer systems, so workers must be proficient in programming and managing these. Nursery workers provide customers with information to help them select and care for trees, shrubs, flowers, and other plants.

The job can also include record keeping, preparing budgets, development of marketing plans, and preparation of trees and shrubs for sale or shipment

A nursery worker works hands on with a plant from seed to maturity. They pick the seeds they want to plant, then they plant row upon row of them – enough to meet consumer demand. Next they focus on nurturing the plants until they can be purchased.

Major activities of Nursery worker includes

- Planting
- harvesting seed
- transplanting
- cultivating
- tending
- pruning ,
- watering,
- fertilizing, and growing plants and trees

They also watch the plants for diseases. It takes observation, monitoring, judgment, and manual dexterity.

Nursery workers are like caring parents who don't mind getting their hands dirty to make sure their plants thrive. Nursery work is both a labor of love and labor intensive. Nursery workers find themselves in a greenhouse or outdoors in all weather conditions. Lifting, shoveling, digging, cutting, pruning, and planting are part of the game. They log lots of hours on their knees with their hands in the dirt.

Most nurseries focus on certain types plants – those that they think will sell. This may mean flowers, ornamental shrubbery, fruit trees, saplings, or exotic flowers. Typically this is a seasonal business with the most work occurring during the growing and planting seasons in spring and fall.

Every plant is different. Some trees take years to grow and develop. Flowers can often be ready in months. Nursery workers must monitor temperatures, humidity, and soils. Sometimes they will cut plants to create clones or graft tree branches to create stronger and healthier trees and plants. Nursery workers are the professional growers that ensure the best plants grow up healthy, so that plant and tree lovers can buy and enjoy them. It definitely takes a green thumb.

After the initial growing process is over, it's time for nursery workers to sell the plants. Usually flowers are sold in trays or pots, while trees are balled and bur lapped to retain the roots and soil during the journey to their new homes. Nursery workers need to be experts on all aspects of the plants and trees they grow so that they can advise customers on how to keep the plants healthy. Customers rely on a nursery worker's advice to ensure that their plant lives a long healthy life.

Nursery workers surround themselves with plants and trees all day, every day. It's a refreshing job that keeps you out of an office. Watching a flower, tree, or shrub grow from a tiny seedling to maturity is what makes a job as a nursery worker so appealing.

Self-Check-1	Written Test

Instructions: Answer all the questions listed below. Illustrations may be necessary to aid some explanations/answers. Write your answers in the sheet provided in the next page.

1. Explain the most common nursery activities? (5 points)

2. Mention Nursery workers personalities. (5 points)

Note: **Satisfactory rating - 10 points** **Unsatisfactory - below 10 points**

You can ask your teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer

1. _____

Information Sheet-2	Negotiating work targets and timelines

2.1. What is Negotiation?

Negotiation is a method by which people settle differences. It is a process by which compromise or agreement is reached while avoiding argument and dispute.

In any disagreement, individuals understandably aim to achieve the best possible outcome for their position (or perhaps an organization they represent). However, the principles of fairness, seeking mutual benefit and maintaining a relationship are the keys to a successful outcome.

Specific forms of negotiation are used in many situations: international affairs, the legal system, government, industrial disputes or domestic relationships as examples. However, general negotiation skills can be learned and applied in a wide range of activities. Negotiation skills can be of great benefit in resolving any differences that arise between you and others.

Timeline is a display of a list of events in chronological order. It is typically a graphic design showing a long bar labelled with dates paralleling it.

Timelines can use any suitable scale representing time, suiting the subject and data; many use a linear scale, in which a unit of distance is equal to a set amount of time.

2.1. Stages of Negotiation

In order to achieve a desirable outcome, it may be useful to follow a structured approach to negotiation. For example, in a work situation a meeting may need to be arranged in which all parties involved can come together.

The process of negotiation includes the following stages:

- Preparation
- Discussion
- Clarification of goals
- Negotiate towards a Win-Win outcome
- Agreement

Implementation of a course of action

1. Preparation

Before any negotiation takes place, a decision needs to be taken as to when and where a meeting will take place to discuss the problem and who will attend. Setting a limited time-scale can also be helpful to prevent the disagreement continuing.

This stage involves ensuring all the pertinent facts of the situation are known in order to clarify your own position. In the work example above, this would include knowing the 'rules' of your organization, to whom help is given, when help is not felt appropriate and the grounds for such refusals. Your organization may well have policies to which you can refer in preparation for the negotiation.

Undertaking preparation before discussing the disagreement will help to avoid further conflict and unnecessarily wasting time during the meeting.

2. Discussion

During this stage, individuals or members of each side put forward the case as they see it, i.e. their understanding of the situation.

Key skills during this stage include questioning, listening and clarifying.

Sometimes it is helpful to take notes during the discussion stage to record all points put forward in case there is need for further clarification. It is extremely important to listen, as when disagreement takes place it is easy to make the mistake of saying too much and listening too little. Each side should have an equal opportunity to present their case.

3. Clarifying Goals

From the discussion, the goals, interests and viewpoints of both sides of the disagreement need to be clarified.

It is helpful to list these factors in order of priority. Through this clarification it is often possible to identify or establish some common ground. Clarification is an essential part of the negotiation process, without it misunderstandings are likely to occur which may cause problems and barriers to reaching a beneficial outcome.

4. **Negotiate Towards a Win-Win Outcome**

This stage focuses on what is termed a 'win-win' outcome where both sides feel they have gained something positive through the process of negotiation and both sides feel their point of view has been taken into consideration.

A win-win outcome is usually the best result. Although this may not always be possible, through negotiation, it should be the ultimate goal.

Suggestions of alternative strategies and compromises need to be considered at this point. Compromises are often positive alternatives which can often achieve greater benefit for all concerned compared to holding to the original positions.

5**. Agreement**

Agreement can be achieved once understanding of both sides' viewpoints and interests have been considered.

It is essential to for everybody involved to keep an open mind in order to achieve an acceptable solution. Any agreement needs to be made perfectly clear so that both sides know what has been decided.

6. **Implementing a Course of Action**

From the agreement, a course of action has to be implemented to carry through the decision.

2.2. Positive and negative interaction

When people are happy at work, they tend to do a better job. Errors are reduced, productivity increases and customer service improves. Having great office interaction also improves teamwork, which makes an entire team more efficient during times of high stress, such as holiday sales or end-of-year report production. It doesn't matter what your company does, what product or service it provides, good interaction means that people are having positive experiences. Good grower and human resources professionals know the benefits of effective working relationships. These are relationships between co-workers, managers and staff, and employees with the public.

2.2.1. **Positive interactions**

A positive interaction also starts with greeting people who are walking into the establishment, perhaps even opening the door for them, as they enter. But interaction goes well beyond politeness and communication between people. Interaction is an experience that other workers and consumers have when working with someone for a short time or for an extended period of time. For example, look at a typical office dynamic.

Importance of positive interaction

- Increase good feelings
- Increase morale and improve work satisfaction,
- Produce good quality seedling,
- Use materials tools and equipment together
- Save the time and costs
- Knowledge, skill, and experience will develop
- To objective of the organization or business will met their goal.

3.1.2. Negative interactions

- It create confusion,
- anxiety
- tension and uncertainty, which adversely affect work efficiency and company productivity. As a product producer, don't leave workplace interactions to chance. Take the time and energy to help everyone in the organization develop the skills for positive interactions, whenever possible. There are many benefits to having effective working relationships.

Self-Check -2	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What is negotiating? (5 pts)
2. What is interaction? (5pts)
3. What are the importance of positives interaction working with other staff and customer? (5pts)
4. Discuss the difference between positive and negative interaction? (5pts)

Note: **Satisfactory rating - 20 points** **Unsatisfactory - below 20 points**

You can ask your teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer

1. _____

Information Sheet-3	Coordinating and timing all resources

3.1. What are resource in plant nursery?

Resources are essential to the success of any business. They come in many forms...people, time, facilities, funding, land, water, equipment or anything else required to complete tasks and projects. The lack of any one resource can be devastating to a business, especially a nursery. Careful consideration and planning prior to starting a nursery can help avoid mistakes and costly oversights. Pay careful attention to land and water resources as well as labor availability.

Starting a nursery business requires strong plant production skills, management skills and the use of sound management practices.

These skills can be acquired by a combination of reading, talking to industry suppliers, Extension faculty, and other nursery operators, as well as on-the-job learning. Employment at a successful nursery is often the springboard to a self-managed nursery.

Crew planting tree seedlings in field nursery. There are outstanding programs at some local community colleges on nursery production, nursery management and business practices. These programs are highly focused on direct skills needed to start work in nursery industry. There are also many workshops held periodically through local agencies and universities addressing concerns of the area nurseries.

3.2. Resource in nursery may include the following

- ***Materials* resource** include goods that will be consumed by the project such as fertilizers, plants, stakes and mulch in a planting program.
- **Equipment and machinery resource** may include hand tools, tractors, watering equipment and personal protective equipment.
- **Personnel resource** *may* include those obtained from within an enterprise, staff "borrowed" from another enterprise, hired from a contracting firm, or hired for the project from outside the industry.

When establishing a nursery, it is important to have somewhere to keep Nursery tools safely and in good conditions. This does not have to be at the nursery itself, but could be in the house, school, church or other location.

The basic tools needed for a nursery include jembes, pangas, shovels, empty tins with small holes in the bottom (to substitute for a watering can), and kitchen knives for root pruning. If resources allow, then proper watering cans, wheelbarrows, pruning knives, knife sharpeners, soil sieves and shovels are also all useful.

Timing

Timing is a critical factor in nursery development. Timing issues include the amount of time needed to set up, acquire materials, and make sure seedlings are ready for planting at the right time of year. An additional timing consideration is arranging labor and transportation for critical times (planting of seeds or stock, transplanting to planting sites, etc.). This planning should be done well in advance, since labor may be in short supply when workers are needed for other farming activities.

The most important time consideration is the timely planting of the seedlings. Since the survival chances of young trees depends directly on the maturity and size of the trees when transplanted, and upon transplanting at the right time of year, the timing of the project must be carefully planned.

The timing involved in seeding or placing open rooted stock or vegetative propagated plants in the nursery must therefore be carefully considered in order to ensure that planting stock is ready at the correct time. Planting too late in the nursery will make for immature seedlings with lessened chances for survival.

Conversely, planting too early in the nursery will produce heavier seedlings that will be harder to move and transplant, and may become pot-bound.

To time the planting, the forester must know how long each species must remain in the nursery and plan nursery time to coincide with the rainy season. For the recommended age of transplanting for species covered in this manual,

The Resource Timing allows you to collect complete timing information related to resources in a document. It enables you to measure user latency, which is crucial to benchmark web pages.

Using the Resource timing allows us to retrieve and analyze a detailed profile of all the network timing data for every resource on the page. For the moment, it's important that you understand how this API can help us in tracking the performance of the resources of our page, and determine how many and what resources we have to optimize. Local industry and in turn have a successful business venture.

3.3. Definition coordination is - the process of organizing people or groups so that they work together properly and well. How to use coordination in a sentence.

The process of organizing the different activities or people involved in something so that they work together effectively:

The important features of coordination are:

- It is essential for group efforts and not for individual efforts.
- It is a continuous and dynamic process.
- Coordination emphasizes the unity of efforts
- Helps in the integration of functions
- It is the responsibility of every manager in the organization.

Self-Check-3	Written Test

Instructions: Answer all the questions listed below. Illustrations may be necessary to aid some explanations/answers. Write your answers in the sheet provided in the next page.

1. Define Coordination? (5 pts)
2. Explain the most common Resource in nursery? (5 points)
3. Mention Materials resource? (5 points)

Note: **Satisfactory rating - 15 points** **Unsatisfactory - below 15 points**

You can ask your teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer

1. _____

Information Sheet-4	• Organizing personnel

Definition: Personnel refer to all the individuals working for a given organization. Simply put, it is a term used to address an entire staff.

The word personnel is most frequently employed in the field of human resources and business organization. It addresses the whole number of individuals working for an organization and the term is mostly used in military contexts.

Organizing is the process of identifying and grouping work to be performed, defining and delegating responsibility and authority and establishing relationships for the purpose of enabling people to work most effectively together in accomplishing objectives." In the words of Allen, organization is an instrument for achieving organizational goals. The work of each and every person is defined and authority and responsibility is fixed for accomplishing the same.

4.1. Personnel resource may include those obtained from within an enterprise, staff "borrowed" from another enterprise, hired from a contracting firm, or hired for the project from outside the industry.

Manage and direct nursery staff to cultivate and harvest trees, flowers, shrubs and other plants.

4.2. Labor Requirements

The number of employees you need in the nursery will depend on the size of your operation. Starting with fewer personnel gives more time for training and requires less financing. Mistakes will also be less likely and less costly.

The nursery business is inherently a seasonal activity with extended labor needs during the fall and spring. By diversifying the types of products (e.g., container-grown plants) and services (e.g., landscaping) offered, you can increase sales and reduce down-time of seasonal and part-time labor (e.g., migrant workers and students).

Labor requirements are extremely variable and depend on methods used, species, and sites. A large, permanent nursery requires more initial preparation and long-term maintenance then a temporary nursery. This means a large work force is needed for site

preparation, and small staff for continual maintenance. Usually a wider variety of species are cultivated in a permanent nursery, which requires additional labor and a more knowledgeable work force.

Labor needs are not as great for a temporary facility. It is advantageous to site the facility near the project site, yet as close to the beneficiaries as possible. By placing the facility near a residence, it is possible to provide 24-hour surveillance, and better yet, a caretaker.

Regardless of the type of nursery, sites located on marginal lands need many days of laborious preparation in order to clear trees, rocks, and work the soil.

It is possible to calculate labor needs by referring to previous records of similar jobs and consulting local experts. Plan ahead to ensure that an adequate workforce is available at critical times. Whenever possible, use local volunteer labor to assist in the early phases of construction. Periodically, request their assistance to perform general maintenance such as weeding and general construction activities. Hold training sessions on the same day so the participants can take some knowledge home with them. If you are applying for a grant, many organizations will require the beneficiaries to contribute some form of assistance, whether it be money or labor However, make it perfectly clear to the participants that they are volunteering. Too many foresters have found themselves without a labor force once workers realized there was no pay.

If the nursery is permanent, provide enough money in the budget for a full-time live-in worker. One way to ensure high-quality work, as well as ensure the continuity of the project, is to recruit a recent graduate from an agricultural school to assist in managing the project. Enroll the manager in a short training program with the national extension service. It may be possible to make an arrangement in which the manager spends several weeks at a government nursery assisting in daily operations. Space considerations are determined by the needs of the plants and the community, how much time and money is available, and how easy it will be to acquire written consent and permission for use of the land. Consider sites that allow expansion if extra room is likely to be needed or desired.

Estimating the Amount of Space Needed. First, the number of trees required by the project is determined by considering the overall project design and the capabilities and needs of the community. After determining numbers, the total space for the nursery can be calculated. As a general rule, when estimating the area needed for a nursery, use the following guidelines: for open-rooted stock, 1,000 trees need 10 square meters of space; for potted stock, 1,000 trees need 7 square meters of space.

4.3. Cooperative Extension Service.

Personnel planning includes complying with Social Security, insurance, wage and hour, and income tax requirements for each of your employees

4.4. Role of nursery manager

Manage, supervise and direct nursery or greenhouse staff in executing their nursery functions.

Supervise testing of soil condition for growing specific plants or flowers.

Provide training to the nursery staff in nursery management issues.

Develop innovative methods in growing plants, shrubs or flowers.

Protect nursery plants from diseases, weeds, insects and pests.

Manage purchases of plant nutrients, seeds and disease control chemicals.

Maintain and manage nursery care equipment in good condition.

Organize nursery shows, exhibitions and events.

Implement the best standards in nursery management issues.

4.4.1. Allocating responsibility to staff and contractors

Who is responsible for implementing the nursery Project Plan?

1. The officers, directors, managers and supervisors, who are charged with development and implementation of quality systems; and

2. Each employee, who is responsible for the quality of his or her work and for suggesting improvements in quality.

4.4.2. Worker training: If you have multiple workers or volunteers, keep track of training that was conducted (when, by whom, topics). Make sure nursery workers have read related materials and have enough training to follow them.

Self-Check-4	Written Test

Instructions: Answer all the questions listed below. Illustrations may be necessary to aid some explanations/answers. Write your answers in the sheet provided in the next page.

1. Explain the most common Role of nursery manager? (5 points)
2. Mention Personnel resource of nursery? (5 points)
3. Elaborate Who is responsible for implementing the nursery Project Plan? (5 points)

Note: **Satisfactory rating - 15 points** **Unsatisfactory - below 15 points**

You can ask your teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer

1. _____

Information Sheet-5	Conducting work

5.1. Undertaking nursery operations

Activities in nursery establishment

5.1.1 Fence:

Prior to the establishment of a nursery, a good fence with barbed wire must be erected all around the nursery to prevent tress pass of animals and theft.

5.1.2 Roads and paths:

- A proper planning for roads and paths inside the nursery will not only add beauty, but also make the nursery operations easy and economical.
- This could be achieved by dividing the nursery into different blocks and various sections.

5.1. 3 Office stores:

- An office-cum-stores is needed for effective management of the nursery.
- A store room of suitable size is needed for storing poly bags, tools and implements, packaging material, labels, pesticides, fertilizers etc.

5.1.4 Seed beds:

- In a nursery, this component is essential to raise the seedlings and rootstocks.
- These are to be laid out near the water source, since they require frequent watering and irrigation. Irrigation channels are to be laid out.
- Alternatively, sprinkler irrigation system may be provided for watering the beds, which offers uniform germination and seedling growth.

Successful nursery operation depends on many factors:

- selection and development of a suitable site
- efficient supervision and administration, adequate planning, forecasting and control procedures, orderly timing of operations;
- use of appropriate production methods and

- Protection from pests, diseases and other damage.

The main operations in a nursery include:

- planning, controlling and recording all stages from receipt of seed to consignment of plants to the forest
- seed storage and pre-treatment or preparation of cuttings
- soil preparation in the seed bed container or medium for inserting cuttings
- basal fertilizer production and top dressing to control nutrition
- sowing seed and/or rooting cuttings
- operations of pricking out, standing out, undercutting, lifting, transplanting, stumping, or preparing seedlings, etc.
- ensuring mycorrhiza or nodule inoculation if necessary for the chosen species
- weed and pest control (e.g. fungi, bacteria, insects and rodents);
- protection against climatic damage (by means of irrigation, shading and frost protection) and
- Staking.

5.2 Seed selection

Some of the seed selection criteria's are:

- High yielding
- Resistance to drought
- Resistance to diseases and pests
- Well mature
- Physiological fitness
- True to name
- True to type
- Widely adaptable
- Vigorous
- Tolerant to stress

5.2.1 Pre-treating seed: it is important to treat seed before it is planted, in order to improve on the **level, speed and uniformity of germination**.

The most common methods for **pre-treatment** are:

- **Soaking seed in hot water** until the seeds look swollen.
- **Soaking seed in cold/cool water**.

- **Cracking** the seed shell method. This method is used for tree species with a hard coat .The cracking is done to allow water penetration for easy germination Cracking is done using a sharp knife, a stone or a cracking machine

5.2.2 Watering

Watering is a nursery maintenance activity that is frequently performed improperly. One of the causes is that for many growers, watering simply means wetting the soil surface. Effective watering, however, requires that water be delivered in adequate amounts to the root zone of the plants (recharging the root zone). It is important to note that the depth of rooting is influenced by moisture supply. Roots grow toward water. So if a plant is watered lightly, the roots stay near the soil surface as opposed to growing down when an area is soaked deeply.

Time of watering

The watering should do **early the morning, before 10.00 a.m. & in the afternoon after 4:00 p.m**.

Fig 5.1. Watering

5.2.3 Mulching

Mulching is any artificial modification of the soil surface.

- Mulching means **covering the bed surface with a 0.5 - 0.2 cm layer of organic materials** Germinating seeds need warmth, moisture, light is not necessary in most cases.

Materials

- Grass

- Rice straw
- Rice husk
- Compost, and
- Partly decomposed forest litters or saw dust is commonly utilized.
- Avoid the use of mulch to beds in rainy areas as this can reduce aeration and risk of damping off would be increased

- Plant stock material from other nurseries (seed, cuttings, scion wood and rootstock) can harbor nursery pests.
- Diseased plants in a nursery should be culled rigorously and burnt rather than composted.

5.2.4 Removing weeds

The chemicals used to kill weeds are referred to as Herbicides.

Weed Elimination techniques (The principal methods of weed control):

Weeds can be eliminated by

- Manually by hand
- mechanically - weed control by motor cultivators, tillers, & rotary hoes attached to a tractor
- Chemically- Herbicides like 2.4.D and 2.4.5.T

5.2.5 Apply fertilizer

- Developing and maintaining high levels of fertility in nurseries are essential for producing good quality nursery stocks.

5.2.6 Root Pruning is a standard in most Ethiopian nurseries. Root pruning involves cutting of the taproot, in some cases also of lateral roots

5.2.7 Thinning

Thinning in nursery refers to the way of reducing the density of seedlings for different purposes.

- To strengthen the vigor and health of plants.
- To reduce completion (water, air and nutrients).
- To minimize disease transmissions.

- To avoid deformed plants.
- To use nursery stock (cuttings and rooting) for duplication

5.3 Nursery policy, procedures and OHS requirements

1. Identify the potential for planting material production and to set realistic production targets based on the resource availability.

2. Location of targeted planting material production as selection of an ideal location can also serve to improve Production quality considerably.
3. The major considerations would be propagation method and its seasonal variations for success and quality of the final produce, rootstock to be used, and specifications for the scion / bud wood including its genuineness and seasonality of availability.
4. Identify the inputs necessary for each stage of production and develop specifications and requirements for each input.
5. An appropriate procedure might call for periodic measurement of microbial load, soluble salts and pH of the water and media prior to use in production while container label of fertilizers and pesticides may be checked for content and active ingredient concentration while procuring and the composition of the fertilizer / pesticide solution should be verified prior to use.
6. Proper nursery records may be maintained incorporating all the above information either in the registers and / or in the computer for monitoring.

Self-Check-5	Written Test

Instructions: Answer all the questions listed below. Illustrations may be necessary to aid some explanations/answers. Write your answers in the sheet provided in the next page.

1. Define mulching**?** (5 points)
2. Mention seed selection criteria? (5 points)
3. Elaborate the purpose of thinning? (5 points)

Note: **Satisfactory rating - 15 points** **Unsatisfactory - below 15 points**

You can ask your teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer

1. _____

Information Sheet-6	• Monitoring and documenting personnel, activities, timelines and resource usage

Documentation:- Documentation is a set of documents provided on paper, or online, or on digital or analog media, such as audio tape or CDs. Examples are user guides, white papers, on-line help, and quick-reference guides. Paper or hard-copy documentation has become less common. Documentation is often distributed via websites, software products, and other on-line applications.

❖ **Monitoring and measurement of product**

The organization shall monitor and measure the characteristics of the product to verify that product. Requirements have been met. This shall be carried out at appropriate stages of the product realization process.

❖ **Infrastructure organizations**

To maximize our ability to develop and deliver high quality products and services, certain infrastructure organizations are in place to deliver internal support services, collectively referred to as infrastructure organizations.

❖ **Information technology**

Information technology (IT) resources of the organization are managed by formulating an organizational IT strategy based on business needs and current technologies. The strategy encompasses managing and executing IT projects, maintaining systems, managing the IT operating environment, delivering enhancements and supporting/training users.

❖ **Plant, equipment & facilities management**:

Work place Services (WPS) manages the physical asset environment of the organization including plants, equipment and facilities. WPS establishes a strategy for employing physical assets, acquiring additional assets as necessary, monitoring usage of physical assets, and performing preventive and corrective maintenance as required.

❖ **Support Services Management**:

These infrastructure sub-processes are part of the support function of an organization that help the organization to deal with managing the administrative functions, legal services, corporate communications, safety and security, and risk management.

Each year, **plant** inspection **personnel** issue thousands of phyto sanitary certificates ... licensing regulators may require **documentation** from the Division of Plant.

Self-Check -6	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page

1. What is documentation? (4 points)

Note: **Satisfactory rating - 4 points** **Unsatisfactory - below 4 points**

You can ask your teacher for the copy of the correct answers.

Score = _____

Rating= _____

Name: _____ Date: _____

Answer sheet

Information Sheet-7	Monitoring nursery activities

Definition

Monitoring is the systematic process of collecting, analyzing and using information to track a program's progress toward reaching its objectives and to guide management decisions. Monitoring usually focuses on processes, such as when and where activities occur, who delivers them and how many people or entities they reach.

Monitoring is conducted after a program has begun and continues throughout the program implementation period. Monitoring is sometimes referred to as process, performance or formative evaluation.

Definition of nursery activity any activity undertaken within the whole sale or retail nursery environment for all horticultural plants.

These includes preparing, conducting, monitoring and completing work in the establishment and care of nursery plants (seedling, rootling's and cuttings)

7.1. Nursery operations

Tree nursery operations involves various activities such as, seed sourcing,

Seed bed preparation, Sowing seeds, Potting, Pricking Out, Shading,

Watering, Weeding, root pruning, application of additional fertilizers or manure

7.2. Organization and record keeping

To help schedule nursery activities for different species, we recommend developing a production calendar and hanging this up in the nursery to keep track of key duties.

A production calendar highlights key milestones for each species (from seed collection right through to planting). Ultimately all activities are geared towards ensuring seedlings will be the right size for planting by a set planting date (e.g. in the seasonal tropics, seedlings need to be planted at the start of the wet season).

For some fast growing species, this may mean keeping the seeds in storage for a short while so that they do not outgrow their pots before planting out at the start of the rainy season.

To perfect this production schedule you will need to keep records on the time of fruit production, time to seed germination and seedling growth rate.

7.3. Nursery Operational Management

Nursery operational management is fundamental to the development and implementation of a biosecurity plan. Assessing the risks associated with the activities that take place at the nursery is necessary. Potential biosecurity risks can originate from the location; the movement of people, vehicles and equipment; as well as production inputs and outputs.

- Nursery Location and Layout
- Biosecurity Zones
- Movement of People, Vehicles and Equipment
- Maintenance of Facilities and Property

Self-Check-7	Written Test

Instructions: Answer all the questions listed below. Illustrations may be necessary to aid some explanations/answers. Write your answers in the sheet provided in the next page.

1. Explain monitoring? (5 points)
2. Mention nursery activity? (5 points)
3. Elaborate Nursery Operational Management? (5 points)

Note: **Satisfactory rating - 15 points** **Unsatisfactory - below 15 points**

You can ask your teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer

1. _____

Information Sheet-8	Monitoring nursery activities against timelines and performance requirements

8.1. How to Monitoring nursery activities

- Adjust the monitoring program during specific times in the production cycle, such as flowering or periods where control measures are more likely to be successful or cost-effective.
- For up-to-date pest information for the area or region, refer to external sources such as weekly pest reports by provincial governments. This information can be provided to employees by posting the reports in common areas.
- **Formal and informal** monitoring may be included in the monitoring program and be used to make decisions to implement control measures.
- The frequency of formal monitoring is dependent on multiple factors such as season, crop and pest.
- Informal monitoring should include the inspection of new plant material when it arrives at the nursery.
- Maintain records of formal monitoring activities, especially pest detections. Records can be used to predict times of pest occurrence. Records may include date, crop, Growing Degree-Days (GDD), phonological indicators, pest, symptoms observed, timing of symptoms, possible causes, control measures and the success of the control measures.
- Record-keeping of informal monitoring may not be necessary.
- A trained employee may be assigned to review monitoring records from previous years to prepare a pest management plan for the next growing season.

8.2. Performance requirements of nursery activity

Determined by organization or departmental operational plans and customer requirements

8.3. Monitoring work processes within time

Monitoring is the process through which the implementers of the project ensure that actual activities conform to the planned and intended ones. It is employed to make things happen in accordance with the plans, programmers and timeframes initially

specified. It is a systematic effort to compare performance with laid-down objectives and standards in order to determine whether progress is in line with them. It also envisages the taking of remedial measures where slippages occur, the foreseeing of difficulties before they arise and making on-line corrections to keep the program me on track.

8.4. Main features of monitoring work processes

- It is a continuous process - an on-going activity that begins with the program me and tracks each activity to its finish;
- It is dynamic - In the sense that its processes and details evolve and change as the monitoring function gets under way
- It is forward looking - inasmuch as it seeks to anticipate problems and Shortcomings;
- It is continuously corrective - in that it suggests remedial measures on-line to rectify defects and failures even as they occur;

It is an all-encompassing function - so that everyone responsible for the implementation of the project has to play his part.

M: Minimum requirements to be met are stated in the guidelines/criteria

O: Observe and analyze the inputs, processes and output of the program me

N: New strategies and techniques applied

I: Issues and problems given due attention and solutions

T: Training of trainers, participants and other stakeholders

O: Opportunities, strengths and weaknesses are considered

R: Record on results of monitoring and evaluation

I: Instruments such as questionnaire, survey and interview

N: Needs of the community are considered

G: Gain updates on the progress of program.

Self-Check 8	Written Test

Name: _____ Date: _____

Directions: Answer all the questions listed below. Illustrations may be necessary to aid some explanations/answers

1. Write main features of monitoring work processes? (5 point)
2. Define monitoring? (5 point)

Answer

Score = _____

Rating: _____

Note: Satisfactory rating – 10 points **Unsatisfactory - below 10 points**

You can ask your teacher for the copy of the correct answer

Name: _____ Date: _____

Short Answer Questions

Information Sheet-9	Identifying rectifying and reporting Potential barriers

.9.1. **Common problems in nursery plants**

There are factors that hinder the production of horticultural products in the study area. The majority of the sample producers indicate pests, drought, and shortage of fertilizer and price of fuel for pumping water for irrigation as major constraints of horticulture production.

The problems are sometimes specific to certain vegetables. For instance, most farmers indicate that shortage of fertilizer, diseases, and frost are the most priority problems of producing potato. On the other hand fertilizer, pests and diseases, and shortage of pesticides are top constraints of production of beetroots and carrots. Water shortage or drought on the one hand and lack of fuel for pumping irrigation water, frost and fertilizer shortage on the other hand are the most important problems for onion production, which is also location and season specific. The constraints of horticultural production could be viewed from the farmers' context, institutional factors, natural factors and infrastructure related factors.

1. **Farmer related:** horticulture production in the eastern part of the country is based on tradition, which is poorly supported by scientific recommendations. Although one can associate this constraint to institutional factors, it is apparent that inadequate farmer skills and knowledge of production and product management affects the supply. Farmers attempt to select varieties and practice traditional crop management practices. Farmers' know-how of product sorting, grading, packing and transporting is traditional, which severely affects the quality of horticultural products supplied to the market. This skill gap should be addressed to improve the quality of marketable horticultural products.

2. **Institutional factors** are related to the provision of improved horticultural production technologies including supply of relevant varieties, agronomic practices and improved product management techniques. The study reveals that the farmers are not receiving the varieties they wish to cultivate. The capacity to distinguish between varieties is also low in the area. Institutions failed to bring up farmers' capacity to the expected level.

Fertilizer, seed and pesticides should be available through known and accountable sources. Conducive policies and enforcement mechanisms should be put them in place.

3. **Quarantine of exotic pests** through the enforcement of laws by exercising phyto sanitary inspection at points of their entry is essential. Institutions like the marketing agency should also make available the market information needed for production planning. The data available should enable to forecast demand to adjust production planning. The extension system lacks highly qualified staff at *woreda* and field level. The observation in the field depicts that some of the development agents have little knowledge compared to the farmers.

4. **Natural factors** such as rainfall, water supply, flood and pests are often beyond the control of farmers and institutions. There is a shortage of irrigation water mainly in the lowland areas. Yet, contingency planning and forecasting of the events which may help to minimize the effect is not available perhaps due to traditional ways of production. Moreover, an appropriate management system including variety selection and diversification would reduce the effect of natural factors. Improving the institutional constraints discussed above will be instrumental for improving the management system.

5. **Infrastructure** such as rural roads and means of communication for efficient flow of goods and market information is a limiting factor. Most of the rural area is not accessible by vehicle. The products are transported to the road side by donkeys or by people. This requires longer time to reach the market and affects the quality of the products. Moreover, there is no telephone or other fast communication systems to access market information that would assist decision making.

Reports format

S/no.	Activities	Problems	Actions taken

Self-Check -9	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1.. List the problems or difficulties occur in your nursery activities? (5pts)

a._____

b. _____

c. _____

d. _____

Note: **Satisfactory rating - 5 points** **Unsatisfactory - below 5 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information Sheet-10	Recording workplace information

10.1. Definition of recording the term **recording** has several different meanings. First, a **recording** is a medium through which information, sound or images can be captured. The act of entering or recording documents affecting or conveying interests in real estate in the recorder's office established in each county. Until it is recorded, a deed or mortgage ordinarily is not effective against subsequent purchasers or mortgagees; the documentation that the registrar's office keeps of the details of properly executed legal documents.

10.2. Recording work place information

With the aim to ensure the complete stand history of certain plantation; it is indispensable to note all operation of nursery tending activity. Moreover for good nursery management, recording all work done, the progress made is essential. Records of workplace information may include:

- Environmental parameters (light, temperature humidity and wind)
- Date of treatments and
- Type of treatment and
- Rate of treatment.

A careful recording will also help to tend nursery plant the most appropriate production data for each species.

I) **Nursery registration form**:

The recording is done on individual nursery bed basis.

1. Species ----------
2. Provenance ----------
3. Date of seed collection
4. Reception date of seeds
5. storing condition
6. Method of seed pretreatment
7. Density of sowing
8. Quantity seed per sq. m ---kg
9. Area seed bed ---sq. m
10. Protective measures taken
11. Registration number of seed bed

12. responsible person
13. Expected number of seedlings per sq.m and in total
14. seedling description for planting
15. Destination of seedling
16. Transportation specification (date, seedling transported, seedlings eliminated) and so on

II) Nursery diary: all the operations and observations of the day should be mentioned in this book as detail as possible

Example

Date	Work done	Remark
2/1/2020	2 people prepared beds	

Table 10.1

III) Nursery calendar: here we record all the activities to be done and when they are to be done.

Example

Activity	S	O	N	D	J	F	M	A	M	J	J	A
weeding												
Pruning												
Treatment application												
Mulching												

Table 10.2

IV) Nursery delivery Record: this shows how and where the seedlings were distributed

Example

Date	Species	Number	Bed No	Receiving station
20/1/ 2020	*Capsicum Annum*	30000	A2	**Addis Ababa town**

22/1/2020	*Solanum*	20000	B3	**Gewane**

Table 10.3

V. Attendance book: daily of laborers' is important.

Example

Name/date	1	2	----------	30
	P	S		H
	A	P		O

Table 10.4

Where: p= present, A = absent, S = sick, H = holiday, O = off duty

Self-Check-10	Written Test

Instructions: Answer all the questions listed below. Illustrations may be necessary to aid some explanations/answers. Write your answers in the sheet provided in the next page.

1. Explain the most Nursery registration form:? (5 points)

2. Mention Records of workplace information? (5 points)

Note: **Satisfactory rating - 10 points** **Unsatisfactory - below 10 points**

You can ask your teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer

1. _____

Information Sheet-11	Writing nursery activity report

11.1. Report work outcomes

Once you have finished your nursery work activities, you have to report the result that what you are done the entire nursery activities must be record daily what, when, how, why the nursery is step by step and must be report the work out comes to the supervisor as well as to the enterprise and concerning body.

When you report work out comes to the concerning bodies/enterprise you should be fill full:

- ✓ Both success and failures
- ✓ Reason of success and failures
- ✓ Tools, materials and equipment you used
- ✓ Those who are involved in the nursery work
- ✓ Feedback of the nursery work
- ✓ Comment/suggestion if you need to arrange for further improvements

Project report includes

- Progress of activities,
- Major issues,
- OHS issues,
- Expenditure and any future activities that may need to be planned

Nursery Inventory Form					
Nursery	Rare tree nursery		Location	Rare Tree Nature Reserve	
Manager	Luis Pinto		Number of workers	2	
Species	Date 30/4/2015	Date 30/6/2015	Date 31/8/2015	Date 31/10/2015	
	Number	Number	Number	Number	
Species A					
Seed sown	600	0	0		
Seed germinated	0	299	0		
Saplings in pots	0	151	440		
Hardening-off	0	0		412	
Species B					
Seed sown	0	490			
Seed germinated	0	210	0		
Saplings in pots	0	0	544	99	
Hardening-off	0	0	0	412	
Species C					
Seed sown	250	92			
Seed germinated	0	158			
Saplings in pots	0	0	211	100	
Hardening-off	0	0		76	

Fig 10.1 nursery inventory form

Self-Check-11	Written Test

Instructions: Answer all the questions listed below. Illustrations may be necessary to aid some explanations/answers. Write your answers in the sheet provided in the next page.

1. Explain the most common report work out comes? (5 points)

2. Mention Project report? (5 points)

Note: **Satisfactory rating - 10 points** **Unsatisfactory - below 10 points**

You can ask your teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer

1. _____

Operation sheet	Performing nursery activities

Objectives to Perform nursery activities

Procedures:

1. Cultivate, pulverize and level the field after bringing soil to a good tilth.
2. Raise 1m wide, 15-20 cm high beds and any convenient length (5-10m).
3. Proper leveling of field and beds is important for water and disease management
4. Raised bed and drainage is important
5. Treat seeds
6. Sow seeds about 1-2 cm deep in lines at 10 cm apart.

LAP Test	Practical Demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions:

Task 1. You are required to perform any of the following:

Task2. Prepare materials for nursery

Task 3. Prepare land

Task 4. Sow the crop

1. Request your teacher for evaluation and feedback

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Profile of trainers participate on special Horticultural Crop Production TTLM development for level III at Adama 2020