Horticultural Crops Production

Level-II

Learning Guide -35

Unit of Competence: Undertake Nursery Activities

Module Title: Undertaking Nursery Activities

LG Code: AGR HCP2 M10 LO1-LG-35

TTLM Code: AGR HCP2 TTLM 0120v1

LO 1: Prepare materials, tools and equipment for nursery work

Instruction Sheet	Learning Guide #35

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

- Identifying materials, tools and equipment
- Checking materials, tools and equipment
- Selecting Suitable personal protective equipment (PPE)
- Identifying OHS hazards.

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 the required materials, tools and equipment
- Conduct cchecks all materials, tools and equipment
- Select and check suitable personal protective equipment (PPE)
- Identify and report OHS hazards

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below 1 to 6.
3. Read the information written in the information “Sheet 1- 4”.
4. Accomplish the “Self-check 1, Self-check t 2, Self-check 3 and Self-check 4”
5. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet’’
6. Do the “LAP test” in page – 20≠ (if you are ready).

Information Sheet-1	Identifying materials, tools and equipment

1. Introduction

Nursery is a place where seeds and cuttings are grown with special care and protection up to the point where the young seedling is able to establish and flourish under field condition.

1.2. The need of nursery establishment

- Provide seedlings with improved soil structure and contour the soil moisture for better development of seedling.
- Protection from pests, including higher animals, such as chicken.
- Protection from rain and sun.
- Protection against temperature extremes.
- To apply optimum growing conditions to the plant during the very early development stages
- To give better conditions for germination.
- To economize seeds that are expensive, especially hybrid seeds
- To eliminate weak and diseased plants, to get strong seedlings and even stand in the field.
- To obtain large number of plants (seedlings) from a small area.
- To produce seedlings in adequate quantity and quality.
- To raise root stock for grafting or budding.

1.3. Types of nursery

A tree nursery can be classified into different categories based on time duration. In general, we have two types of nurseries. These are:

A. Permanent nurseries:

- Large centrally located nurseries that are established
- Usually it has permanent workers including trained foreman or foresters
- It has a better control in most activities and produces quality seedlings.
- Annual plant production exceeds 500,000 and
- Requires bigger capital to establish and run them.

  E.g. Government nurseries.

B. Temporary/flying/satellite nurseries:

- Annual plant production is less than 500,000

- Establish for a short period (<5 years).
- Require lesser capital to establish and run them.

  E.g. Ethiopian Farmers Nurseries.

1.4. Identifying materials tools and equipment

1. **Wheelbarrows**: A wheelbarrow is a small hand-propelled vehicle, usually with just one wheel, designed to be pushed and guided by a single person using two handles at the rear, or by a sail to push the ancient wheelbarrow by wind

fig.1. wheelbarrow

2. Trolleys

Multi use Scissor trolley which comes complete with main bag, plus side accessory bag. Ideal for laundry or waste collection.

fig 2. trollys

3. Scissors

A pair of scissors consists of a pair of metal blades pivoted so that the sharpened edges slide against each other when the handles (bows) opposite to the pivot are closed. Scissors are used for cutting various thin materials, such as paper, cardboard, metal foil, cloth, rope, and wire.

fig.3. scissor

4. Cleaning equipment

Cleaning equipment must be fit for purpose (e.g. heat set bristles in brushes used on food contact surfaces).


fig 4.cleaning equipment

5. **Secateurs**: can be used to clean, cut, and trim away branches, weeds, and stems that are unwanted in your garden. This means that you can: Give shape to plants or bushes. Safely cut thorny plants.

fig 5. Different types of secateurs

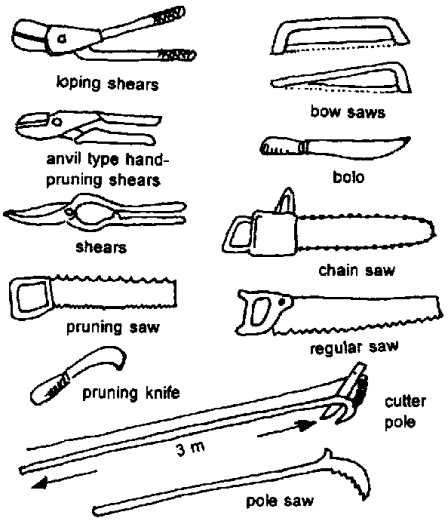
6. **Spade, rake and shovel**



7. **Knives and axes**


fig 6. Knives


fig 7. Axes



8. **Seeding trays**: A good media in the floating tray system should have the ability to wick water and retain it. These small pores increase the water holding capacity of the media and reduce air filled porosity . Particles between 0.01 and 0.08 mm retain most of the water applied.

Fig 8. Seeding trays

9. Water spray container

A watering can is a portable container, usually with a handle and a funnel, used to water plants by hand. Apart from watering plants, it has varied uses, as it is a fairly versatile tool

Fig 9. watering can

10. **Dibblers**: A dibbler is used to plant bulbs, tubers, small plants, and sometimes seeds. These bulb planters come in many different shapes and sizes.

Fig 10. dibbler

fig11. Rubbish bins

11. Meter and rope

Fig 12. Meter

Fig 13.rope

12. **Wooden Pegs**: The wooden dowel rod used in woodworking applications is commonly cut into dowel pins, which are used to reinforce joints and support shelves and other components in cabinet making. Some woodworkers make their own dowel pins, while others purchase dowel pins precut to the required length and diameter.

fig14. Wooden pegs

13. Hammer

fig 15. Hammers

14. Sprayer

fig16. knapsack sprayer

15. ULV sprayer

Fig 17. d/t ULV sprayer

Self-Check -1	Written Test

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

1. What is nursery? (4pts)
2. What are the importance of nursery? (3pts)
3. Discus materials tools and equipment used to nursery work activities? (3pts)

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

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Information Sheet- 2	Checking materials, tools and equipment

2. Checking materials, tools and equipment

Martials, tools and equipment are come in different sizes and functionalities; there are hand tools for cars and special hand tools for electronic equipment. As a consumer, it is very important to know about the product specifications of each hand tool to ensure proper and safe use every time. Here are the most common hand tools being used today:

2.1. Inspection processes

Every manufacturer knows the importance of providing quality product to each consumer worldwide. If consumers like the product, it is safe to expect that the consumer would be a repeat-customer. In order to obtain high quality products all the time, it is very important to perform different tests and inspection process to ensure product reliability, safety and ease of use.

Pre-Production Inspection: The purpose of this inspection process is to verify that all of the needed tools for hand tool production are free from any damage, defects or any loose joints to ensure proper and consistent production when the operation starts. Any devices that show any defects should be repaired or replaced as soon as possible to avoid the risks of creating defective products.

Raw Materials Inspection: The purpose of this inspection process is to thoroughly inspect and verify that all of the needed materials for molding, hardening, cooling, and assembling are in complete and good order to ensure that all of the materials to be used are free from any damages or defects prior to initiating the production process. Any component that is proven to show defects will be labeled “DEFECTIVE” and will be re-assigned to a different queue for repairs or refurbishment.

Assembly Inspection: The purpose of this inspection process is to verify that all of the specifications under the assembly queue meet the initial requirements in order for it to be considered in the next production queue. Items that have the following will be labeled as “DEFECTIVE” and will be reassigned to a different queue according to its defective state.

Visual Inspection: The purpose of this inspection process is to thoroughly inspect all of the hand tools, regardless of the type, for any visible damages, dents, cracks, chips, or any known production anomalies to ensure that all of the hand tools on the queue are ready for the next set of inspection processes

Weight and Measurement Inspection: The purpose of this inspection process is to accurately measure the different, Martials, tools and equipment under the same category to ensure that all of the tools are uniform in height, weight, size and diameter.

Quality Control Inspection: The purpose of this inspection process is to thoroughly test and inspect the behaviors of the different hand tools when being used to raise awareness of how certain items can break and cause unwanted accidents. Each Martials, tools and equipment will be inspected and tested using different sets of tests that would fit the hand tool on the current queue.

Self-Check -2	Written Test

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

1. What will be occur use the tools without checking? (6pts.)
2. Discus how to check or inspect materials tools and equipment? (3pts.)
3. Discuss the consequences while the materials are not maintained? (2pts.)

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

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information Sheet-3	Selecting Suitable personal protective equipment (PPE)

3.1. PPE use and items

PPE can help operators avoid direct contact with toxic chemicals, protect from damage. When mixing pesticides, the operators/workers have to use gloves and eyewear. The efficiency of a working coverall combined with PPE to protect operators against dermal exposure to plant protection products under field conditions was studied. PPE can reduce the risk of exposure to pesticide spraying, but the use of PPE in small-scale farmers is very low. Farmers should be protected against all risks with the use of PPE during spraying. Operators' exposure can be considerably reduced by using personal PPE.

PPE is categorized in five groups. These are head protection, eye and face protection, body protection, respiratory protection, as well as hand and foot protection, as described below.

1. Head protection

Hat

A waterproof hat should be used to protect the operators' head against pesticides. It should be easy to clean.

fig 18. Hats

2. Eye and face protection

Face shields: Farmers should use face shields to avoid the negative effects of pesticides when preparing pesticides as well as during and after pesticide application.

Goggles: Eyes are the most sensitive part of the body. Eyes absorb pesticide quickly and to a great extent. Farmers must use goggles to be protected by spills or splashes that happen during mixing and loading the pesticides.

Body protection

Coveralls: It is recommended that operators use disposable or washable coveralls during pesticide preparation, mixing the tank, spraying and also during sprayer cleaning. Because of the high prices of the coveralls that are recommended for pesticide applications, different alternatives are used instead of coveralls, such as long- sleeved shirts, trousers, and aprons.

Aprons: PVC aprons can be used as an alternative to coveralls. The apron should be long enough to cover the chest and the knees. The apron used during pouring pesticides at any location must be immediately cleanable or washable.

3. Respiratory protection

Respirators: A respirator is a unit that covers the mouth and the nose to prevent spray droplets of pesticide, small particles, and vapors from getting into the lungs. During pesticide application in the greenhouse, the operators are affected by pesticides in the air. For this reason, farmers must use a respirator in greenhouses. Generally, respirators are divided into two classes.

Hand and foot protection

Gloves: Hands almost always become contaminated when handling and applying pesticides. Contaminated hands with pesticides can often affect human health because pesticides can be easily transferred to the eyes, the nose, the mouth, and the face. For this reason, operators must always use gloves in all pesticide applications.

Foot wear: When operator walks into pesticide contaminated areas during or after pesticide spraying, the feet can be contaminated with pesticides. The highest pesticide residues in the greenhouse were found on operators' knee and ankle in pesticide application with a knapsack sprayer. The lower the position of the body is the higher the exposure is in greenhouse spraying. Hence, farmers must use boots in all pesticide applications. In hot climate regions, farmers often wear sandals or slippers during pesticide applications, where the feet are directly exposed to the pesticides. Farmers must wear closed shoes or waterproof boots during pesticide applications.

Self-Check -3	Written Test

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

1. Discus the importance of personal protective equipment in nursery work? (5pts.)

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Information Sheet- 4	Identifying OHS hazards

4.1. **Common hazards causes**

- Operating heavy equipment such as forklifts
- Operating power tools such as pruners and clippers
- Pushing and lifting heavy equipment such as loaded wheelbarrows or large containers
- Using sharp tools such as pruning shears and picking knives
- Working with pesticides

4.2**. Identified hazards**

Respiratory hazards: Farming situations present several respiratory hazards to farm workers. Exposure to these hazards has been linked to excessive coughing and congestion in 20 to 90 percent of farm workers and families. Symptoms of chronic bronchitis were observed in as many as 50 percent of swine confinement workers and grain handlers.

Noise: Agricultural noise is another common health hazard on the farm. It is estimated that 10 percent of U.S. farm workers are exposed to average daily noise levels above 85 decibels, which is the "action" level at which hearing conservation program are required for industrial workers.

Skin Disorders: Contact dermatitis is a skin disorder that occurs among agricultural workers. There are two general categories: irritant and allergic. Irritants act directly on the skin at the place of contact. Allergic sensitizers, however, cause changes in the immune system so that subsequent contact produces a reaction. Phototoxic or photoallergic reactions occur when light, in combination with certain substances, causes skin disease. Other types of agricultural dermatitis include heat rash, origin infections, and insect and plant irritants.

Cancers: Skin cancer is a concern on the farm due to the long hours farmers spend in the sun. Skin cancer is the most common form of cancer, with about 450,000 newly diagnosed cases in America each year. People at high risk include those with fair skin, blue eyes, and red or blond hair. Ninety percent of all skin cancers occur on parts of the body not usually

covered by clothing. A place of particular concern for farmers is the back of the neck. Avoid overexposure, especially between 11 am. and 2 p.m.; use sunblocks that absorb or deflect ultraviolet rays; wear protective clothing, such as long-sleeved shirts, pants, and wide-brimmed hats; and conduct regular self-examinations for early detection.

Chemical Hazards: Many agricultural workers are exposed to chemicals on a daily basis. If they do not observe proper precautions, illness or even death may ensue. Pesticides can enter the body through many routes, but the most common ways are through the skin and by inhaling. To prevent dermal (skin) contact and inhalation of pesticides, applicators should wear personal protective clothing and equipment.

Heat Stress: Heat stress occurs when the body builds up more heat than it can handle. High temperatures, high humidity, sunlight, and heavy workloads increase the likelihood of heat stress. Use fans, ventilation systems, and shade whenever possible. A work area sometimes can be shaded by a tarp or canopy. Drink plenty of water before, during, and after work, and consider wearing cooling vests, which are garments with ice or frozen gel inserts.

Self-check -4	**Written Test**

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

1. What is hazard? (3pts.)
2. List the hazards occur in agriculture work? (4pts.)
3. What are the cases of hazards? (2pts.)

Note: **Satisfactory rating - 9 points** **Unsatisfactory - below 9 points**

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Question

Operation sheet -1	Prepare materials, tools and equipment for nursery work

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

Materials: paper, pen, note book

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	Prepare materials, tools and equipment for nursery work

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. *High Pressure Washing: Safe Work Practices*www.worksafebc.com/publications/health_and_safety/by_topic/assets/pdf/bk123.pdf
2. Personal Protective Equipment (PPE) — various resources (web page)
3. www2.worksafebc.com/Topics/PPE/ Home.asp

Horticultural Crops Production
Level -II

Learning Guide-36

Unit of Competence: Undertake nursery activities

Module Title: Undertaking nursery activities

LG Code: AGR HCP2 M10 LO2-LG-36

TTLM Code: AGR HCP2 TTLM 0120v1

LO 2: Undertake nursery activities

Instruction Sheet	Learning Guide # 36

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

- Following Instructions and directions
- Undertaking nursery work/task in a safe and appropriate environment
- Carrying out a positive Interactions with other staff and customers
- Loading and unloading of materials
- Nursery policy and procedures in workplace hygiene practices
- Reporting Problems or difficulties

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:

- Follow and clarify Instructions and directions
- Undertake nursery work/task
- Carry out Interactions with other staff and customers
- Demonstrate and minimize techniques in loading and unloading materials and correct manual handling
- Observe nursery policy, procedures and OHS requirements, hygiene practices, handling and disposal of materials is observed.
- Report and problems or difficulties in completing work

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 1-6
4. Accomplish the “Self-check 1-6
5. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet”**.**
6. Do the “LAP test” (if you are ready).

Information Sheet-1	Following Instructions and directions

1. Following instruction and direction

Following instructions is important to make tasks simpler, to ensure things are done effectively, to eliminate confusion and to save time. When instructions are properly followed, things work well. People who follow instructions show that they are cooperative, intelligent and dependable, while not following instructions can lead to life and death situations that may end tragically. When people do not follow instructions properly, it can cause chaos and great frustration in any type of environment.

In order to follow instructions, a person must listen well, read carefully and ask questions if necessary.

When a person does not follow instructions, he/she finds that finishing tasks is much more difficult. If a single person on a team does not adhere to instructions, then the entire team suffers on some level. Tasks that are done properly the first time do not have to be redone, so one saves time and effort by following instructions each time a task is tackled.

Following instructions can preserve one's health and wellbeing, and it is a necessary skill for a quality life. Rules are necessary for every well-functioning society.

Professionals that do not follow instructions place themselves and other people at a greater risk for injury and death. Opportunities for advancement are limited, and clashing with others becomes inevitable when a person does not care to heed instructions.

Self-Check -1	Written Test

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

1. The importance of following the direction and instruction of nursery work activities? (4pts)
2. What did the person while follow the working instruction? (2pts.)

Note: **Satisfactory rating above 6 points** **Unsatisfactory - below 6 points**

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information Sheet-2	Undertaking nursery activities

2.1. Nursery site selection

A nursery site must be located with the realization that a perfect site does not exist and that choice of site will require compromise. However, careful attention to the selection of a permanent nursery site will amply repay all the effort expended. An unsatisfactory site will sooner or later (generally, sooner) increase the cost of operations and could lead to unnecessarily high seedling losses and poor stock production. Such a situation will leave customers dissatisfied and may cause the nursery to fail.

2.1.1 Site-selection criteria

A. **Climate**

Growing- season requirements will vary with stock type.

Temperature: Possible nursery sites whose daily temperatures consistently exceed 105°F for extended periods (3 weeks or more) should be avoided: extremely hot periods reduce growth and may cause burning of foliage. Short periods of daytime temperatures of 110°F or more can tax irrigation systems, but properly designed irrigation systems can protect seedlings from burning during those periods. Growth of most species is greatly impeded by ambient temperatures of 90°F and above.

Precipitation: Proposed nursery sites that have a record of frequent heavy snows persisting into the normal seedling processing season should be avoided. Snow melting in late spring can radically reduce the time frame for processing seedlings, which can place undue stresses on workers and managers, facilities, equipment, and seedlings, and create dissatisfied customers because specified out planting dates cannot be met.

Wind: Areas with frequent, long-lasting, high-velocity winds-particularly where humidity is low and winds are drying and from the east—should be avoided. Winds will affect irrigation application and uniformity and may result in soil movement. High winds can desiccate seedlings, and soil carried by winds can blast stems and foliage. Wind can restrict spraying of pesticides, cause tree-seed cover to be blown away, and displace or scatter seedbed mulches.

B. Soil

Perhaps the most important factor in establishing a nursery is the correct choice of soil. Other site features, including fertility, moisture, and microclimate, can be manipulated by the nursery manager, but moving or significantly modifying large masses of soil is, at the very least, impractical and costly. An intensive soil survey, coupled with representative soil sampling, will help the selection team choose the site with the most suitable soil.

Soil pH The optimum soil reaction, or pH, for most tree species is between pH 5.0 and 6.0. Soils of lower pH may have fewer available nutrients, whereas soils of higher pH encourage the invasion of fungus diseases. Soil pH can be altered with soil additives such as sulfur or by injecting phosphoric or sulfuric acid into irrigation water.

C. Water

Securing an adequate supply of domestic and irrigation water can be a major problem. Water rights must be obtained for any water source. Therefore, special consideration must be given to a site where the quantity and quality of water are adequate for current and possible future requirements. All water needs and the timing of those needs must be considered. For example, in most nurseries, irrigation is necessary during the growing season and for frost protection. Restrictions on flow and on periods of delivery must be closely scrutinized.

D. Topography

The area for nursery beds should be level, or nearly so. A slight slope (2% maximum) is beneficial for better surface drainage, but slopes greater than 2% can cause erosion, necessitating expensive control measures, and may cause undesirable translocation of soluble fertilizer salts.

E. Previous land use

Past use of the land may influence its value as a potential nursery site. For example, past practices that have altered soil acidity or caused toxic chemicals to accumulate will be detrimental to growing seedlings.

F. Site production potential

To help determine the acreage needed for the seedling growing area, the selection team must estimate potential requests for seedlings. A rule of thumb is 500,000 seedlings/0.4 ha (1 acre), but this figure may vary with species or seedbed density. For this calculation, subtract all nonproductive areas roads, streams, reservoirs, administrative site, and anywhere else that seedlings will not be grown-from the total nursery site area.

Site growing potential can be derived with the following formula:

$$P = \frac{A \times [1 - (C+F)] \times U \times D \times (m2/ha \text{ or } ft\ 2/acre)}{R}$$

Where

P = Annual production capacity, in 1000s of seedlings

A = Production area (acres or hectares)

C = Estimated cull factor

F = Estimated overrun factor

U = Actual seedbed area

D = Density objective (number of seedlings to be grown per square foot); density desired at seedling harvest age

R = Crop rotation

G. Proximity to customers, labor, and services

Proximity of the nursery to seedling customers, work force, transportation, utilities, and facilities for people all should be evaluated by the site-selection team.

2.2. Lay outing of nursery

A. Access and traffic flow

The nursery should be as compact as possible nearly square or regular in shape to minimize the length of the boundary fence and reduce the time lost moving from one part of the nursery to another. Roads provide access to the site and to growing fields. When the site is developed, all access roads should be paved; they must be capable of taking heavy "semi" truck and tractor traffic in all kinds of weather. Parking areas must be evaluated and particular attention given to pedestrian and vehicle traffic flows. Possible conflicts with people, vehicles, buildings, and landscaping must be taken into consideration.

B. Administrative site

The administrative site includes administrative offices; storage areas for equipment, trees, seed, pesticides, other chemicals, and fuels; shops; a fuel-dispensing station; an employee center; and seedling-processing facilities. The type, number, and location of required buildings can be determined with the team approach. Other administrative development could include employee-enrichment areas (in the form of park like surroundings), holding areas for irrigation water or soil amendments, a culled-seedling disposal area, and an area

for holding scrap material and used equipment until sale is possible (potential aesthetic conflicts with neighbors may arise in this last case).

C. Budgeting and accountability

Budgeting is critical and must have highest priority in the development process. Budgets should be planned 2 to 3 years in advance to ensure that funding, people, and facilities will be available when needed. The budget and the action plan must be developed together. If shortages of funds or people are anticipated, construction may have to be delayed or other alternatives sought.

The main components of a nursery are as follows:

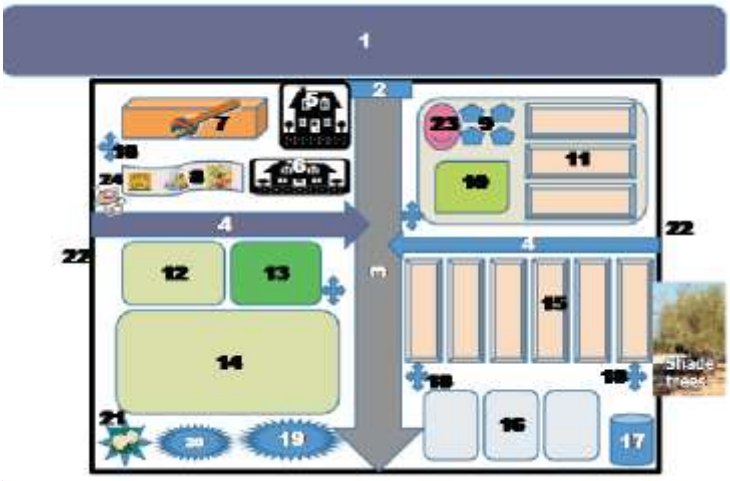


Fig. 19. General layout of nursery

Key: - 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).

2.3. Preparing growing media

The growth medium must be sufficiently firm to hold the seedling or propagules during rooting and supply food and water for the successful growth of young seedlings. Soil is a very common easily available and comparatively cheaper medium used in nursery. Sand is generally used in mother bed and vegetative plant propagation media. The other media used in nursery are peat soil,

A. **Sphagnum mass**

It is the dehydrated remains of acid-bog plants from the genus Sphagnum (i.e. Spapillosum). It is light in weight and has the ability to absorb 10 to 20 times its weight in water. This is attributed to the large groups of water holding cells, characteristic of the genus. Sphagnum

moss contains specific fungistatic substances which accounts for its ability to inhibit damping-off of seedlings

B. **Sand**

Sand, a basic component of soil, ranges in particle size from 0.05mm to 2.0mm in diameter. Fine sands (0.05mm – 0.25mm) do little to improve the physical properties of a growing media and may result in reduced drainage and aeration. Medium and coarse sand particles are those which provide optimum adjustments in media texture. Although sand is generally the least expensive of all inorganic amendments it is also the heaviest. This may result in prohibitive transportation costs. Sand is a valuable amendment for both potting and propagation media.

C. **Perlite**

Perlite is a silicous mineral of volcanic origin. The grades used in container media are first crushed and then heated until the vaporization of combined water expands it to a light powdery substance. Lightness and uniformity make perlite very useful for increasing aeration and drainage.

D. **Vermiculite**

Vermiculite is a micacious mineral produced by heating to approximately 745oC. The expanded, plate-like particles which are formed have a very high water holding capacity and aid in aeration and drainage. Vermiculite has excellent ex-change and buffering capacities as well as the ability to supply potassium and magnesium. Although vermiculite is less du-rable than sand and perlite, its chemical and physical properties

E. **Leaf mold**

Maple, oak, and sycamore are among the principle leaf types suitable for the preparation of leaf mold. Layers of leaves and soil are composted together with small amounts of nitrogenous compounds for approximately 12 to 18 months. The use of leaf mold can effectively improve the aeration, drainage and water holding properties of a growing media. Although these materials are readily available at low cost, leaf mold is not extensively used in container production.

F. **Saw dust**

Sawdust – the species of tree from which sawdust is derived largely determines its quality and value for use in a growing media. Several saw dusts, such as walnut and non-composted redwood, are known to have direct phytotoxic effects. However, the C: N of sawdust is such that it is not readily decomposed. The high cellulose and lignin content along

with insufficient N supplies creates depletion problems which can severely restrict plant growth. However supplemental applications of nitrogen can reduce this problem.

G. **Peat moss**

Peat moss is formed by the accumulation of plant materials in poorly drained areas. The type of plant material and degree of decomposition largely determine its value for use in a growing medium. Although the composition of different peat deposits vary widely, four distinct categories may be identified:

Soil collection:

The soil used to raise seedlings should be

- Fertile and should drain well.
- Clear the surface of weeds, leaves and other litter,
- Dig out the topsoil to a depth of about 10 cm deep.
- Remove any stones and roots,

Potting mixture in poly-pots

Use only topsoil with the texture of sandy loam or loamy sand. You can identify these soils by trying to roll a little moist soil to pencil thickness between your fingers. If this is not possible, there is too much sand. If the roll can be bent in a semi-circle without breaking, there is too much clay. Add washed sand as required to improve the soil texture. Add sieved, well-rotted compost to improve the fertility and moisture retention. Then mix 2 parts of soil with 1 part of manure or compost and 1 part of sand

An ideal potting mixture has the following characteristics:

- Light weight
- Homogeneous;
- Easily available;
- Fertile, and retains nutrients well;
- A pH between 4.5 and 6.0;
- Well drained, but retains sufficient moisture;
- Sufficiently cohesive to maintain the root ball after removal from a poly-pot.

Potting mixture (soil, sand and compost/manure) should be moistened and then pressed into containers to a depth of about three-quarters of the height of pots. Pots should then be topped up more loosely with mixture and pressed down slightly about 2 cm below the top. Heavy compaction should be avoided at the top of pots because it will inhibit root penetration.

Filling the pots/pot size

Polythene pots of different sizes are now used for raising nursery plants. This does not prevent the use of other containers like boxes, half tins, earth pots, etc. The pots are filled with nursery soil, taking care to have no voids by shaking and knocking regularly. The pots are filled, leaving a small space at the top, and stacked side by side on nursery beds.

The quantity of soil needed in a containerized nursery operation is directly related to the size of the containers used. The relationships between the diameter of the containers (ranging from 5 to 15 centimers) and their heights (15, 20 and 25 centimeters) and the soil volume (in square meters) is shown in. A comparison between the smallest containers (diameter 5 centimeters, height 15 centimeters) and the largest (diameter 15 centimers, height 25 centimeters) is quite eloquent. To fill 100,000 small containers, 28 cubic meters of soil are needed; whereas 442 cubic meters of soil are needed for filling 100,000 of the largest containers (16 times more).

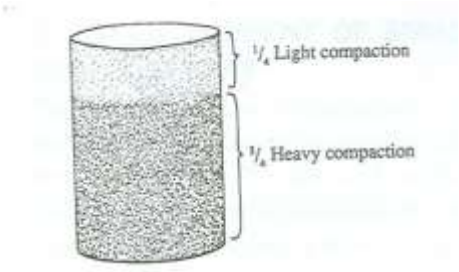


Fig 19. Pot filling

2.4. Seed bed preparation:

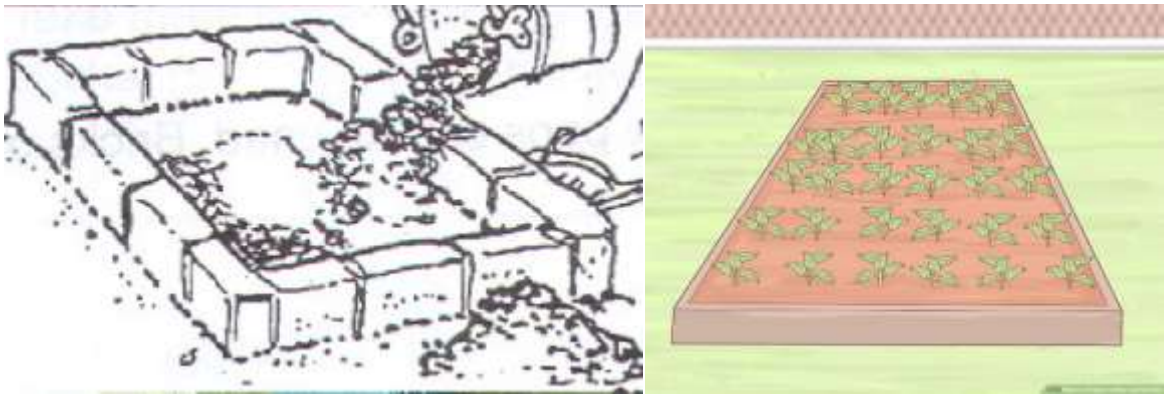
4.4.1. Types of beds

Depending on weather condition and soil type seed beds in the nursery could be;

A. Raised bed

The surface of nursery bed is made smooth and should be slight raised in the center with a little slope on two sides for draining excess water from the middle of the bed. In between two raised beds an alley of about 50-60cm is left which is used for conducting agricultural operations like watering, weeding, spraying of insecticide, uprooting of seedling for

transplanting and for draining out the extra water in the event of heavy rains. The furrows 2-3cm deep and 5-7cm apart, across the width of the bed are opened and seeds are sown.



Fg 20. Filling a raised bed made form bricks with a mix of soil and manure

Advantage of raised bed

- Facilitates proper drainage of excess H2O
- Prevent creation of an aerobic conditions and thus over comes microbial rotting of seeds and proliferation of denitrifying bacterial.
- Watering of seedlings can be done as per their needs
- Used for conducting essential operation like, weeding, watering, spraying insecticides
- Surface of bed becomes soft and therefore, uprooting of seeding results in minimum root damage

B. Sunken bed

Usually constructed in areas where there is low rain fall and soil moisture.


fg21. Sunken bed


C. . Flat bed

During spring – summer, seedlings are raised in flat bed. Further, in areas where rainfall is not so heavy and field is well leveled and drained, flat bed is preferred. Soil is dug 15-20cm deep and all clods are broken and irrigation channel runs in between two tows of the beds and each bed is connected with it.

Advantage of flat bed

1. Flat bed is easy to produce or prepare
2. Cost for preparation is less

fig 22. Flat bed

2.**5. Preparing materials seed and planting materials**

2.5.1. Characteristics of good seeds and planting materials

- Good seed and planting materials results in healthier, heavier, and potentially higher-yielding seedlings.
- Good seed results in seedlings which recover quickly from transplanting shock.
- Good seed results in rapid root growth, enabling seedlings to draw nutrients from the soil quickly and effectively.
- Good seed results in uniform germination and growth of seedlings, making it easier for the farmer to time crop management practices (e.g. transplanting, irrigation, fertilization, weeding).
- Good seed has a high germination rate, facilitating exact calculation of seed requirements and thus preventing wastage," to nursing of too few or too many seedlings.

A good sample of rice seed should be:

- Genetically pure
- Healthy and non-old mother plant
- Dried to less than 14% moisture content (since improperly dried seed often rots during storage.)
- Capable of germinating at a rate of at least 80%
- Free of weed seeds - free of diseases - free of Pest infestation
- Free of inert matter

Characteristics of a good mother plant

- High yielding.
- High leaf quality.
- Good rooting ability.
- Easy adaptability

- Genetically pure

2.5.2. **Treating and maintaining Planting material**

Seed treatment is the process of applying physical, chemical or biological treatment to the seed to keep it viable and healthy, Physical treatment include subjecting seeds to solar energy exposure and soaking seeds in hot & cold water chemical treatment include treating seeds with fungicides, insecticides antibiotic etc. Biological treatment includes treatment of seeds with microbial culture such as shizobium

Purpose of seed treatment:-

- To prevent the infestation of insect-pests and diseases in field and storage conditions.
- To break or enforce dormancy of seeds, whichever is needed?
- To induce higher germination percentage.
- To harden the seed by inducing tolerance to adverse weather and soil conditions.
- To inoculate the seeds with rhizobium. Azotobacter and Azospirilleum biofertilizers.

Types of seed treatments

- **Seed treatment with fungicides** is necessary to destroy seed borne pathogens and protect the germinating seeds from soil inhibiting microorganisms. Seed treatment is done 24hrs prior to sowing.
- **Disinfestations:**- The treatment to eliminate pathogen present on seed surface is known as disinfestations. The most commonly used disinfest ants are carbendazim (Bavistin), Vitavax,
- **Desinfection**:- The treatment that eliminate pathogen from within the seed is known as disinfect ion. Treatment with hot water or mercuric chloride are commonly practiced for disinfect ion. Sometimes oregano-mercury compounds like Agrosan GN and Ceresan are used. Hot water treatment is very effective against fungal or bacterial infection deep inside the healthy looking normal seeds. Cabbage seeds cab be soaked in hot w3ater at 50oc for 30 minutes to control black rot (Xanthomonas campestris) disease.
- **Seed protection**:- The chemical that become effective when applied prior to infection e.g. Captan, Thiram, Ziram, Dithane M-45,etc.
- **Seed treatment with antibiotics**:- Seeds are dipped in a chemical for specified period prior to sowing. Seed treatment with Streptomycin sulphate has been found effective against bacterial disease of cabbage and cauliflower. Seed soaking of cluster bean and aureofungine controls Xanthomonas species.

- **Seed treatment with bio-fertilizers**: -. The bacterial culture slurry may be prepared with gruel or jigger solution. Seeds should be thoroughly mixed with bacterial culture slurry and shade dried for 15 minutes before sowing. If fungicides and insecticides are also used at a time for seed treatment than FIR (fungicide, and insecticides, rhizobium) formula should be used. Fungicides treated seeds can be used for bacterial culture treatment.

2.6. Sowing and planting

2.6.1. Sowing in seed beds and pots

There are two different methods of sowing /planting. One is by directly sowing seeds in the main field and the second is by raising seedlings in the nursery and transplanting them to the main field when they reach at a desired stage.

Direct seeding

Direct seeding may be done by broadcasting, drilling and dibbling or planting.

A. **Broadcasting**

In broadcasting method, the seeds are spread uniformly over well prepared land. It may be done by hand or mechanical spreader. Broadcasting is suitable for close planted crops that do not require specific crop or plant geometry. It is used when the number of plants per unit area is more important than definite spacing from plant to plant. This is the usual method of sowing field crops. Fodder crops and spices like coriander and cumin are sown by broadcasting.

Fig23. broadcasting sowing

Disadvantages of broadcasting

Although broadcasting is simplest and popular sowing method to farmers and other seed multiplier bodies, it has number of disadvantages:-

- Seeds at shallow depth emerge early and seeds fallen deep in the soil may not germinate.

- There is a lot of wastage of seeds.
- Agricultural operations like weeding, hoeing, and ear thing-up
- Plant population become sparse at some places and overcrowded at other.

B. Drilling

Drilling is the practice is of dropping seeds in rows or lines. Furrows at specified distance are made, and the seeds are dropped at definite depth and distance, covered with soil and are compacted Fairley. Seed can be drilled with help of seed drills (bullock or tractor drawn) and seeding funnels attached with country plough. Seeds and fertilizers can be drilled simultaneously.


Fig24. drilling

Advantages of drilling

- It maintains uniform plant population per unit area.
- Reduce competition between plants.
- Reduce seed rate.

Disadvantages of drilling

- It requires more time, energy and cost.

C. Dibbling or planting

This method consists of putting or placing individual seed or seed material in a hole or pit, made at pre-determined depth and spacing by manual labor or with the use of mechanical dibbler or planter. Generally, the crops with bigger size seeds and those needing wider spacing and specific crop geometry for their canopy development are sown by this method.

This method is suitable to plant crops like maize, cotton, potato, sun flower, sugar cane, onion. 

Fig25. dibbling sowing

Advantages of dibbling or planting

- It requires less seeds
- It gives rapid and uniform germination with good seedling vigor

Disadvantages of dibbling

- It is more laborious
- It is time consuming
- It is expensive compared with broad casting and drilling

2.6.2. **Planting (Vegetative propagating)**

a. Cutting
b. Grafting
c. layering
d. budding

2.7. **Pricking out**

This is the process of transferring seedlings from the seed beds to poly-pots. It is a very delicate operation that should be done with great care, preferably by experienced workers. Prick out shortly after germination, when the seedlings have only three or four primary leaves in addition to the cotyledons. Pine seedlings can be pricked out three or four days after germination, when the seed coat is still attached to the cotyledons giving the appearance of a match-stick. Do the pricking out on a cloudy day or in the late afternoon or evening.

Part of the embryo of a seed plant. The cotyledon often becomes the first photosynthetic (green, light-gathering) organ of the young seedling. When the seedlings have started to produce new leaves, start to remove the shade. Generally, after about a week no shade should be given.

Self-check 2	Written test

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

4. Why site selection will be done for nursery activities? (4pts.)
5. Discuss the site selection criteria? (4pts.)
6. List the consideration to be taken during lay outing the nursery structure? (3pts.)
7. Discus the soil condition for nursery establishment? (2pts.)
8. Write the type of seed beds? (2pts.)

Answer Sheet

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

Name: _____ Date: _____

Short Answer Questions

Information Sheet-3	Carrying out a positive Interactions with other staff and customers

3.1. 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.

3.1.1. 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 -3	Written Test

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

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

Note: **Satisfactory rating –above 11 points Unsatisfactory - below 11 points**

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information Sheet-4	Loading and unloading of materials

4.1. Handling materials, tools and equipment

- Handling of material & equipment is all equipment that relates to the movement, storage, control and protection of materials, goods and products throughout the process of manufacturing, distribution, consumption and disposal.
- Handling of material & equipment is used to increase output, control costs, and maximize productivity.
- Storage and handling equipment is a category within the material handling industry.
- Equipment and tools must be maintained in sanitary condition
- All the materials and equipment that serves to the field establishment needs required maintenance handling.
- This is essential to save their durability.
- Correct manual handling (lifting and transferring)

Employees aware of potential injuries that can occur when manually moving materials, including the following:

- Strains and sprains from lifting loads improperly or from carrying loads that are either too large or too heavy,
- Fractures and bruises caused by being struck by materials or by being caught in pinch points,

- Cuts and bruises caused by falling materials that have been improperly stored or by incorrectly cutting ties or other securing devices.

4.2. **Workers take when moving materials manually**

When moving materials manually, workers should attach handles or holders to loads. In addition, workers should always wear appropriate personal protective equipment and use proper lifting techniques. To prevent injury from oversize loads, workers should seek help in the following:

- When a load is so bulky that employees cannot properly grasp or lift it,
- When employees cannot see around or over a load, or
- When employees cannot safely handle a load.

4.3. **Wworkers take when moving materials mechanically**

Using mechanical equipment to move and store materials increases the potential for employee injuries. Workers must be aware of both manual handling safety concerns and safe equipment operating techniques. Employees should avoid overloading equipment when moving materials mechanically by letting the weight, size, and shape of the material being moved dictate the type of equipment used. All materials-handling equipment has rated capacities that determine the maximum weight the equipment can safely handle and the conditions under which it can handle that weight. Employers must ensure that the equipment-rated capacity is displayed on each piece of equipment and is not exceeded except for load testing.

When picking up items with a powered industrial truck, workers must do the following:

- Center the load on the forks as close to the mast as possible to minimize the potential for the truck tipping or the load falling,
- Avoid overloading a lift truck because it impairs control and causes tipping over,
- Do not place extra weight on the rear of a counterbalanced forklift to allow an overload,
- Adjust the load to the lowest position when traveling,
- Follow the truck manufacturer's operational requirements, and
- Pile and cross-tier all stacked loads correctly when possible.

4.4. What precautions must workers take to avoid storage hazards?

Stored materials must not create a hazard for employees. Employers should make workers aware of such factors as the materials' height and weight, how accessible the stored materials are to the user, and the condition of the containers where the materials are being stored when stacking and piling materials. To prevent creating hazards when storing materials, employers must do the following:

- Keep storage areas free from accumulated materials that cause tripping, fires, or explosions
- Place stored materials inside buildings that are under construction and at least 6 feet from hoist ways, or inside floor openings and at least 10 feet away from exterior walls
- Separate non compatible material
- Equip employees who work on stored grain in silos, hoppers, or tanks and safety belts.

4.5. What safeguards must workers follow when stacking materials?

Stacking materials can be dangerous if workers do not follow safety guidelines. Falling materials and collapsing loads can crush or pin workers, causing injuries or death. To help prevent injuries when stacking materials, workers must do the following:

- Stack lumber no more than 16 feet high if it is handled manually, and no more than 20 feet if using a forklift;
- Remove all nails from used lumber before stacking;
- Stack and level lumber on solidly supported bracing;
- Ensure that stacks are stable and self-supporting;
- Do not store pipes and bars in racks that face main aisles to avoid creating a hazard to passersby when removing supplies;
- Stack bags and bundles in interlocking rows to keep them secure; and
- Stack bagged material by stepping back the layers and cross-keying the bags at least every ten layers (to remove bags from the stack, start from the top row first).

During materials stacking activities, workers must also do the following:

- Store baled paper and rags inside a building no closer than 18 inches to the walls, partitions, or sprinkler heads;

- Band boxed materials or secure them with cross-ties or shrink plastic fiber;
- Stack drums, barrels, and kegs symmetrically;
- Block the bottom tiers of drums, barrels, and kegs to keep them from rolling if stored on their sides;
- Place planks, sheets of plywood dunnage, or pallets between each tier of drums, barrels, and kegs to make a firm, flat, stacking surface when stacking on end;
- Chock the bottom tier of drums, barrels, and kegs on each side to prevent shifting in either direction when stacking two or more tiers high; and
- Stack and block poles as well as structural steel, bar stock, and other cylindrical materials to prevent spreading or tilting unless they are in racks.

In addition, workers should do the following:

- Paint walls or posts with stripes to indicate maximum stacking heights for quick reference;
- Observe height limitations when stacking materials;
- Consider the need for availability of the material; and
- Stack loose bricks no more than 7 feet in height.

4.6. **Important Safety Measures**

To reduce the number of accidents associated with workplace equipment, employers must train employees in the proper use and limitations of the equipment they operate. In addition to powered industrial trucks, this includes knowing how to safely and effectively use equipment such as conveyors, cranes, and slings.

Self-Check -4	Written Test

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

1. Explain the manual handling of tools and equipment? (3 pts.)
2. Discuss how to load and unload materials and tools while transporting? (6 pts.)
3. Discus what precondition worker will take before moving the tools and equipment? (3pts.)

Note: **Satisfactory rating – 12 points** **Unsatisfactory – 12 below 8points**

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information Sheet-5	Nursery policy and procedures in workplace hygiene practices

5.1. Nursery Hygiene

Good nursery hygiene is essential if disease free seedlings are to be produced for transplanting in the field. Planning is essential to maintain nursery hygiene and to ensure a high standard of plant health. A seedling nursery must be clearly separated from any other growing system or area and there must be strict control over entry to the nursery to limit the possibility of introducing pests and diseases.

In other words, a nursery must be treated as a quarantine area, with restrictions on entry and movement inside the boundary. This applies to people and to materials or equipment.

The design of the nursery should include defined areas of operation. Briefly these areas can be defined as:

- **Stores** - general goods, chemicals and growing media. etc. as delivered.
- **Preparation** - media mixing area including a section for sterilisation of media and trays; sterile material must be protected.'
- **Seeding house** - includes a special seed store, seed treatment section, seeding and germination rooms.'
- **Pricking out** - this is an extension of the germination room.

- **Growing on** - defined areas for different types and ages of plants.
- **Order preparation** - a direct but isolated extension of the growing areas.
- **Sales/dispatch** - the only area open to the public.
- **Recycling** holding area for reject, surplus material or returned trays for recycling and composting. Until sterilized recycled materials need to be kept separate and isolated from the nursery.
- **Waste disposal** - isolated, secure, well separated from seedling houses and downwind prior to collection or treatment for disposal.

It is essential to design a flow-through system to assist with hygiene controls. For example, a steam sterilisation kiln should have an entry and an exit door to a storage-holding area. So there is a clear separation of functions.

Self-Check -5	**Written Test**

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

1. What is nursery hygiene? (5pts)
2. List the nursery ear need more hygiene? (3pts)
   a._____
   b. _____
   c. _____
   d. _____

Note: **Satisfactory rating - 8 points** **Unsatisfactory - below 8 points**

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information Sheet-6	**Reporting Problems or difficulties**

6.1. **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 the in place.

3. **Quarantine of exotic** pests through the enforcement of laws by exercising phytosanitary 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 -6	**Written Test**

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

1. 2. 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

Operation Sheet 1	**Undertaking nursery work/task in a safe and appropriate environment**

Objectives

- To Select proper site and familiarize with criteria's required to select for site selection

Materials

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

Procedures

Step 1. Survey the topography of the land whether undulating, slopping or plain

Step 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

Step 3. Collect the soil samples layer wise from 0-60,60-120cm,120-2 meter

Step 4. Put samples in bags, label individual bags indicating location of pits and depth

Step 5. Indicate the source of water(such as well or irrigation canals)

Step 6. Take the water sample in plastic bottles from 4-5 places for testing its suitability for irrigation purposes

Step 7. Have the soil and water sample analyze in soil testing laboratory

Step 8. Collect the metrological data from the nearest metrological observatory for the least 5 years.

Step 9. Depending on the metrological data and soil and water test results, select the site for crop planned to be grown.

Operation Sheet 2	**Undertaking nursery work/task in a safe and appropriate environment**

Objectives

- To familiarize students about land preparation
- To acquaint students how to construct seed bed

Materials required

- Hoe
- Axe
- Meter
- Spade
- Peg
- Saw

Procedures

Step 1. Select site based on pre-set criteria's for seed bed construction

Step 2. Clear land

Step 3. Avoid unwanted vegetation's and materials like stones, debris etc.

Step 4. Perform digging of the selected land

Step 5. Perform pulverizing and leveling of the soil

Step 6. Perform proper mixing of soil and nutrient ratio or add organic matter to the soil if needed

Step 7. Perform the lay out using method

Step 8. Measure the land using your meter based on your availability of seed

Step 9. Construct seed bed and make it ready for seed sowing

Operation Sheet 3	**Undertaking nursery work/task in a safe and appropriate environment**

Objective: to able how to prickling the seedling in the nursery site

Materials: seedling, watering can, pots, prepared growing media, containers

Procedure

Step 1. Prepare the patients.

Step 2. Prepare the potting soil.

Step 3. Prepare containers.

Step 4. Label containers.

Step 5. Partially fill containers**.** Sprinkle enough moistened potting soil into the containers to fill them about one-half full.

Step 6. Remove the seedlings**.** Push up on the bottom of the seedling container, and be ready to catch the root ball with your other hand.

Step 7. Replant the seedlings**.** Grasp a leaf from the most accessible seedling, and gently lift it until it comes free.

Step 8. Water and wait**.** Stop every ten minutes or so, and water the seedlings you have pricked out. To give new roots time to grow, wait at least three days before moving the pricked-out seedlings to brighter light.

Operation Sheet 3	**Undertaking nursery work/task in a safe and appropriate environment**

Objectives: to sow the seed on the pots

Materials and tools: seed, pot, mixture soil, watering can and containers

Procedure:

Step1. Water the pot filled with potting medium thoroughly

Step 2. With the use of a dibbling stick, loosen the medium and make a small hole at the center. Step 3.place on seed in each pot and cover it with the medium.

Step 4. Water the carefully after sowing so as not to dislodge the seed and keep the medium moist all the time.

Step 5. Protect the newly sown seeds by covering the pots with plastic or any protective material.

Step 6. If possible, spray the pots with insecticide to ward off insects that might consume the seeds.

LAP Test -1	**Undertaking nursery work/task in a safe and appropriate environment**

Name: _____ Date: _____

Time started: _____ Time finished: _____

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

Task 1: Perform select nursery site.

Task 2. Prepare seed bed

Task 3. Perform seedling prickling

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 -II

Learning Guide-37

Unit of Competence: Undertake Nursery Activities

Module Title: Undertaking Nursery Activities

LG Code: AGR HCP2 M110 LO3-LG-37

TTLM Code: AGR HCP2 TTLM 0120v1

LO 3: Maintain the nursery environment

Instruction Sheet	Learning Guide # 37

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

- Identifying Occupational Health and Safety (OHS) hazards
- Clarifying plant growth and health requirements
- Maintaining Irrigation system components
- checking Performance parameters of the irrigation system
- Monitoring Temperature controls
- Following Nursery Hygiene practices

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 ,asses, and report Occupational Health and Safety (OHS) hazards and risks
- Clarify plant growth and health requirements
- Service irrigation system components
- Check performance parameters of the irrigation system
- Monitor and maintain temperature controls
- Follow nursery hygiene practices to minimize risk of contamination.

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 1-6,
4. Accomplish the “Self-check 1-6

5. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet
6. Do the “LAP test” **in page – 52** (if you are ready).

Information Sheet-1	**Identifying Occupational Health and Safety (OHS) hazards**

1.1. OHS Hazards may include

- Disturbance or interruption of services
- Solar radiation
- Dust
- Noise
- Chemicals and hazardous substances
- Manual handling, moving vehicle
- Machinery and machinery parts
- Sharp tools and equipment
- Uneven surfaces and flying and falling objects

1.2. 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.

1.3. Reporting the hazards

All employees should know how to report an injury or incident to you. When an injury occurs that may result in a workers' compensation claim you should advise your insurer within 48 hours.

The details of any injuries need to keep are:

- The name, age, address and occupation of the injured worker
- The place in which the person was working
- The operation in which the person was engaged at the time of injury
- The date and time that the injury occurred
- A brief description of the type, cause and location of the injury and the treatment given
- The name of the first aid person in attendance
- Most insurers provide these registers free.

If there is a fatality or serious incident on your farm, you should notify Work Cover immediately.

Self-Check -1	Written Test

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

1. List the hazards occurred in tending nursery activities? (4pts.)
2. Discuss the OHS hazard requirements? (3pts)
   a._____
   b. _____
   c. _____
   d. _____

Note: **Satisfactory rating - 7 points** **Unsatisfactory - below 7 points**

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information Sheet-2	**Clarifying plant growth and health requirements**

2.1. Plant growth and health requirements

For health/good growth of nursery plant, it requires

- **Watering**

A good supply of water is indispensable for the growth of seedling but too much water can be harmful. Water should be clean, of pH value ranging from 5.5 to 6.5.

- **Light**

The right amount of light is critical for healthy plant development of seedlings. Too much shade, for example in high plant densities, leads to etiolated and elongated growth of the seedlings and makes them weak and prone to fungal diseases. Too much light leads to sun scorching and drying out of the tender tissue.

- **Fertilizer**

Fertilization of nursery soils is necessary to replace the lost nutrients. Developing and maintaining high levels of fertility in nurseries are essential for producing good quality nursery stocks. However, soil fertility is only one of a number of factors influencing stock quality. Fertile nursery soil does not compensate for poor practice. It may be possible to improve seedling quality by altering the timing and level of fertilization in the nursery, or by monitoring the nutritional status of seedlings during an active growth.

Is there danger in over fertilizing seedlings?

Fertilization depends on

- Species being grown
- Nursery soils
- Timing of application
- Cultural practices used.

Changing irrigation regime or seedbed density can also alter seedling response to fertilization. Site condition and other cultural practices made fertilization decisions some of the most difficult in nursery management.

- **Pruning and shaping**

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

Advantage

- To encourage the development of fibrous root system.
- Controls depth of root penetration and makes lifting of seedlings easier and less harmful.
- Helps the seedlings to have a balanced root-shoot ratio.
- It also helps the seedling to have an adequate root collar diameter

Disadvantage

If root pruning is not done, tap-rooted species in pots send their roots down deep into the soil. This may result vigorous growth compared with root-pruned neighbors. But problems will arise at the time of lifting and planting, as a large part of the root system is cut off during lifting & the seedlings will suffer from a serious shock during planting.

- **Mulching:** Mulching is the process of covering bare garden soil with a porous material to improve the condition of the soil underneath. How the soil is improved depends upon what type of soil you have, what materials you use and how thick you apply the mulch. In general, mulch is used to provide the following benefits:

    1. Reduce weeds by blocking sunlight from reaching the soil and making the resulting spindly weeds easier to pull.
    2. Reducing water requirements by preventing evaporation and keeping the soil cool.
    3. Keep the soil cooler in summer and warmer in winter. A good layer of mulch can prevent the summer sun from wilting tender greens and the winter cold from killing tender roots and growth tips.
    4. Potentially modify the pH of the soil over time.

- **Staking:** Stacking refers to arrange nursery seedlings in an order pile/straight up to avoid growth of root deformity.
- **Repotting :** Repotting does not necessarily mean changing a plant's planter, but rather, changing its soil or potting mix. Fresh soil means new nutrients. This is great news if you love your current planter, but if you're looking to purchase a new one that's fine.
- **Shading:** Shading reduces the temperature of the soil and the amount of water lost by seedlings. However if seedlings are left under shade all the time they grow too tall, too weak and yellow. It is important, therefore, only to shade seedlings when shade is needed. Shades are also used to protect against frost, rain and sun.

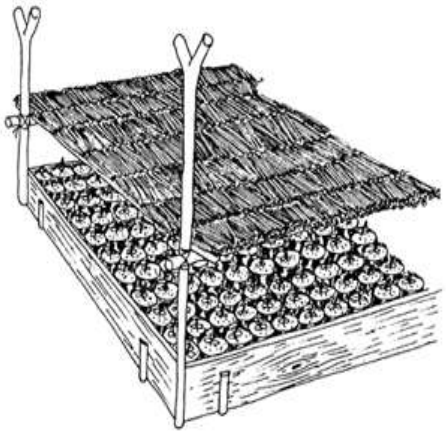


fig26. Shading

Self-Check -2	Written Test

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

1. Discuss the growth and health requirements of plant? (4pts)
2. What is pruning/(2pts
3. Discuss the advantage and disadvantages of root pruning? (3pts.)
4. How to apply the fertilizers? (2pts.)

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information Sheet-3	Maintaining Irrigation system components

3.1. Irrigation system components

Are serviced and faulty parts are repaired or replaced. It includes:

1. **Pump:** Depending on location and volume/pressure requirements, this can vary.
2. **Backflow prevention:** This prevents any foreign material, fertilizer or contaminants from flowing back into the water source.
3. **Pressure regulator;** Depending on the type of emitters, the pressure that this device regulates to can vary widely. This not only reduces the pressure, but can work to keep pressure consistent.
4. **Filter:** There are varying types of filters, but all serve to remove particulates from the water that could plug emitters.
5. **Injector:** These are used to apply water-soluble fertilizers through the irrigation kit.
6. **Adapters:** These vary, but are used to connect various different types of equipment and irrigation lines.
7. **Distribution lines:** These move water from the water source to the location of application.
8. **Submain lines/headers:** These water lines enter the field and distribute water to the emitters.
9. **Emitters:** Drip tape or overhead sprinklers apply the water to the crop.

When properly installed, operated, and maintained, irrigation systems ensure that grounds look their best and remain healthy. But grounds managers also can run into costly leaks, unsightly damage to landscapes, and waste of valuable water resources if just one component of the system does not work properly. It is extremely important that technicians pinpoint and fix problems as soon as they arise.

3.2. Evaluating the System

Comprehensive maintenance of an irrigation system will help managers determine the system's health, and, if problems exist, it will provide information to help managers determine whether repair or replacement is the wisest decision. Effective maintenance should focus on key system components.

Controllers. When an irrigation system is not working correctly, the first component technicians need to check is the controller, which tells the system when to turn on and for how long it should run. In most cases, a programming error is to blame. The most common controller issues involve the controller starting over after it has finished and the irrigation operating at strange times of the day. In both cases, a simple programming error is the cause.

Technicians should check the controller's programming to be sure it contains only the desired start time. They should delete unwanted start times and make sure the start times are correct as to a.m. and p.m. In some cases, the controller reverts to its default settings. The remedy is to reprogram it to the desired start and stop times.

When using electronic controllers, a power surge can cause them to freeze or lock up. To reset the controller, unplug the controller from its power source for two-three minutes. If it has a backup-battery feature, make sure to unplug the backup, as well, which allows the unit's microprocessor to reset itself. After waiting a short time, the technician can plug the controller back in and reprogram it to the usual settings.

Sprinklers. Irrigation systems feature two types of sprinklers — rotary and stationary. A rotary sprinkler is designed for use on large areas and sends a spray of water rotating in a circle. A stationary sprinkler is used for smaller areas and sends a mist in all directions

simultaneously. It is hidden in the ground until the system is pressurized, which makes the sprinkler head pop up.

The most visually obvious problems with irrigation systems are associated with sprinkler heads and result in uneven water coverage and high volumes of water waste. Nozzle heads should pop up completely when the water is on and fully retract when the water is off. If the noticing spray is uneven or intermittent or non-existent, the sprinkler head might be clogged. Dirt, grass and other debris can build up on sprinkler heads and block or redirect the water. Spray nozzles also can get knocked out of adjustment and require regular inspection.

Valves. Water leaks in irrigation systems can result from weather — freezing and thawing — damage from shovels and other sharp tools, vandalism, invasive tree roots, and normal wear and tear. Large leaks are obvious to spot, but smaller leaks might not show up immediately and require careful investigation of system components.

Pipes. Problems with underground pipes generally result in visible pools of water or large wet areas on the surface. If no wet area appears, but the zone has low pressure, technicians look for an area of grass that is significantly greener than the surrounding area. That might indicate the source of the system's leak.

Finally, an uneven spray pattern within a particular zone is a sign of pressure problems, which could be the result of a valve or pipe leak. One easy way for technicians to check for a leak is to monitor the water meter. If it is constantly moving, the system more than likely has a leak.

System age. Although a properly installed and maintained irrigation system might have an operational life of 20 years or more, some older systems might not be repairable if the manufacturer has stopped making the parts. In other cases, the cost to repair a system might be significantly higher than the cost to replace it.

Self-Check -3	Written Test

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

1. What is irrigation system? (3pts)
2. Discus the type of irrigation systems? (3pts)
3. List the main irrigations system components? (2pts)

Note: **Satisfactory rating – 8 points** **Unsatisfactory - below 8 points**

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information Sheet-4	Checking Performance parameters of the irrigation system

4.1. **Performance parameters**

The irrigation system are checked to ensure optimum performance. There are three performance parameters which are important when reporting on the evaluation of an irrigation system, these are adequacy, efficiency and uniformity. All of these parameters are inter-related and will be discussed in the following sections.

1. **Efficiency**

Efficiency is generally defined as the dimensionless ratio of output divided by input. Purcell and efficiency is in fact a dimensionless term obtained by dividing values which have the same units. However, in the context of irrigation there is much confusion with respect to the definition of efficiency.

2. **Uniformity**

'Irrigation uniformity' refers to the variation or non-uniformity in spatial distribution of the amounts of water applied to locations within the wetted area. Uniformity influences crop yields through the agronomic effects of under and overwatering. Insufficient water leads to high soil moisture tension, plant stress and reduced crop yields. Excess water may reduce crop yields as a result of leaching of plant nutrients, results in an anaerobic rooting environment as well as increased disease or failure to stimulate growth of economically

valuable parts of the plant note that irrigation uniformities for overhead sprinkler irrigation systems can be evaluated by measuring the spatial distribution of application depths with catch cans. For drip systems, the emitter discharge is measured and for surface systems the intake opportunity time is typically used for evaluating irrigation uniformities.

3. Adequacy

For a single irrigation event it is pertinent to include a parameter which determines how well the required depth of water has been satisfied. In many cases managers and researchers are interested in the low-quarter depth just equaling the required depth, this is termed the low-quarter adequacy. The shape and slope of is determined by the uniformity of applied water. The more uniform the application the more level the curve. As more water is applied more of the curve will be above the irrigation requirement line, and so the adequacy will be higher.

Objectives of evaluating the performance of an irrigation system are:

- to determine if the system is working according to farmer assumptions and design specifications in terms of the amount of water applied, and to thereby provide a basis for improved irrigation scheduling,
- to determine how much variation there is in the amounts of water applied and whether or not the measured variation has a significant impact on crop yields, deep percolation (drainage) and runoff losses, fertiliser use efficiencies and production cost,
- to determine the causes of the variation in applied water and to investigate and recommend cost effective remedial action,
- to assess whether or not the conveyance system is sized within design norms to check the efficiency with which power is being used,
- to produce recommendations to improve on any aspects that would result in the effective use of water and energy.

Self-Check -4	Written Test

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

1. What are the performance parameters of irrigation systems? (3pts)
2. Discus the importance of checking the performance of irrigation systems? (4pts)
3. What will be check in checking of performance of irrigation system? (4pts)

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

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information Sheet-5	Monitoring temperature controls

5.1. Effect of temperature on plant growth

High temperatures:

- Increase evaporation rates from soil, especially in windy conditions
- Cause wilting which may kill plants if the soil is already dry
- Reduce growth rates of seedling
- Lead to sunburn of seedling that are directly exposed to the sun
- Increase problems with pests and diseases, especially if there is high humidity

Low temperatures:

- May prevent germination of summer crops
- Can reduce the growth rate of seedling
- Can kill plants if temperatures are low enough to produce a severe frost
- Chilling injury will occur.

5.2. Monitoring temperature

Temperature controls are monitored to ensure specified temperatures are maintained. The temperature range for optimal plant development is 25-35°C. Depending on the species and the prevailing humidity, it can be slightly higher, but avoid air temperatures above 40°C. When using any type of black container, the substrate can heat up to temperatures above 50°C in direct sun. This is undesirable and can be prevented by shielding the containers, for example with wooden planks.

Heating cables or mats which provide bottom heat can easily be installed. If these do not have a thermostat, they need to be switched on and off according to a well-monitored schedule. Temperatures need to be most carefully monitored and held inside the recommended range during seed germination, rooting of cuttings and graft union formation.

Self-Check -5	**Written Test**

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

1. Discuss the effect of high and low temperature on the growth of seedling? (3pts)
2. Why monitoring of temperature is necessary in undertaking nursery activities? (4pts)

Note: **Satisfactory rating – 7 points** **Unsatisfactory - below 7 points**

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information Sheet-6	**Following Nursery Hygiene practices**

6.1. **Nursery hygiene**

Healthy plants are the goal of every nursery manager. This is not restricted to research nurseries but applies to nurseries of all sizes and levels of sophistication. Nursery hygiene does not necessarily mean using expensive or toxic chemicals can achieve a healthy nursery with ecologically sound management. **Factors that influence plant health**

A. **abiotic ('non-biological')**

- excessively high or low temperatures
- drought or waterlogging
- injury due to chemicals
- physical damage, for example
- shearing off roots

B. **biotic (biological)**

All biological organisms (bacteria viruses, viroids, phytoplasms, fungi, insects, mites, nematodes, weeds, parasitic plants, birds and mammals) that interfere with plant production

6.2. **Actions to prevent nursery contamination**

There are many entry points for pathogens into the nursery: propagation facilities: containers, flats, knives, secateurs, working surface, boxes etc.

- **propagation substrates**

When substrates, in particular soil and organic material, are brought into a nursery, they provide easy ways for pests to come too. In bare-root nurseries or when practicing open-ground propagation, pests may accumulate in the soil and make large-scale treatments or, in extreme cases, a move to a new location, necessary.

- **irrigation water**

Water for irrigating in nurseries often comes from a dam, a borehole or a tank filled with rain water. These stagnant reservoirs provide excellent conditions for water mould fungi — species of Pythium and Phytophthora — which are commonly associated with damping-off. A small amount of chlorine to provide a 1 ppm concentration for at least 30 minutes can be added to the irrigation water to control damping-off fungi. (Swimming pool water has a maximum concentration of 8 ppm available chlorine).

- **planting stock: seeds, cuttings, scions and rootstocks**

Plant material from other nurseries (seed, cuttings, scion wood and rootstock) can harbour nursery pests. Wherever possible, accept propagation material from nurseries only if it has a plant inspection certificate. If in doubt, surface sterilization should be carried out on all new and unknown material. Diseased plants in a nursery should be culled rigorously and burnt rather than composted.

- **Shoes and clothing**

Shoes and clothing of nursery staff and visitors. Quite often, diseases are brought into a nursery inadvertently on shoes (soil-borne diseases and nematodes) or clothing (weed seeds). This is very difficult to control. The best way is probably to issue to staff boots and work clothes to wear during work in the nursery and to install a dip basin with 10% household bleach solution at the entrance of the nursery through which staff and visitors have to walk to disinfect their shoes, especially when they come from fields where soil-borne diseases or nematodes are present.

- **Propagation facilities**
  - Keep the nursery area itself free of weeds. Many plant species can be alternate hosts of important nursery pests.
  - Treat all wooden supports with old engine oil or chemicals against termite attack.
  - Keep tools, work surfaces and containers clean at all times.

There are two basic approaches to nursery health:

1. **Preventive actions:** Which include balanced fertilizers, use of resistant species or cultivars, timely hardening of plants, cleanliness in the whole nursery, and training of staff.

B. Plant health status

Healthy, well-fertilized and properly irrigated plants are better suited to withstand pest attacks. However, over fertilizing should be avoided, especially excess nitrogen, which weakens plants and makes them more attractive to many sap-sucking insects, such as aphids and psyllids.

C. Plant density

Avoid very dense spacing in germination and nursery beds, because diseases can spread easily. Close spacing can also lead to etiolated and weak plants which are susceptible to disease.

D. Hardening

Timely hardening of seedlings will produce strong and healthy plants that are able to withstand a certain amount of pest or disease attack.

E. Resistant species or cultivars

If possible, grow resistant types or cultivars, or avoid susceptible species altogether. For example, citrus should not be propagated in areas with high incidence of aphids, since aphids transmit citrus greening disease, and spraying against the aphids usually cannot check the problem to the necessary extent.

F. **Cleanliness in vegetative propagation**

When harvesting scion wood and cuttings, take care that they come from healthy stock plants that are not depleted of nutrients or drought stressed, to enhance their resilience to diseases. Always sterilize knives and secateurs with alcohol to avoid spreading virus diseases, which are often transmitted on the tools.

G. Staff training

To keep pest and disease levels low, all employees should be trained to recognize and report pests. Workers, who are in daily close contact with the plants through watering, weeding etc., will probably more often encounter such problems than a nursery manager would.

2. **Curative actions:** Which include the use of pesticides, heat, biological control or physical measures (e.g. cutting out of diseased parts).

A. Practices removing weeds

- Keep the nursery area itself free of weeds. Many plant species can be alternate hosts of important nursery pests. This precaution includes a sensible selection of ornamentals, shade, hedge and windbreak plants in and around the nursery, as they too can be hosts for pests such as nematodes.
- Treat all wooden supports with old engine oil or chemicals against termite attack. If possible, place propagation structures onto a slab of concrete.

B. Removing dead or diseased plant material

C. Washing the work area on transfer of plants:

The whole nursery area needs to be well drained. Avoid water-logging at all costs.

D. Disinfecting tool, equipment and work areas

- Keep tools, work surfaces and containers clean at all times.
- Take particular care with proper sterilization of containers, especially when these are re -usable ones.
- Some tools and containers can be autoclaved but the necessary equipment is not always available. One of the most satisfactory and readily available chemicals for sterilizing nursery equipment is chlorine. E.g. Shoes and clothing
- Quite often, diseases are brought into a nursery inadvertently on shoes (soil-borne diseases and nematodes) or clothing (weed seeds).

Direction for use

- ♦ To use it as a sterile, make a 10% solution (1 part bleach to 9 parts water) and soak house hold instruments or containers in it for at least 30 minutes.
- ♦ A 10% bleach solution is also used to sterilize bench surfaces and other work surfaces.

E. Other disinfectants frequently used, especially in the laboratory are:

- Formalin
- Mercuric chloride and
- 70% alcohol.

These are all more expensive than bleach, and in addition, formalin and mercuric chloride are extremely poisonous and are suspected carcinogens.

- Using foot baths on entry to different work areas.

NB. From these two approaches, integrated pest management has evolved, combining 'preventive' measures with 'curative' methods, and using chemical, biological and cultural control. It is neither practical nor wholly desirable to attempt total elimination of pests many beneficial organisms are destroyed in such efforts, and a lack of beneficial organisms can lead to an explosive re-colonization of the nursery beds with pests.

Self-Check -6	**Written Test**

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

1. Discuss two basic approaches to nursery health? (3pts)
2. What Actions to prevent nursery contamination? (4pts)
3. Discus how to use chlorine as disinfectant? (4pts)
4. Explain the factors that affect the plant health? (3pts.)

Note: **Satisfactory rating – 14 points** **Unsatisfactory - below 14 points**

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Reference

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Horticultural Crops Production

Level -II

Learning Guide-38

Unit of Competence: Undertake Nursery Activities

Module Title: Undertaking Nursery Activities

LG Code: AGR HCP2 M110 LO4-LG-38

TTLM Code: AGR HCP2 TTLM 0102v1

LO 4: Maintain nursery plant

Instruction Sheet	Learning Guide # 38

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

- Selecting Suitable Personal Protective Equipment (PPE)
- Recognizing Common problems in nursery plants
- Selecting tools and equipment for plant maintenance
- Applying plant growth treatments
- Applying water
- Undertaking nursery operations
- Maintaining plant quality

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, use and maintain suitable personal protective equipment (PPE)
- Recognize, rectify and report common problems in nursery plants

- Select and use tools and equipment for plant maintenance.
- Apply treatments are to assist plant growth
- Apply water

- Undertake nursery operations
- Maintain plant quality

Learning Instructions:

- Read the specific objectives of this Learning Guide.
- Follow the instructions described below 3 to 6.
- Read the information written in the information “Sheet 1-7
- Accomplish the “Self-check 1-7.
- If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet”
- Do the “LAP test” **in page** (if you are ready).

Information Sheet-1	**Selecting Suitable Personal Protective Equipment (PPE)**

A nursery plant refers to Containerized (potted seedling), balled and bagged, in-ground (bare root), and aquatic, stock plants (seed, cutting, and rooting). The conditions associated with nursery plant such as: Nursery environment, plant growth and health requirements, nursery hygiene, common problems, treatment, tools and equipment and Wastes all these are need to maintain.

1.1. Selecting personal protective equipment (PPE)

Coveralls

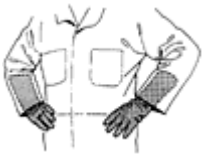
Wear long sleeved coveralls over full length pants and long-sleeved shirts. Make sure the coveralls are closed at the neckline and wrists. Remove your coveralls as soon as you have finished your pesticide activities. Remove them immediately if they become wet through with pesticide. Wear

waterproof clothing if you might get wet during pesticide application.

Waterproof Spray Suits

It should be made of a material that will resist penetration of the solvents in the pesticide. Rubber, neoprene, and polyvinyl chloride are usually suitable.

Gloves



- Always wear gloves when handling pesticides.
- Use unlined nit rile gloves unless the pesticide label recommends a different material.
- Do not use gloves made of leather, cloth, or natural rubber or gloves with cloth linings as these will absorb chemicals.

Boots

Wear waterproof, unlined knee-high boots of rubber or neoprene when you load, mix or apply pesticides. Wear your pant legs outside of your boots so the pesticide doesn't run into your boots. Do not wear boots made of leather or fabric.

Goggles and Face Shields: Pesticides are readily absorbed through the eyes and can cause eye injury. Wear goggles if there is a chance of getting pesticide spray or dust in your eyes. Do not use goggles with cloth or foam headbands. Do not wear contact lenses when handling pesticides as they are permeable to vapors and gases.

Hats: Protect your head and neck area. Do not wear baseball caps, fabric hats, straw hats or hats with leather or cloth inner bands as these will absorb and retain pesticides. Wash waterproof hat in warm, soapy water immediately after use and store in a clean, dry place.

Types of Respirators

Four types of respirators are discussed below:

1. **Chemical Cartridge Respirators** are available in different sizes in half face and full face models. The half face piece respirator is the most common respirator worn for pesticide use. Filters are attached to the face piece. There is a dust pre-filter and a cartridge filter. The cartridge filter contains absorbents such as activated charcoal to remove pesticides.

2. **Canister Respirators** are similar to cartridge respirators but generally have a full face piece and a larger canister of absorbent material. They should not be used to work in a greenhouse after release of a fumigant.

3. **Powered Air Purifiers** use an electric pump to draw air through a filter. Breathing is easy because no effort is required to draw air through the filter.

4. **Supplied-Air Respirators** come with their own air supply, either a cylinder worn on the back, or a line to a distant tank. They are designed for use in emergencies such as re-entries to fumigated areas or fighting fires in a pesticide storage area.

Self-Check -1	**Written Test**

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

1. Discus the personal protective equipment? (3pts.)
2. Explain the type of repertories? (3pts)

Note: **Satisfactory rating - 6 points** **Unsatisfactory - below 6 points**

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information Sheet-2	**Recognizing Common problems in nursery plants**

Common problems in nursery plants are recognized, and rectified and/or reported to the supervisor. The most Common problems of Nursery plants may include:

- **Dehydration/lack of moisture**

  Moisture stress occurs when the water in a plant's cells is reduced to less than normal levels. This can occur because of a lack of water in the plant's root zone, higher rates of transpiration than the rate of moisture uptake by the roots, for example, because of an inability to absorb water due to a high salt content in the soil water or loss of roots due to transplantation. Moisture stress is more strongly related to water potential than it is to water content. Moisture stress also has an effect on stomata openings of a plant, mainly causing a closure in stomata as to reduce the amount of carbon dioxide assimilation.

Closing of the stomata also slows the rate of transpiration, which limits water loss and helps to prevent the wilting effects of moisture stress. This closing can be trigged by the roots sensing dry soil and in response producing the hormone ABA which when transported up the xylem into the leaves will reduce stomata conductance and wall extensibility of growing cells. This lowers the rates of transpiration, photosynthesis and leaf expansion. ABA also increases the loosening of growing root cell walls and in turn increases root growth in an effort to find water in the soil.

- **Pests and diseases**

  - Hygiene has a vital role in the control of pests and diseases.
  - Use steam or chemical sterilization of the growing media, structures, tools and trays.
  - Effective ventilation and air movement is also a sound disease prevention method.
  - Understand pests and diseases that could affect the growth of healthy seedlings
  - Care must be taken with the use of pesticides within enclosed areas.
  - Note also that in a greenhouse plants can be more sensitive to chemicals than in the open field.

- **Nutrient deficiencies causes**

- **Burning:** severe localized yellowing; scorched appearance.
- **Chlorosis:** general yellowing of the plant tissue; lack of chlorophyll.
- **Generalized:** symptoms not limited to one area of a plant, but rather spread over the entire plant.
- **Immobile nutrient:** not able to be moved from one part of the plant to another.
- **Interveinal Chlorosis:** yellowing in between leaf veins, yet veins remain green.
- **Localized:** symptoms limited to one leaf or one section of the leaf or plant.
- **Mobile nutrient:** able to be moved from one plant part to another.
- **Mottling:** spotted, irregular, inconsistent pattern.
- **Necrosis:** death of plant tissue; tissue browns and dies.
- **Stunting:** decreased growth; shorter height of the affected plants.

- **Plants deformity**

Root deformities — the hidden curse

Root deformities below the soil line are the hidden curse in seedling production. They retard growth, cause the plant to lean or even fall over, and can result in the plant's death. Root deformities do not correct themselves over time — in fact, they become more acute as the tree grows. The main root should be as straight as a carrot, or if there is no main tap root, the many smaller roots should branch out without any pattern or strong bends. If the roots are in knots or coiled, they will eventually strangle the tree, or they may die, attracting insects or fungi that will damage the tree.

There are two types of root deformities:

Root deformities caused by poor pricking out from the germination bed into the container

The deformities are generally within the first 10 cm under the surface of the soil or at about a finger's length. Often, seedlings are squeezed into holes that are too short for the root system. Roots are stuffed forcefully into bags or, while placing a seedling into a hole, the end of the root remains curled upwards. Because roots always want to grow downwards, they will bend back and grow into a 'knee' or even a complete loop. Nursery customers can check for these deformities by following the stem down with their finger. These plants should be refused because they will never grow well in the field.

Self-Check -2	**Written Test**

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

1. Discuss the problems occurred in nursery? (6pts)

Note: **Satisfactory rating - 6 points** **Unsatisfactory - below 6points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information Sheet-3	**Selecting tools and equipment for plant maintenance**

3.1. Selecting/identifying tools and equipment

Tools and equipment used for tending nursery plants may include:

Secateurs: secateurs are similar to scissors, with two blades that glide past each other. They're suited to caring for delicate, living plants and saplings, as well as fully grown shrubs. A good, sharp pair of bypass secateurs should be able to cut through thicker branches and solid wood too. Anvil secateurs, on the other hand, make a “crushing” action, like a knife on a on chopping board. They should only be used on very thick branches or for dead wood, as the cutting blade comes into compressing contact with metal, which can bruise the plant tissue.

- Water spray containers; *Seedling Sprayer*/Duster. This is the ideal watering device for your tender *seedlings* or *seed* starting trays. It offers a gentle *spray* that does not

wash away those tiny *seeds* in your cell pack trays or especially the 20 rows *seed* flats into another row.

- Dibblers; A dibbler (sometimes spelled 'dibber', without the l) is a simple tool used by gardeners to poke and create holes in the ground. It is useful for creating holes and furrows for planting seeds or seedlings into the soil. A dibbler is used to plant bulbs, tubers, small plants, and sometimes seeds. These bulb planters come in many different shapes and sizes. A dibbler is used by pushing the tapered end into the garden soil to the depth required and twisting it to loosen the soil. The dibbler is also known by the commercial name Bulb Planter, which is a solid, stainless steel construction with ash wood handles.

- Plant supports Plant support

When your plant is in its early stages of development, it may need a little help in the form of a plant support. As different plants need support in various ways, Suttons Seeds range caters to plants of all sizes and ensures the grow-up to be tall, strong and healthy. Our collection of garden plant supports includes simple fixes such as ties and grips, to ornate solutions including growth roughs and classical obelisks. Climbing plant supports are in stock too; our drainpipe supports disguise unsightly guttering by encouraging creeper plants to grow up them – practical and beautiful

- **Plant Ties**. Whether you grow veggies or flowers, at some point you will need a **plant tie**. Choices include jute, nylon, plastic, foam, and Velcro. These garden **plant ties** gently encourage vertical growth without damaging stems.
- ***Rubbish bin*** - a container for things that are no longer useful or wanted and that are being been thrown out.

Self-Check -3	Written Test

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

1. What is weather forecasting? (3pts)
2. What are the importance of forecasting weather for horticultural crops production? (3pts)
3. Discuss the type of forecasting? (2pts)

Note: **Satisfactory rating – 8 points** **Unsatisfactory - below 8 points**

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information Sheet-4	**Applying plant growth treatments**

4.1. Plant growth and treatment

Treatments are applied to as***sist*** plant growth as directed by the supervisor. Generally, application of treatment for nursery plants includes:

- Pesticides
- Fungicides
- Fertilizer, mulching
- Removing weeds
- Removing dead material
- Tip pruning
- Formative pruning
- Aeration
- Staking
- Tying
- Spacing and
- Thinning

Pesticides

Pesticides are chemicals used to kill insects. Usually the larval stage of an insect life cycle is harmful. At this stage, most feeding on leaves, shoots, roots and boring in stem takes place. An exception is the weevil group in which adults mostly cause the damage. In general, a particular insect problem is localized to; certain nurseries.

The final choice of insecticides depends on

- Local availability
- Use of pest detection survey
- Cultural practice
- Sources of advice and on site expertise
- Cost

All pesticides must be used in accordance with the directions for use on the label! When treating a specific plant or pest.

3.4.2. Fungicides

Fungicides are chemicals used to ***kill fungi***. Damping-off is a disease of young seedlings caused by a number of soil born fungi (such as fusarium, pythium, Rhizoctonia etc) altogether there are about 30 species of fungi.

Damping off can be divided into two.

- **Post emergence damping off** decay occurs in the root and the stem. Tissue of the root collar turn dark in color causing seedlings to fall over with their leaves still green and die. This is the common type damping-off and regarded as the any type of damping-off by some authorities.
- **Pre-emergence damping off:** Fungi, which live in, the soil attack seeds immediately after germination. They destroy the emerging radical (primary root). This type of damping-off is difficult to identify. Failure of seedlings to emerge can be attributed to other reasons such as quality of seed. Some scientists do not regard this pre-emergence damping-off at all.

Control: Damping-off is favored high humidity, damp soil surface and heavy clay soils, cloud weather, too heavy shade, dense stands of seedlings which reduce evaporation, high content of

organic matter, high levels of nitrogen, alkaline soils (pH 6 or above). Warm weather encourages its spread. The risk of damping-off is especially high when sowing done during rains. Damping-off can be controlled by paying due attention to proper cultural practices and by using certain chemicals.

Cultural practices (Aeration)

The most effective preventive measures are avoiding of excessive watering and maintain of good aeration in seedbeds. Correct density of sowing is important as aeration in dense patches of seedlings is much reduced. Too heavy shading must be avoided. During long periods of cloudy weather, it is advisable t remove the shades entirely.

Soil sterilization

- Helps in controlling pre-emergence damping-off. However, it is much less effective in controlling post-emergence damping-off.
  1. Cooking the soil with some water for some minutes can treat small quantities of seedbed soil.
  2. Bigger amount of soil can be treated with formaldehydes (formal). Commercial (40%) formaldehyde is applied to the bed at the rate of 80 cc per 5-liter of water per one square meter. Formaldehyde should be applied 7 to 10 days before sowing to avoid soil damage to seed.
  3. Methyl bromide is widely used for soil sterilization.

3.4.3. Removing weeds

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

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

Hand weeding

Weeding by hand should be limited to plant containers or germination beds were the weeds cannot be reached by tools without disturbing or damaging the tree seedlings. In all other cases, small **weeding hoes, cultivators** etc. may be used for weeding of plants are somewhat widely spaced as in traditional beds.

Mechanical weeding: Mechanical weed control by motor cultivators, tillers, & rotary hoes attached to a tractor is limited to large level nurseries producing bare rooted plant stocks.

Chemical weed control

Weed killing chemicals are called herbicides. They are widely used in agriculture and land clearing during planting. The use of herbicides should be restricted to large nurseries raising mainly conifer seedlings and to nurseries where labor is expensive or not available.

Fertilizer: Fertilization of nursery soils is necessary to replace the lost nutrients. Developing and maintaining high levels of fertility in nurseries are essential for producing good quality nursery stocks. However, soil fertility is only one of a number of factors influencing stock quality. Fertile nursery soil does not compensate for poor practice.

It may be possible to improve seedling quality by altering the timing and level of fertilization in the nursery, or by monitoring the nutritional status of seedlings during an active growth. Site condition and other cultural practices made fertilization decisions some of the most difficult in nursery management.

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. To be effective a, layer of mulching should be 1-2cm thick.

The primary purpose were to conserve soil moisture by reducing evaporation from the soil and protects it against sun, hence lowers the soil temperature and also protects the soil against heavy rains that can wash the seeds which are sown.

Mulch also minimizes the risk of exposing the seeds to birds and rodents. In areas where watering is necessary throughout the year; mulching helps to reduce both the frequency and amount of watering needed.

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

Removing dead material and diseased plants

Plant stock material from other nurseries (seed, cuttings, scion wood and rootstock) can harbor nursery pests. Wherever possible, accept propagation material from nurseries only if it has a plant inspection certificate. If in doubt, surface sterilization should be carried out on all new and unknown material.

Diseased plants in a nursery should be culled rigorously and burnt rather than composted. Composting diseased material can only be recommended if the compost temperatures are high enough to kill pests (above 60°C), and can be maintained at this level for several days.

Pruning

Root Pruning is a standard in most Ethiopian nurseries. Root pruning involves cutting of the taproot, in some cases also of lateral roots, to encourage the development of fibrous root system. This kind of root system gives the seedlings the best possible start in plantation. Root pruning also controls depth of root penetration and makes lifting of seedlings easier and less harmful. Root pruning helps the seedlings to have a balanced root-shoot ratio. It also helps the seedling to have an adequate root collar diameter (because of the slowdown of the top growth)

Methods of root Pruning

Root pruning can be done in several ways:

A) Pruning with knife or secateurs

This is the most common method with potted seedlings. Each pot is lifted up & the protruding roots are snipped off. Consume time as a single person can only prune 500 seedlings a day. If root pruning is done using this method, it is good to leave some 30cm of the storage bed without pots at one end.

B) Root wrenching /shocking/

Pots are only lifted off the ground to snip or pull roots which has grown in to the ground. It is much faster than knife pruning and the operation can be combined with weeding or cultivation. As this method is not sufficient to use it alone, roots should be cut with knife or secateurs every 4-6 weeks between root wrenching.

C) Pruning with piano wire

This method can be applied to potted seedlings, which are kept in raised beds framed with reverting boards, and to bare rooted seedlings.

Frequency of root pruning

Depends on: -

- The growth rate of seedlings
- Species and
- Environmental condition of the nursery.

Care of seedlings during pruning

- It is best to do root pruning on a dull, cloudy or during the cool hours of the day.
- A clean cut with a sharp blade will favor proper healing of the pruned roots.
- Immediately before and after root pruning the container bed should be watered

Staking

Stacking refers to arrange nursery seedlings in an order pile/straight up to avoid growth of root deformity.

Spacing

Avoid very dense spacing in germination and nursery beds, because diseases can spread easily. Close spacing can also lead to etiolated and weak plants which are susceptible to disease.

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

Self-Check -3	Written Test

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

1. Explain the following terms? (6pts)
   a. Pruning
   b. Mulching
   c. Fertilizer
   d. Pesticides
   e. Fungicides

2. What are the importance of thinning? (4pts)
3. List the control mechanisms of weed? (4pts)

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

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information Sheet-5	Applying water

4. 1. Applying Water

Water is applied in required quantity and in an appropriate method specified by enterprise work procedures. Two aspects should be emphasized: (a) water quality; and (b) daily water requirement.

Water quality: It must be slightly acidic with a pH less than 7, with dissolved salts less than 550 parts/million, and with a conductivity less than 0.8 mho/cm. Generally fairly sweet and clear.

Water quantity: Adequate water of the above description should be supplied daily to the nursery. The amount of water applied (at any one time) will vary with the weather conditions, the soil infiltration rate, and the size of the plant. During the period of germination, frequent light" watering is required to keep the seedbeds moist, but not saturated. As plants become larger, the total quantity of water applied is increased and the frequency of application is reduced. As a guide to estimate the quantity of water to apply in one month, the following calculation can be made:

Water quantity = water loss factor x E x area of seedbed where: water loss factor = values between 1.2 and 1.4, averaging 1.3 , E = monthly evaporation

For example, assuming a water loss factor of 1.3, for a monthly evapotranspiration (E) of 0.2 meter and a seedbed area of 10,000 square meters, the water requirement for one month is: Water quantity = 1.3 x 0.2 x 10,000 = 2,600 cubic meters

Disinfecting irrigation water

Household bleach usually has a strength of 3.5% or 35 000 ppm NaOCI. It contains 24, 000 ppm chlorine (Cl2). To make 1 L of a 1 ppm Cl2 dilution, 0.042 ml (or 42ul) of household bleach is needed. Generally, a good supply of water is indispensable for the growth of seedling but too much water can be harmful. Water should be clean, of pH value ranging from 5.5 to 6.5. Newly sown containers seed trays or nursery beds must never dry out, but kept continually moist though not soaking wet.

Methods used to apply water

Methods used to apply water may be applied manually or by operating the irrigation system too heavy watering should be avoided, as this causes pudding of soil and poor aeration, which creates favorable condition to damping off-fungi. Every nursery manager should find out the best possible watering regime himself/herself.

Fine – hose watering cans must be used in watering of seedbeds without grass mulch. If not available, try to use grass much.

The common methods used in irrigation are:

- Surface (furrow or flood);
- Overhead (sprinklers);
- Trickle (drip or buried);
- Micro sprinklers.

Frequency of watering

There is no fixed rule about the intervals between watering and quantity of water required, because this varies with species, soil conditions, age of plants, weather condition, etc. Watering should be done frequently, at least twice a day in small quantities. Seedlings are watered immediately after transplanting. Therefore, light watering is carried out 2- 4 times a day depending on the progress of the seedlings.

Time of watering

The watering should do early the morning, before 10.00 a.m. & in the afternoon after 4:00 p.m. This will enable the seedlings to utilize efficiently with the water sprayed on to them without being lost.

Self-Check -5	Written Test

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

1. Discus the water quality and water quantity for applying? (3pts)
2. What are the condition to be consider while applying water? (4pts)
3. List the common irrigation methods? (4pts)

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

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information Sheet-6	Undertaking nursery operations

6.1. 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.
- Monitoring and evaluation

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 mycorrhizal 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.
- Monitoring and evaluation the activities

Self-Check -6	Written Test

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

1. 2. Discus the nursery operations (4pts)
3. List the conmen factors for the successful nursery operations? (4pts)

Note: **Satisfactory rating – 8 points** **Unsatisfactory - below 8 points**

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Information Sheet-7	Maintaining plant quality

7. **Maintaining plant quality**

- select planting material from plantations free of the problem or with low infection rates, such as young, vigorous plantations in their first production cycle; pare and/or boil suckers to minimize nematodes or weevils present on the suckers.
- Discard suckers with excessive brown or black corm material; apply sucker sanitation practices (paring and/or boiling) close to where suckers were extracted. This avoids contamination of the field to be planted with infested roots or discarded corm parts;
- store sanitized
- ensure clean substrate in nursery bags (free of plant parasitic nematodes) if macro propagation techniques are used.
- Practices good agronomic management
- Apply quality and enough amount of water as the type of seedling required
- Regular cultivation of the soil
- Repotting if necessary
- Apply the nutrients by good diagnosis of the nutrient deficiency
- Pruning
- Shading
- Conserving the moisture
- Controlling the weed
- Controlling insect

  Managing the disease

How to Assess Quality of Seedlings?

Nursery is an area where young/infant seedlings are maintained under intensive care for upto their planting. Quality seedlings production starts from the collection of quality seed, nursery establishment and maintenance after its germination. Even though quality is a qualitative gradable trait it can be measured indirectly by its correlation with growth, productivity, and vigor and quality index. If the quality

of a specific group of seedlings is to be assessed, destructive sampling through random selection of some seedlings of the group and computing Dickson Quality Index (DQI) as below is quite useful.

$$DQI = \frac{\text{Total seedling dry weight (g)}}{\{\text{height (cm)} / \text{stem diameter (mm)}\} + \{\text{shoot dry weight (g)} / \text{root dry weight (g)}\}}$$

Self-Check -7	Written Test

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

2. What are the importance of maintaining quality? (4pts)
3. Discus how to maintain quality? (4pts)

Note: **Satisfactory rating – 8 points** **Unsatisfactory - below 8 points**

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Operation sheet 1	Clarifying plant growth and health requirements

Objective: to perform root pruning of the seedling

Materials and tools: seedling, pruning kit, *pruners*, clippers or *secateurs*

Procedure:

Step 1. Remove the plant from its pot.

Step 2. Cut away the outer soil and roots.

Step 3. Loosen up the root ball.

Step 4. Trim off up to a third of the root ball as necessary.

Step 5. Repot your plant at the same depth.

LAP Test 1	Clarifying plant growth and health requirements

Name: _____ Date: _____

Time started: _____ Time finished: _____

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

Task 1. Perform root pruning

Horticultural Crops Production

Level -II

Learning Guide-39

Unit of Competence: Undertake Nursery Activities

Module Title: Undertaking Nursery Activities

LG Code: AGR HCP2 M110 LO5-LG-39

TTLM Code: AGR HCP2 TTLM 0120v1

LO 5: Store and stockpile materials

Instruction Sheet	Learning Guide # 39

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

- Storing plant debris and waste material
- Preparing and processing plant debris and waste materials
- Stockpiling surplus materials
- Maintaining a clean and safe work site

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:

- Store Plant debris and waste material produced during nursery activities
- Prepare and processes plant debris and waste material
- Stockpile Surplus materials
- Maintain a clean and safe work site

Learning Instructions:

- Read the specific objectives of this Learning Guide.
- Follow the instructions described below 3 to 6.
- Read the information written in the information “Sheet 1-4
- Accomplish the “Self-check 1-4
- If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet
- Do the “LAP test” (if you are ready).

Information Sheet-1	Storing plant debris and waste material

1.1. What is plant debris and waste materials

Plant debris: Litter fall is characterized as fresh, undecomposed, and easily recognizable (by species and type) plant debris. This can be anything from leaves, cones, needles, twigs, bark, seeds/nuts, logs, or reproductive organs (e.g. the stamen of flowering plants). *Plant debris* (bracts, leaves, twigs from mechanical gathering) decompose during storage because, if there is an excess of moisture in seeds, there is fermentation and overheating. Storage must then be ventilated (wheat, cotton). Metallic *debris* could lead to sparks that may generate fires and even an explosion.

Waste materials; Many materials that were once considered 'waste' are now considered to be a tradable commodity that could provide a small income instead of adding to costs - and that's just one reason for nurseries to conduct a regular review of what's coming into and going out of their sites.

1.2. Storing process

Collection

Collection refers to the initial capture and gathering of the waste from the point of origin or deposition to a collection point. The agriculture waste management system /AWMS/ plan should identify the method of collection, location of the collection points, scheduling of the collection, labor requirements, necessary equipment or structural facilities, management and installation costs of the components, and the impact that collection has on the consistency of the waste.

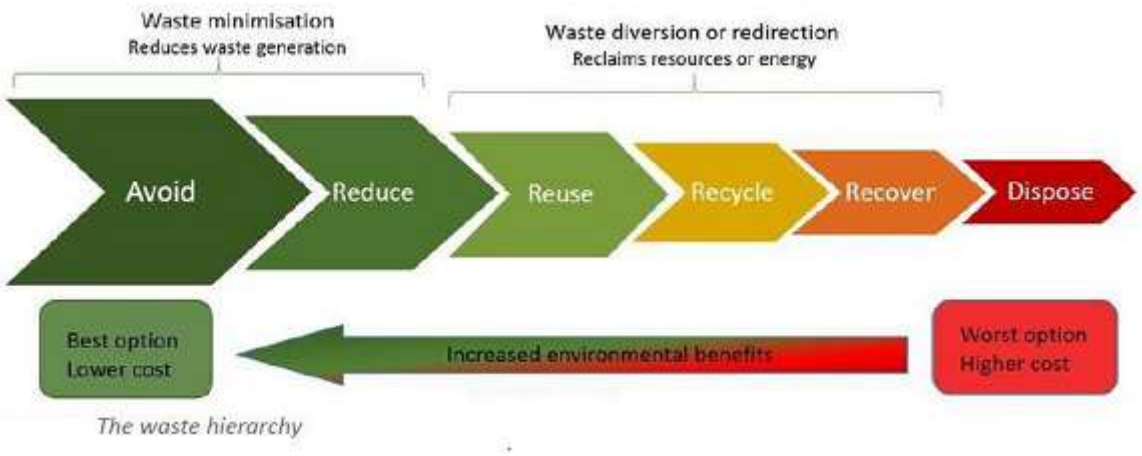
(c) Transfer

Transfer refers to the movement and transportation of the waste throughout the system. It includes the transfer of the waste from the collection point to the storage facility, to the treatment facility, and to the utilization site. As shown in figure 9–2, the waste may actually be transferred several times before utilization. For example, a liquid or slurry waste may be collected, transferred to a storage facility, and then to a solid/ liquid separator (treatment). From there, the solid portion may be transferred to another storage facility for additional treatment or reutilized as bedding, while the liquid portion is applied (transferred) to a crop field to supply plant nutrients (utilization). The system plan should include an

analysis of the consistency of the waste to be moved, method of transportation, and distance between transfer points, frequency and scheduling, necessary equipment, and installation and management costs of the transfer system.

(d) Storage

Storage is the temporary containment of the waste. The storage facility of a waste management system is the tool that gives the manager control over the scheduling and timing of the system functions. For example, with adequate storage, the manager has the flexibility to schedule the land application of the waste when the spreading operations do not interfere with other necessary tasks, weather and field conditions are suitable and the nutrients in the waste can best be used by the crop. The storage period should be determined by the utilization schedule. The waste management system should identify the storage period; required storage volume; type, estimated size, location, and installation cost of the storage facility; management cost of the storage process; and impact of the storage on the consistency of the waste.



The waste hierarchy

Self-Check -1	Written Test

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

1. Identify the plant debris? (2pts.)
2. List the importance of storing waste? (3pts.)
3. How can you store the waste materials? (3pts)
   a._____
   b. _____
   c. _____
   d. _____

Note: **Satisfactory rating - 6 points** **Unsatisfactory - below 8 points**

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information Sheet-2	Preparing and processing plant debris and waste materials

2.1. Processing plant debris an waste materials

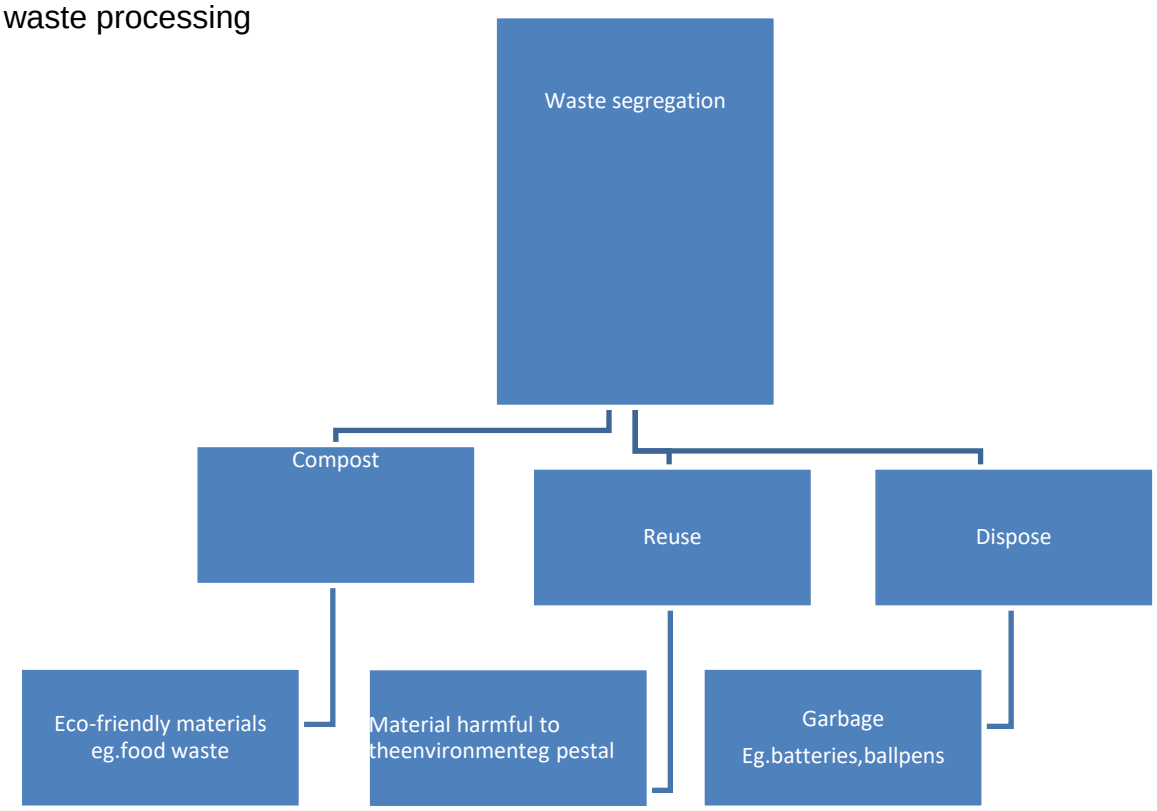
The successful diversion of biodegradable wastes from landfill relies on the separation of these wastes at source. Whilst the biodegradable fraction can be extracted from mixed wastes, this is laborious and produces a contaminated product. Separation at source offers the opportunity of a high-quality clean feedstock for composting and the prospect of an uncontaminated product. A ‘clean’ waste collected via separate collection is more likely to meet compost standards and be suitable for sale or use, bringing associated environmental benefits. Use of the compost end product offsets the requirement for other soil conditioners, such as peat, in agricultural and garden uses. Separation of biodegradable wastes at source also allows for the promotion of home composting, or composting within small, local communities.

2.2. biodegradable wastes has two major advantages:

The environmental impacts of waste transport and handling are avoided; and there is generally a use for the compost product by the householder, closing the recycling loop and realising environmental benefits from the offset use of other products (in contrast to the problems sometimes experienced in finding a ‘market’ for composts produced centrally). Additionally, separating their own waste stream will raise the awareness of householders regarding waste generation and help develop a sense of responsibility for their waste.

More generally, composting as a technology is adaptable and suitable for treating wastes in a variety of socioeconomic and geographical locations. Despite the range of treatment technologies from simple home composting schemes to high-tech centralised systems, both the technology and the associated collection systems can be implemented relatively simply and inexpensively. Public acceptability for composting schemes is also high in comparison with other technologies such as incineration or landfilling of wastes. Furthermore, the compostable fraction of waste is often one of the most polluting of the waste stream, and implementing such a scheme diverts waste from the traditional disposal routes such as incineration and landfill. As one of the largest fractions of household waste, diverting organic waste from landfill can also significantly contribute to meeting local recycling targets.

Fig. waste processing



Self-Check -2	Written Test

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

4. Discuss the importance of processing waste materials? (4pts)

Note: **Satisfactory rating - 4 points** **Unsatisfactory – 4 below 6points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information Sheet-3	Stockpiling surplus materials

3.1. Material stockpile and waste management

A stockpile is a pile or storage location for bulk materials, forming part of the bulk material handling process. Stockpiles are used in many different areas, such as in a port, refinery or manufacturing facility. The stockpile is normally created by a stacker. A reclaimed is used to recover the material. Materials may be accidentally dropped and not put in the bin. A perimeter fence will help to keep this material from being carried off site by wind or water. A perimeter fence can also prevent unauthorised persons gaining access to a site. You have a duty of care under the Work Health and Safety Act 2011 and Work Health and Safety Regulation 2011 to protect the public as well as workers from hazards associated with building works.

3.2. **Reduce waste**

Builders should reduce waste by ensuring that they:

- Design and order only what is needed.
- Use prefabricated products.
- Separate materials for recycling.

3.3. **Maintenance of stockpiles and waste**

- Ensure controls are checked daily and any repairs undertaken immediately.
- A good maintenance program should include ongoing modification throughout the construction process.
- Ensure controls are put back in place if they are moved for any reason.
- It is important that controls are in place at the end of the day or before it rains.

3.4. **Management of stockpiles**

- Appropriate location and protection of stockpiles will assist in reducing damage to the building block.
- When ordering materials, give clear instructions on where you want them placed on your building block.
- Clearly mark your stockpile area. This will assist with the management of the site.
- To prevent the potential loss of materials, plan to limit the amount of material onsite if possible.

- Ensure all workers (including subcontractors, delivery drivers, etc) are aware of their responsibilities to minimise pollution.
- To protect stockpiles and building materials from entering the stormwater system:
- Place them near the stabilized access point.
- Store them behind sediment fences. Protect them from costly losses by covering where necessary.
- Locate them away from high water flow areas and Keep stockpile height below 2m.
- Apply a stabilising agent to the surface.

3.5. **Waste Disposal**

- Install onsite waste collection.
- Material must be stored in such a way that it does not, or is not likely to, escape.
- Locking the bin will assist in preventing illegal use.
- Arrange regular and timely clearance of bins to avoid overfilling.
- Where possible, collect materials for recycling and/or keep different materials in separate bins

Self-Check -3	Written Test

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

1. How did you stockpile the surplus materials? (5pts)
2. List the materials which will be stockpile? (3pts.)
3. How to manage the stockpile materials? (2pts)

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

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information Sheet-4	Maintaining a clean and safe work site

4.1. Safe work site

Safe work practices are generally written methods outlining how to perform a task with minimum risk to people, equipment, materials, environment, and processes. Safe work practices should be developed as a result of completing a Hazard Assessment and should closely reflect the activities most common in the company's type or sector of construction. All safe work practices should be kept in a location central to the work being performed and readily available to the workforce. Some safe work practices will require specific job procedures, which clearly set out in a chronological order each step in a process.

4.2. **A clean workplace**

The workplace environment influences employees' productivity, performance and well-being. No matter the industry, maintaining a clean workplace may help keep staff members safe, healthy and efficient. However, busy production schedules and increasing workloads may cause standards to dip.

While it may be tempting to put off dusting or other types of cleaning around the office or worksite, doing so may put employees at risk of suffering an injury or illness and may even impact performance levels. Maintaining a clean workplace is vital for employers to reduce their workers compensation claims and keep efficiency high.

4.3. What can employers do to improve workplace safety?

Creating a safe workplace is an ongoing commitment. Employers can make the company a safe place by doing the following or ensuring that it is done (for example, by a supervisor):

- Provide regular safety training for supervisors and workers.
- Lead by example and demonstrate safe work habits.
- Regularly check that workers are following company safety procedures.
- Regularly check that workers are correctly using the protective equipment and devices provided.
- Encourage workers to report illnesses and injuries immediately.
- Encourage workers to report potential hazards.
- Keep workplace health and safety programs current.

• Stay aware of workplace hazards and how to handle them.

• Respond promptly to all health and safety concerns.

4.3. Worker training

This manual includes information on:

• How to conduct crew talks

• Crew talks on topics that include common hazards, safety tips, and real-life

Self-Check -4	Written Test

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

1. What can employers do to improve workplace safety? (4pts)

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

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Reference

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2. Dickson, A., Leaf, A.L. and Hosner, J.F. 1960. Seedling quality- soil fertility relationship of white spruce and, red and white fruits in nurseries. For Chronicle, 36: 237-241.
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Horticultural Crops Production

Level -II

Learning Guide-39

Unit of Competence: Undertake Nursery Activities

Module Title: Undertaking Nursery Activities

LG Code: AGR HCP2 M110 LO6-LG-39

TTLM Code: AGR HCP2 TTLM 1219v1

LO 6: Clean up on completion of nursery work

Instruction Sheet	Learning Guide # 39

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

- Storing plants and materials
- Collecting and disposing waste
- Cleaning, maintaining and storing tools and equipment
- Recording workplace information

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:

- Store plants and materials
- Collect and dispose waste
- Clean, maintain and store tools and equipment
- Record workplace information
- Report work outcomes

Learning Instructions:

- Read the specific objectives of this Learning Guide.
- Follow the instructions described below 3 to 6.
- Read the information written in the information “Sheet 1-4.
- Accomplish the “Self-check 1-4.
- If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet ”
- Do the “LAP test” (if you are ready).

Information Sheet-1	Storing plants and materials

1.1. Plant Materials

Identification and general information

Plant materials include a wide and varied group of plant parts from many species. General categories of plant materials include grasses, rushes, barks, woods, gourds, stems, roots, seeds, and leaves. These materials can be used to construct baskets, netting, cordage, and even fabrics. Common production methods include felting, knitting, knotting, coiling, plaiting, and weaving, to name a few. Identification of plant materials is often done microscopically. Some individuals may have developed a more intimate knowledge of surrounding terrains, plants, and techniques, which allows them to identify plant species through visual examination. These versatile materials, as well as their processing and construction techniques, vary greatly from region to region.

1.2. Basic Care and Storage

Pay extra care and attention to items made from plant materials because of their inherent fragility. The decomposition of items made from plant materials is often initiated by the fragility of the materials themselves, the construction techniques, normal use, inadequate storage, and mishandling. They are particularly susceptible to the three leading types of deterioration.

Physical Deterioration: Swelling and shrinkage due to an excessively humid or dry environment, and fragility due to excessive light exposure; also includes tears, breaks, misshapen structures, abrasion, and soiling.

Chemical Deterioration: Reaction between the item and other materials causing a chemical change that leads to such problems as embritlement.

Biological Deterioration*:* Mold, bacteria, fungi, soiling, or infestation of insects or rodents.

Deterioration, whether it is physical, chemical, mechanical, or biological, will likely result in very fragile items that are prone to embrittlement, distortion, and areas of loss. Items constructed of plant materials, including three-dimensional items, such as baskets and hats, and two-dimensional or flat items, such as mats, should not be flexed, scraped, or abraded.

Plant materials are susceptible to damage from both humid and dry environments. A basket constructed of woven reeds, leaves, grasses, or bundles of pine needles that becomes saturated with moisture from high humidity may become too heavy to support itself. Swelling due to humidity can cause stress on many traditional construction techniques. Items made of birch bark can swell or warp. This swelling leads to breaks within woven or tied fiber bundles, allowing the bundles to splay out of position. Warping or fractures can also occur on a microscopic level within the plant materials. The risk is also greater for older, more fragile items stored within humid environments.

Special Pest Concerns

Fungi, which include mold and mildew, will grow on plant materials in excessively humid environments and cause discoloration, embrittlement, and structural damage. Baskets with food deposits are particularly susceptible to fungi, insects, and rodents. If your plant material items suffer from water or humidity damage, or if mold is visible on the surface of items, isolate them and contact a conservator for advice.

Routine Handling Wash your hands prior to handling and wear gloves when handling items made of plant materials. When transporting items made of plant materials, use a board or box for support to limit the stresses of handling.

Flat Storage

Secure flat plant material items on support boards with twill tape ties, or line a board with a piece of washed cotton muslin, securing this in place with small tabs of 3M #415 double-sided tape. The texture of the fabric will prevent slippage of the item when opening and closing drawers or moving items from one location to another.

Exterior Flexible Supports

Rings and coils are often wrapped around the exterior of baskets to support the walls from the outside. The rings can be constructed of polyethylene tubing available from conservation catalogs, which comes in 3/4-inch or 1 1/4-inch diameter rolls. Once cut to the appropriate size, these tubes can be hot-glued together, creating stable doughnut supports.

Interior Flexible Supports

When a basket is collapsing, internal polyethylene rings may be too stiff and unwieldy to insert. In this instance, it may help to insert softer, suppler tubing made of thermal-bonded polyester batting covered in washed cotton knit fabric. Another option is to fill the space with soft crumpled, unbuffered, acid-free tissue.

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Cleaning and Minor Repairs

Storing items in protective boxes or a cabinet and displaying them in cases are a good defense against dust and dirt accumulation. The less dust accumulation you have, the less handling and abrasion your items will receive during cleaning.

Since plant materials are so susceptible to damage from water, only dry surface cleaning is recommended. Vacuuming with the aid of a soft brush can help remove loose dust and dirt with minimal risk to plant materials. However, thoroughly examine your item for broken and unstable areas prior to any surface cleaning. Brushing the surface gently with a soft bristled brush will help loosen dirt, which can then be picked up with a vacuum micro-attachment. Take care to have the vacuum on a low suction setting. Remember to vacuum the surface in a methodical row-by-row manner. This will facilitate the overall cleaning of the item so that no one area is brighter than another.

Do not remove unknown substances found in storage containers without thoroughly examining them. Foodstuffs, herbs, or other materials found on items may provide significant clues about an item's previous use. If the surface of an item will not be abraded, distorted, or affected by soil and loose particulates found within it, you may want to leave the item as is for later testing and documentation. A curator or other appropriate person may be able to help you decide whether to maintain or discard such information. However, if you must clean a basket to prevent further damage, you may want to keep a sample of the material and take photographs and notes to document the area.

Items made from plant materials often have areas of loss due to use, fragility of materials, or handling and storage procedures. No one method of repair answers the needs of all plant materials. Adhesives, patches, and solvents can cause irreversible changes to the item and may be inappropriate for museum objects. For this reason, it usually is recommended that you choose repair methods that will not alter the item permanently.

Self-Check -1	Written Test

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

1. Discus the three deterioration of plant materials in storage? (3pts)
2. How to clean plant materials? (4pts)
3. Discus the way of storing plant materials? (4pts)

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

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Information Sheet-2	Collecting and disposing waste

2.1. What is disposing and waste?

Dispose; - Set out of wastes. During discarded or left over product, and the waste should be collect in safe area and bury it in hull. To have save environment it is better to dispose it in safe area.

Wastes; - Unwanted material produced by human activity, which is usually referred to as garbage. Collection refers to the initial capture and gathering of the waste from the point of origin or deposition to a collection point.

The Agricultural waste management system plan should identify

- the method of collection,
- location of the collection points,
- scheduling of the collection,
- labor requirements,
- necessary equipment or structural facilities,
- management and installation costs of the components,
- the impact that collection has on the consistency of the waste.

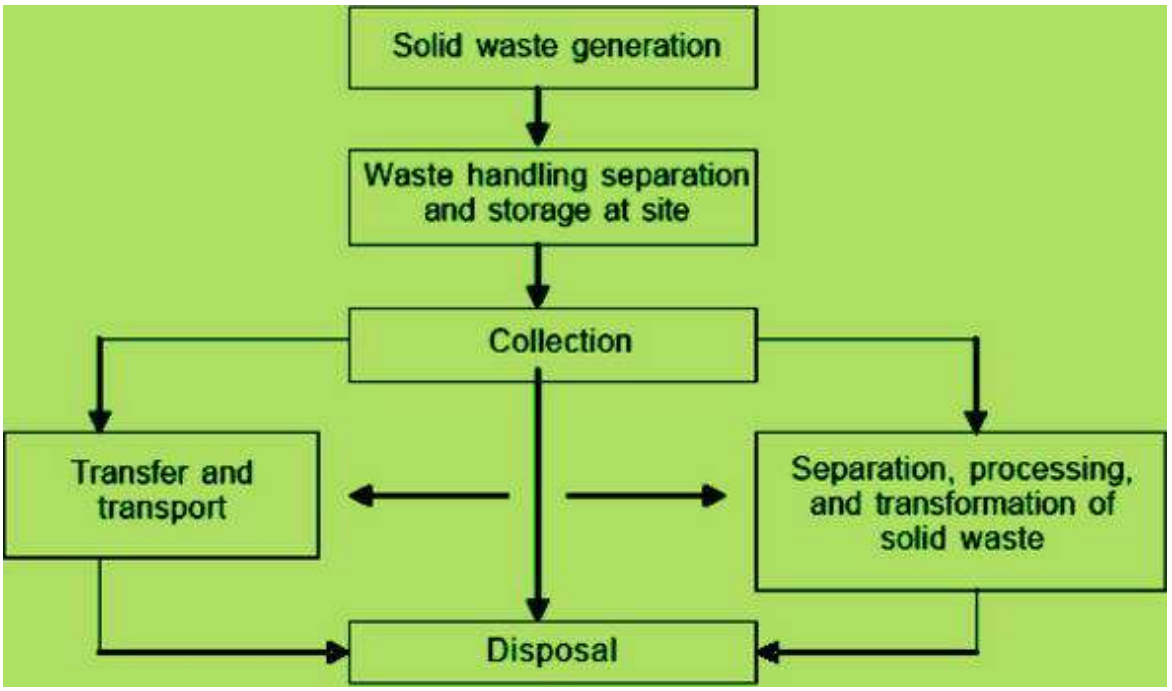

Fig. Proper waste disposal

Self-Check -2	Written Test

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

1. What is disposing? (2pts.)
2. What is waste? (3pts)
3. What will be consider while collecting the waste? (2pts)
   a._____
   b. _____
   c. _____
   d. _____

Note: **Satisfactory rating - 9 points** **Unsatisfactory - below 9 points**

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Question

Information Sheet-3	Cleaning, maintaining and storing tools and equipment

3.1. Cleaning and storing tools and equipment

Materials are returned to store or disposed of according to supervisor's instructions. Tools and equipment are cleaned, maintained and stored according to manufacturers' specifications and supervisor's instructions.

Cleaning is just making farm equipment free of any dusts, soil, seeds, chemicals, etc. Try to clean tractors, trucks and other farm equipment as soon as possible. Delay will make dirt and silt harder to remove and may cause considerable rusting and corrosion. After cleaning farm equipment's should be maintained and stored in a safe place or at their storage place. Finally work out comes should be reported.

Here are five top tips for maintenance:

1. Stay on top of large machinery operator training

Many types of large machinery have multiple operators. One of the ongoing inspections on any checklist should be overseeing the correct operation of the equipment.

Large machinery should be inspected as soon as it is purchased. Operator training is usually done at that point, but training needs to be kept up. Employees come and go, skills become rusty and poor operation leads to breakdowns.

Operator manuals can be revised for the specific work situation. They can be rewritten in simpler language. A short manual can be provided to each operator for easy reference. And, if you operate in a paperless environment, you can rest assured operators use the most current version of each manual.

One other note is to identify best practices, which can then be applied to other facilities or geographic locations. The knowledge you learn about how to maintain your equipment can become quite valuable – be sure to best leverage this important knowledge and use it at every applicable location.

2. Add and test lubricants frequently

Lubricants reduce friction around any moving part. A schedule of good lubrication maintenance extends the life of large machinery equipment and parts.

3. Check for signs of wear

Vibration, shock, high temperatures, friction and age all contribute to the breakdown of parts in heavy machinery.

- Vibration can come from gears and belts that are out of alignment
- Shock can come from accidents and from poor operator technique
- High temperatures can come from extended use, friction, poor lubrication and worn parts, among other reasons
- Age affects many key components. Over time, belts will warp. Seals will dry and crack. Bolts will loosen and stretch out of shape. Age is a factor to monitor in equipment.

4. Keep large machinery clean, and maintain a clean environment

There are many seals and filters in place on heavy machinery to keep working parts clean and free of contamination. Large machinery should be stored in a shed or other building if at all possible. Exposure to wind and weather can lead to rust and rot. The machinery should be run periodically if it is not in use.

5. Have a maintenance and repair schedule, and keep good records

Fluids, tires, tracks and electrical systems are among the components that have to be checked regularly for preventive maintenance. Know what needs to be inspected and when.

3.2. **Storage equipment**

Positioning materials and Equipment

- Equipment used to handle material at a single location so that it is in the correct position for subsequent handling, transporting and storage. Prioritization in ordering and poisoning of the equipment & tagging using mechanical equipment to move and store materials increases the potential for employee injuries. Workers must be aware of both manual handling safety

concerns and safe equipment operating techniques. Employees should avoid overloading equipment when moving materials mechanically.

Self-Check -3	**Written Test**

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

3.2.1.1. Discuss cleaning, maintaining and storing? (4pts)

3.2.1.2. Writ the top maintenances tips? (3pts.)

Note: **Satisfactory rating - 7 points Unsatisfactory - below 7 piont**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information Sheet-4	Recording workplace information

4.1. 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

III) Nursery calendar:

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

Self-Check -4	Written Test

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

1. What is recording? (3pts)
2. What are the importance of recording information of nurseries? (3pts)
3. Discuss the type nursery information will be record of forecasting? (2pts)

Note: **Satisfactory rating – 8 points** **Unsatisfactory - below 8 points**

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Question

Information Sheet-5	Report work outcomes

5.1. Keeping Farm Records

Records are important to the financial health of your farm. Good records do not ensure your farm will be successful; however, success is unlikely without them. Farm records are like report cards students receive in school. With a farm report card, you can tell how well you are managing your operation compared with other producers in your "classes. You also can see the strengths and weaknesses of your farm operation.

5.2. Improving Farm Records

Accurate records are essential for evaluating your farm's performance: accurate analysis requires accurate data. Too often farmers rely on publications which describe an "average" farm instead of personal records that describe their farm. To make the best financial decisions concerning your farm, use data collected from your farm. You can make your recordkeeping job easier. Consider using forms and accounting systems designed especially for the farm. A good source for recordkeeping books is your local Extension agent or agricultural lender. Also, software packages for farm recordkeeping can be purchased for your personal computer.

Example of simple record

Crop	Variety	Date of planting	Amount of seed used/no of cutting	Amount of fertilizer used	No of seedling	Observation & remark	Transplanting date

Self-Check -5	Written Test

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

1. What is recording? (3pts)
2. What are the importance of recording for horticultural crops production? (4pts)

Note: **Satisfactory rating – 7 points** **Unsatisfactory - below 7 points**

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Reference

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2. Copyright © International Labor Organization 2011, First published 2011
3. I.J. Warrington Challenges and Opportunities for Horticulture and Priorities for Horticultural Research at the start of the Twenty-First Century
4. http://www.acs.edu.au/links http://www.allsun.com.au/
5. G. D. Mullan and P. J. White (2002) Seedling Quality

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