HORTCULTURAL CROP PRODUCTION

Level-I

#Learning Guide -33

Unit of Competence:-Undertake Horticultural Production practices

Module Title:-Undertaking Horticultural Production practices

LG Code: AGR HCP1 M09 LO1-LG-33

TTLM Code: AGR HCP1 TTLM1219v1

LO1: Prepare materials, tools and equipment for horticultural production work

Instruction Sheet	Learning Guide #33

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

- Identifying materials, tools and equipment
- Checking all materials, tools and equipment
- Demonstrating techniques used loading and unloading materials
- Selecting personal protective equipment (PPE)
- Providing Work support
- 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 materials, tools and equipment
- Check all materials, tools and equipment
- Demonstrate the techniques used to loading and unloading materials
- Select personal protective equipment (PPE)
- Provide Work support and Identify OHS hazards

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described in number 3 to 7.
3. Read the information written in the “Information Sheets 1”. Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
4. Accomplish the “Self-check 1,2,3,4,5 and 6” **in page 9,11,13,16,18 and 21 and operational sheet 1 and 2 on page:22 and24 respectively.**
5. Ask from your teacher the key to correction (key answers) or you can request your teacher to correct your work. (You are to get the key answer only after you finished answering the Self-check 1).
6. If you earned a satisfactory evaluation proceed to “Information Sheet 2”. However, if your rating is unsatisfactory, see your teacher for further instructions or go back to Learning Activity #1
7. Do LAP Test on page: 23 and 25

Information Sheet-1	Identifying materials, tools and equipment

1.1. Introduction

The term horticulture is derived from two Latin words *hortus* 'garden' and *colere* 'to cultivate'. Halfacre and Barden (1979) states that the first known use of the term horticulture was in 1631. Bailey (1939) observed that horticulture is concerned with production within an enclosure. Gardens are distinguished from fields by the concept of enclosure. One of the definitions of "Horticulture is the branch of agriculture concerned with intensively cultured plants used for food, for medicinal purposes or for aesthetic gratification." Horticulture: The science and an art that deals with the production ,handling, processing, marketing and utilization of fruits, vegetables, ornamentals ,beverages, stimulant crops, spices, medicine plants and others.

Divisions of horticulture

- Pomology;- deals with fruits
- Olericulture: - deals with vegetables
- Floriculture: -deals with flowers
- Landscape and nursery industry: - deals with growing different plants in landscape

1.2. Identifying materials, tools and equipment

Depending on size of enterprise, various materials, tools and equipment are used in horticultural production. In most cases the following are essential tools for horticultural crop production area.

- Spade/ fork spade: for digging up soils.
- Harrow: to break up large clods of the soil
- Garden hoe: for land preparation
- Strong cord/ thick string: for lying off rows or lining out rows so that the land can be suitable for work.
- Wheel barrow: for hawing purposes e.g. fertilizer ,mulch and harvest
- Rotary tiller: as a substitute of rake used for gardens measuring over 4000sq.ft
- A wheel hoe: used for cultivation of the land
- Sprayer or duster: for application of sprays and dusts to the crops e.g. knapsack sprayer
- Containers: equipment used for storing seed to grow plants for transplanting e.g. flats, benches, pot
- Dibbles: for dibbling or to make holes in
- Knives: for cutting purposes
- Pair of scissors: for cutting preparation
- Watering can /sprinkling can: for watering, it must be galvanized and with rose for

watering seed beds and plants in benches and pots.

- A garden hose: for watering the field
- A rubber bulb sprinkler: for watering seed beds, used in small scale plantation
- Wooden scoop/trowel: for taking the soil, for filling flats.
- Chemicals
- Seeds
- Planting materials /cutting and fertilizers and Essential operations in the nursery are: Digging, Pruning, Hoeing, Raking, Site Clearing, Seed collection… etc

1.2.1. Classification of tools and equipment based on their function

A. Tools required for working on the soil

The table below is a summary of the description and function of selected tools that You may encounter on a farm.

<table>
<tr><th colspan="2">Pick axes and mattocks</th></tr>
<tr><td>  </td><td>How is it used?
▪ Picks and mattocks are used to work soil that is hard, rocky or root filled.
▪ A pick has a pointed tip on one end and a chisel like tip on the other.
▪ Mattocks are used for loosening soil that is root filled.
▪ Mattocks have an axe-head on one side and a flat
hoe like head on the other</td></tr>
<tr><th colspan="2">Spades</th></tr>
<tr><td>Hand Tool
  </td><td>How is it used?
• Spades are useful for cutting and digging heavy
soil, digging straight-sided, flat-bottomed Trenches or removing a layer of sod.</td></tr>
<tr><th colspan="2">Rakes</th></tr>
<tr><td>  </td><td>How is it used?
➢ There are two main types of rake - a steel rake and a plastics or rubber lawn rake.
➢ Steel garden rakes are used to level and prepare seedbeds for sowing. They are not meant for use in lawned areas. Garden</td></tr>
</table>

	rakes damage the turf as their tines become plugged with debris. ➢ Lawn rakes handle lawn debris such as grass clippings and leaves. They are best used with a drawn sweeping motion like you would draw
Hoes	
Hand Tool 	**How is it used?** - Hoes are used for cultivation and weeding. - There are many types of hoe available. - Triangular shaped hoes are good for breaking into hardened soil, weeding, and cultivation in tight spots. - The blade of the hoe rests on the ground and is moved - back and forth to remove weeds just below the soil surface
Panga or machete	
Hand Tool 	**How is it used?** • Panga's or machetes are used to cut down stubborn weeds, reeds, tree saplings and can also be used to harvest grain.

- ✓ **Pickaxe** --- used to break up hard and stony ground
- ✓ **Traditional hoe** --- for loosen the soil
- ✓ **Shovel** --- for moving earth, sieving soil and soil mixing
- ✓ **Flat pronged fork** --- for loosening the soil and to lift bare-roofed seedlings and to turn over compost
- ✓ **Rake** --- break up and level the soil; and it has a row of 10-16 teeth and is kitted up with a 1.80 m handle

B) For layout

- ✓ **Tracing line** --- thin hemp or nylon cord 10 cm long (with knots at 1m intervals), attached to 30~50 cm long pegs at each end, and used to trace straight lines. e.g. boards of seed beds or pot beds to measure distance.

Figure 2 Tracing line

C) For preparation of putting soiled pot filling

- ✓ **Sieve**—soil for seed beds and for potting should not contain large-size particles, stones, pieces of weed or something alike.
  - sieve size approx 1.5m
  - Dimension 1×1.5m
- ✓ **Funnel**: for speeding up pot filling if inserted in the polythene tube
- ✓ **Scoop** - made of metal sheet, it is an efficient tool for filling and compacting soils in pots

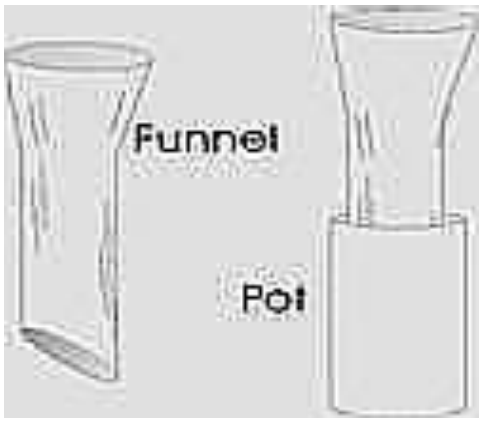


Figure 3 Potting funnel

- ✓ **Pot cutting roll**---- a simple cutting gauge which permits rapid cutting of the tube into pots of standard length (15, 20 or 30cm).It can be made locally.
  - To obtain pots in 20cm length, the piece of rounded tube has to have diameter of 6.5cm and of 9.5cm for 30cm long.

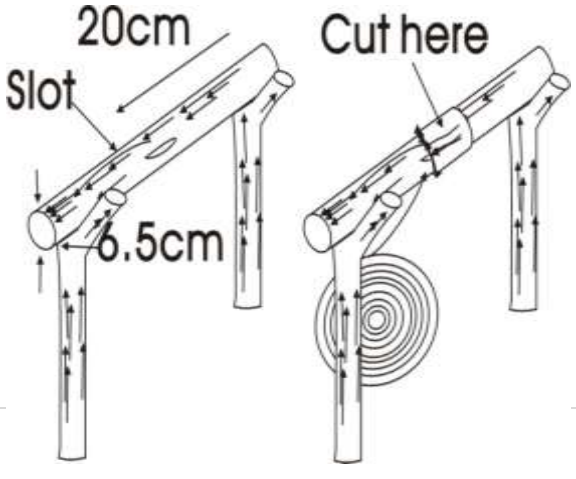


Figure 4 Pot cutting roll

D) For watering

- ✓ **Watering can-**---it can be made of metal or plastic; and it should have a capacity of 10-12L; kitted up with fined-perforated sprinkler to avoid damage to young plants and dentations of root from splashing water.

E) For transport within Nursery

- ✓ **Wheel barrel-**--- for transferring all kinds of materials in the nursery; potting soil, seedling ready for delivery…etc.

F) For tending seedlings

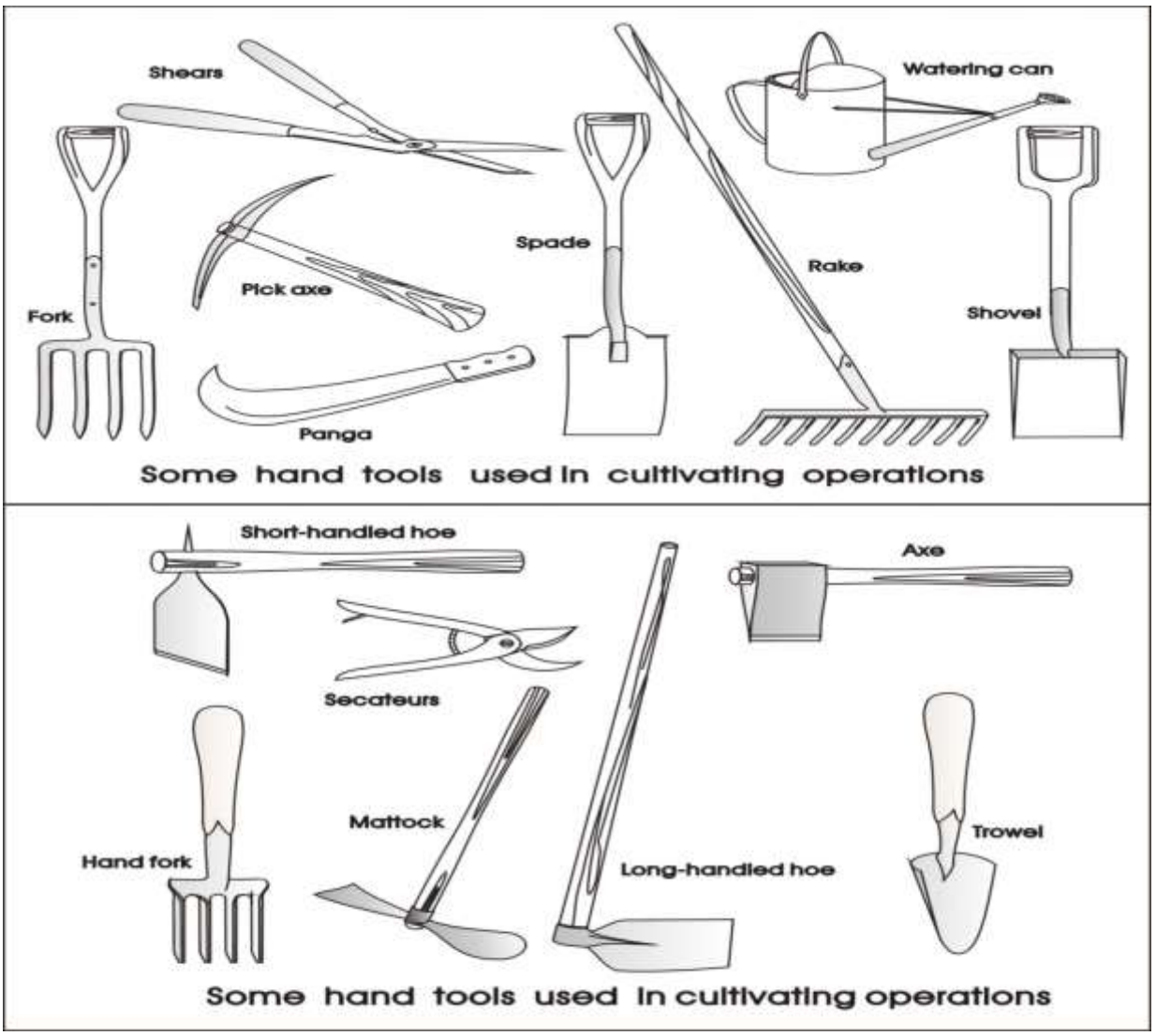
- ✓ **pruning knives, shears**:
  - Used to prune the roots that grow out of pot/root zone
- ✓ **Trowels** : pots into the ground of the pot bed
- ✓ **Flexible steel wire** Used to prune the roots that grow out of pot/ root zone
- ✓ **Machete -**--- long knife which can be used for many purpose such as cutting fence posts
  - Removing weedy fences
  - Trimming living fences
  - Chopping left-over seedlings for composing…etc.

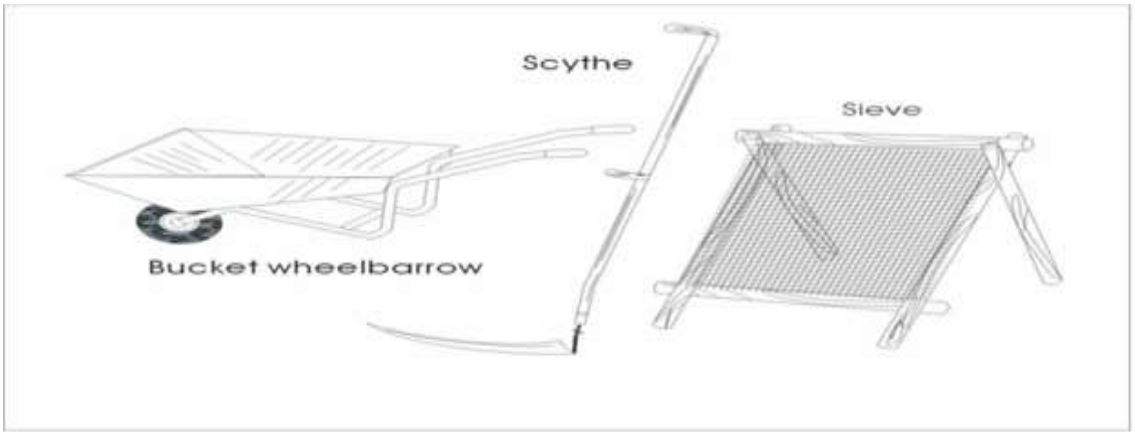
G) Tools for weeding

- ✓ Simple tools like a pointed piece of stick, with strong hammered flat at one end and a handle at the other, are useful for weeding on seed beds & potted stock.

H) Tool for pricking out

- ✓ A small shovel, a flat piece of wood, or simply a spoon is useful to lift germinated seedlings for pots transplanting without damaging their roots.


Shears
Watering can
Spade
Pick axe
Rake
Fork
Shovel
Panga
Some hand tools used in cultivating operations
Short-handled hoe
Axe
Secateurs
Mattock
Hand fork
Long-handled hoe
Trowel
Some hand tools used in cultivating operations


Scythe
Sieve
Bucket wheelbarrow

Self-Check -1	Written Test

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

1. What does horticulture mean? (3pts)
2. What are divisions of horticulture? (2pts)
3. Mention all the materials required for horticultural production and state their ultimate purpose? (3 point)

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information Sheet-2	Checking all materials, tools and equipment

2.1. Checking the materials, tools and equipment

Before and after using the different materials, tools and equipment in the horticultural crop production it is very important. This makes the equipment free from some things unpleasant, undesirable, damaging that happen unexpected during work operation in the work place. If the materials are damaged it is possible to report to the supervisor immediately.

- ❖ Check all the materials, tools and equipment before use, ask question like:-
  - ✓ Are all the materials, tools and equipment ***functional and sufficient*** in number?
  - ✓ Are all ***clean*** of any contaminants?
  - ✓ Check and report to your supervisor how much of the materials, tools and equipment he/she provided in the list are functional and how much of them are faulty.
  - ✓ Are the functional tools and equipment's sufficient enough to the horticultural crop work with the available labour power?
  - ✓ After reporting the faulty and functional materials, tools and equipment your supervisor will guide you what to do if there is insufficiency of tools and equipments for that particular horticultural crop work.
- ❖ To identify all materials, tools and equipments used in horticultural crop works and separate faulty once follow the following steps;-

use a list of materials, tools and equipment provided by your supervisor and then classify them according to their purpose during land preparation, cultivation or harvesting, etc, identify their name by observing shop of horticultural crop or plant science department, describe the use or purpose of each of them, check wear and tears of each materials, tools and equipment, separate materials, tools and equipment which doesn't have best match with handle, broken, have hole on containers, not sharp/can be easily broken, or can't function relative to the purpose of the work, or any other unspecified reasons, count the number of faulty, functional or that can be maintained very easily and finally report to your supervisor the categories of materials, tools and equipment based on their purpose, the total number of each category, the number of faulty materials.

Self-Check -2	Written Test

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

1. List down the importance of checking materials, tools and equipments required for horticultural crop production?(5)

Note: **Satisfactory rating – 2.5 points** **Unsatisfactory - below – 2.5 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information Sheet-3	Demonstrating techniques used loading and unloading materials, tools and equipment's

3.1. Proper handling and transport of materials, tools and equipments

3.1.1. Loading and unloading of materials, tools and equipment

To do the horticultural crop work, we have to properly prepare the working materials, tools and equipments in a working area. In this regarded the required type and their sufficient number is already decided by the supervisor, hence these materials, tools and equipments will be counted and will be loaded on a transporting vehicle and in the working site these materials will be unloaded.

During loading and unloading we should have to take the necessary care for materials, tools and equipments, which can be used for prolong the time of service they can give and also minimize the cost of buying new materials in replacement to faulty once. Therefore the care we should take during loading and unloading includes the following dos and undoes.

- Do not through materials, tools and equipment from ground on to the vehicle
- Do not through materials, tools and equipments from vehicle on to ground
- Hold and place materials, tools and equipments one by one rather than making more than one or two
- When placing materials, tools and equipments on the vehicle place them in stable position
- Place materials, tools and equipments on ground in stable position
- Place similar materials, tools and equipments together on the vehicle while loading and on ground when unloading

As already mentioned in the above, if materials, tools and equipments will not be loaded properly, it is not only the materials, tools and equipments that will be affected, but also the vehicle as well. If we through materials, tools and equipment from ground on vehicle we could break the glasses of the vehicle, we might hurt the loading surface and lead to fast depreciation of the vehicle. We might also create a problem when unloading materials, tools and equipment improperly. Generally, the first principle in loading and unloading materials, tools and equipment is hold the materials, tools and equipments properly in both hands, keeping balance and safely placing the materials, tools and equipments on vehicles or on ground, for these purpose at least two or more people are necessary one or more on the vehicle and one or more on ground.

Self-Check -3	Written Test

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

1. List down the cares undertaken during loading and unloading materials, tools and equipments?(5)
2. List the importance of proper handling materials, tools and equipments?(5)

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information Sheet-4	Selecting personal protective equipment (PPE)

4.1. Personal protective equipment (PPE)

4.1.1. Selecting suitable personal protective equipment (PPE)

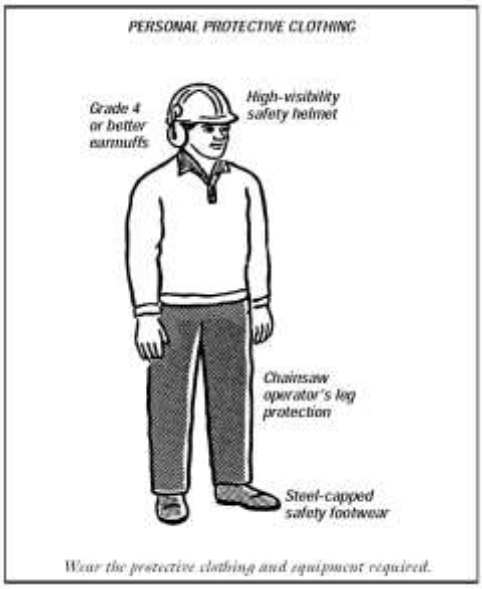
PPE is defined in the regulations as 'all equipment (including clothing affording protection against the weather) which is intended to be work or held by a person at work and which protects him against one or more risks to his health or safety.

- Example:
  - Safety helmets,
  - gloves,
  - eye protection,
  - high visibility clothing,
  - Safety footwear and safety harnesses.
  - Hearing protection and respiratory protective equipment

Provided for most work situations are not covered by these regulations because other regulations apply to them. However, these items need to be compatible with any other PPE provided.

- **Protective equipment that must be available**

❖ These include:



- Overalls.
- Rubber gloves or leather gloves
- Face shields.
- Face mask and ear protectors
- Steel capped boots/shoes
- sunscreen lotion
- Head protection
- Hard hat

Head protection

Foot protection

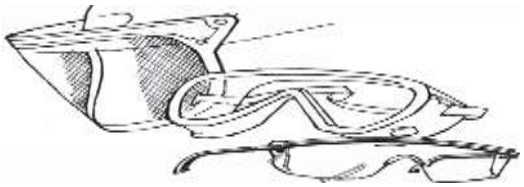
Wear leather boots with ankle protection. *For utility line clearance work*

- **Hand protection**

Wear gloves to protect against cuts, vibration, cold, harmful vegetation(thorn)

- **Eye and face protection**

Wear -approved eye and face protection *for utility line clearance work*



- **Clothing**

. As a general rule, wear

Brightly coloured,

Fire-resistant clothing.

When working near roadways or mobile equipment, wear high-visibility clothing

- **Leg protection**

Wear chainsaw pants that meet the current standard to prevent cuts when using a chainsaw.

- **Communications equipment**

Self-Check -4	Written Test

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

1. Mention all PPE and their use? (5 PTS)
2. Explain the importance of each?(5)

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information Sheet-5	Providing Work support

5.1. What is in-work support?

- **In-work support includes:**
  - To sustain employment – e.g. help with transport to work, assistance with organising caring responsibilities, help with training relevant to the job, etc.;
  - Guidance on work-related matters;
  - Supporting beneficiaries with non-work related issues that impinge on their ability to hold down a job from an adviser/mentor on a formal or informal basis; and
  - Assistance provided to an employer to support a beneficiary's job retention.

- **Key points in-work support are**:
  - Integrated support is particularly beneficial.
  - There are two main times when in-work support is particularly important:

    1 .In the early days of employment; and

    2. at times of crisis in a beneficiary's home and work life.
  - Employment retention (and progression) is eased by:

    1. individuals being in a job they like and which suits their skills and preferred hours of working, and that is relatively easily accessible geographically; and

    2. Employer commitment to sustaining employment of the individual employee.

- Based on the conservation of resources theory, when there is lack of resources in the form of organizational support, employees experience stress in the form of work-family conflict.

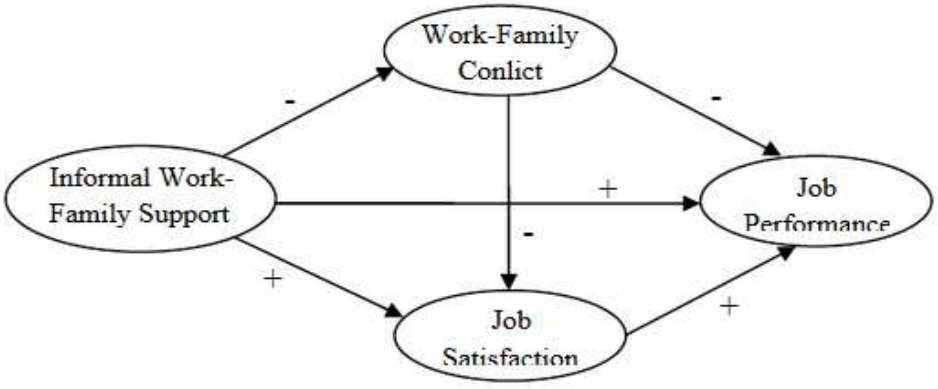


Figure-1.employees experience stress in the form of work-family conflict.

Therefore in giving this horticultural crop work support, there are jobs or activities that might harm your health and safety, hence you need to take care of those hazards by using the appropriate personal protective equipment, and by taking all the necessary care as it has been said "prevention is better than cure***";*** even sometimes the risk may not be cured letting the person to die.

Self-Check -5	Written Test

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

1. Mention the activities included in supporting work and their importance? (5 PTS)

Note: **Satisfactory rating – 2.5 points** **Unsatisfactory - below – 2.5 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information Sheet-6	Identifying OHS hazard

6.1. **Identifying and reporting OHS hazards**

Definition: Occupational health and safety is concerned with health and safety in its relation to work the working environment.

Aims of occupational health

Occupational health should aim at:-

- The ***promotion and maintenance*** of the highest degree of physical, mental and social well being of workers in all occupation
- The ***prevention*** amongst workers of departures from health caused by their working conditions.
- The ***protection of workers*** in their employment from risks resulting from factors adverse to health.
- The placing and maintenance of workers in an occupational environment adapted to his physiological and psychological capabilities and
- To summarize the adaptation of worker to man and of each man to his job.

6.1.1. Work place hazards

The various work place environmental factors or stresses that may cause sickness, impaired health, or significant discomfort or inefficiency in works may be classified as chemical, physical, biological and ergonomic.

Chemical hazards include the followings;

A. Dusts Are substances consisting of solid particles that have been reduced to small size by some mechanical process. E.g. ***silica, coal, asbestos, lead cotton, wood, cement***. Dust from earth, hay and straw is not in itself very dangerous for the lungs because it is no siliceous as mine or quarry dust. It may, however, hamper breathing, may also hamper perspiration by clogging the pores of the skin, may be ***dangerous for the eyes***, and may carry other contaminants(fungi, bacteria, and so on) which cause illness.

B. Mist

Suspension in air of very small drops usually formed by mechanical means (atomization) or by condensation from the gaseous state.

E.g. acid mists

C. Gases Substance that will diffuse to evenly occupy the space in which it is enclosed. A gas does not appear in the solid state or liquid state at standard temperature and pressure.

E.g. **chlorine, sulphur dioxide, ethylene oxide, ozone** etc.

D. Fumes

Substances composed of solid particles formed by condensation from a gaseous state, these particles are microscopically small (odorous)

E.g. ***smoke***

E. vapors Gaseous form of a substance that is normally a liquid or solid.

E.g. ***alcohols***

❖ **Physical hazards**

All work places encounter some agents of the physical environment which have potential to present health hazards at work.

The ***physical hazards*** can be:

1. Noise: absorbed through the ear:

Noise from farm tools and machinery can cause permanent hearing loss. Hearing loss may be temporary at first, but repeated exposure will lead to permanent damage. The damage can occur gradually over a number of years and remain unnoticed until it is too late. Some noises, such as gunshots are so loud they can cause immediate permanent damage: Once hearing is gone, it is gone forever and hearing aids are of little help. They can make speech lauder but they can't make it clearer.Typical farm noises that can damage hearing include: Tractor and Chainsaw etc.

Protective equipment

- Where noise exposure cannot be reduced, hearing protection should be worn. e.g. ear muffs and ear plugs
- try on earmuffs before buying ,to ensure comfort and a sound –proof fit
- Clean and maintain re-usable hearing protectors, replace worn or damaged parts .keep protectors near the area of noisy activity.

2. Vibration

A particular source of danger to which man is exposed is the mechanical vibration of moving machines.

3. Heat

The ill effects of work in a hot climate are associated with the deficiency or exhaustion of the thermoregulatory mechanisms. In a ***hot climate***, beside the heat resulting from metabolic processes, the organism has to get rid of heat from the environment also.

❖ **Biological hazards** some workers are subject to specific health hazards relating to the nature of their work with biological materials or from working in environments where micro-organisms may around .some biological hazards of work place include: ***bacteria, fungal, virus*** etc.

Self-Check -6	Written Test

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

1. Explain OHS? (5 pts.)

Note: **Satisfactory rating – 2.5 points** **Unsatisfactory - below – 2.5 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Operation Sheet-1	Prepare materials, tools and equipment for horticultural production work

- To identify all materials used in horticultural production works and separate faulty once, follow the following steps:

1. Identify all the materials, tools and equipment physically one by one and
2. Describe the use or purpose of each materials, tools and equipment
3. Check whether each materials, tools and equipments are functional/non- functional
4. Count the number of faulty and functional materials, tools and equipment
6. Finally report to your supervisor the categories of materials, tools and equipment

LAP Test-1	Practical Demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions:

- **You are required to perform any of the following tasks:**

Task 1.1. Identify the categorize materials, tools and equipment for horticultural production work from the storing room?

Task 1.2. Inspect all the tools and equipments in each category and make sure that you can separate them with any kind of fault and count their numbers?

Task 1.2.Report about profile of them?

Operation Sheet-2	Loading and unloading materials

Objectives

- ✓ To take care for materials
- ✓ To avoid hazards

Materials required

- ✓ Vehicle or any transporting system
- ✓ Personal protective equipment's
- ✓ Hand cart

Procedures

1. First go to the store and check that the different agricultural crop work materials are already there the vehicle provided and you are also ready to load materials by wearing the suitable personal protective equipments
2. Then group yourself in pair of two person or more persons
3. Open the back or the side of the carriage for easy loading if necessary, for loading the materials you should take care of the vehicles glasses or the vehicle could be carriage and a tractor.
4. Let one person or one group be on the vehicle and the other group on ground
5. Let the group on ground take materials from store and give it for his counterpart on the vehicle, note material should be taken one by one, or if suitable two by two or more if suitable
6. Let the group or person on the vehicle receive the material from the person on the ground and place it on the vehicle. Note the materials should be placed orderly and safely, by note throwing the materials on the vehicle.
7. Finally close the back side of the carriage and move to the site of agricultural crop work or unload the materials
8. Use the same procedure above for unloading

LAP Test-2	Practical Demonstration

Name_____ Date: _____

Time started: _____ Time finished:_____

Instructions:

Task 1.Identify the type of personal protective equipment used in Cleaning and maintaining Tools and equipment activates.

Task 2.show the procedure required for unloading

Reference of learning guide-33

1. Botanga, M., Biotechnology and cassava processing in Africa, Food Technol. 49(1):86 (1995).

2. Booth, R. H., Storage of fresh cassava (Manihot esculenta) II. Simple Storage technique, Exp. Agric. 13:119 (1977).

3. Horticultural crop material's transportation. https://www.youtube.com accessed 23/09/19

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5. FAO (1984). Guide to establishing small packing stations for fruit and vegetables in rural areas. FAO, Rome.

HORTCULTURAL CROP PRODUCTION

Level-I

#Learning Guide -34

Unit of Competence:-Undertake Horticultural Production practices

Module Title:-Undertaking Horticultural Production practices

LG Code: AGR HCP1 M09 LO2-LG-34

TTLM Code: AGR HCP1 TTLM1219v1

LO2: Undertake horticultural production work as directed

Instruction Sheet-	Learning Guide 34

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

- Providing Instructions and directions
- Undertaking work
- Carrying out interactions with other staff and customers
- Observing enterprise policy and procedures
- 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 –**

- Provide Instructions and directions
- Undertake work
- Carry out interactions with other staff and customers
- Observe enterprise policy and procedures
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6. If you earned a satisfactory evaluation proceed to “Information Sheet 2”. However, if your rating is unsatisfactory, see your teacher for further instructions or go back to Learning Activity #1.
7. Do the LAP Test on:52

Information Sheet-1	Providing Instructions and directions

1.1. Instructions and directions for horticultural crop production

Before horticultural crop seed/seedling is planted, based on production plan, the appropriate site must be selected and prepared in some fashion to provide an adequate seed bed. Land preparation entails removing vegetation and losing the soil to facilitate seed germination and root penetration. You are expected to prepare tools; equipments used for land preparation then according to work site procedure which is instructed and directed by your supervisor land preparation like clearing the site, preparing beds, holes, ploughing the entire land should takes place for horticulture production. Your supervisor will give you information about the size of the bed, hole size, method of ploughing, clearing methods, spacing between rows and plants.

Self-Check -1	Written Test

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

1. List the instruction required for horticultural crop production? (5 pts.)

Note: **Satisfactory rating – 2.5 points** **Unsatisfactory - below – 2.5 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information Sheet-2	Undertaking work

2.1. Planning for horticultural crop production

Requirements for the horticultural crop work to be undertaken should be interpreted**.** The method, time and order of cultivation should be also identified and interpreted from the planting plan. Planting plan may include for those crops like fruit and vegetable to be cultivated. Exposure hazards should be identified, and suitable controls should be implemented. Systems and procedures for preparing sites for planting, as well as working with and should also be in place. Environmental conditions should be controlled e.g., keeping moisture levels as low as possible will reduce the likelihood of fire.

- The environmental implications of cultivating the site and detrimental effects such as erosion, loss of moisture, debilitating germination rates, and polluting water bodies etc should be identified, and, if necessary, responsible action should be taken.

Fig-1 design of horticultural crop activities

- Horticultural crop works should be conducted up on appropriate instructions and direction. In this activities, there are a serious of steps that must followed by the workers.

2.1.1. Site selection

The site location of the farm is the most basic requirement of crop production. It is the first activity that should be considered before land preparation. The location of farm depends upon several factors.

Factors considered during site selection for horticultural crops

A. Ecological factors:

※ **Climate:**

The climatic requirements of the crop which are to be produced at the farm will decide the location of the farm. Rainfall(it is the most important climatic factor influencing agriculture in the tropics as it has biggest effect in farming systems, sequence & timing of farming operations. The distribution and reliability of rainfall are more crucial factors determining vegetation) and temperature (Temperature is closely connected to radiation and elevation. Each crop has its own approximate temperature range, i.e its maximum, optimum and minimum temperatures for growth & flowering. Most crops make their best development between 15^{o}C to 32^{o}C.Generally climatic factors mainly rainfalls, temperature, Sunlight, relative humidity, Photoperiod and wind.

- **Avoid** areas with extremes of climatic condition: (High temperature; High rainfall; High ice, storms**…).**

B. Topography: Select- an area with gentle slope (**2~3% slope**). The land should be flat or slope gently. Land with a steep slope will later create erosion problem. If hilly; it's very hard for management. Earth & fertilizer or manure will be easily flow away

C. Soil:

It is one of the most important factors for selecting site. The site must have soil that is good for crops. If the land is to be cropped for the first time, the fertility should be high enough to sustain crop production for 2-3 years before the farmers move away (shifting cultivation) or needs to apply fertilizers (in continuous cropping).The ideal soils are those in which various soil particles (sand, silt and clay) occur together in desirable proportions. Main requirement of soil for growing crops are: Fertile soil, Medium clay loam or sometimes sandy loam, and well-drained soil.

D. **Irrigation water and market:** is one of the best criteria for choosing site for horticultural crop production.

-The site should be next to the area where water is available all the year.

-Near ponds; springs; rivers; lakes…

E. **Economic Factors:**

- **Land availability**

The site selected should be **large enough** to allow the production of intense number of horticultural crops. If possible, try to avoid selecting the land, which has been claimed by many individuals.

- **Lab our & Material supply:**

Relatively ample and cheaper labours could be available nearby. Also, **basic tools and materials** have to be available.

- **Accessibility and facilities:**

※If we are establishing a permanent nursery especially, the site selected should be near the **main road** and should be connected to the main road by any means.

※These should have **transport facilities** (also), **electricity supply** and **housing facilities** for the workers near the site (if possible).

F. Social factors:

There are many factors which influence the establishing and management site, such as government policy; local economic situation; education background; security situation; neighbors' future relationship….etc.

G. Biological factors:

In selecting site, one has to consider the presence of serious insects, disease, or weed pests, as these can affect the growing seedlings seriously in the site.

2.1.1.1. Preparing the cultivating equipment

The vehicles and equipment required for site cultivation should be selected and prepared according to the planting plan and organization guidelines before operation. *Vehicles* might include tractors, trucks and four-wheel drive vehicles. *Equipment* might be mounted or trailing and may include ploughs (mould board, local plough or "maresha", harrower, disk, chisel etc), cultivators, scarifiers, fertilizer spreaders, spraying, equipment, crop/stick puller, cultivators, buster, disc, lister, riger, mulcher, tandem or offset discs, or rakes.

- The vehicles and equipment should be serviced, adjusted for the conditions and worn parts should be replaced to ensure reliability during cultivation.
- All containers, leftover fluids, waste and debris from the maintenance and servicing work should be disposed of safely and appropriately.

2.1.2. Land preparation

A. Land clearing

Once the site for the farm has been selected and acquired, the farmer proceeds with clearing. This involves cutting down the vegetation that is growing on the land and then removing the dead plant material from the cropping area. In traditional practice, the plant material is cut down with cutlasses, axes and saws.

⌘ **Objectives of site clearing:**

- To increasing the water containing capability of the soil, decreasing soil water evaporations; improving soil's water conditions.
- To enlarging soil porous degree; increasing soil temperature; enhancing micro-organism activities in soil; accelerating soil weathering in order to release the potential nutrients of the soil.
- To destroying weeds and insect pests.

- To effectively improve the relationship of water, fertility, aeration, heat in soil; provide good circumstances for seed-germination and root-growth.

⌘ **Purposes of clearing: -**

- ❖ Avoiding competition of nutrients, water, light and air.
- ❖ Reduction of shading.
- ❖ Eliminating the shelter of pests and diseases.
- ❖ Enhancing good vegetable crop development

⌘ **Materials to be removed from the vegetable site:-**

Unwanted vegetation (trees, bushes, weeds, etc.), Tree roots, Stones, Stumps

⌘ **Clearing Operations: -**

- ❖ Removing shrubs and trees.
- ❖ Cutting, burning, and burying all diseased vegetation.
- ❖ Removing stones and larger pebbles.
- ❖ Keeping few trees to provide shade for compost heaps and the nursery.

⌘ **Avoiding cleared materials from the site:-**

- ❖ Burning waste, woods and diseased vegetation
- ❖ Use the crop trash for making compost heaps.

⌘ **Uses of cut trees and shrubs:-** Fences, Stakes, Firewood, Construction materials

⌘ **Tools used for clearing a site**

Machete, Pickaxes, Cutlass, Saws**,** Sickle, Shovel

⌘ **Methods of Site clearing :**Manual clearing, Burning (fire),Machine clearing and Chemical

⌘ **The methods depend on**

a) Manual methods are applied if: Labour is available and cost effective, the terrain is inaccessible, and Vegetation is very light in terms of density (like shrub, grasses).

b) Mechanical clearing

- Used to clear large shrub and tree
- Site can be cleared with bulldozer, brush cutters.

c) Chemical methods

- By applied chemicals (herbicide, Sodium Arsenate)
- After killed the plant through application of chemical, then burning

d) Burning

- The cheapest method, the vegetation removed without any doubt.

⌘ **Consideration during burning**

- First, provide fire line (firebreak) perpetually erected to wind direction.

- Calm weather 10~15cm/ hr wind speed.
- The vegetation is simple or only grass.
- The topography cannot be steep, erodible areas.

B. Leveling

The leveling of cleared land is necessary for performing tillage operations for seedbed preparation. It will reduce erosion problem (wind and water). The irrigation water can be utilized is Judicious way in whole cleared field. Bulldozers are used to level the field while performing clearing operationThe most important aim of levelling is to determine the relative heights of different objects on or below the surface of the earth and to determine the undulation of the ground surface.

C. Tillage

Refers the mechanical operation of soil for creating a friable surface that will enable seeds to germinate and plants to grow and develop in an ideal state. It includes all operations and practices that are used for the purpose of modifying the physical character of the soil. Tilling the soil is the most difficult time consuming and costly operation in field crop production. It typically involves (1) plowing to "till" or dig-up, mix, and overturn the **soil**; (2) harrowing to break the **soil** clods into smaller mass and incorporate plant residue, and (3) leveling the field. Initial **land preparation** begins after your last harvest or during fallow period.

❖ **Tillage is classified into**:

- Primary tillage and Secondary tillage

✓ **Primary Tillage**: - is a relatively deeper operation that leaves the surface rough.

It used for cuts, breaks, and inverts soil and Buries trash and mixes into tilled soil

✓ **Secondary Tillage**: - is an operation for stirring the soil at comparatively shallow depth. It is lighter and finer operation on the soil after primary tillage.

❖ **Preparing the land for planting:-**

- Tillage operations are aimed at producing & maintaining good tilth.
- Tilth is the term used to express the physical condition of soil resulting from tillage.
- A soil with good tilth will be mellow, friable and adequately aerated.
- The following tillage operations are carried out to prepare land for growing crops.

❖ **Identifying Types of seed beds:-**

i. **Raised seed beds**:-

Prepare 120-150cm wide beds and 10-15 cm high from the ground level for vegetables. Raised broad bed with different size can be prepared by BBM plough or

Broad Bed Maker These beds are mostly practiced in wet tropics to encourage drainage.

Fig-1 raised type of seed bed

ii. **Sunken seed beds:**

In low land dry tropics, sunken and flat beds are preferred to conserve moisture and reduce evaporation.

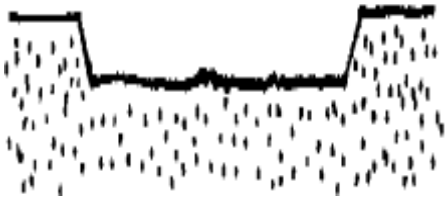


Figure 2.sunken type of seed bed

iii. **Ridges and furrows:**

Ridging involves the collection of soil into elongated heaps called ridges. The distance between ridges & furrows is variable but is usually 30-70cm for most vegetable crops. In order to further discourage flow of water within the furrows, cross ridges or tie ridges are made across the furrow at suitable intervals to connect one ridge to the next.

Figure 3.ridges and furrows type of seed bed

Factors determining the choice of type of seed bed:-

i. **Soil characteristics: -** Heavy clays are generally difficult to work particularly during the wet season, therefore raised beds are preferred. Since sandy soils have less water holding capacity, sunken beds can be used. Ridging has useful measure for erosion control particularly on sloping land.

ii. **Water availability**: - Use raised beds in heavy rainfall areas whereas sunken beds will be suitable for low rainfall areas. In areas where there may be periodic water shortage, ridge and furrow soil formation should be used rather than broad beds as this will give the plants better access to water.

iii. **Type of plants to be cultivated**: - Ridge and furrows are preferred for root and tuber vegetables; whereas flat beds are suitable for most field crops leafy vegetables and cucurbits.

❖ **Establishing good soil condition:-** Loosening the soil to the right depth, Moistening the soil and aerating the soil.

❖ **Soil conditioning: -** Any crop gives its best yields in suitable soil conditions in regard to texture, water holding capacities, nutrients, and pH and so on.

Types of soil conditioning:-

✓ **Organic manuring**:-used for: the improvement of soil structure ,water retention capacity within the root zone,increase aeration of the rooting medium,Lower bulk density and increases holding of other major nutrients like nitrogen and phosphorus.

✓ **Chemical fertilizers: -** Inorganic fertilizers like as organic manures used for most type of crops growing. Eg. DAP and REA are useful.

✓ **Gypsum and limestone: -** Used for reclamation of alkaline and acid soil respectively.

✓ **Crop rotation:** - used for improving soil fertility and Preventing the buildup of soil borne organisms.

2.1.3. **Seed sowing: -** Sowing is the placement of a specific quantity of seed in the soil at optimum position for germination and growth.

3.1.1. Time of sowing

Sowing should be timed properly so that seedlings can attain the right size (shoot length).

In many areas of Ethiopia the rains start in May or June and planting starts in June or July.

A large amount of seed should be sown into seedbeds in several batches at about 7 to 10 days intervals, so that transplanting can be done smoothly when the seedlings are ready for transplanting.

❖ The following factors should be considered when decide a proper time for Sowing a crop:

Rainfall, Cropping Systems, Temperature, Day length, Occurrence of diseases and pests, Availability of labour and equipment's and Time taken to maturity.

➡ **Method of Sowing**

Direct sowing into Pots versus Seed bed sowing

Formerly seeds of most species used to be sown into seeds beds and seedlings were then transplanted into beds or containers. Nowadays, there is a tendency towards more and more direct sowing into pots, to eliminate the labor consuming operation. However, for expensive seeds that are small in size, direct seeding is not advisable.

- **Seedbed sowing should be done when:** Seed is expensive or scarce, Germination percent or germination period is not known and Seeds takes a long time to germinate (occur over a period of many weeks or months).

In seed beds where seeds and small seedlings are in a limited space it is easier to control watering and shading than in transplant beds. It is always better to sow the seeds of a new or little known species into the seedbed.

- **Direct sowing onto pots can be done when:**
  - Germination percent is known to be fairly high
  - Germination period is short
  - Transplanting would cause damage or deaths to seedlings, as it sometimes the case in everyday areas.
  - The species develops a long sensitive taproot
  - There is a shortage of skilled workers to do the transplanting.

Direct sowing leads to wastage of pots if germination takes a long time. The plastic pots start to disintegrate, and the soil in the pots becomes leached of nutrients owing to many weeks of watering. In some nurseries the empty pots, where germination failed, are used for short-duration seedlings such as potting of eucalyptus seedlings.

- **Sowing Techniques** :-

a. **Broadcast Sowing onto seedbeds**

This is now a days the most common method of sowing onto seedbeds. It is used to sowing seeds of all sizes, but is best suited to sowing of small seeds. The seedbed shall be leveled, watered the day before sowing; seeds are then broadcast sown as evenly as possible. Mixing the seeds with an equal or double amount of fine sand and sowing makes sowing evenly possible. The seeds are then covered with seedbed soil mixture or with sand at a depth of about twice the thickness of the seed.

Figure 2.broad casting methods

b. **Drill method**

This method has been practiced mainly with species having larger seeds, but also with smaller seeds when very even distribution of seeds is desired in sowing.

The distance between drills is usually about 10 cm. The plants are later thinned so that the distance between the plants is 5-10 cm.

Figure 2. Drill method

c. Direct sowing onto the polythene tubes

The direct sowing onto pots has become increasingly popular. It eliminates the time consuming operation of transplanting which causes slowed growth and even seedling mortality. Fertilizers have been observed to prevent or slow down germination, but this is not usually a problem in Ethiopian nurseries where little or no fertilizers are used. The detrimental influence of the fertilizers can be prevented by putting a few centimeters thick layer of unfertilized soil mixture on top of the top soil mixture as barrier between the fertilizer and seed. The seeds are placed in the middle of the pot, pressed down and covered with soil so that the covering layer is about the ticks of the seed.

Figure .3 Direct sowing methods

d. Mulching and Nursery bed shades

Mulching may be defined as mainly artificial modification of the soil surface. It can be done in many ways, such as mulching by ordinary cultivation and covering of grass, leaves straw sawdust, sand etc. The primary purpose of mulching is to conserve soil moisture by lowering soil temperature and by physically blocking the loss of water.

e. Nursery bed shades

Germinating seeds need no light but only warmth and moisture. Of course, seedlings need protection from drought, cold wind, heavy rain and burning sunshine. For these reasons, shades must be provided especially when the seedlings are young. On the seedbeds, germinating seeds and tiny seedlings need protection against both sun and heavy rains. The grass is removed after germination has started. Simple shades for private peasant nurseries can be constructed with any available material. Forked sticks can be used for support shades, which is 60-100 cm from the ground. Too low shades make watering difficult. Depending on the direction of aspect, the shade facing the strongest sunshine is usually shorter than the one facing relatively less baking sun.

2.1.4. Horticultural crop protection and management

- **Orientation of shades**

In order to obtain the maximum effect of the shade, the beds should be oriented east at west 45^{0}. During the period from April to September, when the sun is north of the equator, the shades should be sloping down to the north. During the rest of the year, which is the main nursery period with most species in Ethiopia, the shades should slope down towards the south;

- **Watering Seedbeds**

It is important that he seedbed is kept constantly moist down to a minimum of 5-6 cm depth. The bed must not be allowed to get dry as drying would slow down germination and kill germinating seeds. Watering should be done frequently, at least twice a day, in small quantities. The amount and frequency of watering depends on the soil mixture in the bed and on weather.

- **Transplanting**

Any plant that is growing in the seedbed is called seedlings. A plant, which is raised in a traditional bed where it was grown directly as well as from direct sowing into pot are also called seedlings. If a seedling is lifted from its bed and planted to another bed or pot in the nursery it is thereafter called “transplant” Transplanting is a crucial stage in the life of a plant. It always causes a shock to the seedling, even when carefully done and bad transplanting easily kills the seedling.

- **Size of seedlings**: transplanted immediately after the seed coat appears above the soil surface at the “match stick” stage. There appears to be nothing to be gained by leaving them longer in the seedbeds.

- **Root Pruning**

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. The seedlings grown in beds and which did not receive root pruning develop roots that are long, and intertwined with roots of neighbors.

- **Cultivation and weeding.**
  - **Cultivation**

Satisfactory growth of seedlings may be expected when the soil is in good physical condition. Cultivation (working of the soil surface) is the technique of maintaining good physical condition of the soil in pots and beds during the growing season. Repeated wetting and drying of the soil surface creates a compact crust, especially if the soil is of clayey type cultivation breaks the crust, permits adequate aeration and improves absorption of water. Generally the interval between cultivation should not more than one month. Seedlings grown

in pots and beds can be cultivated using flat sharpened wooden sticks or small hand tools. Cultivation must not be done too deep, as this would damage seedling roots.

- **Weeding**

A weed is a plant growing where it is not wanted. Weeds compete with plants for water and soil nutrients. They may also harbor insects or diseases. Therefore, weed competition must be eliminated. The principal methods of weed control are manual and chemical.

- **Pest control**

Pest is any living organisms which adversely affect human benefits. However, Control pests (disease, weeds and insects) control activities include: physical, cultural, biological and chemical methods.

Self-Check –2	Written Test

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

1. list the factors considered during site selection for horticultural crops (5)
2. list the activities of horticultural crop protection and management(5)

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information Sheet-3	Carrying out interactions with other staff and customers

3.1. Work Interactions with other staff and customers.

Before cropping any plant you have to contact with agricultural experts, neighbors' farmer, staff members and customer to have common understanding. In addition to this assessing the socio-economic of the people who live around the production area is necessary to know the need of the client. The interaction between nursery conductors (Experts) and workers, workers with workers, should be available between this part (Nursery producing planting material) and to whom these products are going to be forwarded, mostly this "traditional interactions" can be in practice are infarction with customers (product users) and also with other staffs (knowledgeable and skilled persons) from different organizations related to the demand of nursery products.

※ **Factors that affect work interaction with other staff and customer**:

Socio-economic of the people, Productivity of the area, Crop type of the neighbors farmers' land, Behaviors' of neighbors farmer, Quality of the product, Adjusting planting time, Material requirement and Cooperate training. For example altering sowing date deprive pests (control pest) from their food but planting time require negotiation between farmers in a given locality because let say one farmer plant sorghum crop early in the seasons others farmer may plant after the first farmer complete planting of sorghum so the first farmers' plant mature early while you compare with the surrounding so if one pest (pathogen) rise at this stage all pests concentrate only in the first farmer because other crops remain un mature. So to avoid such case we need to have interaction with the neighbors' farmer. Planting time creates difference between susceptible stages of plant and attacks this stage.

- ⌘ Generally, having good interaction with other staff and customer can be used for the following porpuses:
  - ✓ Communicate the ideas and information about the job tasks and problems with other members in the work team and supervisor.
  - ✓ Work with others and team and cooperatives with other staff in completing nursery task.
  - ✓ Having positive interaction with customers and staff members in the work place is very important.

Self-Check –3	Written Test

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

1. Write down the porpuse of having good interaction with other staff and customer(5)
2. List factors that affect work interaction with other staff and customer(5)

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information Sheet-4	Observing enterprise policy and procedures

4.1. Enterprise policy and procedures in relation to workplace practices, handling and disposal of materials

Any enterprise has its own policy and procedures that helps to guide the work operators how to use their time, how to perform their work, how to handle their tools, materials and equipments and other activities. Therefore, the employee before starting their work, they should know or understand the enterprise policies and procedures to perform their work properly with in proposed time. Knowing the policy and procedures of the enterprise may support the employee from doing wrong things.

Un safe working conditions and practices or machenes that are unsafe to oprate must bereported to supervisors,immediatly.workers must also report to their supervisor any injuries that occur at work place. In absence of approprate regulations,standards,of nationally recognized professional health and safety organizations will serve as a guide.The purpose of agricultural safety policy is to create on over all awareness of the hazards of the job as wellas to provide guidelines for agricultural practices. Agricultural workers are required to review familiar and understand the information set by the policy.

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 (SWPs) are a control. SWPs must be developed to address specific company work activities, tools and equipment.

- Every activity must be carried out in accordance with a developed safe working Practice.
- The safe working Practice shall follow a logical sequence of progression.
- Consider what must be done before the task starts?
- How the task is done?
- What training is needed?

4.2. Safe job procedures

Safe job procedures are a series of specific steps that guide a worker through a task from start to finish in a chronological order. Safe job procedures are designed to reduce the risk by minimizing potential exposure.

4.3. Developing safe work practice

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. Safe job procedures are usually developed by management and workers as a result of a Hazard Assessment, accident investigation and/or as a supplement to a safe work practice.

Self-Check –4	Written Test

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

1. Explain Safe work practices and its importance (5).

Note: **Satisfactory rating -2. 5 points** **Unsatisfactory – below- 2. 5 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information Sheet-5	Reporting problems or difficulties

5.1. **Challenges and Opportunities for Horticulture**

During the process of landscape work operation, the workers and the working environment may face certain challenges; to tackle these challenges reporting of problems and difficulties is very important. This is because inconvenient situations may face the workers and the people those settled around the working environment. Related to the above conditions and performance to achieving the goal of the task, problems and difficulties are practically expected to be seen. These situations should be immediately reported to directly concerned bodies to correct and retain the work functional, productive and safe.

Horticulture and the closely associated horticultural sciences are critical elements of modern society in most developed countries and in many developing countries around the world. The contributions of horticultural crops, and their related industries, to society at large are very considerable, generally taken for granted but often poorly understood or acknowledged.

These contributions include:

• The ongoing provision of safe, healthy and nutritious food, generally to a very high quality and in abundant quantities in many countries;

• The provision of many essential vitamins and minerals, assisting consumers to achieve a balanced diet;

• The contributions to economies through export-related activities and the sophistication associated with all elements of the supply chain. This is becoming increasingly important in developing countries who are contributing more frequently to food supply to developed countries, especially in Europe and North America;

• The viability of rural communities directly through employment and the sustainability of service provision—so retaining populations that justify the delivery of services such as health and education;

• Overall wealth generation through the activities of those involved with production, processing, marketing, servicing, and related sectors

• The contributions to leisure, sport and recreational activities through specialized areas such as turf management, landscaping and the creation and management of private and public parks and gardens.

5.1.1. Problems during horticultural crop production work.

※ To undertake horticultural crop production work there may be some difficulties these:

- Shortage of skilled manpower
- Inadequate of horticultural crop production work materials, tools and equipments
- Absence of good varieties

- Attitude of the farmers towards the crop
- Socio-economic and culture of the people
- Shortage of water
- Environmental pollution
- Disease, pests, rodents
- Incidence of the weed

5.1.2. Reporting work difficulties to the supervisors

Reporting is the way of communicating the responsible person and the concerned body (supervisors).While the employees repot his/her work he/she has given the following important information should be included; introduction, model activities, strengthenss, weakness and problems encountered during perform the task and their solution under taken, accidental problem happen all the necessary requirements.

Report is important for:

- Giving model works for others;
- The employees get feedback from his supervisors
- Evaluation, the performed tasks with their given plan
- To facilitate the work
- Providing the given tasks based on the enterprise guidelines
- To identify the problems with the work and to find the solution

Self-Check –5	Written Test

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

1. list the difficulties to undertake horticultural crop production work (5)
2. write down the importance of reporting difficulties with work of horticultural crop production(5)

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Operation Sheet-1	Under taking work

1. Site selection

It is the first activity that should be considered before land preparation

Material required:-

- Personal protective equipment's
- Note book and pencil
- Metrological data
- Water level,rope and pegs
- Data of soil fertility
- Pre-history of the site

➥ Objective of site selecting:-

- To obtain good agro-ecology of the crop
- To increase the quantity and quality of crop yield

➥ Procedures of site selecting:-

- ✓ Identifying type of horticultural crop you need to produce
- ✓ Obtain the pre history of the location and Metrological data
- ✓ Based on the type of crop, pre-history of the land and metrological data select the good site for the production.

1.1. Land preparation and sowing/planting selected horticultural crop seed.

It is the activity required for creating favourable condition of the land for the crop to be sown.

Sowing is placing specified quantity of seed on specified place at optimum depth and right time.

Material required:-

- Materials, tools, machineries and equipment
- Sickle,spade,shovel,rope,rake and pages
- Mater tape, fire, Pick axes,machete and saw
- Tractor, wheel barrow, water cane, dry grass, wood trees…etc

Procedures:-

- Clearing the selected site
- Leveling(if necessary)
- ploughing
- Preparing seed bed (up on type of crop to be sown and location…)
- Sowing/planting the crop type to be planted based on their optimum space, depth…etc.
- Watering (if necessary…)

- Making mulching/shading based on their requirement
- Check as all activities are completed in correct manner, storing materials, tool and equipment and disposing waste materials.
- Reporting your work out come for the person it may concern (your supervisor).
- Keep the record (filing the document properly).

1.2. Transplanting seedling into pot

Materials required:

Seedling

Polyethylene

Shovel

Spade

Water

Water can

- **Transplanting into pots is done following the following procedure below;-**

1. Erect a large portable shade above the bed.
2. The trans-planters should work in pairs on opposite side of bed.
3. A hole is made with the dibble in the center of each pot.
4. The root of seedling is placed carefully in the hole, and the soil is pushed toward the root with dibble to make sure no air is left around the root. Any air pocket prevents the establishment of the plant in the soil.
5. If the seedlings have left too long in the seed bed the root should be trimmed back to 2-3 cm. It is important that the roots hang straight in the hole. Twisted root systems do not produce satisfactory seedlings.
6. The seedlings are placed at the same depth or slightly deeper than they were in the seedbed.

Operation Sheet-2	Loading and unloading materials

Objectives

- ✓ To take care for materials
- ✓ To avoid hazards

Materials required

- ✓ Vehicle or any transporting system
- ✓ Personal protective equipment's
- ✓ Hand cart

Procedures

Before loading and unloading your materials, tools and equipments you will be provided with horticultural crop production materials, tools and equipments in the store, vehicle on which to load them and suitable personal protective equipment.

Procedures

1. First go to the store and check that the different agricultural crop work materials are already there the vehicle provided and you are also ready to load materials by wearing the suitable personal protective equipment
2. Then group yourself in pair of two person or more persons
3. Open the back or the side of the carriage for easy loading if necessary, for loading the materials you should take care of the vehicles glasses or the vehicle could be carriage and a tractor.
4. Let one person or one group be on the vehicle and the other group on ground
5. Let the group on ground take materials from store and give it for his counterpart on the vehicle, note material should be taken one by one, or if suitable two by two or more if suitable
6. Let the group or person on the vehicle receive the material from the person on the ground and place it on the vehicle. Note the materials should be placed orderly and safely, by note throwing the materials on the vehicle.
7. Finally close the back side of the carriage and move to the site of agricultural crop work or unload the materials
8. Use the same procedure above for unloading

LAP Test-1	Practical Demonstration

Name_____ Date: _____

Time started: _____ Time finished:_____

Task 1. Select site for production of horticultural crop production

Task 2.preparing land for sowing/planting

Task 3.prepare seed bed and sow/planting selected crop seed

Task 4. Show the step of transplanting seedling into pot

LAP Test-2	Practical Demonstration

Name_____ Date: _____

Time started: _____ Time finished:_____

Task1. List the procedure of loading and un loading of material required for horticultural crop production

Refrence of #LG-34

1. Ingram, J. S., and J. R. O. Humphries, Cassava storagea review, *Trop. Sci. 14:*131 (1972).
2. Scherry, R. W., Manioc: A tropical stuff of life, *Econ. Bot. 1:*20 (1947).
3. Ghosh, S. P., T. Ramnujam, J. S. Tos, S. N. Moorthy, and R. G. Nair, *Tuber Crops,* Oxford and IBH Publishing Co., New Delhi, 1988, p. 87

HORTCULTURAL CROP PRODUCTION

Level-I

#Learning Guide -35

Unit of Competence:-Undertake Horticultural Production practices

Module Title:-Undertaking Horticultural Production practices

LG Code: AGR HCP1 M09 LO3-LG-35

TTLM Code: AGR HCP1 TTLM1219v1

LO3: Handle materials and equipment

Instruction Sheet	Learning Guide 36

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

- Store waste material
- Handling materials, equipment and machinery
- Maintaining 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 –**

- Handle materials, equipment and machinery, Maintain, clean ,safe work site and Store waste material

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described in number 3 to 5.
3. Read the information written in the “Information Sheets 1”. Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
4. Accomplish the “Self-check 1,2 and3” **in page -.** 57,62 and 66 respectively.
5. Ask from your teacher the key to correction (key answers) or you can request your teacher to correct your work. (You are to get the key answer only after you finished).

Information Sheet-1	Storing waste material

.2. Storage of waste material and debris

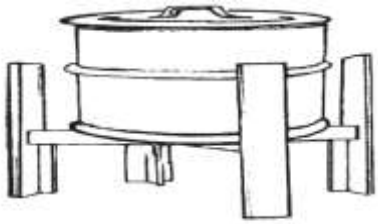
Waste is a wide ranging term encompassing most unwanted materials, defined by the Environmental Protection Act 1990. Waste includes any scrap material, effluent or unwanted surplus substance or article that requires disposal because it is broken, worn out, contaminated or otherwise spoiled. The law says you must keep every part of your construction site in ‘good order’ and every place of work clean”. Waste is defined as "refuse from places of human or animal habitation."

The World Book Dictionary defines waste as "useless or worthless material; stuff to be thrown away." Unfortunately, both definitions reflect a widespread attitude that does not recognize waste as a resource. “Zero Waste America” defines waste as "a resource that is not safely recycled back into the environment or the marketplace." This definition takes into account the value of waste as a resource, as well as the threat unsafe recycling can present to the environment and public health. The word 'waste' and the act of 'wasting' are human inventions. Waste doesn't exist in nature. In nature, everything has a purpose. Waste was created by humans for short-term convenience and short-term profit.

Wasting results in long-term harmful consequences for humans, nature, and the economy. Based on this understanding of waste in irrigation work activity most wastes generated are valuable recourses for re-fertilizing of productive soils like from the wastes we can process humus and organic materials. The objective is to achieve what is usually called a good standard of working site. In addition, all contractors must plan, manage and monitor their work so it is carried safely and without risks to health and environment.

This includes careful planning on how the site will be kept tidy and work operation actively managed. Safe and efficient waste materials storage depends on good co-operation and co-ordination between everyone involved including, client, contractors, suppliers and the residents.

- **Storage areas**- designate storage areas for plant, materials, waste, flammable substances e.g. foam plastics, flammable liquids and gases such as propane and hazardous substances e.g. pesticides and timber treatment chemicals;



Cylinder-type waste container made from oil drum cut in half

Fig.1. Waste containers recommended for small hospitals in Thailand

- **Pedestrian routes**- do not allow storage to 'spread' in an uncontrolled manner on to footpaths and other walkways. Do not store materials where they obstruct access routes or where they could interfere with emergency escape;
- **Flammable materials**- will usually need to be stored away from other materials and protected from accidental ignition;

2.1. categories of potential waste

- Worn but functioning substances or objects that are still useable (albeit after repair) for the purpose they were made.
- Substances or objects that can be put to immediate use otherwise than by a specialized waste recovery establishment or undertaking for example ash from a power station used as a raw material in building blocks.
- Degenerated substances or objects that can be put to use only by establishments or undertakings Specialized in waste recovery. These are always wastes even if transferred for recovery for value for example contaminated solvents or scrap. Such substances only cease to be waste when they have been recovered
- Substances or objects which the holder does not want and which he has to pay to have taken away. If substances or objects are consigned to the process of waste collection then they are waste but they may not be where they are fit for use in their present form by another identified person

2.2. General Requirements for Storage of Materials

Basically waste materials and debris produced or generated during horticultural crop produce work is stored in a designated area according to enterprise guidelines with close supervision and responsibility of supervisor assigned. Store materials in a planned and orderly manner that does not endanger employee safety. Ensure stacks, tiers, and piles are stable and stacked to aid safe handling and loading. Store hazardous materials in accordance with the individual requirements. Store all materials on pallets to discourage rodent infestation. Immediately clean up spills and leaks that create such rodent habitat. Use slings to hoist bagged material, lumber, bricks, masonry blocks, and similar loosely stacked materials only if the slings are fully secured against falling by straps, sideboards, nets, or other suitable devices.

Self-Check –1	Written Test

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

1. Define waste materials (5)
2. List the categories of potential wastes (5)

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information Sheet-2	Handling materials, equipment and machinery

2.3. Overview of Material Handling

Material handling (MH) involves "short-distance movement that usually takes place within the confines of a building such as a plant or a warehouse and between a building and a transportation agency."1 It can be used to create "time and place utility" through the handling, storage, and control of material, as distinct from manufacturing (i.e., fabrication and assembly operations), which creates "form utility" by changing the shape, form, and makeup of material.2It is often said that MH only adds to the cost of a product, it does not add to the value of a product. Although MH does not provide a product with form utility, the time and place utility provided by MH can add real value to a product, i.e., the value of a product can increase after MH has taken place; for example:• The value (to the customer) added by the overnight delivery of a package (e.g., Federal Express) is greater than or equal to the additional cost of the service as compared to regular mail service—otherwise regular mail would have been used.• The value added by having parts stored next to a bottleneck machine is the savings associated with the increase in machine utilization minus the cost of storing the parts at the machine.

In handling materials in horticultural crop production activity we should concentrate on safety storage of our materials (tools, equipment and machinery) and input materials like seeds, fertilizer, herbicides… If you need to store waste or materials on your premises then you keep them in a way where they cannot escape. This means that your business premises should be set up to keep all waste and materials under control. Storage options include bin, tanks areas, all of which may need to be covered by a roof to prevent carriage by rain or wind. In order to perform the activities of materials handling the basic goal is to minimize the production costs.

- This general objective can be further subdivided into specific objectives as follows :

  i) To reduce the costs by decreasing inventories, minimising the distance to be handled and increasing productivity.

  ii) To increase the production capacity by smoothing the work flow,

  iii) To minimize the waste during handling.

  iv) To improve distribution through better location of facilities and improved routing.

  v) To increase the equipment and space utilisation.

  vi) To improve the working conditions. '

  vii) To improve the customer service.

2.3.1. Handling of machinery and equipment

Any basic machinery and equipment required for enterprises specific usage are investment assets and key for accomplishment tools to perform all targets as directed. For these expensive means of productions proper handling is very crucial issue. In proper handling manufacturer's spesificatons for each and indivisual types of machinery and equipment, and supevisor's instructions strictly should be applied during and after usage.

These specifications and instructions on cleaning, securing and storing, must be and perfectly in practice implemented. These respecting of specification and instruction will secure, guarantee and sustain the enterprise interests.

2.3.2. Guideline for handling and transporting of materials, equipment and machinery

The Manual Handling Operations Regulations define it as 'any transporting or supporting of a load (including the lifting, putting down, pushing, pulling, carrying or moving thereof) by hand or by bodily force'. In effect, any activity that requires an individual to lift, move or support a load will be classified as a manual handling task. Handling and transporting will be conducted as of the instruction and guidelines of which the enterprise follows.

Related to the shuttle or transporting of these materials, equipment and machineries workers should understand characteristic of materials that should be transported from one place to other. Because some irrigation works equipment, tools and machineries are made of iron, sharp and difficult to handle with bare hands. For these conditions we have to think more before this activity is started and make ready of personal protective equipment (PPE) and aware about occupational health and safety (OHS) regulations and rules.

- ✓ Basic Materials Handling Systems: The different material handling systems can be classified according to the type of equipment used, material handled, method used or the function performed.
- ✓ Equipment-Oriented Systems: Depending upon the type of equipment used, there are several systems. : Overhead systems, Conveyer systems, Tractor-trailor system, Fork-life truck and pallet system, Industrial truck systems and Underground systems.
- ✓ Material Oriented Systems : These may be of the following types:i) Unit handling systemsii) Bulk handling systemsiii) Liquid handling systems

A unit load consists of a number of items so arranged that it can be picked up and moved as a single entity such as a box, bale, roll etc. Such a system in more flexible and requires less investment.

- ✓ Method Oriented Systems: According to the method of handling and method of production, the material handling systems can be: Manual systems, Mechanized or

automated systems, Job-shop handling systems, or, Mass-production handling systems.

- ✓ Function Oriented Systems: The systems can be defined according to the material handling function performed as follows: Transportation systems, Conveying systems, Transferring systems and Elevating systems.
- ✓ Selection and Design of Handling System: The selection and design of the material system should be done alongside the development of the layout as each one affects each other. Hence, an integrated approach to the design process is usable. A computerized technique known as COFAC (Computerized Facilities Design) has been developed for.

※ **Integrated handling system and layout design.**

The steps to be followed in the selection and design of handling systems are as follows: i) Identification of system ,ii) Review of design criteria and objectives of the handling system iii) Data collection regarding flow pattern and flow requirements iv) Identification of activity relationships, v) Determining space requirement and establishing material flow pattern ,vi) Analysis of material and building characteristics, vii) Preliminary selection of basic handling system and generation alternatives considering feasibility of mechanization and equipment capabilities,viii) Evaluation of alternatives with respect to optimal material flow, utilizing gravity, minimum cost, flexibility, ease of maintenance, capacity utilisation and other objectives of the system design considering various tangible and intangible factors, ix) Selection of the best suited alternative and checking it for compatibility, x) Specification of the system, xi) Procurement of the equipment and implementation of the system.

2.3.3. Method of materials handling

- ➢ Five Major Types of Materials Handling Methods:
- ✓ Movement - involves the actual transportation or transfer of material from one point to the next.
- ✓ Quantity - dictates the type and nature of the material handling equipment and also cost per unit for the conveyance of the goods.
- ✓ Time -how quickly the material can move through the facility
- ✓ Space - concerned with the required space for the storage of the material handling equipment and their movement, as well as the queuing or staging space for the material itself.
- ✓ Control - tracking of the material, positive identification, and inventory management

- Advantages of correct materials handling
  - Savings in storage and operating space
  - Better stock control
  - Improved working conditions
  - Improved quality
  - Lower risk of accidents
  - Reduced processing time
  - Lower production costs
  - Less waste of time and materials

Self-Check –2	Written Test

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

1. list the objective of handling materials (5)
2. List the methods of handling materials and equipment (5)

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information Sheet-3	Maintaining clean and safe work site

3.1. Clean and safe work site

The work place should be clear and safe always, this favorable situation encourages the workers to perform their task properly. To sustain clean and safe work site, this place should be cleaned before starting and after finishing their work. Regular maintenance is essential to keep equipment, machines and the work environment safe and reliable. Lack of maintenance or inadequate maintenance can lead to dangerous situations, accidents and health problems. Maintenance is a high-risk activity with some of the hazards resulting from the nature of the work. Maintenance is carried out in all natural area conservation and all workplaces.

The items of remnants are varying from material to material, because different work operation needs different materials. These materials should be segregated according their items, based on this segregation the reusable remnants should be processed to use again and non reusable remnants disposed without polluting the environment. If the materials are stored properly in a planned manner we can mitigate or reduce the dangers on the employees and on the environment. Storing materials in an open yard requires attention to combustible materials, access to power lines and fire protection. Look at more detail in the above part of the lesson.

3.2. Requirements for cleaning and maintenance of workplace areas

- **Why should we pay attention to cleaning and maintaining the work place**?

Effective housekeeping can eliminate some workplace hazards and help get a job done safely and properly. Poor work place hygen /housekeeping/ can frequently contribute to accidents by hiding hazards that cause injuries. If the sight of paper, debris, clutter and spills is accepted as normal, then other more serious health and safety hazards may be taken for granted. Housekeeping is not just cleanliness. It includes keeping work areas neat and orderly; maintaining halls and floors free of slip and trip hazards; and removing of waste materials (e.g., paper, cardboard) and other fire hazards from work areas. It also requires paying attention to important details such as the layout of the whole workplace, aisle marking, the adequacy of storage facilities, and maintenance. Good housekeeping is also a basic part of accident and fire prevention.

Effective housekeeping is an ongoing operation: it is not a hit-and-miss cleanup done occasionally. Periodic "panic" cleanups are costly and ineffective in reducing accidents.

- **What is the purpose of keeping the workplace**?

Poor maintenance can be a cause of accidents, such as:

- tripping over loose objects on floors, stairs and platforms
- being hit by falling objects
- slipping on greasy, wet or dirty surfaces
- striking against projecting, poorly stacked items or misplaced material
- cutting, puncturing, or tearing the skin of hands or other parts of the body on projecting nails, wire or steel strapping

To avoid these hazards, a workplace must "maintain" order throughout a workday. Although this effort requires a great deal of management and planning, the benefits are many.

- **Effective maintenance results in**:

- reduced handling to ease the flow of materials
- fewer tripping and slipping accidents in clutter-free and spill-free work areas
- decreased fire hazards
- lower worker exposures to hazardous substances (e.g. dusts, vapours)
- better control of tools and materials, including inventory and supplies
- more efficient equipment cleanup and maintenance
- better hygienic conditions leading to improved health
- more effective use of space
- reduced property damage by improving preventive maintenance
- less janitorial work
- improved morale
- improved productivity (tools and materials will be easy to find)

- **How do we plan a good maintenance program?**

A good housekeeping program plans and manages the orderly storage and movement of materials from point of entry to exit. It includes a material flow plan to ensure minimal handling. The plan also ensures that work areas are not used as storage areas by having workers move materials to and from work areas as needed. Part of the plan could include investing in extra bins and more frequent disposal. The costs of this investment could be offset by the elimination of repeated handling of the same material and more effective use of the workers' time. Often, ineffective or insufficient storage planning results in materials being handled and stored in hazardous ways. Knowing the plant layout and the movement of

materials throughout the workplace can help plan work procedures. Worker training is an essential part of any good housekeeping program. Workers need to know how to work safely with the products they use. They also need to know how to protect other workers such as by posting signs (e.g., "Wet - Slippery Floor") and reporting any unusual conditions. Housekeeping order is "maintained" not "achieved." Cleaning and organization must be done regularly, not just at the end of the shift. Integrating housekeeping into jobs can help ensure this is done. A good housekeeping program identifies and assigns responsibilities for the following:

- clean up during the shift
- day-to-day cleanup
- waste disposal
- removal of unused materials
- inspection to ensure cleanup is complete

Do not forget out-of-the-way places such as shelves, basements, sheds, and boiler rooms that would otherwise be overlooked. The orderly arrangement of operations, tools, equipment and supplies is an important part of a good housekeeping program. The final addition to any housekeeping program is inspection. It is the only way to check for deficiencies in the program so that changes can be made. The documents on workplace inspection checklists provide a general guide and examples of checklists for inspecting offices and manufacturing facilities.

Self-Check –3	Written Test

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

1. List the responsibilities a good housekeeping program (5)

2. Write down the importance of maintaining and cleaning work site (5)

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

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1.Roca, W. M., A. Rodriguez, L. F. Pitena, R. C. Barbara, and J. C. Toto, Improvement of propagation techniques for cassava using single leaf cutting: preliminary report, *Cassava Newsletter 8:*4 (1980).

2. Abraham, T. E., K. C. M. Raja, V. P. Sreedharan, and H. S. Nathan, Some quality aspects of a few varieties of cassava, *J. Food Sci. Techno. 16:*237 (1979).

3. Salunkhe, D. K., and B. B. Desai, Cassava, in *Postharvest Biotechnology of Vegetables,* Vol. II, CRC Press,

4.Material identification for horticultural crops **https://www.youtube.com**

HORTCULTURAL CROP PRODUCTION

Level-I

#Learning Guide -36

Unit of Competence:-Undertake Horticultural Production practices

Module Title:-Undertaking Horticultural Production practices

LG Code: AGR HCP1 M09 LO4-LG-36

TTLM Code: AGR HCP1 TTLM1219v1

LO4: Clean up on completion of work

Instruction Sheet	Learning Guide 37

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

- Cleaning and maintaining tools and equipment
- Disposing and storing materials
- Reporting Work outcomes

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 –**

- Clean, maintain tools and equipment, Dispose, store materials and Reporte Work outcomes

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
3. Follow the instructions described in number 3 to 6.
4. Read the information written in the “Information Sheets 1”. Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
5. Accomplish the “Self-check 1,2 and3” **in page -72,78 and 80 respectively.**
6. Ask from your teacher the key to correction (key answers) or you can request your teacher to correct your work. (You are to get the key answer only after you finished answering the Self-check 1).

Information Sheet-1	Cleaning and maintaining tools and equipment

1.1. Cleaning of work place areas

Definition: Field residues are materials left in an agricultural field or orchard after the crop has been harvested. These residues include stalks and stubble (stems), leaves, and seed pods. Good management of field residues can increase efficiency of irrigation and control of erosion. Process residues are those materials left after the processing of the crop into a usable resource. These residues include husks, seeds, bagasse, and roots. They can be used as animal fodder and soil amendment, fertilizers and in manufacturing crop waste. Any unusable portion of plant matter left in a field after harvest.

A clean and organized work area is essential to any agricultural mechanics project. Knowing where to find tools, supplies and materials will save time and useful in maintaining the proper inventory of tools and materials. A work place area that is cluttered and disorganized will not only be unsafe, but will hinder the proper maintenance of tools and equipment. A disciplined approach to daily cleaning and organizing will save time and effort in the long run and help ensure that accidents are prevented. Each worker should have a clear vision of what is meant by a clean and orderly work area. Also they should help produce and maintain a clean and orderly work area.

- Some positive indicators of a properly cleaned work place area are as follows:
  - Benches are cleared and clean
  - Machines are clean
  - Paint brushes and spray equipment are properly cleaned and stored.
  - Solvents, paints and greases are properly stored.
  - Tools are in their place.
  - Lumber, metal and other construction materials are stored.
  - Projects and other related materials are in approved places.
  - Floor is clear and trash is in a containers.
  - Cabinets and storage areas are locked.

1.2. Maintaining Tools and equipment

The first step in maintenance of farm machinery is preventive maintenance process (i.e., checking oil, and fuel levels, cleaning radiators, preventing chaff build-up, and monitoring gauges). On a farm operation, there are a number of screwdrivers, wrenches, and tools used in the daily maintenance and operation of farm machinery such as, the daily maintenance of the machinery, daily routine checkups of pulleys, or adapting the machinery to different uses. In order to maintain machinery, it is often necessary to hoist or elevate machinery, parts of

machinery, or other objects while working around the farm. There are a number of different ways to hoist an object depending on the structure of the article. It is important for students to be aware of the weight range, strength, and capacity of the jack and the item being lifted.

6.1.1. Cleaning of machinery and equipment

Before attempting any of the service or maintenance tasks, the machine or component should be cleaned. Dirt and dust particles are one of the major causes of wear and break down in any machine. The importance of keeping every particle of dirt and dust out of machinery components when caring out servicing, maintenance or repairs cannot be over emphasized.

6.1.2. Equipment and containers useful for cleanup

There are many items of equipment that are necessary to clean work place area quickly and efficiently and to store materials safely. These items include the following:

-Floor brooms -bench brushes

-Floor dust mops - Shop vacume cleaner(s)

- Scoop shovels and dust pans to pick up dust and trash.

The soft bristled brush and shop vacume cleaner are the standard tools for removing dirt, saw dust, and trash from benches and machines. The floor broom and dust mop are important floor cleaning equipment. The dust pan and standard scoop shovel are commonly used to move the trash from the floor to the trash can.

6.1.2.1. Dust collection systems

Many shops are equipped with dust collection systems. These systems consist of a large centrally located vacume with ducts running to various machines and areas in the workplace. As a machine creates dust (such as saw dust or sanding dust) the dust is pulled from around the machine and transported to a collection bin. Also, vents may be located in the floor.These systems have to be properly maintained by cleaning the dusts, making sure they are not clogged, and emptying the storage bin periodically.

Self-Check –1	Written Test

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

1. List the items of equipment that are necessary to clean work place area quickly and efficiently and to store materials safely (5)

2. Define cleaning work area (5)

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

Answer Sheet

Score = _____

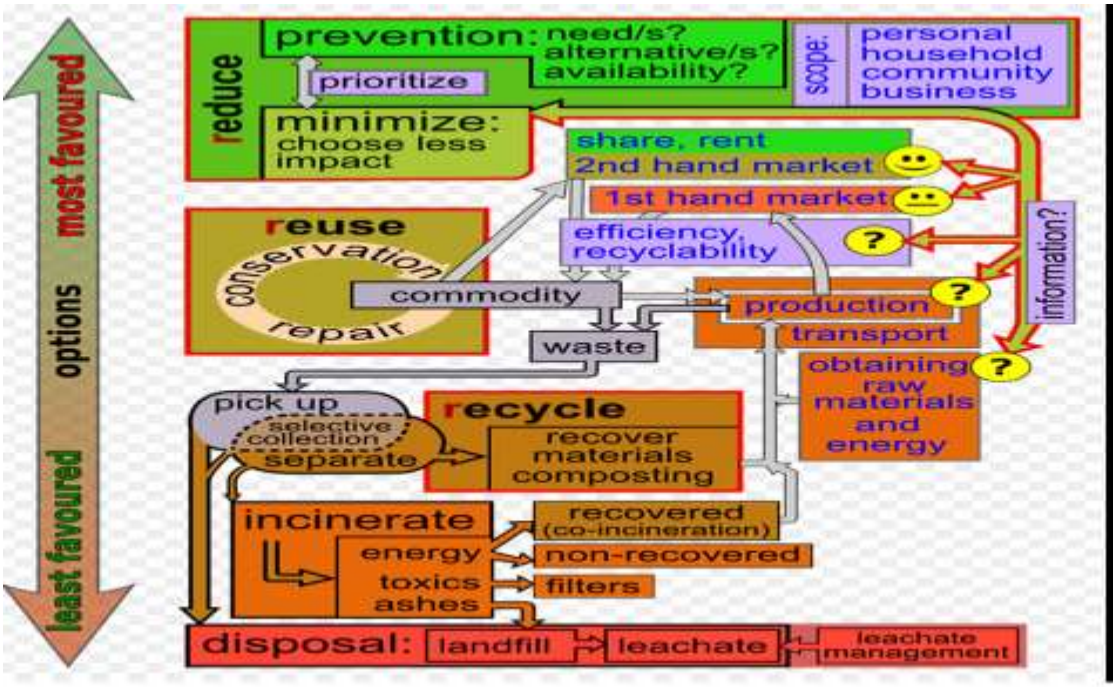
Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information Sheet-2	Disposing and storing materials

2.1. Waste minimization



- Most horticultural products require cool storage and refrigerated transport. Ensure you have access to suitable storage and transport facilities and include the associated costs in your budget.

Waste minimisation is a set of processes and practices intended to reduce the amount of waste produced. By reducing or eliminating the generation of harmful and persistent wastes, waste minimisation supports efforts to promote a more sustainable society.Waste minimisation involves redesigning products and processes and/or changing societal patterns of consumption and production. “Waste prevention" redirects here. For the prevention of uncontrolled waste dumping, see pollution prevention. Waste hierarchy. Refusing, reducing, reusing, recycling and composting allow reducing waste.

The most environmentally resourceful, economically efficient, and cost effective way to manage waste often is to not have to address the problem in the first place. Managers see waste minimisation as a primary focus for most waste management strategies. Proper waste treatment and disposal can require a significant amount of time and resources; therefore, the benefits of waste minimisation can be considerable if carried out in an effective, safe and sustainable manner. Traditional waste management focuses on processing waste after it is created, concentrating on re-use, recycling, and waste-to-energy conversion.[2] Waste minimisation involves efforts to avoid creating the waste during manufacturing. To effectively implement waste minimisation the manager requires knowledge of the production process,

cradle-to-grave analysis (the tracking of materials from their extraction to their return to earth) and details of the composition of the waste.

The main sources of waste vary from country to country. In the UK, most waste comes from the construction and demolition of buildings, followed by mining and quarrying, industry and commerce.[3] Household waste constitutes a relatively small proportion of all waste. Industrial waste is often tied to requirements in the supply chain. For example, a company handling a product may insist that it should be shipped using particular packing because it fits downstream needs.

2.2. General Requirements for Storage of Materials

Store materials in a planned and orderly manner that does not endanger employee safety. Ensure stacks, tiers, and piles are stable and stacked to aid safe handling and loading. Store hazardous materials in accordance with the individual requirements. Store all materials on pallets to discourage rodent infestation. Immediately clean up spills and leaks that create such rodent habitat. Use slings to hoist bagged material, lumber, bricks, masonry blocks, and similar loosely stacked materials only if the slings are fully secured against falling by straps, sideboards, nets, or other suitable devices.

2.2.1. POLLUTION PREVENTION:

Pollution prevention measures have been considered and incorporated in the model procedures. Implementation of these measures may be more effective and reduce or eliminate the need to implement other more complicated or costly procedures. Possible pollution prevention measures for material storage, handling, and disposal include:

- Store material indoors, or covered if outdoors.
- Prevent storm water run-on.
- Once per year, educate municipal staff on pollution prevention measures.

General Material Storage, Handling, and Disposal

- **Storage**

Store materials indoors if possible. If stored outdoors, cover the storage area with a roof or withy temporary cover during rain events. [Note: the local fire authority/department must be consulted for limitations on clearance of roof covers over containers used to store flammable materials].

- Keep storage areas clean and dry. Conduct regular inspections so that leaks and spills are detected as soon as possible.
- Minimize storm water run-on and runoff by covering, enclosing or providing secondary containment for the area.

- Keep outdoor storage areas in good condition (e.g. repair roofs, floors, etc. to limit releases to runoff.
- Drums stored in an area where unauthorized persons may gain access must be secured to prevent accidental spillage, pilferage, or any unauthorized use. Only personnel with proper training may handle hazardous waste. See Waste Handling and Disposal Procedures.
- Wood products treated with chromated copper arsenate, ammonical copper zinc arsenate, creosote, or pentachlorophenol should be covered with tarps during rain events or stored indoors.
- Parking lots or other surfaces near bulk materials storage areas should be swept periodically to remove debris blown or washed from storage area.
- Train employees in proper storage measures.

- **Secondary Containment**

  - Tanks should be bermed or surrounded by a secondary containment system such as dikes, liners, vaults, or double walled tanks.
  - Keep liquids in a designated area on a paved impervious surface within a secondary containment.
  - The area inside the berm should slope to a drain with a dead-end sump that is periodically pumped out.

- **Inspection**

  - Inspect storage areas regularly for leaks or spills.
  - Conduct routine inspections and check for external corrosion of material containers. Also check for structural failure, spills and overfills due to operator error, failure of piping system.
  - Check for leaks or spills during pumping of liquids or gases from trucks to a storage facility or vice versa.
  - Visually inspect new tank or container installations for loose fittings, poor welding, and improper or poorly fitted gaskets.
  - Inspect tank foundations, connections, coatings, and tank walls and piping system. Look for corrosion, leaks, cracks, scratches,

and other physical damage that may weaken the tank or container system.

2.3. General Chemical Material Handling and Disposal

General Guidelines

- Do not store chemicals, drums, or bagged materials directly on the ground. Place these items in secondary containers. Designate a secure chemical material storage area that is paved with Portland cement concrete, free of cracks and gaps, and impervious in order to contain leaks and spills.
- Containers should be placed in a designated area and covered.
- Design and maintain chemical storage areas that reduce exposure to storm water:

-Store materials inside or under cover on paved surfaces

-Use secondary containment (see section above)

- Use covered dumpsters for waste product containers. Dumpsters shall be kept in good condition without corrosion or leaky seams. Garbage dumpsters shall be replaced if they are deteriorating to the point where leakage is occurring.
- Liquid materials should be stored in UL approved double walled tanks or surrounded by a curb or dike to provide the volume to contain 10 percent of the volume of all the containers or 110 percent of the volume of the largest container, whichever is greater.
- Try to keep chemicals in their original containers, and keep them well labeled.
- Keep secured lids on waste barrels and containers.

Spill Control

- See Spill Prevention and Control procedures sheet
- Clean up spills immediately.
- Safeguards against accidental releases:

–Overflow protection devices to warn operator or automatic shutdown transfer pumps

–Protection guards (bollards) around tanks and piping to prevent vehicle or forklift damage

- Clear tagging or labeling, and restricting access to valves to reduce human error.
- Employees trained in emergency spill cleanup procedures should be present when dangerous waste, liquid chemicals, or other wastes are delivered or transferred off-site.

Self-Check –2	Written Test

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

1. List the Possible pollution prevention measures for material storage, handling, and disposal (5)

2. Define waste minimization (5)

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information Sheet-3	Reporting of work outcomes

1.1. Reporting of work outcomes

On completion of crop work out comes like productivity, production, strengths of production, weaknesses of production, and problems of production should be reported to you supervisor according to instructions and formats given from the supervisor. The work outcomes can vary depending on objective; it can be fruit, seeds, leafy parts, stem parts, flowers, lawns, etc. Reporting work out come helps you to get feedback by your supervisor so that you can leave your weakness and encourage your strength. It also helps the supervisor to get full information about the production. The reporting format may vary but it can be as follows.

After completion of work activities the output of the work should be reported to the concerned bodies on time. This report of work out put gives some clue about the positive performance of the activities and the weakness or limitation of the work activities. Based on the report of work outcomes the organization either improves the way of work procedures (method) or continues with the former method.

Table-1.format of reporting work out come

S. No.	Type of work	Unit	quantity	production	Unit	quantity	Problems	remarks
1								
2								
3								
4								

Prepared by: ----------date----------sign----------

Self-Check 3	Written Test

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

1. What is the need of reporting work outcomes? (5 points)
2. What are the possible work outcomes of horticultural crop work? (5 points)

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Reference of #LG-36

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NO	TTLM developer Name	Back ground Qualification	College Address	College Name	Cell Phone	E-mail
1	Deribow Gonfa	Plant science(Bsc)	Oromiya	Fitche PollyTVET	0912774688	gonfad24@gmail.com
2	Tesfaye Tekola	Agronomy (Msc)	Benishangul Gumuz	Assosa ATVET	0910550651	tttekola@gmail.com
3	Berhanu Mammo	Horticulture (BSc)	Mizan ATVET	Federal	0912676883	birehanmammo@gmail.com
4	Haftu Mehari	Plant science(BSc)	Tigray	Maichew ATVET	0914312311	Kalabkalab61@gmail.com
5	Melaku Bawoke	Agronomy (Msc)	Federal	Gewane	0920258287	Melakubawoke10@gmail.com
6	Tadesse Yasin	Horticulture (BSc)	Amhara	Kombolcha PollyTVET	0921626541	tadaseyasin2019@gmaio.com
7	Zewde Paulos	Agronomy(Msc)	SNNPR	Sodo ATVET	0921004814	Zedpa2013@gmail.com
8	Bekele Belete	Agronomy (Msc)	SNNPR	Sodo ATVET	0916379025	Bekelebelete6@gmail.com
9	Fetene Muluken	Agronomy (Msc)	Amhara	Woreta ATVET	0986911690	Fetenemuluken9@gmail.com
10	Misgana Belay	Agronomy (Msc)	Oromia	Nedjo ATVET	0911983854	Misbel2000@gmail.com
11	Sadik Ebrahim	Agronomy (Msc)	Federal	Agarfa ATVET	0920617776	sadikebra@gmail.com
12	Birhanu reda	Horticulture(BSc)	Tigray	Maichew ATVET	0923452395	birhanureda@gmail.com

Profile of trainers participate on special Horticultural Crop Production TTLM development for level I at Adama 2019