HORTICULTURAL CROPS PRODUCTION Level-III

Learning Guide-26

Unit of Competence: Prepare Organic Fertilizer/Soil Improvement

Module Title: Preparing Organic Fertilizer/Soil Improvement

LG Code: AGR HCP3 M07 LO1-LG-26

TTLM Code: AGR HCP3 TTLM 0120v1

LO 1: Organize for processing

Instruction Sheet	Learning Guide 26

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

- Reviewing job sheet to identify processing requirements.
- Crop calendar and climatic conditions
- Determining type of organic fertilizer
- Selecting and check machinery, equipment and materials
- Identify Potential OHS hazards
- Selecting suitable personal protective equipment's (PPE)

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 –

- Review job sheet to identify processing requirements.
- Crop calendar and climatic conditions
- Determine type of organic fertilizer
- Select and check machinery, equipment and materials
- Identify Potential OHS hazards
- Select suitable personal protective equipment's (PPE)

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below 3 to 5.
3. Read the information written in the information "Sheet 1 – 7'' respectively.
4. Accomplish the "Self-check 1 – 7.'' respectively.
5. If you earned a satisfactory evaluation from the "Self-check" proceed to "Operation Sheet 1 - 2" respectively.
6. Do the "LAP test" (if you are ready).

Information Sheet-1	Reviewing job sheet to identify processing requirements.

1.1 Definition of job sheet:

- ✓ It is a work order which is a key document which we use to communicate with both our customers and workmates.
- ✓ It contains details of the services to be provided by us, and the authorization from the customer.

👍 To make sure everyone understands clearly about what's involved, a job sheet or work order should contain information about:

- Name of company or service providers
- Name of participants
- The service operations
- Address
- Amount of inputs required
- Amount of production / out put
- Area to be used
- Selection of appropriate technology
- Type of raw materials
- method of receivable and storage of raw materials
- Method of mixing of raw materials
- Mix ratios of raw materials
- Management and monitoring of the composting process.

Self-Check 1	Written Test

Name: _____ Date: _____

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

1. Define job sheet? (5pts)
2. Discuss what are the information included in job sheet? (5 pts.)

Answer sheet:

1.----------

2.----------

Score = _____

Rating: _____

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

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

Information Sheet-2	Crop calendar and climatic conditions

- Crop Calendar**:** is a tool that provides timely information about seeds to promote local crop production.

It contains information on planting, sowing and harvesting periods of locally adapted crops in specific agro-ecological zones.

It also provides information on the sowing rates of seed and planting material and the main agricultural practices.

This tool supports farmers and agriculture extensionists across the world in taking appropriate decisions on crops and their sowing period, respecting the agro-ecological dimension. It also provides a solid base for emergency planning of the rehabilitation of farming systems after disasters.

Determine the best date to plant. This information can be gathered from local experience, agricultural advisors and leading farmers in the district.

Determine the time the variety takes from planting to harvest. The length of time from establishment to harvest is known for each variety. It may vary a little depending on the growing conditions especially water availability and solar radiation. Normally short duration varieties take 100−120 days, medium duration 120−140 days, and long duration 160 days plus.

Most varieties take 60−65 days from panicle initiation to harvest.

Mark on the calendar the date of planting and then when each other operation needs to be done (plowing, weeding, fertilizing, harvesting).

Then determine how much labor, equipment and finance will be required at each step during the growing period.

- Climatic Condition:

implementation of organic practices will be more obvious under arid conditions than under ideal humid conditions. For example, compost application into topsoil or into planting holes will increase

the soils water retention capacity and the crop's tolerance to water scarcity. In very warm and dry climate, losses of water through transpiration from plants and evaporation from soils are high. These losses may be further encouraged by strong winds, enhancing soil erosion. The soils' organic matter content is generally low, as biomass production is low, implying that the availability of nutrients to the plants is highly reduced. Under such conditions, the key to increasing crop productivity lies in protecting the soil from strong sun and wind and increasing the supply of organic matter and water to the soil. Soil organic matter can either be increased through compost or through cultivation of green manure crops. In the case of compost production, the challenge is to increase production of plant biomass, which is needed for compost production.

In warm and humid climate, high aboveground biomass production and rapid decomposition of soil organic matter imply that the nutrients are easily made available to the plants. But it also involves a high risk that the nutrients are easily washed out and lost. Under such conditions a balance between production and decomposition of organic matter is important to avoid depletion of soil. These practices include creating a diverse and multi-layer cropping system ideally including trees, growing nitrogen-fixing cover crops in orchards and applying compost to enrich the soil with organic matter and in this way increase its capacity to retain water and nutrients.

Self-Check 2	Written Test

Name: _____ Date: _____

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

1. What is crop calendar? (5pts)
2. Discuss the importance of crop calendar? (5 pts)

Answer

1.----------

2.----------

Score = _____

Rating: _____

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

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

Information Sheet-3	Determining type of organic fertilizer

3.1 Definition of organic fertilizer:

The term '*organic*' can mean several things, but in the case of fertilizers, it refers to sources of plant nutrients that are naturally occurring such as: -

- ✓ End products of plants and animals such as compost, manure, bone meal and green manure crops.
- ✓ Mineral like rock phosphate that are mined from the earth and used without undergoing any chemical treatment.

Organic fertilizer is a fertilizer material in which carbon is an essential component if it's basic structure. It is a complex and varied mixture of organic substances. This group of materials includes all fertilizers of plant residue, animal residue, city/ town refuse or industrial waste origin.

- The term organic fertilizer is generally used to represent the organic constituents in the substances, including decayed plant and animal tissue, their partial decomposition products, and the soil biomass. As a general rule, organic fertilizers release about half their nutrients in the first season and continue to feed the soil over subsequent years.

3.2 Importance of Organic Fertilizers

Farmers since ancient times have recognized significant benefit of organic fertilizer to crop productivity.

- It serves as a slow release source of nitrogen, phosphorus, and potassium for plant nutrition and microorganism growth.
- It processes considerable water holding capacity and thereby helps to maintain the water regime of the soil.
- It acts as a buffer against changes in PH of the soil.
- Its dark color contributes to absorption of energy from the sun and heating of the soil.
- It acts as "cement" for holding clay and silt particles together, thus contributing to the crumb structure of the soil and to resistance against soil erosion.
- It binds micronutrient metal ions in the soil that otherwise might be leached out of surface soils.
- Organic constituents in the humic substances may act as plant growth stimulants.

- Certain components of organic fertilizers are largely responsible for the formation and stabilization of soil aggregates.
- It used to enhance microbial functions such as nitrogen fixation decomposition.
- It used for production of polysaccharides and other non-humic substances.
- It serves in increases of competition and antagonism against plant pests.
- It used to increases ion absorption capacity.
- It used to reduce water losses through evaporation
- It serves as soil temperature moderates.
- It used to reduce toxicity of certain elements.
- It used to reduce land degradation and water pollution.
- It serves as a material used to improve soil physical and chemical properties.
- Organics like compost and manure are generally free or very low cost for most farmers.
- Organic fertilizers take relatively little skill to use properly.
- Plant or animal derived organics like compost or manure usually contain significant amounts of micronutrients in addition to macronutrients such as N, P, & K.
- Plant or animal derived organics like manure not only supply plant nutrients but also organic matter which improves soil physical conditions, stimulates beneficial soil microorganisms.
- Plants grown in organically fertilized soil might be more disease resistant than in soils with artificial fertilizer only
- Soil fertility is improved in the long run: nutrients from the organic fertilizer are released gradually over a long period. Much of the nitrogen in organics is in a slow release, organic form. This is a plus for nitrogen which is susceptible to leaching losses when supplied by chemical fertilizers.
- The phosphorus in organic fertilizer is less prone to soil tie-up than that from chemical fertilizers, making it more available to plants.

➢ Disadvantages of organic fertilizer preparation

- Preparing compost, liquid manure or bokashi is very labour intensive and time consuming;
- Making your own organic fertilizers is not possible everywhere. It depends on space, available material, local conditions and other factors;
- applying compost could enhance weeds and diseases in the crop to be grown;
- A compost heap attracts vermin, such as insects, rats, mice and also snakes!

- The concentration of available nutrients in organic fertilizers is considerably lower than in chemical fertilizers. This means very large amounts that is 300-800quintals per hectare must be applied to supply enough nutrients for crop growth and to add enough humus to benefit soil physical condition.
- The exact nutrient content of most organics like compost or manure varies a lot.

3.3 Type of organic fertilizer

1. Plant-based fertilizers.

Most of the plant-based fertilizers contain large quantities of specific nutrients like nitrogen.

Examples of plant-based fertilizers:

- ❖ Alfalfa meal: Derived from alfalfa plants and pressed into a pellet form, alfalfa meal is beneficial for adding nitrogen and potassium (about 2 percent each), as well as trace minerals and growth stimulants. Roses, in particular, seem to like this fertilizer and benefit from up to 5 cups of alfalfa meal per plant every ten weeks, worked into the soil. Add it to your compost pile to speed up the process.
- ❖ Corn gluten meal: Derived from corn, this powder contains 10 percent nitrogen fertilizer. Apply it only to actively growing plants because it inhibits the growth of seeds. The manufacturer recommends allowing 1 to 4 months after using this product before planting seeds, depending on the soil and weather conditions. Use it on lawns in early spring to green up the grass and prevent annual weed seeds from sprouting.
- ❖ Cottonseed meal: Derived from the seed in cotton bolls, this granular fertilizer is particularly good at supplying nitrogen (6 percent) and potassium (1.5 percent). Look for organic cottonseed meal because traditional cotton crops are heavily sprayed with pesticides, some of which can remain in the seed oils.
- ❖ Kelp/seaweed: Derived from sea plants, you can find this product offered in liquid, powder, or pellet form. Although containing only small amounts of N-P-K fertilizer, kelp meal adds valuable micronutrients, growth hormones, and vitamins that can help increase yields, reduce the plant stress from drought, and increase frost tolerance. Apply it to the soil or as a foliar spray.
- ❖ Soybean meal: Derived from soybeans and used in a pellet form, soybean meal is prized for its high nitrogen (7 percent) content and as a source of phosphorous (2

percent). Like alfalfa meal, it is particularly beneficial to nitrogen-loving plants, such as roses.

- Humus: When looking at organic fertilizer products, you'll invariably come across those containing humus, humic acid, or humates. Some of these products have almost magical claims as to what they can do for your plants. Humus, humates, and humic acids are organic compounds often found in compost.

Humus is touted to increase soil microbial activity, improve soil structure, and enhance root development of plants. These products have no fertilizer value, but rather are used as stimulants to support soil microbial life that, in turn, support the plants. Use them as supplements, but not to replace proper soil building and nutrition.

2. Animal-based fertilizers:

These use the waste materials that are generated by industries such as fish processing, meat processing or dairy farming.

These waste products are then dried or very minimally processed to convert them into usable fertilizers.

Examples of animal-based fertilizers:

- Manures: Animal manures provide lots of organic matter to the soil, but most have low nutrient value. A few, such as chicken manure, do have high available nitrogen content, but should only be used composted because the fresh manure can burn the roots of tender seedlings.
- Bat/seabird guano: Yes, this is what it sounds like — the poop from bats and seabirds. It comes in powdered or pellet form and is actually high in nitrogen (10 to 12 percent). Bat guano only provides about 2 percent phosphorous and no potassium, but seabird guano contains 10 to 12 percent P, plus 2 percent K. The concentrated nitrogen in these products can burn young plants if not used carefully. They tend to be more expensive than land-animal manures.
- Blood meal: This is the powdered blood from slaughtered animals. It contains about 14 percent nitrogen and many micronutrients. Leafy, nitrogen-loving plants, such as lettuce, grow well with this fertilizer. It also reportedly repels deer, but may attract dogs and cats.
- Bone meal**:** A popular source of phosphorous (11 percent) and calcium (22 percent), bone meal is derived from animal or fish bones and commonly used in a powdered form

on root crops and bulbs. It also contains 2 percent nitrogen and many micronutrients. It may attract rodents.

- ❖ Fish products: Fish by-products make excellent fertilizers. You can buy them in several different forms. Fish emulsion is derived from fermented remains of fish. This liquid product can have a fishy smell (even the deodorized version), but it's a great complete fertilizer (5-2-2) and adds trace elements to the soil. When mixed with water, it is gentle, yet effective for stimulating the growth of young seedlings. Hydrolysed fish powder has higher nitrogen content (12 percent) and is mixed with water and sprayed on plants. Fish meal is high in nitrogen and phosphorus and is applied to the soil. Some products blend fish with seaweed or kelp for added nutrition and growth stimulation.

3. Mineral-based fertilizers.
    - When we talk of organic fertilizers that are mineral-based we essentially mean that they have not been artificially manufactured or processed, that only naturally occurring minerals have been used.
    - Examples of mineral-based fertilizers

- ❖ Chilean nitrate of soda: Mined in the deserts of Chile, this highly soluble, fast-acting granular fertilizer contains 16 percent nitrogen. It's also high in sodium, though, so don't use it on arid soils where salt build up is likely or on salt-sensitive plants.
- ❖ Epsom salt: not only helps tired feet; it's a fertilizer too! Containing magnesium (10 percent) and sulphur (13 percent), Epsom salt is a fast-acting fertilizer that you can apply in a granular form or dissolve in water and spray on leaves as a foliar fertilizer. Tomatoes, peppers, and roses love this stuff! Mix 1 tablespoon of Epsom salt in a gallon of water and spray it on when plants start to bloom.
- ❖ Greensand: Mined in New Jersey from 70 million-year-old marine deposits, greensand contains 3 percent potassium and many micronutrients. It's sold in a powdered form, but breaks down slowly so is used to build the long-term reserves of soil potassium.
- ❖ Gypsum: This powdered mineral contains calcium (20 percent) and sulphur (15 percent). It's used to add calcium to soils without raising the soil PH.
- ❖ Hard-rock phosphate: This mineral powder contains 20 percent phosphorous and 48 percent calcium, which can raise soil pH — avoid it if your soil is already alkaline. It breaks down slowly, so use it to build the long-term supply of phosphorous in your soils.

- ❖ Soft-rock phosphate: Often called colloidal phosphate, soft-rock phosphate contains less phosphorus (16 percent) and calcium (19 percent) than hard-rock phosphate, but the nutrients are in chemical forms that plants can use more easily. This powder breaks down slowly, so one application may last for years in the soil. It also contains many micronutrients.
- ❖ Limestone: This mined product has various nutrient levels, depending on its source. It's used primarily to raise pH, but *dolomitic* limestone, which is high in calcium (46 percent) and magnesium (38 percent), also adds magnesium to the soil. This powder also comes in an easier to spread granular form. *Calcitic* limestone is high in calcium carbonate (usually above 90 percent). Conduct a soil test for pH and for magnesium to find out which kind of lime and how much to add to your soil.

4. Compost:
    - Composts are typically made from different raw materials though it has been noticed that finally, the main nutrients of phosphorus, nitrogen and potassium are generated to the same extent in all of them.
    - Composts are very effective in fertilizing the soil because they are an excellent source of humus

➢ Summary advantage of Organic Fertilizer**:**

1. Maintaining the soil fertility and decreasing nutrient losses.
2. Long-term Benefits to the Soil.

✓ Chemical fertilizers are manufactured with the sole purpose of helping the growth of a plant. As a result, while they may contain a better balance of all the major nutrients that a plant needs, they also contain certain harmful elements that can cause acidity in the soil. This can kill the helpful microbes that live in the soil and studies indicate that long-term use of chemical fertilizers can cause great damage to the soil.

✓ On the other hand, since organic fertilizers need these microbes to work on them to release the nutrients, they end up stimulating the growth of these microorganisms, ensuring long-term fertility of the soil.

3. Long-term Benefits to the Environment.

✓ Chemical fertilizers also tend to release many chemicals into the soil that contain nutrients helpful to soil but may also contain elements that are not easily biodegradable.

These may go on to contaminate our lands and our water. On the other hand, by definition, organic fertilizers almost always have only biodegradable contents.

4. Cheap and Cost-Effective.
   - Organic Fertilizers can be produced at home or on farms by using a mix of cow, sheep and horse manure along with wastes like leaves and dead plants. This is a great way of getting rid of waste from your garden or farm and certainly a cheaper alternative to purchasing chemical fertilizers.
5. Safety.
   - When lawns and gardens are sprayed with chemical fertilizers, one has to be careful that the family members, especially kids and pets who often play on lawns, do not ingest the harmful chemicals. However, there is no preventing from local wildlife from being affected. Organic fertilizers raise no such concerns and can be used safely.

➢ Chemical Fertilizer vs Organic Fertilizer

A chemical fertilizer is defined as any inorganic material of wholly or partially synthetic origin that is added to the soil to sustain plant growth.

Organic fertilizers are substances that are derived from the remains or by products of organisms which contain the essential nutrients for plant growth.

	Chemical Fertilizer	Organic Fertilizer
Example:	Ammonium sulfate, ammonium phosphate, ammonium nitrate, urea, ammonium chloride and the like.	Cottonseed meal, blood meal, fish emulsion, and manure and sewage sludge, etc.
Advantages:	Chemical fertilizers are rich equally in three essential nutrients that are needed for crops and always ready for immediate supply of nutrients to plants if	Adds natural nutrients to soil, increases soil organic matter, improves soil structure and tilth, improves water holding capacity, reduces soil crusting problems, reduces erosion from wind and water, Slow and consistent release

	Chemical Fertilizer	Organic Fertilizer
	situation demands. Required as small quantities, in terms of rates	of nutrients, Required as large quantities, in terms of rates
Disadvantages:	Several chemical fertilizers have high acid content. They have the ability to burn the skin. Changes soil fertility.	Have slow release capability; distribution of nutrients in organic fertilizers is not equal.
Rate of production:	Immediate supply.	Slow release
About:	Chemical fertilizers are manufactured from synthetic material	Organic fertilizers are made from materials derived from living things.
Preparation:	Artificially prepared.	Prepared naturally. One can prepare organic fertilizers, themselves or can also buy.
Cost:	Costly	Cheap
NPK Ratio:	20 to 60%	About 14%
Nutrients:	Have equal distribution of three essential nutrients: phosphorous, nitrogen, potassium.	Have unequal distribution of essential nutrients.

Self-Check 3	Written Test

Name: _____ Date: _____

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

1. What is the organic fertilizer? (5pts)
2. Write the importance of organic fertilizer? (5pts)
3. Write the difference organic and synthetic fertilizer? (5pts)

Answer

Score = _____

Rating: _____

1. ----------

2. ----------

3. ----------

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

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

Information Sheet-4	Selecting and check machinery, equipment and materials

4.1 Proper use of tools, equipment and materials for organic fertilizer preparation

Every production area of organic fertilizers should have sufficient supply of tools and equipment for different operations. the tools and equipment required for organic fertilizer preparation is listed below:

- Spade and Shovel
- Digging forks/garden forks
- Matches or cutlass and sickle
- Measuring tapes
- Carpenters saw
- Trowel (garden trowel)
- Hand hoe
- String
- Pick mattock
- Watering cans
- Peg

A good care should be taken of the tools and equipment, which would then have a long life. It is not wise to keep workers sitting idle at critical periods of work because of shortage of tools.

Rules in handling tools and equipment are: -

- Used all tools for what they are designed or constructed.
- Clean the tools and equipment always before storing them away.
- Store them in a neat dry place.

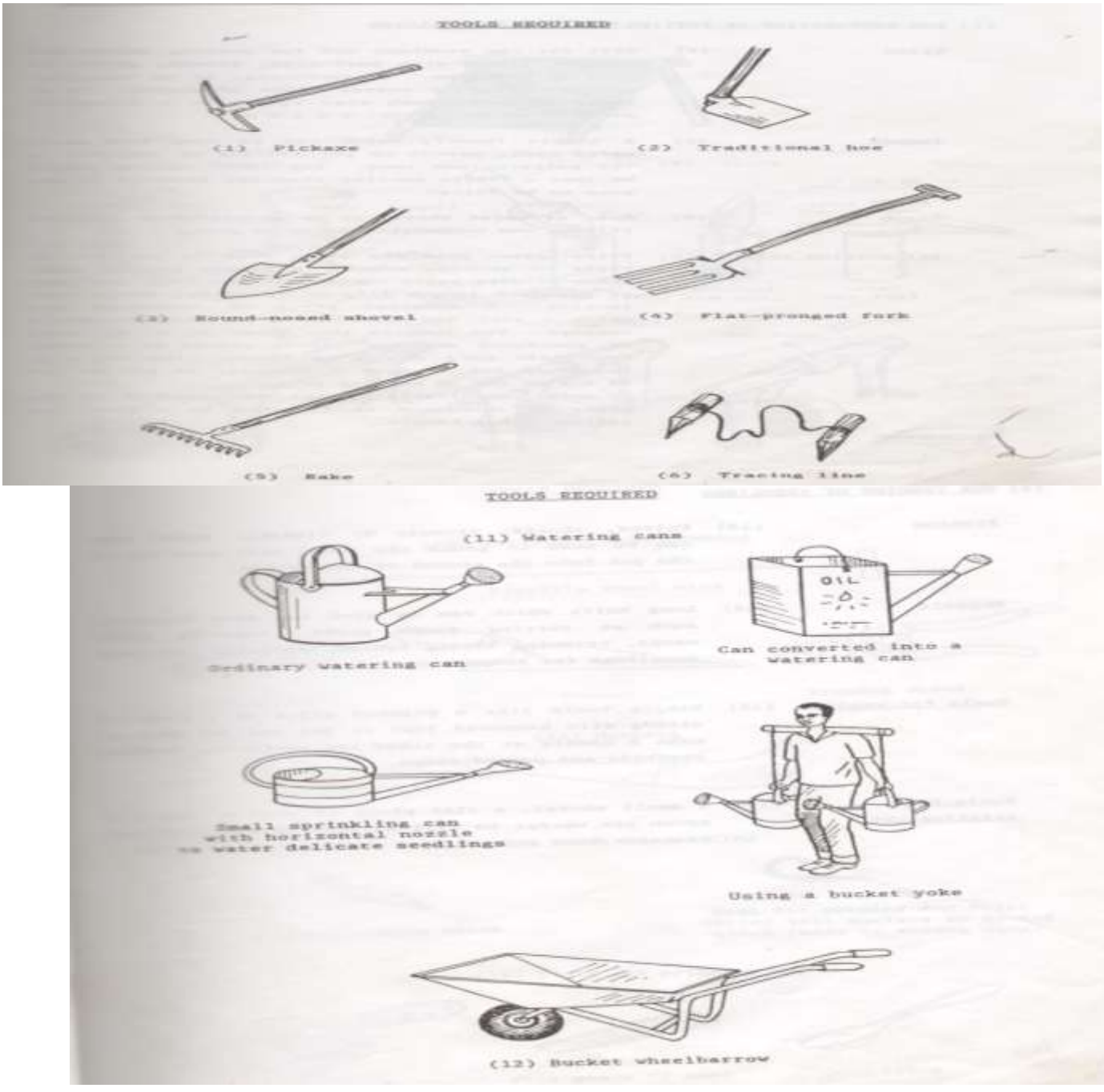

Figure 1: Tools and equipment which are used for organic fertilizer preparation

Self-Check 4	Written Test

Name: _____ Date: _____

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

1. List at least six examples of tools and equipment used for preparation of organic fertilizer? (3pts)
2. Write the rules of handling materials? (2pts)

Answer Sheet

1. **----------**
2. **----------**

Score = _____

Rating: _____

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

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

Information Sheet-5	Identify Potential OHS hazards

- identify Potential OHS hazards
  - Potential OHS hazards are identified and assessed, and appropriate action is taken to minimize risk to self and others.
  - Identify Hazards-Know what hazards are present
  - Assess Risks-evaluate the situation of risks
  - Control Hazards-and Risks Determine options for eliminating or reducing risk, selecting the best and implementing it
  - Check –Controls review the implemented controls to ensure they are working as planned and effective

❖ Methods of identifying workplace hazards include:

- Developing a workplace hazard checklist.
- Conducting a walk-through survey of the workplace.
- Analyzing unsafe incidents and accidents data.
- Consulting with employees.
- Seeking advice from workplace OH&S specialists.

❖ Hazards commonly arise from five key areas:

1. Environment – the client's home and property. Hazards associated with the environment can include: uneven or slippery floor surfaces, tight work spaces, clutter, hot/cold environments, smoking, pets, poor lighting, electrical hazards, and heavy furniture.
2. Equipment – used to do the tasks e.g. vacuum cleaner, mop, bucket, hoist, sling, shower hose, cleaning substances. Hazards associated with equipment

are usually related to the equipment being in poor repair, not working, unavailable, inappropriate for the task, or not the right size for the worker.

3. Tasks – hazards relating to tasks can include insufficient time allocated, repetitive tasks, work design, task organization, maintaining a fixed posture, poor postures, and insufficient worker numbers.
4. Support workers - can present risks to themselves by being ill prepared for the job; having insufficient training, knowledge, and/or fitness; wearing inappropriate clothing; not following procedures or using equipment; or being unable to say 'no' to unsafe tasks.

- Safety in organic fertilizer preparation and handling

During preparation and application, some organic fertilizers are potentially toxic to human beings and pollutant environmental conditions. However, they can be used safety if the user has full knowledge of the hazards involved and of the procedures to be followed to avoid these hazards.

Skin contact with sewage or sludge or compost or their residues, injection by mouth, smoking while working with them and other avoidable exposure must be avoided. Persons engaged in the mixing/turning and application of organic fertilizer (sewage, sludge, compost, farm yard manure, etc.) must wear rubber gloves, rubber boots, hat, goggles and impervious over-all or coat covering the body.

In case of poisoning through swallowing, inhalation or absorption through the skin, the affected person should be given medical attention immediately.

Self-Check 5	Written Test

Name: _____ Date: _____

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

1. Discuss what are the methods of identifying work place hazards? (3)
2. List five key areas commonly arises hazard? (3pts)

Answer Sheet:

1.----------

2.----------

Score = _____

Rating: _____

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

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

Information Sheet-6	**Selecting suitable personal protective equipment's (PPE)**

6.1 suitable personal protective equipment (PPE)

- Suitable personal protective equipment (PPE) is selected, fitted, used, maintained and stored according to work requirements, manufacturer specifications and enterprise procedures.
- Personal protective equipment (PPE) ;-refers to protective clothing, helmets, goggles, or other garment designed to protect the wearer's body from injury by blunt impacts, electrical hazards, heat, chemicals, and infection, for job-related occupational safety and health purposes.

❖ Personal protective clothing and equipment may include

- Ear protection
- Overalls
- Safety goggles and protect the eyes provide barrier protection for the eyes;
- Sunscreen lotion
- Head protection
- Boots - protects feet surrounding parts
- Gloves- protect the hands .they should not be too loose or too tight. They also should not tear or damage easily
- Respiratory: - Masks should fully cover the nose and mouth and prevent fluid, dust penetration

Self-Check 6	Written Test

Name: _____ Date: _____

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

1. What is PPE?(3)
2. List five example of PPE with their purposes? (4)

Answer

Score = _____

Rating: _____

1.----------

2.----------

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

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

Reference:

https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/organic-fertilizer

https://en.wikipedia.org/wiki/Organic_fertilizer

https://www.hse.gov.uk/work-equipment-machinery/inspection.htm

https://www.hse.gov.uk/work-equipment-machinery/selection-conformity.htm

https://www.osha.gov/shpguidelines/hazard-Identification.html

HORTICULTURAL CROPS PRODUCTION

Level-III

Learning Guide-27

Unit of Competence: Prepare organic fertilizers (Organic Soil Improvement)

Module Title: Preparing organic fertilizers (Organic Soil Improvement)

LG Code: AGR HCP3 M07 LO2-LG-27

TTLM Code: AGR HCP3 TTLM 0120v1

LO2: Manage crop residue/by product

Instruction Sheet	Learning Guide 27

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

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

- undertaking activities in crop residue/by-product management
- Separating Crop residue/by-product
- Collecting and storing crop residue/ leftovers and by-product
- Converting and using crop by-products

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 –

- undertake activities in crop residue/by-product management
- Separate Crop residue/by-product
- Collect and store crop residue/ leftovers and by-product
- Convert and use crop by-products

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the information “Sheet 1- 4”.
4. Accomplish the “Self-check 1- 4 respectively and proceed to operation sheet -1.
5. Do the “LAP test” (if you are ready).

Information Sheet-1	undertaking activities in crop residue/by-product management

1.1. Production Planning and Scheduling

Production planning is the function of establishing an overall level of output, called the production plan. The process also includes any other activities needed to satisfy current planned levels of sales, while meeting the firm's general objectives regarding profit, productivity, lead times, and customer satisfaction, as expressed in the overall business plan. The managerial objective of production planning is to develop an integrated game plan where the operations portion is the production plan.

1.1.1. Determining agro-ecological requirements for establishment of compost production

Selection of a compost heap, pit and basket site is very important for a better compost-making process. A heap/pit/basket/barrel method of the site should be selected close to where you want to use compost. The site should be sheltered from the sun, rain, and protected from surface run-off example put under a tree, under a roof or an old store or house to avoid loss of nutrients. A compost pit/basket should be under the shade of a tree to help retain moisture and flood water should not enter the pit. Trainees should be taken for an outdoor practice in selecting compost sites and should discuss about the location among them before reporting back to the trainer:

- If the site is not found in a good place with shade and appropriate slope in the area, a compost pit can be dug with some safeguards. These are:
  - first, to make a shade with plastic, grasses, old sacks, etc. similar to the shade used in a seedling nursery
  - Second, make structures to divert possible flood water from entering into the pit.
  - Both these safeguards should be put in place after the pit/basket has been completely filled with composting materials.
  - It is especially useful for food production in home gardens with basket.
  - Using barrels might make it easier and more hygienic to practice composting near the house/residence.

There is ever increasing pressure on the farmer to reduce impacts to the environment from what have long been considered traditional methods of farming. In part, this is the result of a more stringent regulatory environment. It also results from more intensive farming methods combined with a decrease in land base. The following environmental issues also should be considered:

- Surface Water Contamination - Runoff
- Ground Water Contamination - Infiltration
- Nitrate Build-up in Agricultural Soil
- Legal and Cost-Effective Alternatives for Organic Waste Disposal (Utilization)

1.1.2. On-Farm Composting Facility

A site for an agricultural composting facility must provide the required area and conditions for all weather composting as well as limit the environmental risk associated with odor, noise, dust, leaching, and surface water runoff. Site planning involves finding an acceptable location, adapting the composting method to the site, providing sufficient land area, and implementing surface water runoff and pollution control measures as needed. The materials being composted and system management will also impact these environmental concerns. In addition to the site regulatory requirements that may apply, it is important to be aware that starting a composting facility may raise concerns among neighbors and local public officials.

Educating these groups about composting and its advantages will be a critical part of getting started smoothly. It is essential to include concerned individuals in the planning process from the beginning to develop a “good-neighbor” working relationship. The location of the composting site should allow easy access, a minimum of travel and materials handling, and a firm surface to support vehicles under varying weather conditions. Usually the most convenient composting site on the farm is near the barn or manure storage facility. However, the convenience of a particular site must be weighed against factors such as area, proximity to neighbors, visibility, drainage, and runoff control. The best site on the farm may not be the most convenient; or a convenient site may require modifications such as grading or drainage.

Odor is the single greatest reason for composting facilities to be shut down. Sites near sensitive locations, such as schools, hospitals, and nursing homes, should be avoided. Odors from the

composting process are minimized through good management only if the composting system is properly designed and laid out. In siting the facility, consider the direction of prevailing winds during warm periods (open windows and outdoor activities) and cold periods (thermal inversions). Turning windrows should be avoided during high impact weather conditions. Consideration must also be given to the noise and dust resulting from the composting operations and from transport vehicles traveling to and from the site. This can be addressed somewhat by selective scheduling of activities during the day.

1.1.3. Separation Distances

The separation distance, or buffer zone, between the farm composting operation and streams, water resources, and nearby human housing is intended to address water quality concerns and the nuisance factors of odor, dust and equipment noise.

Sensitive Area	Minimum Distance (feet, 0ne feet = 0.3m)
❖ Residence or Place of Business	200 - 500
❖ Private well or other potable water source	100 - 200
❖ Wetlands or surface water (streams, ponds, lakes)	100 - 200
❖ Water table (seasonal high)	2 - 5 (vertical)

1.1.4. Drainage Requirements

Good drainage at composting sites is critical. Poor site drainage leads to ponding of water, saturated composting materials, muddy site conditions, and excessive runoff and leachate from the site. In areas of high precipitation, composting operations should be conducted on an impervious surface, such as concrete or asphalt, or under cover to provide all-weather access to composting equipment and to avoid contamination of the finished compost with soil and rocks. An impervious surface also serves to protect infiltration of compost leachate and prevent contamination of the ground water.

The site should be graded to direct surface water runoff to one or more collection points (e.g., catch basins, manure lagoons, retention ponds). The collected runoff can be directed to pasture, cropland, or retained for future beneficial use. Run-on water or the surface water from surrounding land that drains onto the site should be diverted away from the composting pad and storage areas. This can be accomplished by using diversion ditches, interceptor drains.

Self-Check 1	Written Test

Name: _____ Date: _____

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

1. What is by product/residues mean (5)

Answer

1.----------

2.----------

Score = _____

Rating: _____

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

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

Information Sheet-2	Separating Crop residue/by-product

2.1 Identifying the Major Sources of Organic Matter.

- Crop residues, tree wastes and aquatic weeds
  - Crop residues of cereals, pulses and oil seeds.
  - Stalks of corn, cotton, tobacco, sugarcane trash, leaves of cotton, jute, tapioca, areca nut, tree leaves, water hyacinth, forest litter, etc.
- Agro – industries by – products
  - Paddy husk and bran.
  - Bagasse and press mud.
  - Sawdust.
  - Fruit and vegetable wastes.
  - Cotton, wool and silk wastes.
  - Tea and tobacco wastes

Table- 2. The major nutrient contents of main raw materials for ex – situ manuring.

Name of materials	Natural dried			Fresh		
	N%	P%	K%	N%	P%	K%
Straw	1.051	0.141	1.482	0.347	0.046	0.539
Rice S	0.826	0.119	1.708	0. 302	0.044	0.663
Wheat S	0.617	0.071	1.017	0.314	0.040	0.653
Maize S	0.869	0.133	1.112	0.298	0.043	0.384
Soybean S	1.633	0.170	1.056	0.577	0.063	0.368
Potato S	2.403	0.247	3.581	0.310	0.032	0.461
Sweet Potato S	2.131	0.256	2.750	0.350	0.045	0.484
Groundnut S	1.658	0.149	0.990	0.572	0.056	0.357
Broad Bean S	2.215	0.204	1.466	0.482	0.051	0.303

Agri – by – product						
Rice Husk	0.310	0.034	0.307			
Maize Cobs	0.606	0.071	0.542			
Bagasse	1.001	0.128	1.005	0.205	0.043	0.511
Bean Cake	6.684	0.440	1.186	4.838	0.521	1.338
Cassava Residue	0.475	0.054	0.247	0.106	0.011	0.051
Urban Residue	0.319	0.175	1.344	0.275	0.117	1.072
Rural Residue	0.882	0.348	1.135	0.317	0.173	0.788

- Proper management of crop residues

Maintenance of highly productive cropping requires effective protection of soils against erosion, conservation of relatively high amounts of soil organic matter, provision of optimum conditions for soil biota, and, to prevent undesirable environmental effects of high-level fertilizer applications, the highest possible rate of recycling of plant nutrients. At the same time, minimizing the human impacts on tropospheric chemistry requires lower emissions of greenhouse and other gases, and avoiding serious health hazards posed by smoke necessitates severe restrictions, or outright elimination, of all unnecessary Phyto mass burning. Appropriate field management of crop residues can help to achieve all of these goals.

Residues in excess of carefully determined recycling requirements can make a major difference at both the local and regional levels in producing high-quality animal and fungal protein or fiber. Better ways of compacting residues would lower their transportation costs and improve their nutritional value, making their off-field use for feed, fiber, or substrate more economical. Perhaps the best way to promote these rational ways of dealing with straws, stalks, and leaves is to see them not as residues—as often undesirable leftovers of much more highly prized crops—but as valuable resources that provide irreplaceable environmental services and assure the perpetuation of productive agroecosystems and sustainable food production.

Separation of crop residues depends on crop species: some crops are threshed after dried their above ground parts harvested and some are green leftover after food preparation.
Shelling and threshing: these operations are carried out by manual and machine based on farmers requirement and size of the area.

- Grain Cleaning: threshing operations leave all kinds of trash mixed with the grain; they comprise both vegetable (e.g. foreign seeds or kernels, chaff, stalk, empty grains, etc.) and mineral materials (e.g. earth, stones, sand, metal particles, etc.), and can adversely affect subsequent storage and processing conditions. The cleaning operation aims at removing as much trash as possible from the threshed grain.

The simplest traditional cleaning method is winnowing, which uses the wind to remove light elements from the grain.

- Mechanized cleaning: the most rustic equipment is the winnower: a fan-originated current of air passes through several superposed reciprocating sieves or screens. It can be either manually powered or motorised; capacities range from a few hundred kilogrammes to several tonnes per hour.

These machines, also equipped with a system of vibrating sieves, are generally capable of very high outputs (several tens of tonnes per hour).

In developing countries, mechanizing the cleaning operation at village level has seldom been felt as a necessity, because of the lack of quality standards in grain trading. However, because of the current trend towards privatization of marketing networks, the demand for cleaning machines will probably increase. The local manufacture and popularization of simple and easily portable equipment, such as winnowers or screen graders suited to cereal crops, need to be encouraged.

Self-Check 2	Written Test

Name: _____ Date: _____

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

1. How do you can separate crop residue? (4)

Answer

1.----------

Score = _____

Rating: _____

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

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

Information Sheet-3	Collecting and storing crop residue/leftovers and by product

3.1 Initial handling requirements, stockpiling location and arrangement on site

Location of a plant is determined on the basis of proximity to raw material, nearness to potential market outlets and the availability of developed infrastructure. Consideration is also given to fair distribution of industrial projects. It is therefore proposed that the organic fertilizer plant be located near town. Manure should be suitably contained before treatment. The location for storage and treatment of animal manure should be as far away as possible from produce growing areas. Barriers or some type of physical containment should be used in manure storage areas to prevent contamination of produce or production areas by pathogens. These can be spread from the stored manure by rain wash, subterranean water-flow or wind. Contamination of groundwater supplies can be minimized by storing animal manure on a cement floor or in special holes lined with clay.

Rainfall on manure piles can result in a run-off containing pathogenic bacteria that can contaminate the fields, equipment, etc. Therefore, manure piles should be covered with plastic or other materials and/or stored underneath a raised shed. Equipment (tractors) coming into contact with untreated manure can be a source of contamination for the produce and/or the production area. Equipment should be cleaned with high-pressure water or steam before it is allowed into the production area. In a similar way, personnel handling manure should not enter the growing fields without paying attention to personal hygiene.

Treated manure should be kept covered and away from waste and garbage to prevent recontamination by birds or rodents. It should be stored well away from the growing fields and separated from product packaging material, so it will not contaminate the fresh produce, water sources or packaged products. Properly-treated organic fertilizer should be applied prior to planting or during the early stages of plant growth. It should be applied near the roots

and covered with soil. Organic fertilizers should NOT be used when the fruit or vegetable is nearing maturity or harvest.

Crop residues collection and storage practices were observed to depend on the mechanism of harvesting grain from the crops. With teff, wheat, barley and haricot bean, collection of grains from the crops necessarily demands the harvesting and transporting of the crops to homesteads where they are threshed and their grain and straws are separated. Finally, the straws are stacked near homesteads and, in some cases, fenced with locally available wood. In case of maize and sorghum, the maize ears and sorghum grain heads are usually removed from the stalk right in the field leaving the rest for *in situ* grazing. This condition is further complemented with the status of farmers in having suitable conditions that enable them to collect these residues, the severity of feed problem the farmers have and the importance of none-feed purposes for which the stovers are required. In situations where farmers have no means of transportation, or where they have sufficient feeds from other sources, or where they need the stovers for other non-feed purposes, less stovers are collected and stored for animal feeding.

Self-Check 3	Written Test

Name: _____ Date: _____

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

1. How do store crop residues? (5pts)
2. What is the purpose collecting storing crop residues? (5pts)

Answer

1.----------

2. ----------

Score = _____

Rating: _____

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

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

Information Sheet-4	Converting and using crop by-products

4.1 Converting and using crop by-products

Tillage in any production system is performed to prepare a seedbed, remedy compaction, incorporate fertilizers and herbicides and control weeds. However, one of the accompanying results of tillage is the destruction of crop residues that remain after harvest of arable crops. It is an accepted fact that returning crop residues to the soil environment is an agronomically important practice. The positive effects are many and they include:

- Providing ground cover to absorb the impact of raindrops, thus reducing soil particle detachment which in turn decreases erosion potential
- Recycling nutrients removed by a growing crop
- Maintaining or increasing soil organic carbon (SOC) to provide a substrate for soil microorganisms and to increase the organic component of soil.

Historically, farmers perceive this residue as trash, or a problem which must be destroyed by fire or tillage. However, regularly management of crop residue generated in crop rotation systems can produce substantial long-term benefits which are likely to far outweigh any short-term savings accomplished by destroying residue.

Farm experts have always favoured ploughing of crop residues, instead of burning. Burning of crop residue eliminates an opportunity to improve organic matter content and potentially can lead to substantial nutrient loss. Nearly all nitrogen and at least 75% of sulfur contained in plant residues will be lost upon combustion. Although phosphorus and potash are not theoretically lost due to residue combustion, considerable loss will realistically occur from smoke and ash that are not recoverable or recycled into the soil.

Fig 4.1. Ploughing of crop residue

Although plant residues of some crops (maize) often cause problems because of its large mass, it's recommended to chop plant residues, add UREA fertilizer and plough them to 20-30 cm, thus enriching the soil with humus. UREA is added for faster decomposition of crop residues, increasing of soil microbial activity and thereby better C/N ratio.

The organic material in the soil contains about 50% of carbon and about 5% of nitrogen, and the C/N ratio of about 10: 1. With its activities, microorganisms lead to the narrowing of this ratio in the process of carbon oxidation. As long as the C/N ratio falls to a certain value, microorganisms use all released nitrogen for their needs. Therefore, in order to prevent nitrogen depression, UREA needs to be added. One part of the partially decomposed fresh organic matter, with further process of humification and the help of micro-organisms, is transformed into humus. Humus is important to maintain good soil structure and improve air and water soil regime, thermal and chemical soil properties and its buffer capacity. Therefore, ploughing of crop residues is especially important in soils where there is no possibility of applying of organic fertilizers.

Fig 4.1. Benefits of humus (organic matter) on soil

✓ Compost starting mixes

The choice of input materials also influences the composting process, and the resulting compost quality. To obtain a high compost quality, it is first of all important that the organic input materials are of high quality. They should be free from pollutants and other undesirable materials like plastics, metal or glass. High-quality compost can only be produced with source separated organic materials. To guarantee a good Composting process, the starting mixture has to have an adequate C/N ratio between 25 and 35. The mixture should also have an appropriate structure to allow optimal oxygenation of the material without too much loss of Lignin-rich material can be stored for a long time without loss of nutrients.

👍 A useful rule-of-thumb to prepare a starting mix is:

• 1/3 rough wood (e.g. shredded wood, saving rest material from compost, snipped bark).

• 1/3 medium-fine, fibrous material (e.g. shredded branches, wood fibers, straw, foliage, switch grass, reed).

• 1/3 fine materials (kitchen waste, grass clippings, manure, vegetable waste).

To improve the composting process, clays such as zeolites (5-10 kg/m3 starting mixture) or clay-rich soil (3-5 % of the starting mixture) can be added. These materials buffer the composting process, diminish odor emissions and improve the formation of stable crumbs during the curing phase of the compost. The technical preparation of the input materials also plays an important role in the decomposition of the material.

This is especially important for wood. If wood is chopped into chips, microbial colonization is inefficient and the capacity of the wood as a structure-adding material to improve the aeration of the windrow is low. If the wood is correctly shredded and well de-fibered,

microorganisms have good access to the material and the aeration of the windrow is highly improved. Finally, it is essential that the starting mixture contains sufficient moisture to allow the microorganisms to become active.

Fig 4.1 . conversions of crop residues

Self-Check 4	Written Test

Name: _____ Date: _____

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

1. Discuss the how do you convert crop residue? (5pts)
2. Write the importance of crop residues in the soil? (5pts)

Answer

1.----------

2. ----------

Score = _____

Rating: _____

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

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

Operation Sheet - 1	Separating of crop by-products
Objective:	To know how to separate crop by-products
Materials required	✓ Manual or machine thresher and separator
Procedure	✓ Site selection ✓ observe field for the availability materials ✓ prepare materials used for separation of crop by products ✓ crushing crops ✓ winnowing or separating by wind or machine from the crop ✓ collect and store in suitable place
Precautions:	Do not take from fresh products
Quality criteria	Store in appropriate place until use it

LAP Test	Practical Demonstration
NAME_____	DATE_____
TIME STARTED_____	TIME FINISHED_____

INSTRUCTION

Instructions: Given necessary information, work site, tools and materials you are required to perform the following tasks within 4:30 hour.

Task 1: perform crop by-product separation

Reference:

https://www.sciencedirect.com/topics/earth-and-planetary-sciences/crop-residue

https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/crop-residue-management

https://www.researchgate.net/post/What_are_the_strategies_for_converting_farm_waste_to_wealth_through_value_addition

https://telanganatoday.com/turning-crop-residue-into-useful-products

HORTICULTURAL CROPS PRODUCTION Level-III

Learning Guide-28

Unit of Competence: Prepare Organic Fertilizer/Soil Improvement

Module Title: Prepare Organic Fertilizer/Soil Improvement

LG Code: AGR HCP3 M07 LO3-LG-28

TTLM Code: AGR HCP3 TTLM 0120v1

LO3: Establish green manure crops and tree hedges

Instruction Sheet	Learning Guide 28

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

- Identifying and establishing leguminous crops and trees
- Identifying and planting leguminous trees

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

- Identify and establish leguminous crops and trees
- Identify and plant leguminous trees

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below 3 to 5.
3. Read the information written in the information “Sheet 1 – 7’’ respectively.
4. Accomplish the “Self-check 1 – 7.’’ respectively.
5. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1 - 2” respectively.
6. Do the “LAP test” (if you are ready).

Information Sheet-1	Identifying and establishing leguminous crops and trees

1.1 Establishment and management of leguminous crops

Like any crop, green manures require good management for successful establishment and growth. Good seedbed preparation, correct sowing rate and depth are all important. Other keys to success include:

- ✓ Weed management:

Although densely planted green manures can effectively smother weeds, early weed management is important to ensure good crop establishment and prevent the early establishment of weeds. Correct timing of sowing; sowing into a weed-free seedbed and well-timed mechanical weeding will all help get the crop off to a good start.

- ✓ Nutrition & irrigation:

In vegetable cropping, green manures require irrigation for optimal production of organic matter. The need for nutrient and water inputs depends on the crop chosen as well as local climate and soil conditions. Some fertilizer application is likely to be needed to optimize establishment and growth of the crops. Nitrogen is generally not required for leguminous green manure crops but a small amount will aid establishment of the plants during the pre-nodulation stage. Non-legumes such as millet require adequate levels of nitrogen for good production a range of nitrogenous fertilizers approved for use by certified organic growers are available commercially. These are generally based on pelletized, composted poultry or cow manure.

- ✓ Inoculation:

Leguminous crops such as cowpea, bean, clover and vetch should be inoculated with the appropriate strain of Rhizobium bacteria before sowing. This helps the crop establish good levels of root nodulation and nitrogen fixation.

1.2 Leguminous crops and trees:

- ✓ Leguminous crops are like pulses, beans, peas, groundnut and Bengal gram
- ✓ There plants have the ability to fix atmospheric nitrogen to form nitrogen compounds through the help of certain bacteria present in their root. These nitrogen compounds go into the soil and make it more fertile. After the leguminous plants utilize some of the nitrogen compounds, the rest of it is left in the soil to enrich it. Thus, planting a leguminous plant will result in nitrogen rich soil and when a cereal is grown in this soil there is increase in food grain production.

➢ Nitrogen fixation:

- ✓ Legumes have a special characteristic, that they can absorb nitrogen from the air and use it for their own growth.
- ✓ They store the nitrogen in nodules on their roots, with the help of special bacteria (Rhizobia). As the root nodules grow they start to produce nitrogen.
- ✓ The root provides the rhizobium bacteria with food and shelter and in return the bacteria help the plant to store nitrogen.
- ✓ Rhizobia are bacteria which induce the root hairs of the plant to form nodules in which nitrogen is stored.
- ✓ Rhizobia are found in most soils, but they do not always form nodules. Sometimes there are not enough bacteria in the soil to form nodules, or they might not be the right type of rhizobium for soya plants. Just as there are different sorts of legumes there are also different sorts of rhizobia.
- ✓ For nitrogen fixation to take place, the correct combination of rhizobium and legume is needed.

➢ Root nodule activity:

- ✓ It is possible to tell from the colour of the root nodules whether or not they are active, and therefore fixing nitrogen.

- ✓ Active root nodules are pink inside. By cutting through a root nodule it is possible to see whether it is active or not.
- ✓ The best time to do this is when the plant is flowering.
- ✓ Root nodules that remain white or light green on the inside throughout the growth cycle of the soya plant are not active. Even if the soya receives nitrogen in the form of artificial fertilizer the root nodules remain small and white.
- ✓ Only once the nitrogen from the fertilizer has been used up do the root nodules become active and grow bigger. For this reason it is worthwhile giving soya extra nitrogen if it is grown on poor soil.

➢ Rhizobium treatment:

- ✓ If the soya plants do not develop active root nodules on their own, it is possible to add rhizobium to the seed or the soil. This is called inoculation.
- ✓ It is possible to check whether a rhizobium treatment has been effective.
- ✓ Check the development of the root nodules four or five weeks after sowing.
- ✓ Check again when the soya plant is flowering. Check for a third time while the pods are forming to see how much the different types of rhizobium have contributed to pod formation. You will gain the most information by carrying out all three checks

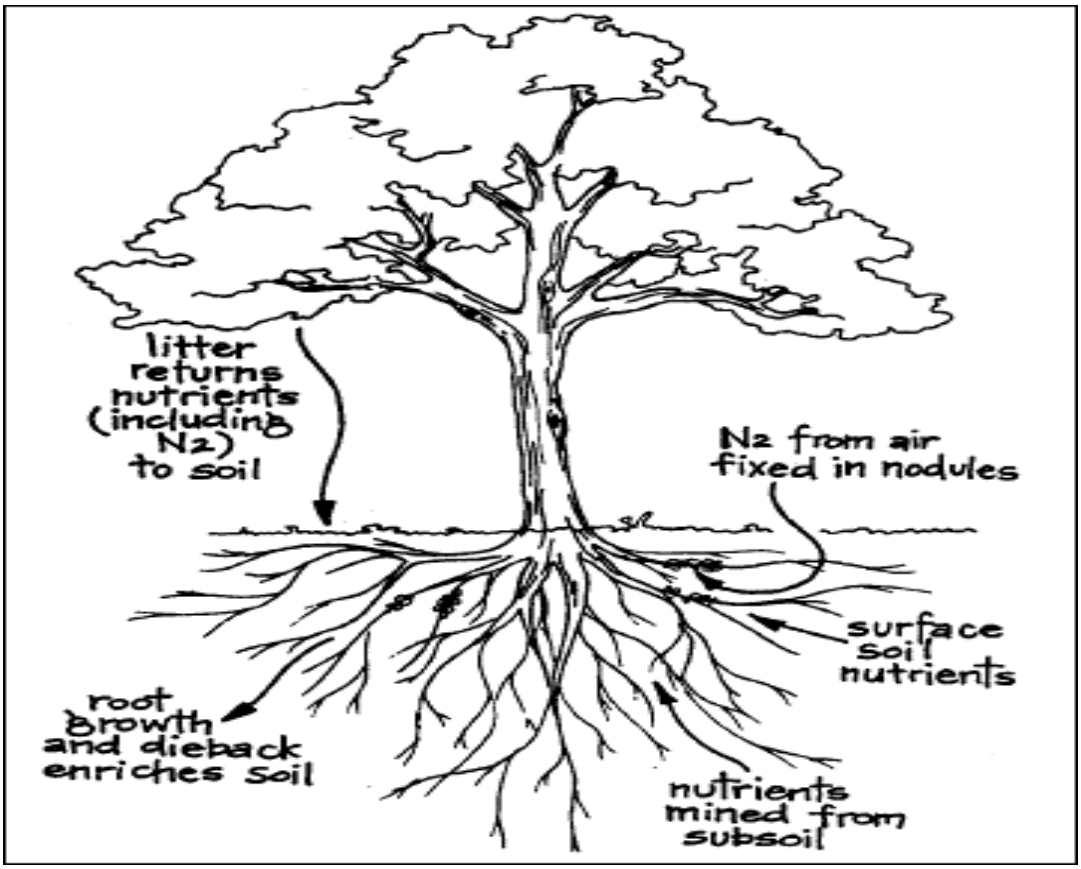

fig.1.1 relationship between legume tree and soil

- Uses of legume crops

Crop:

- ➤ combine with other crops to improve soil fertility
- ➤ Green manure
- ➤ Ground cover

Crop remains:

- ➤ Animal feed
- ➤ worked into the soil to improve soil fertility

Beans:

- ➤ Important source of vegetable oil
- ➤ cooked or eaten as pulses and split peas
- ➤ Ground into flour for cooking

- **Leguminous trees**
  - Honey locust (*Gleditisia triacanthos*L.

Fig. 1.2 Native Mesquites and Moringa pterygosperma Gaertn.(shiferaw)

- M. oleifera is easily established by cuttings or by seeds. Seeds can be sown either directly or in containers. No seed pre-treatment is required and seeds sprout readily in 1-2 weeks.
- Plants raised from seed produce fruit of unpredictable quality.
- Shield budding is successful, and budded trees begin to bear in 6 months and continue to give a good crop for 13 years.
- Food: The leaves, a good source of protein, vitamins A, B and C and minerals such as calcium and iron, are used as a spinach equivalent.
- They are an excellent source of the sulphur-containing amino acids methionine and cystine, which are often in short supply.
- Young plants are eaten as a tender vegetable and the taproots as an alternative for horseradish.

- Young pods are edible and reportedly have a taste reminiscent of asparagus.
- The green peas and surrounding white material can be removed from larger pods and cooked in various ways.
- Seeds from mature pods (which can be 40-50 cm long) can be browned in a skillet, mashed and placed in boiling water, which causes an excellent cooking or lubricating oil to float to the surface.
- The pleasantly flavoured edible oil, resembling olive oil, is an excellent salad oil. The flowers can be eaten or used to make a tea.
- Fodder: Leaves are mainly used for human food and not to any great extent for livestock, but branches are occasionally lopped for feeding camels and cattle.

Self-check 1	Written test

Name: _____ Date: _____

Directions: Answer all the questions listed below.

1. What are leguminous crops? (2 pt)
2. Discuss in detail about nitrogen fixation? (4 pt)
3. What is the advantage & dis advantage of leguminous crops? (4 pt)

Answer sheet:

1.----------

2.----------

3.----------

Score = _____

Rating: _____

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

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

Information Sheet-2	Identifying and planting leguminous trees

2.1 Identifying and planting leguminous trees as hedge and periodically pruned

This is the system by which multipurpose trees in agroforestry that involves trees in combination with other agricultural enterprises, including livestock. Different species of trees can be planted with many types of crops in a variety of patterns. Trees in agroforestry system promote soil and water conservation, enhance soil fertility and act a wind breaks for nearby crops.

- ✓ <u>What are the best multipurpose trees in agroforestry?</u>
  - It is important to select the most suitable trees, since it not easy to replace them once they have been planted.
- ✓ <u>Factors for selecting trees</u>

- Environmental adaptation
- Needs of farmers
- Ease of maintenance
- Availability of genetic material

Farmers should prune hedge grows regularly to prevent them from competing with nearby crops for sunlight and water. Plant them in North to South not to east to west.

To obtain green manure farmers can prune the top of the hedge grows every 6 - 8 weeks.

- ✓ <u>Desirable characteristics of species</u>

- Easily established and Good sprouting
- Fast growing and Nitrogen fixing
- Heavy and palatable foliage (provide more green manure and acceptable fodder)
- Deep root system (to absorb water and nutrients from deeper layers)
- Easy to propagate
- Adaptable to close spacing (hedges require dense planting)

Self-Check 2	Written Test

Name: _____ Date: _____

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

1. What importance of planting leguminous trees? (5pts)
2. Discuss the considerations during planting of leguminous trees? (5 pts)

Answer

Score = _____

Rating: _____

1.----------

2.----------

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

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

Operation Sheet - 1	Establishing legume crops
Objective:	To know how to establish legume crops
Materials required	✓ Seed, hoe, tape, string and water
Procedure	✓ Site selection ✓ prepare materials ✓ land preparation and lay outing ✓ sowing ✓ watering
Precautions:	Do not use unknown seeds
Quality criteria	Sow based on required space
LAP Test	Practical Demonstration

NAME_____ DATE_____

TIME STARTED_____ TIME FINISHED_____

Instructions: Given necessary information, work site, tools and materials you are required to perform the following tasks within 4:30 hour.

Task 1: perform legume crop establishment

Reference

http://www.fao.org/forestry/agroforestry/89998/en/

https://extension.umn.edu/how-manage-soil-and-nutrients-home-gardens/cover-crops-and-green-manures

https://worldwidescience.org/topicpages/l/leguminous+tree+species.html

https://www.daera-ni.gov.uk/articles/green-manures

https://homeguides.sfgate.com/trim-hedge-trees-80142.html
https://www.truevaluepaint.com/lawn_and_garden/landscaping/trim_trees_and_hedges_before_winter.aspx

HORTICULTURAL CROPS PRODUCTION

Level-III

Learning Guide-29

Unit of Competence: Prepare organic fertilizers (Organic Soil Improvement)

Module Title: Preparing organic fertilizers (Organic Soil Improvement)

LG Code: AGR HCP3 M07 LO4-LG-29

TTLM Code: AGR HCP3 TTLM 0120v1

LO4: Collect Green Manure and Incorporate

Instruction Sheet	Learning Guide 29

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

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

- Determining green manure requirements
- Identifying, collecting and checking raw materials
- Utilizing locally available materials
- Analyzing/assessing weather and soil conditions
- Identifying conditions favor rapid decomposition of green manure
- Incorporating green manure crop
- Pruning tree hedges.

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 –

- Determine green manure requirements
- Identify, collect and check raw materials
- Utilize locally available materials
- Analyze/assess weather and soil conditions
- Identify conditions favor rapid decomposition of green manure
- Incorporate green manure crop
- Prune tree hedges

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the information “Sheet 1- 4”.
4. Accomplish the “Self-check 1- 4 respectively and proceed to operation sheet -1.
5. Do the “LAP test” (if you are ready).

Information Sheet-1	Determining green manure requirements

1.1 What are green manures:

Green manures, often known as cover crops, are plants which are grown to improve the structure and nutrient content of the soil. They are a cheap alternative to artificial fertilizers and can be used to complement animal manures. Growing a green manure is not the same as simply growing a legume crop, such as beans, in a rotation. Green manures are usually dug into the soil when the plants are still young, before they produce any crop and often before they flower. They are grown for their green leafy material which is high in nutrients and protects the soil.

If food is in very short supply it may be better to grow a legume from which a bean crop can be harvested and then dig the plant remains into the soil. These plant remains will not break down into the soil so quickly and will not be as good for the soil as younger plants but they will still add some nutrients to the soil for the next crop.

1.1. Importance of using green manures

Green manuring offers an inexpensive way of improving crop yields and it takes little extra effort. Green manures are especially important on farms where there is not enough animal manure available, and when it is not possible to bring in natural fertilizers from elsewhere. Although the use of green manures may seem to create extra work, they do provide a number of benefits:

Green manures recycle nutrients and add organic matter to the soil. They help prevent nutrients being washed out of the soil. The nutrients are taken up by the green manure and held inside the plant. When the nutrients are needed for the next crop the plants are dug into the soil or used as mulch on top of the soil. This helps to increase crop yields. Legumes and other nitrogen fixing plants which take nitrogen from the air to the soil are particularly beneficial. It also improves soil structure, prevent soil erosion, and control weeds.

Green manures are crops grown within a rotation for the purposes of:

- building soil organic matter and soil structure
- supplying nitrogen and other nutrients for a following crop
- preventing leaching of soluble nutrients from the soil
- providing ground cover to prevent damage to soil structure
- bringing crop nutrients up from lower soil profiles
- smothering weeds and preventing weed seedling growth

1.3. Method of green manure preparation

How are green manures used?

Farmers often see the benefits of green manures but many do not use them because they do not know which species to use and how to include them in their own farming system. It is therefore important to plan in advance where and when they are to be grown.

1. Green manures in rotation

Growing green manures as part of a crop rotation is an important part of an organic farming system. They help to build soil fertility and are particularly useful when grown before crops which need a lot of nutrients.

Green manures can be used in rotation:

• Whenever there is no crop in the ground, rather than leaving the land bare and allowing weeds to grow and nutrients to leach out of the soil.

• As break crops, when there is only a short time between main crops.

Timing of sowing is important. The green manure must be ready to dig in before the crop next is sown. There should not be a long gap between digging- in the green manure and planting the next crop. This is to prevent nutrients from the green manure leaching out of the soil, before being taken up by the next crop.

2. Green manures and under sowing

Under sowing involves growing a green manure at the same time as a crop, among the

crop plants. Sometimes they are sown with the crop or slightly later when the crops are already growing. This reduces competition between the green manure and the crop. For example, under sowing is sometimes used with maize crops where a green manure is sown under the young maize plants. The green manure seeds are broadcast sown when the second weeding of the maize is carried out. In this way when the maize is harvested the green manure is already established and ready to grow quickly.

3. Green manures for mulching

Green manure plants can be cut and left on the soil surface as a mulch. Mulching releases nutrients slowly but has some advantages:

- Mulching helps to prevent weed growth
- Mulching protects the soil from erosion
- Mulching keeps the soil moist by reducing evaporation

4. Green manures in agro forestry

Agro forestry is the practice of growing trees and/or shrubs together, with crops and/or animals. The trees/shrubs act as long term green manures and the leaves can be used for digging in or as a mulch. The regular pruning of agroforestry trees such as Leucaena (Leucaena leucocephala), Mother of cocoa (Gliricidia sepium) and Calliandra (Calliandra calothyrsus calothyrsus) during the crop growing period provides large amounts of green material for digging into the soil and reduces competition with the main crop. The material can also be used as mulch. It is spread on the top soil, usually between crop rows or before a crop has been planted. As well as improving the soil in the ways described above, trees and shrubs also provide food, fodder, fuel wood, erosion control and other benefits.

1.2. Time and application

👍 Digging in green manures

Before a crop is sown the green manure is dug back into the soil. Here it decomposes and the nutrients held inside green manure plants are released.

• The plants take a short time, usually about two weeks, to rot down into the soil before the next crop is sown.

• Green manures should not be ploughed in as this buries the plants and the nutrients too deep. They should be turned in just under the soil surface.

• Digging is easier if the plants have been chopped into small pieces before digging. This also helps prevent the problem of regrowth if this should occur.

• If digging-in is difficult the plants can be dug in roughly, left for a few days and dug over again.

- Digging in a green manure

Younger green manure plants are easier to dig into the soil than older ones and land will be ready to use more quickly after they have been dug in. So, over a long period, two short term green manures may be better than one longer term green manure. However, this may involve more of time and effort. For most green manure plants, the best time to dig in is just before flowering begins, but this is different for some species. If plants become too old and tough, they will be more difficult to dig in. Soil organisms will find it difficult to break down and decompose old, tough plants. If this happens green manures can be cut and composted instead.

- The choice of green manure

When choosing which green manure plant to use, you should consider the following points:

• A green manure must suit the local climate, and the soil that it is to be sown in. This will help to keep the green manure healthy and to keep pests and diseases to a minimum.

• Fast growing and leafy green manures are often preferred as they provide more nutrients when dug in.

• Green manures should not be closely related to the following crop as they could attract pests and diseases which may affect the following crop.

• It is important to know whether seed is easily available and affordable.

• The length of time that land is free and how long the green manure will take to grow.
• Plants which can be grown as a green manure include legumes and non-legumes.

➢ Classification of green manure

It mainly classified in to two groups. These are legume and non-legumes. The legume and non-legume green manures are differentiated as follows: -

a). Legumes -

- Fix free nitrogen from the atmosphere
- Physical condition of the soil is improved by cultivation and incorporation.
- They are more succulent than the non-legume and less soil moisture is utilized for their decomposition.
- They serve as cover crops by their vigorous growth and weeds are smothered e.g. clover and cowpea.

b). Non legumes

- Free nitrogen is not fixed by non-legumes except in specific plants which have root nodules produced by bacteria or fungi.
- They are not as succulent as legumes and hence required more soil moisture and time for decomposition.

➢ Characteristics of Legume green manure:

- Multipurpose use
- Short duration, fast growing, high nutrient accumulation ability.
- Tolerance to shade, flood, drought and adverse temperatures.
- Wide ecological adaptability
- Efficiency in use of water
- Early onset of biological nitrogen fixation
- High nitrogen accumulation rates

- Timely release of nutrients
- Photoperiod insensitivity
- High seed production
- High seed viability
- Ease in incorporation
- Ability to cross inoculate or responsive to inoculation
- Pest and disease resistant
- High nitrogen sinks in underground plant parts.

➢ Selection of green manure species:

Various nitrogen fixing leguminous and non-leguminous species, particularly trees, creepers, and bushes can be used as green manures. The criteria for selection of plants as green manure is: -

- ✓ High biomass production (to mobilize nutrients from soil in to vegetation).
- ✓ Deep rooting system (to pumping up leached nutrients from the soil layers not occupied by roots of main crops).
- ✓ Fast initial growth (for quick soil cover for effective soil protection and suppression weeds)
- ✓ More leaf than wood (to easy decompose)
- ✓ Low C/N ratio (to enhance availability of nutrients for succeeding crops).
- ✓ Nitrogen fixing ability
- ✓ Good affinity with mycorrhiza
- ✓ Efficient water use
- ✓ Non host for crop related pests and diseases
- ✓ Easy and abundant seed formation

➢ Forms of green manuring:

Green manure crops can be planted in different combinations and configurations in time and space:

- Improved fallow, i.e. replacing natural fallow vegetation with green manure crops to speed up regeneration of soil fertility and permit permanent cultivation; these green manures may be left to grow for one or several years or only during the dry season.
- Alley cropping, a form of simultaneous fallow in which quickly growing trees, shrubs or grasses are planted in rows and are regularly cut back; the pruning are used as mulch or worked in to the soil in the alleys between the rows.
- Integration of trees in to crop land as is found in several traditional farming systems, where tree legumes growing among the crops regularly cut mulch material to maintain soil fertility in plots of coffee and other crops.
- Relay fallowing by sowing bush legumes among the food crops after these have established and in the dry season, using the cut green biomass as mulch or working it in to the soil.
- Shaded green manures (in fruit orchards, coffee plots, multistory kitchen gardens.

Figure 1.1: Corn with green manure

Figure 1.2 : Alley cropping

✓ Advantages and limitations of Green manuring

Advantageous:-

- Green manuring has a positive influence on the physical and chemical properties of the soil.
- It helps to maintain the organic matter status of arable soils
- Green manure serves as a source of food and energy for the soil microbial population which multiplies rapidly in the presence of easily decomposable organic matter.
- The enhanced activities of soil organisms not only cause rapid decomposition of the green manure but also result in the release of plant nutrients in available forms for use by the crops.
- Green manuring improves aeration in the rice soils by stimulating the activities of surface film of algae and bacteria.
- Many green manure crops have additional use as sources of food, feed and fuel.

- In soil structure and tilth improvement

  - Green manuring builds up soil structure and improves tilth.
  - It promotes formation of crumbs in heavy soils leading to better aeration and drainage.
  - Depending on the amount humus formed, green manuring increases the water holding capacity of light soils.
  - Green manure crops form a canopy cover over the soil and reduce the soil temperature and protect the soil from erosive action of rain and water currents.

- In fertility improvements of soils

  - Green manure crops absorb nutrients from the lower layer of soils and leave them in the soil surface layer when ploughed in for use by the succeeding crops.
  - Green manure crops prevent leaching of nutrients to lower layers.
  - Leguminous green manure plants harbour nitrogen fixing bacteria, rhizobia in the root nodules and fix atmospheric nitrogen.
  - Green manure crops increase the solubility of lime phosphate; trace elements etc., through the activity of the soil microorganisms and by producing organic acids during decomposition.
  - A crop of green manure on an average is reported to fix 60-100 kg nitrogen /ha in single season under favourable conditions.

- In amelioration of soil problems

  - Green manuring helps to ameliorate soil problems. *Sesbania aculeate*, when applied to sodic soils continuously for four or five seasons, improves the permeability and helps to leach out the harmful sodic salts. The soil becomes fit for growing crops
  - Green leaf manure from sources such as *Argemone mexicana* and *Tamarindus indica* has a buffering effect when applied to sodic soils.

- In improvement of crop yield and quality

  - Green manuring increases the yield of crops to an extent of 15 to 20% compared to no green manuring.
  - Vitamin and protein content if rice have been found to be increased by green manuring of rice crop.

- In pest control

  - Certain green manure like *Pogamia* and *Neem* leaves are reported to have control effects.

✓ Limitations in raising green manure crops:-

Though there are several advantages of green manuring, it is not being practiced on a large scale by the farmers due to certain limitations: -

- Non-availability of water resources may restrict raising of green manure crops.
- Non-availability of good quality seeds poses a problem
- Allotment of 6-8 weeks exclusively for growing a green manure crop is not preferred by farmers in intensive cropping system.
- As the benefits of green manuring are not as spectacular as those usually derives from direct application of inorganic fertilizers, are not convinced about the usefulness of green manuring.
- Sensitivity of certain leguminous green manure crops to photoperiodism is a constraint.
- Vegetative growth is retarded by early flowering a short, dry season, resulting in less biomass production.
- A green manure crop may compete for time, labour and water, the cost of which must be balanced against the cost of inorganic fertilizers.
- Poor germination of certain green manure seeds is also a problem.

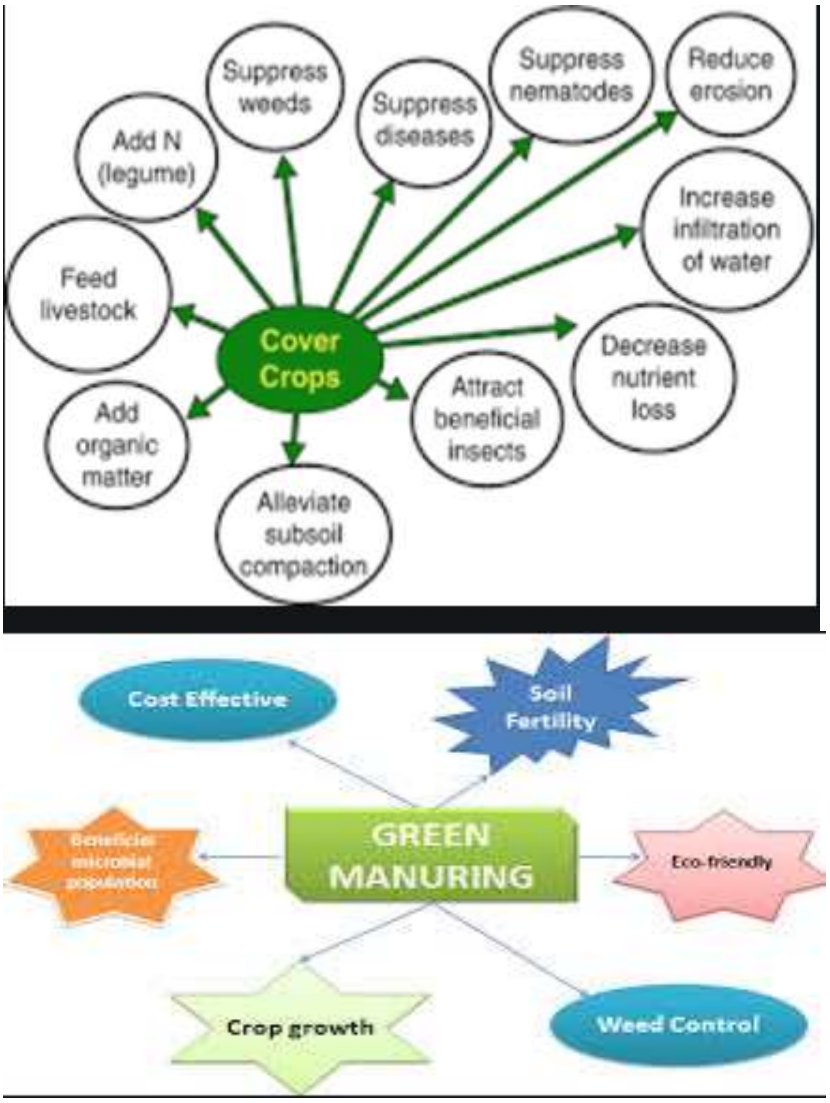

diagram. 1.3 green manure and its importance

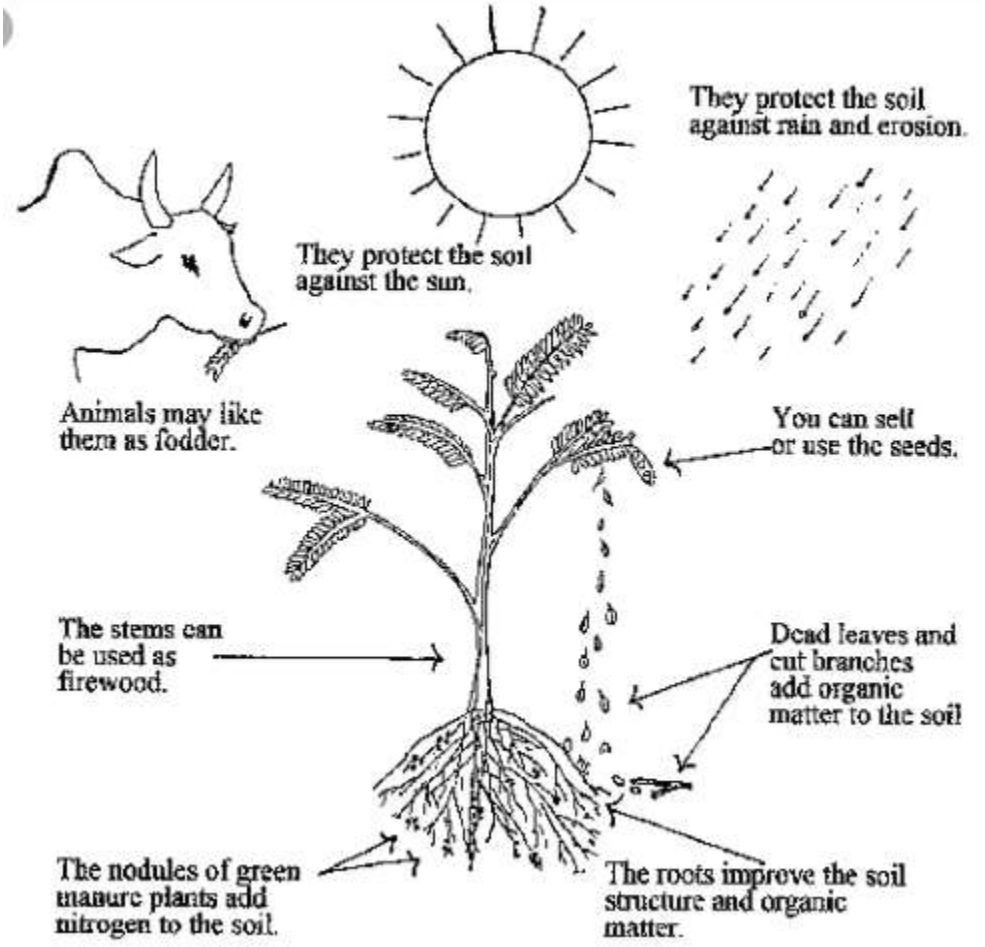

Fig. 1.4 use of green manure to soil and animal foder

Self-Check 1	Written Test

Name: _____ Date: _____

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

1. What are the major advantage of green manure? (3)
2. List the characteristics of legume green manure? (5)
3. Discuss the classification of green manure? (2)

Answer

1.----------

2.----------

Score = _____

Rating: _____

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

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

Information Sheet-2	Identifying, collecting and checking raw materials

2.1 Identifying green manure in economic consideration:

Green manure plant material which can be used as manure can be identified and collected. The choice and management of green manure crops depends largely upon the farmer's objectives. For example, the structure of fertile soils may be improved with cereal and other non-legume crops, but legumes or mixtures including legumes would be chosen to improve the nitrogen status of poorer soils. Following are some of the points to be considered when selecting green manures for particular situations and purposes:

- major objective (nitrogen source, bulk organic matter, weed competition, Bio-fumigation);
- adaptation to seasonal climatic conditions (heat or cold tolerance);
- adaptation to local soils (heavy or light, pH, salinity);
- availability of water (rainfall or irrigation);
- availability and cost of seed and microbial inoculants if required;
- Length of time from sowing to flowering (short enough to fit the 'window' between cash crops).
- Collection can be from the green leaves and twigs of trees, shrubs and herbs that are growing outside of the farm land. Trees that are important for this purpose are like neem and sesbania

Self-Check 2	Written Test

Name: _____ Date: _____

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

1. what is the purpose of collecting and checking raw materials? (5pts)

Answer

1.----------

2.----------

Score = _____

Rating: _____

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

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

Information Sheet-3	Utilizing locally available materials

3.1 Preparing raw materials and compost the feedstock mixture

Identifying, collecting and checking locally available Raw materials and additives for processing

- Confirming Composting technology and methods to be used
- pre-processing raw materials into suitable forms for composting
- Mixing pre-processed raw materials into suitable feedstock Mixtures for composting
- Handling Feedstock mixtures for composting method, Industry best practice and technology procedures.
- Assigning, Creating and documenting batch numbers or codes
- through compost production cycle

Monitoring composting Process

- Monitoring field testing and maintaining effective composting process and efficient compost production schedule in Ethiopian standards
- Maintaining and controlling compost production cycle *processing and operations records*
- Reporting faults or variations observed to supervisor and remedial action is taken

Self-Check 3	Written Test

Name: _____ Date: _____

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

1. what is the objective of using locally available materials? (3)

Answer

1.----------

2.----------

Score = _____

Rating: _____

Note: Satisfactory rating – 3 points Unsatisfactory - below 3 points

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

Information Sheet-4	Analyzing/assessing weather and soil conditions

4.1 Weather condition

- ✓ Legumes can be grown under a wide range of agro climatic conditions
- ✓ Using local climate data you can start to decide which legumes may be suitable to grow in your area.
- ✓ Some legumes grow better in cooler climates, where there are cold periods, others do better in a humid and warm climate, such as lowland areas in the tropics. Others are adapted to extremely arid and hot conditions.

I. Legumes grow better in moderate climates

- Beans, lentils (Lens culinaris), peas (Pisum sativa), kidney beans (Phaseolus sp.) and chickpeas (Cicer arietinum).

II. Legumes grow better in humid tropical climates

- Soya (Glycine max) and pigeon peas (Cajanus cajan) are suitable for warm, humid climates.

III. Legumes grow better in hot arid climates

- Cowpea (Vigna inguiculata), green gram (Vigna aureus), black gram (Vigna mungo) and groundnut (Arachis hypogaea) can tolerate extreme dryness and high temperatures. Groundnuts, for example, are grown in semi-arid and low-humid tropical areas.

➢ Soil conditions

- Legumes grow in different soils, even very acid soils (up to pH 3.8).

Self-Check 4	Written Test

Name: _____ Date: _____

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

1. List the crops that crow better in hot climate? (5pts)
2. How soil conditions affect growth of crops? (5pts)

Answer

1.----------

2. ----------

Score = _____

Rating: _____

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

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

Information Sheet-5	Identifying conditions favor rapid decomposition of green manure

5.1 Analysing /assessing and identifying conditions that favours rapid decomposition of green manure:

1. Optimum temperature for microorganism activity
2. Optimum moisture that is suitable for both the plant and function of micro organism
3. Appropriate stage of the plant:

N.B. if there is weed with in the green manure plant, remember there stage

- If the weed is with matured seed, weeding must carried out before entering to the incorporation of the manure
- If the weed is at vegetative and flowering stage mix it.

Self-Check 5	Written Test

Name: _____ Date: _____

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

1. discuss the requirements to favour manure decomposition? (5pts)
2. Discus temperature and moisture affect decomposition? (5pts.)

Answer

Score = _____

Rating: _____

1.----------

2. ----------

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

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

Information Sheet-6	Incorporating green manure crop

6.1 Incorporating the green manure and crop with the soil at appropriate stage

Incorporation:

Green manure is planned incorporation of ground mass of certain crops, grown specifically for this purpose, into soil. It enriches the soil with organic matter, improves the biological soil activity and uses less accessible nutrients, while on heavier soils it performs biological water drainage. On lighter soils green manure enhances soil capacity and ensures supply of soil with organic matter and better accessibility of nutritive elements. For green manure can be used; legumes (vetch, lupine, broad beans and clover), fodder beet, oilseed radish, white mustard, turnip rape, phacelia and buckwheat. Which crop to choose for green manure, depends on suitable sowing time and availability of free farm surface. They are most often sown after removing the grains, oilseeds and vegetables.

In general, all green manures should be incorporated whilst they are still relatively soft and green, and before they have chance to set seed.

However, in some cases such as long-term vetches, tougher organic matter will also be present in the long stems.

Traditional deep ploughing may not be the best way to incorporate a green manure as it may simply bury the green manure in a layer beneath the furrow where it will only slowly decompose.

Ideally, green manures should be incorporated throughout the surface few centimetres of the soil where most rooting of the following crop will occur.

This is also the place where decomposing organisms are most active.

Lush growth should be cut or mulched and allowed to wilt. Several passes of a rotavator, or an alternative cultivator, at intervals of a few days will then incorporate the green manure throughout the soil profile.

It is important to make sure that incorporation is complete so that the plants do not re-root and become weeds in their own right.

After incorporating a green manure, allow two to three weeks before planting the next crop, particularly if it is to be sown directly into the soil.

Mulching green manures

During the growth of a medium to long-term green manure it may be desirable to mulch the crop occasionally by 'topping' it with a mower. The material removed will then decompose and be recycled to the growing green manure crop.

It is important that mowing and mulching are carried out whist the crop is relatively short and that it is not cut so low so that regrowth is prevented, or the plants smothered by mulched material.

- Green manuring helps improve soil quality in the following ways:
  - Increases organic content of soil
  - Increases nutrient availability
  - Improves the tilth of soil
  - Restricts growth of weeds
  - Helps in pest control
  - Increases biological activity in the soil.

Pic 6.1 show green manure crops; red clover, oilseed radish, white mustard and phacelia

Green manure crops also prevent leaching of nitrates into the soil and thus ensure maximum utilization of nutrients. Ploughing of green manure crops has a favourable impact on both heavy and sandy soils and is strongly recommended on surfaces that are fertilized only with mineral fertilizers.

6.1 Fig. slashing and ploughing of green manure

Another reason for sowing of green manure is environmental awareness and efficiency of the farm production, which thus applies less fertilizer and prevents nitrates leaching. Since sowing of green manure crops is a part of nitrate directive's measure, farmers sow them more often on their farm lands.

- Stage of incorporation:

When the green manure crops are grown and incorporated in the same field, the best stage of incorporation is the flowering stage of the crop. When the plants are used for green leaf manuring should be incorporated in to the soil before they mature or attain the woody nature. Plants of very young nature also should not be incorporated as they will very easily decompose leaving little residue in the soil. Woody plants will decompose very slowly. Hence, the best stage for incorporation of plants in either at the following stages or before they attain the woody texture.

Self-Check 6	Written Test

Name: _____ Date: _____

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

1. What is incorporation of green manure? (5pts)
2. Discus what are the importance of green manuring? (5pts.)

Answer

1.----------

2. ----------

Score = _____

Rating: _____

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

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

Information Sheet-7	Pruning tree hedges

6.1 Pruning tree hedges and applying as green manure at appropriate stage

Green manures, often known as cover crops, are plants which are grown to improve the structure and nutrient content of the soil. They are a cheap alternative to artificial fertilizers and can be used to complement animal manures. Growing a green manure is not the same as simply growing a legume crop, such as beans, in a rotation. Green manures are usually dug into the soil when the plants are still young, before they produce any crop and often before they flower. They are grown for their green leafy material which is high in nutrients and protects the soil.

If food is in very short supply it may be better to grow a legume from which a bean crop can be harvested and then dig the plant remains into the soil. These plant remains will not break down into the soil so quickly and will not be as good for the soil as younger plants but they will still add some nutrients to the soil for the next crop.

6.2 Green manures in agro forestry

Agro forestry is the practice of growing trees and/or shrubs together, with crops and/or animals. The trees/shrubs act as long term green manures and the leaves can be used for digging in or as a mulch. The regular pruning of agroforestry trees such as Leucaena (Leucaena leucocephala*),* Mother of cocoa (Gliricidia sep*ium)* and Calliandra (*Calliandra calothyrsus calothyrsus*) during the crop growing period provides large amounts of green material for digging into the soil and reduces competition with the main crop. The material can also be used as mulch. It is spread on the top soil, usually between crop rows or before a crop has been planted. As well as improving the soil in the ways described above, trees and shrubs also provide food, fodder, fuel wood, erosion control and other benefits.

♠ Tree hedges will be pruned when the following characteristics is fulfilled by the tree:

- There is high green leaves
- Either at flowering or before it
- But before setting the seeds
- Selective pruning is important to avoid unwanted plant species
- Free from any types of pests
- When there is high biomass
- Give more emphasis for species that have best N fixation potential

Self-Check 7	Written Test

Name: _____ Date: _____

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

1. How do you can prune hedge trees? (5pts)
2. Discus what are the importance of pruning hedge trees? (5pts.)

Answer

1.----------

2. ----------

Score = _____

Rating: _____

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

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

Operation Sheet - 1	Incorporating green manure
Objective:	To know how to incorporating green manure
Materials required	✓ sickle, machete, mower,
Procedure	✓ Site selection ✓ prepare materials ✓ slashing/mowing ✓ ploughing/incorporating
Precautions:	Slashing with appropriate
Quality criteria	Know the proper stage

Operation Sheet - 2	Pruning hedge trees and use as green manure
Objective:	To know how to prune and use hedge trees as green manure
Materials required	✓ secateurs, saw, pruning shear, pruning knives, ploughing tools and materials
Procedure	✓ Site selection ✓ prepare materials ✓ pruning the hedge tree ✓ collecting and spreading in the field ✓ plough and incorporate into soil
Precautions:	Do not use dried materials unless composted
Quality criteria	Use fresh pruned hedge tree residues

LAP Test	Practical Demonstration

NAME_____ DATE_____

TIME STARTED_____ TIME FINISHED_____

Instructions: Given necessary information, work site, tools and materials you are required to perform the following tasks within 4:30 hour.

Task 1: perform pruning hedge tree and use as green manure

Task 2: perform incorporating green manure

Reference:

https://www.echocommunity.org/en/resources/aa593147-43e3-42c1-aa81-3b764b4eaa4c

https://orgprints.org/30588/1/Sort%20Out%20Your%20Soil.pdf

https://www.daera-ni.gov.uk/articles/green-manures

https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/green-manures

https://www.echocommunity.org/en/resources/713a7a87-91e4-4e98-ad95-f96a5331bc57

HORTICULTURAL CROPS PRODUCTION Level-III

Learning Guide-30

Unit of Competence: Prepare Organic Fertilizer/Soil Improvement

Module Title: Preparing Organic Fertilizer/Soil Improvement

LG Code: **AGR HCP3 M07 LO5-LG-30**

TTLM Code: **AGR HCP3 TTLM 0120v1**

LO 5: Prepare and regulate eco-san toilet

Instruction Sheet	Learning Guide 30

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

- Site selection
- Identifying and collecting materials
- Determining size of the chamber and preparing toilet
- Inspecting usage, potential health risks and care
- Inspecting of urine container and faeces chamber
- Monitoring faeces batch
- Maintaining processing and operation records
- Reporting faults or variations observed

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 –

- Site selection
- Identify and collect materials
- Determine size of the chamber and preparing toilet
- Inspecting usage, potential health risks and care
- Inspecting of urine container and faeces chamber
- Monitoring faeces batch
- Maintaining processing and operation records
- Reporting faults or variations observed

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below 3 to 5.
3. Read the information written in the information “Sheet 1 – 7’’ respectively.
4. Accomplish the “Self-check 1 – 7.’’ respectively.
5. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1 - 2” respectively.
6. Do the “LAP test” (if you are ready).

Information Sheet-1	Site selection

1.1 Preparing and regulating eco-san toilet

- Site selection

- Ideally, an eco-san system will prevent pollution, sanitize excretal nutrients and return them to the soil and require no water for transport or processing. For the sake of brevity we have called this arrangement sanitize and recycle'.
- However, each of these systems was developed to address those issues that were of greatest concern in the place where they are used. This discussion provides a framework for thinking about applying the eco-san approach in response to local circumstances.
- Many local variables influence the choice of an appropriate sanitation system:

1. Climate: Temperature, humidity and precipitation.
2. Topography and soil type: The relative ease or difficulty of placing systems in the ground, how quickly and the direction in which water and pollutants move through soils.
3. Abundance/scarcity of water: The relative importance of water conservation.
4. Proximity/sensitivity of water resources and aquatic ecosystems.

- Ground water level and availability, closeness to lakes, rivers and streams, or coastal waters.

5. Energy: The availability of local energy inputs, such as solar radiation.
6. Social/cultural: The customs, beliefs, values and practices that influence the design of the .social. Components of a sanitation system, its acceptability or .fit. Within a community. (It should be noted, however, that these things are not static, and that new practices are constantly evolving in most societies.)
7. Economic: The financial resources of both individuals and the community as a whole to support a sanitation system.
8. Technical capacity: The level of technology that can be supported by local skills and tools.
9. Infrastructure: The existing level of both physical infrastructure and existing services that might help support a sanitation system (i.e. extent of existing water supply, transport, public health network, educational system etc.).

10. Population density and settlement pattern: The availability of space for on-site processing and storage and local recycling.
11. Agriculture: The characteristics of local agriculture and home gardening.

Self-Check 1	Written Test

Name: _____ Date: _____

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

1. What are the considerations during site selection for preparation of ecosan toilet? (5pts)

Answer sheet:

1.----------

2.----------

3.----------

Score = _____

Rating: _____

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

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

Information Sheet-2	Identifying and collecting materials

.2.1 Identify and collect necessary materials

A. Squatting pan

- To effectively separate urine and faeces, prevent cross-contamination, allow faeces to fall into one of the two tanks and still have an easy-touse shape,

Pic 2.1 squatting pan

a. Combined pan

- The combined pan has a urine hole in the middle and two larger holes on either end for faeces.
- Each faeces hole is located over one of the two faeces chambers, and each has a cover to prevent vector access and eliminate odours.
- The hole over the full chamber ought to be covered with a special sign or symbol to allow the chamber to sit for six months without the addition of fresh faeces. This type of pan may be molded out of cement or from polyvinyl chloride (PVC).

➢ Advantage.

- It saves space compared to a two-pan design
- saves money by only requiring one pan, rather than two, and one urine diversion pipe.

➢ Dis advantage.

- Also, the urine pipe often becomes disconnected from the pan and allows urine into one of the faeces tanks. (This can be fixed by using a threaded pipe connection into the pan and perhaps tightening the connection using Teflon tape).

- Any leakage of urine or water into the faeces tank will create excess moisture and prevent faeces desiccation so it is important to fix any pipe connection problems. Unless faeces are dry, large numbers of pathogens will remain in the excrement and later contaminate crops.

Pic 2.1 combined pan

a. Faeces collection chambers

b. Pan cover

- The faeces hole cover is a surprisingly important component of Ecosan toilets.
- If the lid is consistently placed over the hole, lifted only for use, and replaced afterwards, the likelihood of flies breeding inside the vault diminishes.
- Lids at the village sites were made of cement, metal, PVC, or plastic.
- During site visits, it was found that about 11 percent of the toilets had no lid, which is not satisfactory.

c. Urine pipes and the urine collection tank

- Urine pipes posed a problem in many of the Ecosan toilets observed. As noted earlier, the joint between the pipe and the pan is often loose and may cause leakage.
- This is particularly bad in the PVC pans where the urine pipe does not have a proper connection mechanism and the pipe itself is often very short. Without adequate length, any movement in the pipe or pressure put on it may cause it to become disconnected from the pan.
- This is an easy problem to fix although a longer PVC pipe will be slightly more expensive than a shorter one.
- The size of urine pipes was sometimes a problem in certain toilets. Some were using 15 mm diameter pipes which were easily clogged by salt precipitation from

the urine. Therefore, urine pipes should not be less than 50 mms in diameter in order to prevent clogging.

- In most cases, the urine pipe is placed so that urine flows freely into the tank unassisted. The end of the pipe must be submerged in urine inside the tank to prevent the air from reacting with urine and producing ammonia.
- Nitrogen is urine's most abundant nutrient and if ammonia is formed, part of the nitrogen will be lost when the ammonia escapes as a volatile gas.
- If the pipe outlet is placed near the bottom of the tank, at least halfway to the bottom, the problem of nitrogen loss should be minimal.

d. Ventilation pipes

- A ventilation pipe is another crucial component of the Ecosan toilet.
- Proper ventilation is necessary for the dehydration of faeces and for minimisation of odours inside the toilet.

e. Access doors in vaults

- Faeces chamber access doors must be properly designed so that vaults are easy to open every six months but stay tightly closed the rest of the year.
- The doors must allow faeces to be removed easily from the vaults twice per year. In most of the Ecosan toilets studied, access doors are made of metal, concrete, wooden planks, transparent PVC sheet and other materials.
- Hole sizes were not uniform: some were not large enough to allow easy access to the vault contents while others provided plenty of area for emptying.

H. Lighting

Self-Check 2	Written Test

Name: _____ Date: _____

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

1. List materials used to prepare ecosan toilet? (5pts)

Answer

Score = _____

Rating: _____

1.----------

2.----------

3.----------

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

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

Information Sheet-3	Determining size of the chamber and preparing toilet

3.1 Size of the chamber

- In a 12-month period, an adult will produce 500 litres of urine & 50 kg of faeces. The chamber size must be adjusted for the planned number of users.
- Typically, for a household of 5 people, this will require two chambers of 0.40 m^3 minimum. This will result in a chamber of 0.9m high x 0.7m deep x 0.6 wide, giving a usable volume of 0.40 m^3.
- The larger the volume, the longer the faeces retention time, resulting in better pathogen die-off. However, larger volumes will result in higher costs due to increased quantities of materials and higher labour costs.
- The chamber's main function is to provide just enough clearance to get the 15 gallon poop drum in to position under the poop hole when the drum is empty, and out safely and easily when it is full.
- Accordingly, the chamber is not tall and the toilet structure is very solid.

3.2 Toilet preparation and wind/rain-drift directions

➢ Factors influencing design and management

- Many local variables influence the choice of an ECOSAN system:

1. Climate: temperature, humidity, precipitation and solar radiation. In dry areas it will be easiest to sanitize feces through dehydration, whereas composting may be more successful in humid areas.
2. Population density and settlement pattern: the availability of space for on-site/off-site processing, storage and local recycling.
3. Social/cultural: the customs, beliefs, values and practices that influence the design of the social components of a sanitation system, its acceptability
4. By a community. (It should be noted, however, that these things are not static, and that new practices are constantly evolving in most societies.)
5. Economic: the financial resources of both individuals and the community as a whole to support a sanitation system.

6. Technical capacity: the level of technology that can be supported and maintained by local skills and tools.
7. Agriculture: the characteristics of local agriculture and homestead gardening.
8. Institutional support: legal framework, extent of support for the ECOSAN concept in government, industry, financial institutions, universities and NGOs.

- Construction Arborloos,

  - ✓ The arborloo is a very low cost toilet ideal for rural areas where there is ample space and low risk of flooding.
  - ✓ This toilet is a simple shallow pit (less than 1 meter) toilet with a light weight superstructure placed over a hole.
  - ✓ The toilet itself can be either squatting or sitting and has a single hole with no separation of poop and urine.
  - ✓ Each time the toilet is used, cover material (either soil or carbon rich organic material) is added to the pit to reduce odours and flies and speed the decomposition of the wastes.
  - ✓ When the toilet is almost full the superstructure is moved to a new hole, the old pit is covered with a layer of soil and a tree is planted in the old pit. The decomposing wastes provide nourishment for the tree and the user never has to handle the wastes. This method is extremely low cost and a toilet can be built using only local materials.

- ✓ Construction -4 steps

1. The Beneficiaries dug their pits (90 cm diameter & 2 m deep), with a community supervisor providing technical supports as the communities were digging.
2. A local contractor, from the community, manufactured reinforced slabs (120x120cm) near the pits. A 30 x 40 cm masonry rim was built to prevent cave ins and surface water inflows. The rim is made of stones and ‘poor’ concrete, but capable of supporting the slab’s weight. The stones and wooden frame can be reused for a new latrine at a later date.
3. Were given responsibility to complete the superstructure using locally available materials. Many people chose mud walls (similar to local houses), but woven palm tree leaves were also used. Trained community volunteers supervised the work.

4. When completed, the contractor installed them italic roofing and finalized technical aspects of the work.

- Construction of Urine diversion (UD) toilets
  - These are commonly used to separate human urine at source before it mixes with the faeces. This means urine and faeces can be handled separately and in a specific manner. Separation is achieved through specially designed toilets and urinals, UD toilets, which are connected to a collection system and then to either a storage container or a soak away.
  - The easiest way to construct an UD toilet is to build it above ground. This makes it easier to both contain and to remove contents when desiccated. The impermeable bottom of chamber prevents contamination of the soil and ground water. Commonly, above ground vault structures have twin chambers, with one chamber being used while the faeces in the other chamber break down into dry compost. Enough space must be left at the top of the chambers in order to install the hose or piping required to collect the urine, and to take it from the urine separation bowl to either a storage container or a specially designed urine soak away.

Pic 3.2 urine diversion toilet

Toilet type	Positive	Negative
Arborloo	Cheap	Requires a lot of space
	Trees are produced	Floods easily
	No handling of wastes	Not near water source
	Easy for young children	
Humanure toilet	Cheap	Heavy to transport
	Easily removable	Increased cover needed
	Space requirements low	Bucket close to seat
	Conserve urine	Fill quickly
	Easy for children	
Double Vault Toilet	Infrequent waste handling	Expensive
	Long lasting design	Difficult to empty
UD Toilet with drums	Easy to empty	Regular drum removal
	Less contact with wastes	
Portable UD unit	Easy to transport	Urine clogs easily
	Space requirements low	Bucket close to seat

Door shutter

- ✓ Toilets are places of privacy; the toilet user must feel safe, comfortable and unwatched.
- ✓ To ensure acceptability of Ecosan technology, it is better to use a solid door made of wood or metal.

Height of toilet

- ✓ Ecosan toilets, like any toilet, should allow any user to stand inside without hitting his/her head.
- ✓ While this is not typically a problem in the Ecosan toilets visited, a few toilets had a very low ceiling height. This can make using the toilet difficult and uncomfortable, so it is best for designers to create an interior height of around two metres.

Roof

- ✓ Ecosan toilets are, at their essence, dry toilets: the faeces vault, urine tank and inner toilet area should be completely watertight.
- ✓ However, during field observations, 10 toilets were found without a complete roof and 21 toilets had a leaky roof.
- ✓ Any leakage in the roof may lead to dampness in the vaults and generally create an unpleasant or smelly environment within the toilet room.
- ✓ Ecosan stores faeces in a composting chamber where ash, lime or other additives are used to raise the pH of the waste and thereby break down pathogens. After about six months of storage without the addition of fresh faeces, the resulting material should be

dry, rich, soil-like compost containing relatively few pathogens and may be used as a soil conditioner for agriculture.

- ✓ If Ecosan is installed and used properly, it assists in the prevention of disease.

👍 Additive materials

- Ash, rice husks and saw dust are the primary additive materials used for the Ecosan toilets.
- Of these, ash is the most commonly used with more than 96 percent of households using it.
- Depending on their availability, people may use more than one additive material. Since most Ecosan users are involved with agriculture and use firewood or other burning materials for cooking, they have plenty of ashes to use in toilets.
- However, 9 percent of users are using rice husks as additives & some of those use husks in combination with ash.
- The filling time of vaults may depend on many factors such as the population using the toilets, quantity of additives use, frequency of moving the piles, ventilation, temperature etc.
- In our study, the average family size is 5.99. With this population size, it was estimated that one vault would be enough for more than six months.

➢ Time of emptying the vault

- The promoters of the ecosan toilet have suggested that the ecosan user empty the vault only after six month of its closing. This is very important for sanitisation of the faeces. Studies have shown that storage for six months with a relatively high pH kills almost all of the pathogens in faeces.

➢ Use of dry faeces

- Dry faeces are Store for a few days before applying it to the field

Self-Check 3	Written Test

Name: _____ Date: _____

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

1. What are the factors influence design of Ecosan toilet? (5pts)
2. Write the four steps of low-cost toilet construction? (5pts)

Answer

1.----------

2.----------

Score = _____

Rating: _____

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

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

Information Sheet-4	Inspecting usage, potential health risks and care

- WORKPLACE INSPECTIONS
  - General requirement

Every employer must ensure that regular inspections are made of all workplaces, including buildings, structures, grounds, excavations, tools, equipment, machinery and work methods and practices, at intervals that will prevent the development of unsafe working conditions.

Remedy without delay Unsafe or harmful conditions found in the course of an inspection must be remedied without delay

4.1 Inspecting compost quality:

is determined by the composition of the feedstock, the type of separation process and the adequacy of the composting process. Compost is largely microbial cells and skeletons, byproducts of microbial decomposition and un-decomposed organic and inorganic particles. Its chemical composition varies depending on the initial feedstock. The quality of the compost required is dependent also on the end-use. Its physical, chemical and biological characteristics are important particularly when it is to be sold. Physical characteristics the physical characteristics used to determine compost quality are particle size, texture and the level of contaminants (Table 5). Chemical characteristics The chemical characteristics of compost are measured in terms of its: • value as fertilizer or soil amendment; • potential toxicity to plants; • organic matter content; • moisture content; • pH and soluble salts; • water holding capacity. Nutrient value Finished compost contains little nitrogen (N), phosphorous (P) or potassium (K). A typical breakdown of nutrients in manure-derived compost

Moisture content in finished compost the desirable moisture content is 30 to 50 percent. Compost with moisture content greater than 60 percent tends to form clumps that are difficult to break apart. Dry compost with moisture less than 35 percent produces significant amounts of dust. Also, dry compost with high organic matter content is difficult to incorporate into soil because it tends to stay on the surface. pH the pH of compost should be between 6 to 8. Acidic or basic compost can be made depending on the crop to be grown and the sensitivity of the end use. For potting soil and germination mixes, a pH of 5.5 to 6.5 is best while for compost to be used as a soil amendment, top dressing or mulch, a pH of 5.5 to 7.8 is suitable. Soluble salts Soluble salts can be harmful to plants by reducing water absorption and producing toxic conditions. Potting soils require a soluble salt content between 2 to 4 mmhos/cm (Field guide to compost use, 1996). When used as a soil amendment or mulch compost can have a higher soluble salt content, for instance 12 mmhos/cm, as it is diluted with a large quantity of soil. Organic matter content The organic content of compost ranges from approximately 35 to 70 percent. The preferred range is from 50 to 60 percent. Water holding capacity Water holding capacity is a measure of the ability of the compost to hold water. For many composts, the water holding capacity ranges from 75 to 200 percent (on a wet weight basis). The preferred range is 100 percent or greater. Biological characteristics the three main desirable biological characteristics are the stability of the compost, absence of pathogenic micro-organisms and germination tests. Stability The stability of compost is measured to assess potential phytotoxic effects. Also, stability is used in combination with other chemical measurements to assess the degree to which compost suppresses plant pathogens. A stability measurement determines the biological activity within a compost sample having adequate moisture and oxygen and not inhibited by high (> 500C) or low (< 200C) temperatures (VanderGheyst, 2000). There are three common measurements of stability: • heat production; • oxygen consumption; • carbon dioxide production. Since stability represents the state of microbial activity, measurements of respiration either through

carbon dioxide evolution or oxygen uptake provide the best indication. Oxygen uptake as a result of microbial activity has been used for many years. The rate of oxygen depletion from the environment and/or the change in oxygen within the environment over a given period is used to determine a compost stability

Exposure of farm workers to untreated excreta constitutes a significant health risk due to its pathogen content. There can be a large amount of enteric bacteria, virus, protozoa, and helminth eggs in feces. This risk also extends to consumers of crops fertilized with untreated excreta. Therefore, excreta needs to be appropriately treated before reuse, and health aspects need to be managed for all reuse applications as the excreta can contain pathogens even after treatment.

Self-Check 4	Written Test

Name: _____ Date: _____

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

1. What is occupational health and safety? (3pts)
2. What is the purpose of inspection? (3pts)

Answer Sheet

1. **----------**
2. **----------**
3. **----------**

Score = _____

Rating: _____

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

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

Information Sheet-5	Inspecting of urine container and faeces chamber

5.1 Inspecting of urine container and faeces chamber

The filling time of vaults may depend on many factors such as the population using the toilets, quantity of additives uses, frequency of moving the piles, ventilation, temperature etc.

In our study, the average family size is 5.99. With this population size, it was estimated that one vault would be enough for more than six months.

Time of emptying the vault:

- The promoters of the Ecosan toilet have suggested that the Ecosan user empty the vault only after six months of its closing. This is very important for sanitization of the faeces. Studies have shown that storage for six months with a relatively high pH kills almost all of the pathogens in faeces.

Self-Check 5	Written Test

Name: _____ Date: _____

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

1. how do you inspect container of faeces? (5pts)

Answer Sheet:

1.----------

2.----------

Score = _____

Rating: _____

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

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

Information Sheet-6	**Monitoring faeces batch**

6.1 inspected and assessed finished faeces to use

The agricultural use practices (and recommendations) will be dependent on the preceding treatment. Even if a treatment is aimed at elimination of the risk of pathogen transmission and its potential has been proven in laboratory and/or field experiments, process steps may malfunction, resulting in a fertilizer product that is not completely hygienically safe. Therefore additional measures should be taken in order to further minimize the risk for disease transmission.

Thus:

• Equipment used for e.g. transportation of unsanitized faeces should not be used for the treated (sanitized) product.

• When applying faeces to soil, precautions related to the handling of potentially infectious material should be taken. These precautions should include personal protection and hygiene. Hand washing should naturally be done.

• Faeces should be worked into the soil as soon as possible and not be left on the soil surface.

• Improperly sanitized faeces should not be used for vegetables, fruits or root crops that will be consumed raw, excluding fruit trees. Incinerated faeces will be hygienically safe. The subsequent handling of the resulting ash is outside the scope of this summary recommendation.

Working the excreta into the soil will minimize further human or animal exposure except for some soil-borne helminths, and will decrease the risk for pathogen run-off to nearby waters. A withholding period between fertilizing and harvest, as suggested for urine above (Table 6), is recommended also for faeces. This will allow further reduction of pathogens due to ambient factors such as microbial activity, UV-light and desiccation, thus adding another barrier against disease transmission. This withholding period should to be at least a month.

Self-Check 6	Written Test

Name: _____ Date: _____

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

3. What do you think about finished or ready to use faeces? (3)
4. How do you use faeces as fertilizer? (4)

Answer

Score = _____

Rating: _____

1.----------

2.----------

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

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

Information Sheet-7	**Maintaining processing and operation records**

7.1 Identify and carry out site maintenance requirements.

Composting may be defined as a biochemical process by which diverse and mixed group of microorganisms breaks down organic materials to humus. Some favorable characteristics of site include:

- Located adjacent to Public Works Facility –
  - Facilitates site monitoring of pubic use and easy access by Public Works Staff as needed to complete tasks.
- Compost pad is fenced and site is generally buffered from residential receptors or
- impacting other sensitive areas –
  - Reduces negative residential impacted by sight, noise, odors and dust.
- Outgoing Material Demand –
  - Finished mulch and compost material moves offsite quickly because of the demand by residents and local landscapers.
  - This minimizes the need for large material storing areas.
  - Material is readily available for the rented gardens.
- Paved Compost Pad
  - The paved compost pad provides an efficient and solid working surface to manage compost piles, which minimizes impact

(E.g. ponding) from rain events, reduces dust, improves vehicle mobility and eliminates soil and gravel being mixed into windrows.

7.2. Identifying Traffic access routes and site traffic/pedestrian safety rules.

Traffic Flow and Safety

- ✓ Residential and commercial vehicles that enter the drop off or
- ✓ Receiving area at the compost facility enter and park to unload or dump yard waste onto a centralized pile.

- ✓ In periods of low traffic volume, the current configuration appears to operate satisfactorily
- ✓ The configuration could be safer and more efficient.
- ✓ the finished compost and mulch is located inside the gate of the drop-off/receiving area,

7.3. Maintaining Vehicle access routes on site

- Vehicles, during the time of transportation of animal by-products other than manure or poultry litter must not enter any place where farm animals are kept.
- Vehicles and receptacles used for transporting compost products/material shall be maintained
- Containers, receptacles and vehicles used for transporting untreated material must be cleaned, washed and disinfected after each use, with the following exceptions:
  - In the case of vehicles transporting only untreated catering waste, only the wheels of the vehicle need to be cleaned and disinfected
  - Vehicles transporting external cleaning and disinfection procedures before leaving the Plant.
  - This is particularly important in the case of vehicles transporting manure where the vehicle is returning to a place where farm animals are kept.
- Wheel-wash facilities must be designed, operated and maintained in a manner which works properly.
- In the case of manually operated cleaning and disinfection facilities for containers/receptacles /vehicles, the cleaning procedures must be recorded and signed off by the transporter.

Therefore, optimum conditions should be maintained to maximize the microbial activity in the compost production system.

Influencing Factors to maintain process operations:

- C: N ratio in raw materials:

- Low C: N ratio in raw materials is beneficial for decomposition.
- Low C: N ratio increases microbial activity.
- Green leaves are low in C:N ratio
- Do not use materials with high C:N ratio alone.
- Arrange high C: N ratio and low C: N ratio raw materials alternatively.

⇤ Moisture Content :

- Moisture is necessary for microbes
- If moisture is low microbial activity is also low
- Too much of moisture is not suitable.
- Optimum moisture should be maintained throughout the process.
- A suitable cover should be used to maintain the optimum moisture content.

⇤ Aeration:

- During the composting process O_2 should be well supplied and CO_2 should be easily released.
- If not anaerobic condition may take place.
- Under the anaerobic condition bad odor may appear.
- To obtain good aeration arrange different types of raw materials in layers
- Turning may increase the aeration.
- Keep the reasonable width in heap method (maximum 6-7 feet).

⇤ Reaction:

- Reaction is important for microbial activity.
- In the alkaline condition activity of microorganisms may reduce.
- Therefore, liming materials such as ash, lime and dolomite are not recommended.
- In addition, under the alkaline condition N in raw materials may loss as NH_3.
- Ash could be added after completion of the composting process.

⇤ Shredding:

- Shredding or chopping of raw materials in to small pieces will increase the microbial activity.
- Increase aeration
- Optimum size of pieces is almost 5 cm.
- Increase surface area for microbial activity.
- Shredding is laborious.
- Recommended raw materials such as banana trunk, hard raw materials etc..
- In general shredding is not recommended due to high cost.

- Turning:

- Increase aeration
- Increase decomposition
- Un-decomposed raw materials may mix properly.
- Facilitate to keep the optimum moisture by adding water or drying.
- It is laborious.
- Maximum 3 times turning is recommended

- Microbial activity:
- Add inoculants after every 2-3 layers of raw materials.
- Inoculants may increase the microbial activity and increase the decomposition.
- In addition to compost decomposed garbage or any other organic materials are suitable as inoculants.

- Nutrient supply:

- Addition of N fertilizers reduces the C: N ratio and increase the decomposition of raw materials.
- Increase the microbial activity.
- Increase decomposition.
- Rock phosphate is suitable to enrich compost with P

Self-Check 7	Written Test

Name: _____ Date: _____

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

1. What do you think about recording? (3)
2. How do you maintain operations? (4)

Answer

Score = _____

Rating: _____

1.----------

2.----------

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

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

Information Sheet-8	**Reporting faults or variations observed**

8.1 Reporting faults or variations observed to supervisor

Avoid any products that have a strong unpleasant smell (Ammonia or sever gas) B/C the odor indicates an immature compost that might damage the plant later on when applied to the land by producing different gases. In preparation of compost worker face so many hazards like: -

-Contamination by different kinds of disease-causing organisms.

-compost preparations areas are the home of different kind's organisms that affect humans like snakes

-Different kinds of chemicals may be released due to different chemical process under taken in compost preparation.

- Reporting unsafe conditions

Whenever a person observes what appears to be an unsafe or harmful condition or act the person must report it as soon as possible to a supervisor or to the employer, and the person receiving the report must investigate the reported unsafe condition or act and must ensure that any necessary corrective action is taken without delay.

- Emergency circumstances

If emergency action is required to correct a condition which constitutes an immediate threat to workers only those qualified and properly instructed workers necessary to correct the unsafe condition may be exposed to the hazard, and every possible effort must be made to control the hazard while this is being done.

Self-Check 8	Written Test

Name: _____ Date: _____

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

1. What does it mean unsafe work places? (3)
2. How do you report emergency? (4)

Answer

1.----------

2.----------

Score = _____
Rating: _____

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

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

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HORTICULTURAL CROPS PRODUCTION Level-III

Learning Guide-31

Unit of Competence: Prepare Organic Fertilizer/Soil Improvement

Module Title: Preparing Organic Fertilizer/Soil Improvement

LG Code: AGR HCP3 M07 LO6-LG-31

TTLM Code: AGR HCP3 TTLM 0120v1

LO 6: Treat and Apply urine and faeces as fertilizer

Instruction Sheet	Learning Guide 31

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

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

- Identifying crops that require urine and faces
- Identifying and selecting personal protective equipment
- Determining and incorporating faeces
- Undertaking pre-application urine treatments
- Identifying urine-water mixing ratio.

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 crops that require urine and faces
- Identify and selecting personal protective equipment
- Determine and incorporating faeces
- Undertake pre-application urine treatments
- Identify urine-water mixing ratio

Learning Instructions:

3. Read the specific objectives of this Learning Guide.
4. Follow the instructions described below.
5. Read the information written in the information “Sheet 1- 4”.
6. Accomplish the “Self-check 1- 4 respectively and proceed to operation sheet - 1.
7. Do the “LAP test” (if you are ready).

Information Sheet-1	Identifying crops that require urine and faces

1.1. Identify crops that require urine and face

- Urine:
  - Most of the plant nutrients in human excreta are found in the urine. An adult may produce about 400-500 litres of urine a year containing 4.0-5.6 kg of nitrogen, 0.4 kg of phosphorus and 0.9-0.1 kg of potassium. Interestingly, these nutrients are in ideal forms for uptake by plants: nitrogen in the form of urea, phosphorus as superphosphate and potassium as an ion. The total quantities of nutrients in urine are more appropriate when compared with the quantities of nutrients in the chemical fertilizers used in agriculture.
  - Human urine can be used as fertilizer by the producer household or else collected at a communal level and used by commercial farmers. When urine is applied on open soil it can be undiluted. If used on plants it must be diluted to prevent scorching, typically one part to 2–5 parts of water. Where there is no interest in actively using urine it is possible to dispose of it in an evapo-transpiration bed or by evaporation until the producer households have become aware of its value as a fertilizer.
  - Take urine to the field when needed and put it in the compost when do not need it.
- Urine use:
  - it is best to collect urine in plastic containers or jerry cans (since urine corrodes metal due to its high pH),
  - not use more than 1.5 litres of urine should be used per m2 of crops per year to avoid hyper salinization of the soil,
  - urine should not be poured directly on plants or too near the roots (pour it into furrows instead), or done within a month of harvest time**,**

- Urine should be diluted (at least one volume of urine for 3 to 4 litres of water).

✓ Special difficulties and remedial action and/or precautions to be taken, if any

- Urine may be strongly contaminated by any contact with faeces. Particular care should thus be taken to make sure that users use these latrines properly and do not introduce urine through the holes in the slabs or seats reserved for faeces or vice versa.
- Hands should be washed after using the latrine or handling compost or urine.
- Most of these latrines do not allow anal cleansing. This can nevertheless be done using a receptacle containing crushed plants, sawdust or shavings. Some models, however, provide for this by collecting the corresponding small amount of water used in a small container.
- Human urine could act as effective as chemical fertilizer if nutrient losses could minimize
- Urine should be applied preferably in three split at different crop growth stage
    - ✓ Before planting
    - ✓ 25-30 days
    - ✓ 45-50 days
- Urine can be applied in 2 split for short duration crop like potato
- conduct long term (3-4 years) experiment to see the effect of urine on soil properties and plant health
- Urine should be supplemented with compost
- Recommended Urine Dosage: Urine/Ropani Heavy feeder crop/Infertile soil: 1500 lit. Low feeder crops/fertile soil: 750 lit.

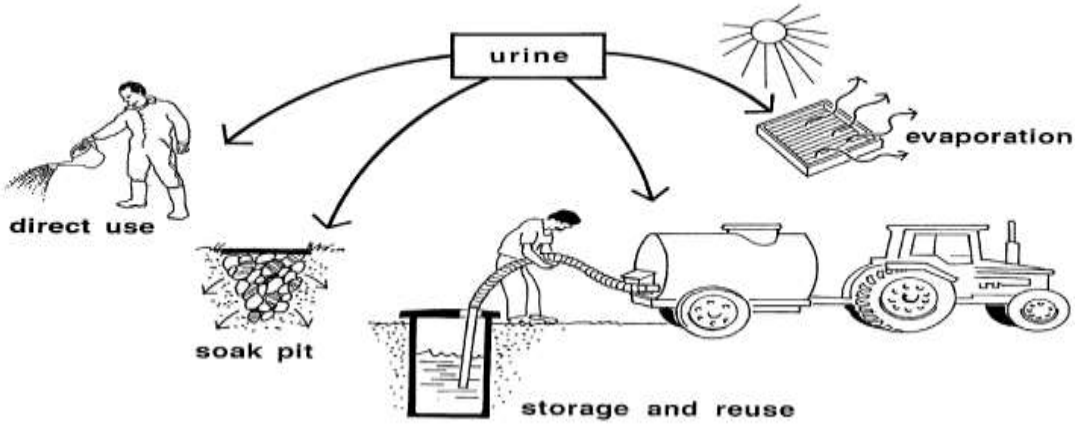

Figure 2.6 Alternative ways of handling/using urine diverted from toilets.

- Faeces:
  - Human faeces consist mainly of undigested organic matter such as fibres made up of carbon. The total amount per person per year is 25.50 kg containing up to 0.55 kg of nitrogen, 0.18 kg of phosphorus and 0.37 kg of potassium15.
  - Although faeces contain fewer nutrients than urine, they are a valuable soil conditioner. After pathogen destruction through dehydration and/or decomposition the resulting inoffensive material may be N applied to the soil to increase the organic matter content, improve water holding capacity and increase the availability of nutrients.
  - Humus from the decomposition process also helps to maintain a healthy population of beneficial soil organisms that actually protect plants from soil-borne diseases.
  - The faecal part of the by-products must always be sanitized before use as a fertiliser. The faeces, although having a lower nutrient content, is high in organic matter, phosphorus, aids water retention and is also a good soil improver.

- Sanitized faeces should be applied prior to planting or sowing, as the high phosphorus content is good for young plants. The decomposed faeces needs to be fully mixed in and covered.
- If excreta or excreta-derived products are applied to the field before planting crops:

  • People removing faeces should be adequately protected during the process;

  • The faeces should be placed in trenches and covered with at least 25cm of soil; and

  • Root crops should not be planted directly over the trenches.

- Contamination of crops, which is particularly important for crops that may not be cooked before eating, such as tomatoes or lettuce.

Fertilizer	**Urine** (kg/500 l)	**Faeces** (kg/ 50 l)	**Total** (kg)	Requirement for 250kg cereal
Nitrogen	5.6kg	0.09kg	5.7kg	5.6kg
Phosphorus	0.4kg	0.19kg	0.6kg	0.7kg
Potassium	1.0kg	0.17kg	1.2kg	1.2kg

- Crops that require urine and face:
  - Potatoes and most of vegetables as well as beans.

Self-Check 1	Written Test

Name: _____ Date: _____

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

1. What is the use of urine?(4 pts)
2. When we apply dry faces?(4pts)

Answer

1.----------

2.----------

Score = _____

Rating: _____

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

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

Information Sheet-2	Identifying and selecting personal protective equipment

2.1 Identifying and selecting personal protective equipment

Work equipment must be suitable for the purpose for which it is used or provided, and used only for operations for which it is suitable. In selecting work equipment, employers must take account of:

the working conditions and risk to health and safety from the premises it will be used in
- who will use the equipment?
- the work equipment itself

New work equipment should conform to any essential requirements for safety applicable to it through European product supply law.

Self-Check 2	Written Test

Name: _____ Date: _____

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

2. What is the importance of PPE in the work place? (3)

Answer

Score = _____

Rating: _____

1.----------

2.----------

3.----------

Note: Satisfactory rating – 3 points Unsatisfactory - below 3 points

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

Information Sheet-3	Determining and incorporating faeces

3.1 Determine and incorporated the amount of faces

- The primary processing in an ECOSAN system is generally either through dehydration or decomposition, but a combination of both is also possible.
- The purpose of the primary processing is to destroy pathogenic organisms, to prevent nuisance and to facilitate subsequent transport, secondary processing and end use.

✓ Dehydration**:**

- Dehydration means lowering the moisture content of the material in the processing vault or container to less than 25% through evaporation and addition of dry material (ash, sawdust, husks). No water, urine or moist plant material must be added to the processing chamber.
- Dehydration is a way of destroying pathogenic organisms.

✓ Decomposition (composting):

- is a complex natural biological process in which organic substances are mineralized and turned into humus. The speed of decomposition is influenced by a number of environmental factors inside the pile such as the amount of oxygen (aeration), temperature, moisture, pH value, the ratio of carbon to nitrogen (C:N ratio), competition among micro-organisms for nutrients, and the toxic by-products of decomposing organisms.

When the high application rates stated above are used, normally very impressive yield improvements are achieved, as the organic matter, pH and buffering capacity are increased and large stocks of P and K are supplied to the soil, enough to last for many years or even decades. However, these application rates are not resource-efficient with respect to use of nutrients in the faeces, even though the result is a very good effect on crop production. The application rates in the examples stated above are in the approximate range of 20-150 tons of faecal product per hectare. Normal application rates for farmyard manure in agriculture are in the range of 20-40 tons per hectare.

Self-Check 3	Written Test

Name: _____ Date: _____

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

1. What is the effect of over application of faeces? (3pts)
2. Describe how many tons of faeces are recommended per hectare? (3pts)

Answer

1.----------

2.----------

Score = _____

Rating: _____

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

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

Information Sheet-4	Undertaking pre-application urine treatments

4.1 Treatment of Urine

Storage The fate of the enteric pathogens entering the urine collection container is of importance for assessing the hygiene risks related to the handling and use of the urine.

The survival of various microorganisms in urine through time is affected by the storage conditions.

Studies have been performed with different microorganisms added to the urine and them inactivation followed over time. For the urine, mainly temperature and elevated pH (~9) in combination with ammonia have been concluded to affect the inactivation of microorganisms. The temperatures were mainly chosen based on temperate climate conditions.

For single households, the urine mixture can be used without storage for all type of crops, provided that the crop is intended for the household's own consumption and that one month passes between fertilizing and harvesting, i.e. time between last urine application and consumption. One reason for less stringent guidelines for single households is that person-to person transmission will exceed the risk from urine-related environmental transmission.

Collection and storage of urine may occur on different scales. When the collection involves large collection tanks, or storage tanks at the fields (like in these figures) higher security level and more stringent guidelines are needed in relation to storage of material emanating from different people.

Direct use or short storage periods are also applicable for small domestic systems. In addition, higher ambient temperatures in many developing countries will also increase inactivation rates and safety. In situations where the prevalence of some enteric infections is high, and the technical systems do not safeguard for faecal cross-contamination, an increased time of storage is recommended. The general recommendation of storage is mainly aimed at reducing the risks from consuming urine-fertilized crops. It will also reduce the risk for the persons handling and applying the urine. Due to the complexity of the system, the guidelines given in Table 6 can be adopted for larger (urban) systems in developing countries and regions. The withholding time of one month between fertilization and harvest should however be adhered to. Environmental factors will result in the inactivation of pathogens in the soil and on crops after application. In small-scale family-based systems, the urine may be used directly or after short periods of storage if the crops

are intended for family use. The likelihood of transmission is larger between family members than through urine-fertilized crops.

The only difference with not requiring storage systems would thus be exposure to potentially higher concentrations of pathogens when applying urine and entering or working in the fields.

Storage time Possible pathogens in the urine mixture after storage

Urine or urine and water: When diluted it is assumed that the urine mixture has at least pH 8.8 and a nitrogen concentration of at least 1 g/l.

During storage the urine should be contained in a sealed tank or container. This prevents humans and animals coming into contact with the urine and hinders evaporation of ammonia, thus decreasing the risk of odour and loss of plant-available nitrogen.

Concentrated urine provides a harsher environment for microorganisms, increases the die-off rate of pathogens and prevents breeding of mosquitoes. Thus, the less water that dilutes the urine the better.

Other possible treatments So far, storage at ambient temperature is the only method practiced to sanitize urine.

Methods to concentrate the nutrients in urine have been tested but are not yet efficient enough, commercially available or evaluated from a hygienic point of view. Some, e.g. evaporation of nitrogen (ammonia) through heat application will substantially reduce the number of microorganisms. Drying urine in open trenches has been tested in Sweden and Mali but will result in substantial loss of nitrogen, while phosphorous and potassium will be retained. A dry urine fraction (in the form of a powder) has not been shown to pose microbial health risks. Increased temperature or pH of the collected urine would further speed up the inactivation of potential pathogens. The relative increased inactivation rates at temperatures above 20°C have not been tested and need to be quantified.

Storage of urine Storage at ambient temperature is considered as a viable treatment option for urine. Recommended storage time at temperatures of 4-20°C varies between one and six months for large-scale systems depending on the type of crop to be fertilized.

Self-Check 4	Written Test

Name: _____ Date: _____

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

3. List the points considering in urine treatment?. (5pts)
4. What is the importance of urine treatment? (5pts)

Answer

1.----------

2 ----------

Score = _____

Rating: _____

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

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

Information Sheet-5	Identifying urine-water mixing ratio

5.1 urine-water mixing ratio

Dilution Urine can be applied neat (without dilution) or diluted with water, which is practiced in many places. The level of dilution varies between approximately 1:1 (1part water to 1part urine) to 10:1, and 3:1 seems common. Dilution implies increasing the volume to be spread and thus the labor, the equipment needed, the energy use and the risk for soil compaction are all increased.

Dilution has the advantage of decreasing, or eliminating, the risk of over-application, of applying urine at such high rates that it becomes toxic to the crop. However, irrespective of whether the urine is applied diluted or neat, urine is a fertilizer and should, just as the much more concentrated chemical fertilizers, be applied at the rate corresponding to the desired application rate of N, while additional water should be applied according to the needs of the plants. Thus, urine can be applied neat, or even concentrated to the soil, which then is irrigated according to crop water requirements. The urine can also be diluted into the irrigation water at a rate that depends on the need for nutrients and water by the crop. The application of a water/ urine mix normally needs to be interspersed with irrigation with water only. Diluted urine should be handled in the same way as urine. In order to avoid smells, loss of ammonia, generation of aerosols, burns and possible contamination on plants by remaining pathogens, urine should be applied close to, on or incorporated into the soil. Foliar fertilization is not recommended. In areas where salinization of soils is a problem, urine fertilization is only recommended if it gives a good yield increase. If salinization is by far the most limiting factor, other improvements are needed for increased soil fertility than application of urine.

Self-Check 5	Written Test

Name: _____ Date: _____

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

3. List the requirements included in labelling soil sample?(5pts)
4. Discus what are the importance of labelling? (5pts.)

Answer

1.----------

Score = _____

Rating: _____

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

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

Reference

http://www.fao.org/3/k1455e/k1455e.pdf

https://books.google.com.et/books?id=52gN7S2SwM4C&pg=PA72&lpg=PA72&dq=Adjustment+compost+processing+technique+and+faeces+batch+management&source=bl&ots=rzICkBPZzk&sig=ACfU3U1A1BPs_AfanT5D7iDfHQj_TMtXRQ&hl=en&sa=X&ved=2ahUKEwi83pzT5oXnAhUMY8AKHc58CioQ6AEwCnoECAkQAQ#v=onepage&q=Adjustment%20compost%20processing%20technique%20and%20faeces%20batch%20management&f=false

HORTICULTURAL CROPS PRODUCTION Level-III

Learning Guide-32

Unit of Competence: Prepare Organic Fertilizer/Soil Improvement

Module Title: Preparing Organic Fertilizer/Soil Improvement

LG Code: AGR HCP3 M07 LO7-LG-32

TTLM Code: AGR HCP3 TTLM 0120v1

LO7: Conduct quality control inspection

Instruction Sheet	Learning Guide 32

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

- Inspecting and assessing finished compost, faeces and urine
- Observing and reporting faults or variations
- Adjustment compost processing technique and faeces batch management
- Confirming Compliance of compost and faeces batch
- Documenting batch compliant compost and faeces
- Informing sales and operational staff
- 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 –

Inspect and assess finished compost, faeces and urine

Observe and report faults or variations

Adjustment compost processing technique and faeces batch management

Confirm Compliance of compost and faeces batch

Document batch compliant compost and faeces

Inform sales and operational staff

Report work outcomes

Learning Instructions:

7. Read the specific objectives of this Learning Guide.
8. Follow the instructions described below 3 to 5.
9. Read the information written in the information “Sheet 1 – 7’’ respectively.
10. Accomplish the “Self-check 1 – 7.’’ respectively.
11. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1 - 2” respectively.
12. Do the “LAP test” (if you are ready).

Information Sheet-1	Inspecting and assessing finished compost, faeces and urine

1.1 Inspecting and assessing finished compost, faeces and urine for compliance

The quality of commercial compost varies because they are usually made from whatever local waste materials are available at the time. The contents will differ from batch to batch. Unless the producer monitors each batch carefully, brand that tested at the top of the class this month might flun out the net time. A simple look can be all you need to do to find a good quality product. How to check out the texture, color, moisture, and bouquet. The texture should be loose, and granular with little or no recognizable wood or bark.

The color should always be dark brown or almost black. Avoid products that are light in color. They probably contain too little organic matter and too much soil.it is easiest to tell the true color if you let the compost sample dry out. Urine and faeces should not be exposed for excessive heat or sun radiation, if it is they will produce too much gas that will burn out plant roots later on the field. Hence, there should not be any further change in color as compared to the fresh wastes. Compost should be moist, not dry or soggy.one of compost biggest benefits is that it can hold up to 2-1/2 times its weight in water.

- Compost quality is measured by several criteria, including the following:
  - Moisture Content

The moisture content of the compost product is controlled by storing the product so as to avoid significant moisture addition by rainfall. The product must be dry enough to allow hauling with conventional loading, hauling, and spreading equipment / methods. The 45 percent moisture content criterion for efficient screening also provides a dry enough product to meet these needs. Care must also be taken not to over-dry the product as well. When compost is too dry, it will generate dust when handled, and dry compost can be difficult to re-wet.

  - Nutrient Content

The nutrient content of compost is also a quality component. The major plant nutrients supplied by compost are nitrogen, phosphorus, and potassium. Most minor plant nutrients are also contained in compost and these also contribute to its quality. The level of nutrients in

compost is controlled by the chemical composition of the material. While not a fertilizer, compost is often used as a fertilizer supplement.

- Particle Size Distribution

This quality parameter is primarily a function of the screen size used. Different end-users of compost will have different requirements for particle size distribution of the compost. The most demanding user in this regard will be horticulturists that will use the material in potting mixtures. The specifications for particle size distribution requirements can be ascertained from users. Those who will use the compost to amend field soils (e.g., landscapers, orchardists, field crop growers) will have less stringent requirements, but still should be provided samples of the product to test prior to deciding on an appropriate particle size specification.

- Stability

The term "stability" as used here means a product that will not undergo rapid decomposition or produce nuisance odors when applied by users. If the compost has undergone the adequate composting and curing procedures, there should be no problem in achieving a stable product. Assuring a minimum curing period of 30 days is important to producing a stable compost product.

- Product Consistency over Time

This quality parameter is one of the most important to users. In order to incorporate compost into their operating practices, users must be certain that each batch of materials has the same properties, within relatively narrow limits. Inconsistency in product quality will result in reduced consumer confidence and will jeopardize future marketing efforts.

- Pathogen Reduction Criteria

Agricultural waste compost is not required by regulation to comply with the pathogen reduction criteria that are stipulated for municipal sludge (bio solids) compost. However it is good practice and may be required if a site permit is required for non-farm organic waste material. The compost product should fulfill the following criteria:

- The compost product should be brought to a minimum temperature of 131oF (55^{o}C) in order to fulfill the requirements of a bio solids stabilization process to further reduce pathogens
- In addition to stabilization, these elevated temperatures are effective at killing weed seeds, which is a very important product quality concern.

The compost product should be exposed to a minimum composting period of 42 calendar days and a minimum curing period of 30 calendar days prior to distribution.

Self-Check 1	**Written Test**

Name: _____ Date: _____

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

1. Define inspection? (5pts)
2. discuss the importance of inspection (5pts)

Answer sheet:

1.----------

2.----------

3.----------

Score = _____

Rating: _____

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

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

Information Sheet-2	Observing and reporting faults or variations

2.1 Reporting faults or variations observed to supervisor

Avoid any products that have a strong unpleasant smell (Ammonia or sever gas) B/C the odor indicates an immature compost that might damage the plant later on when applied to the land by producing different gases. In preparation of compost worker face so many hazards like: -

-Contamination by different kinds of disease-causing organisms.

-compost preparations areas are the home of different kind's organisms that affect humans like snakes

-Different kinds of chemicals may be released due to different chemical process under taken in compost preparation.

- General requirement:

Every employer must ensure that regular inspections are made of all workplaces, including buildings, structures, grounds, excavations, tools, equipment, machinery and work methods and practices, at intervals that will prevent the development of unsafe working conditions.

Remedy without delay Unsafe or harmful conditions found in the course of an inspection must be remedied without delay.

- Reporting unsafe conditions:

Whenever a person observes what appears to be an unsafe or harmful condition or act the person must report it as soon as possible to a supervisor or to the employer, and the person receiving the report must investigate the reported unsafe condition or act and must ensure that any necessary corrective action is taken without delay.

- Emergency circumstances

If emergency action is required to correct a condition which constitutes an immediate threat to workers only those qualified and properly instructed workers necessary to correct the unsafe condition may be exposed to the hazard, and every possible effort must be made to control the hazard while this is being done.

Self-Check 2	Written Test

Name: _____ Date: _____

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

1. What makes rises of hazards in the work place? (5pts)
2. discuss the considerations during reporting faults? (5 pts)

Answer

Score = _____

Rating: _____

1.----------

2.----------

3.----------

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

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

Information Sheet-3	Adjustment compost processing technique and faeces batch management

3.1 Processing non-compliant product further with necessary adjustments to achieve product quality

Not all composts are created equal. Compost quality depends on many different factors such as the characteristics of raw materials, environmental factors such as precipitation and ambient temperature, management practices, and most importantly, most importantly the intended use of compost. Compost has many biological, chemical and physical characteristics that allow it to be used in different ways.

- Typical ranges of test parameters in quality compost.

Test parameter	Range
P^H	6.8-7.3
C: N ratio	10:1-15:1
EC (soluble salts)	1:5V/V method0.35-0.64ds/m (mmhos/cm)
Nitrogen	1-2 % (by weight)
Phosphorus	0.6-0.9% (by weight)
Potassium	0.2-0.5% (by weight)
Moisture content	45-50% (by weight)
Organic matter	34-45% (by weight)
Particle size passes	3/8” screen
Bulk density	900-1000lb/yd3

Self-Check 3	Written Test

Name: _____ Date: _____

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

1. What is the importance compost quality? (5pts)
2. Write characteristics of quality organic products? (3pts)

Answer

1.----------

2. ----------

Score = _____

Rating: _____

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

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

Information Sheet-4	Confirming Compliance of compost and faeces batch

4.1 Confirming compliance of compost and faeces batch product requirements

- All composts will require the following information to appear on the label:
- Product name
- Granted analysis
- Name and address of the registrant or the responsible packager
- Lot number
- Directions for use
- Net weight
- Cautionary statements

Self-Check 4	Written Test

Name: _____ Date: _____

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

1. What is the compliance of faeces and composts? (5pts)

Answer Sheet

1----------

Score = _____
Rating: _____

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

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

Information Sheet-5	Documenting batch compliant compost and faeces

5.1Completing batch documentation for compliant compost and faeces product

Documentation provides the route for auditors to assess the overall quality of operations within a company and the final product. When time and space is not critical, a farmer has significantly greater flexibility in how they use their compost. A batch of compost set up in the spring, even if not fully cured, can be applied to fields in the fall. However, batches set up in the summer and fall may not be mature enough for spring application, hence experienced farmers often wait a full year before using a batch to ensure the compost is fully cured and mature, especially when used on high-valued crops.

Self-Check 5	Written Test

Name: _____ Date: _____

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

1. What is documentation? (3)
2. List different types documentation? (3pts)

Answer Sheet:

1.----------

2.----------

Score = _____

Rating: _____

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

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

Information Sheet-6	**Informing sales and operational staff**

6.1 Informing to sales and operational staff members suitable product for sale and/or preparation of value-added products.

Since organic production work is a local technology, the supervisor may invite different experts about organic production how can the trainees apply more, what are the things needed for organic production, how can we alleviate environmental problems by using organic production work.

1.2. Observing the handling and disposal of materials

♠. Observing the handling of materials and equipment in the store or

Your work site according to work place policy and procedure carefully.

♠. For example, in our work activity the application of compost material we should take care.

♠. your work place policy and procedure lead you how to perform the activities (how to handle and dispose materials) properly

Self-Check 6	Written Test

Name: _____ Date: _____

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

3. What is the purpose of informing your staff? (3)
4. List the methods of information sharing methods to staff? (4)

Answer

Score = _____

Rating: _____

1.----------

2.----------

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

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

Information Sheet-7	**Reporting work outcomes**

7.1 Reporting work outcomes to supervisor and, noting required improvements for future action

Reporting means informing related information to a person who concerns. Reporting outcomes means announcing whether its goodness or badness about the work result for example if we want to report the problems, we can use the following table format.

Table.1. Example of problems reporting format

No	Activities	Type of problem	Possible solution
1			
2			
3			
4			

Self-Check 7	Written Test

Name: _____ Date: _____

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

1. Write the steps of reporting format? (10)

Answer

Score = _____

Rating: _____

1.----------

2.----------

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

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

Reference

https://books.google.com.et/books?id=52gN7S2SwM4C&pg=PA72&lpg=PA72&dq=Adjustment+compost+processing+technique+and+faeces+batch+management&source=bl&ots=rzICkBPZzk&sig=ACfU3U1A1BPs_AfanT5D7iDfHQj_TMtXRQ&hl=en&sa=X&ved=2ahUKEwi83pzT5oXnAhUMY8AKHc58CioQ

HORTICULTURAL CROPS PRODUCTION

Level-III

Learning Guide-33

Unit of Competence: prepare organic fertilizer/soil improvement

Module Title: preparing organic fertilizer/soil improvement

LG Code: AGR HCP3 M07 LO8-LG-33

TTLM Code: AGR HCP3 TTLM 0120v1

LO8: Clean up area

Instruction Sheet	Learning Guide 33

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

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

Cleaning loading-shifting machinery and other processing equipment

Clearing raw materials and finished products

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 loading-shifting machinery and other processing equipment

Clear raw materials and finished products

Learning Instructions:

7 Read the specific objectives of this Learning Guide.

8 Follow the instructions described below.

9 Read the information written in the information “Sheet 1- 4”.

10 Accomplish the “Self-check 1- 4 respectively and proceed to operation sheet -1.

11 Do the “LAP test” (if you are ready).

Information Sheet-1	Cleaning loading-shifting machinery and other processing equipment

1.1 Clearing and cleaning Loading-shifting machinery and equipment to avoid contamination

An effective cleaning program must be established and maintained. Product and other debris must not be allowed to accumulate in production areas or on the site as a whole.

1. Frequent and regular cleaning by scraping, brushing, aspirating and washing should be employed in storage areas, cleaning and drying equipment, conveyors and other accessible equipment, to avoid the buildup of problem areas and residues. Where a problem does arise steam, cleaning is recommended.

2. All product contact surfaces must be clean before work begins and cleaned as frequently as necessary throughout work periods to prevent the buildup of undesirable microorganisms which could contaminate the product.

3. Wet cleaning routines and the use of disinfectants and sanitizers must be followed by a thorough rinsing with potable water to prevent residues remaining on surfaces where they might contaminate the food products.

4. Detergents, disinfectants and sanitizers must be properly labeled and stored safely when not in use to avoid the risk of contaminating the products.

5. The following materials may be used for cleaning purposes provided they are approved for use in food processing establishments and effective steps are taken to ensure that residues do not remain on contact surfaces:

• Detergents, disinfectants and sanitizing agents approved for use in food processing establishments

• Terminal sanitizers

• Washing in or with a controlled hypochlorite solution

(Note: All the above requires a rinse with potable water after use).

Self-Check 1	Written Test

Name: _____ Date: _____

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

1. How do you can clean loading-shifting machinery? (3)

Answer

1.----------

Score = _____

Rating: _____

Note: Satisfactory rating – 3 points Unsatisfactory - below 3 points

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

Information Sheet-2	Clearing raw materials and finished products

2.1 Clearing and cleaning raw materials and finished compost products to designated areas, and processing site

- Organic Products Management:

PURPOSE: To ensure all precautions are taken to prevent contamination products that are determined as organics.

- RESPONSIBILITY:

It is the responsibility of the management to ensure that the following procedures are adhered to and understood by all relevant personnel and the personnel follow State or local health department requirements. The Commercial Manager is responsible for ensuring the procurement procedure with regard to organic products is adhered to. The Technical Manager is responsible for ensuring any necessary risk assessments etc. are carried out.

- ✓ Maintaining of tools, materials and equipment

- M maintenance and storage of materials, tools and equipment is very important for their reuse, minimizing cost to buy other new materials, tools and equipment.
- As we have seen in the above proper storing based on their category is very important.

- ✓ Cleaning materials, tools and equipment after work
  - -Cleaning materials, tools and equipment after work has so many advantages, such as:
  - To prevent from rust
  - To be durable and long-life span to use
  - To prevent our health and the environmental pollution etc.
- ✓ Reporting and following the direction of super visor

-Dear trainees you have to respect your super visor's instructions during and after your organic production work activities.

- ✓ Benefits of cleaning working materials

- Dear trainees we have already seen the advantage cleaning materials, tools and equipment after work, so you can read the above.

- ✓ Disposing unwanted materials, tools and equipment base on super visor direction

-Disposing means removing the materials, tools and equipment which are not functional during our work. So, you have to properly dispose in the designated area.

Self-Check 2	Written Test

Name: _____ Date: _____

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

3. Define what is cleaning of materials? (3)
4. Discuss the purpose of cleaning? (3)
5. How do dispose wastes? (3)

Answer

Score = _____

Rating: _____

1.----------

2.----------

3.----------

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

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

REFERENSE

April 2013, National Organic Waste Composting Strategy

Aendekerk, T. G. L. 2002. Use-related quality classification of compost. In *International Symposium: Composting and Compost Utilization 56*, Columbus, Ohio

Marinari, S., G. Masciandaro, B. Ceccanti, and S. Grego. 2000. Influence of organic and mineral fertilisers on soil biological and physical properties. *Bioresource Technology* 72:9–

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