



Natural Resources Conservation and Development Level II

Learning Guide-16

**Unit of Competence: Assist in Planting Material
Collection and Processing**

**Module Title: Assisting in Planting Material
Collection and Processing**

LG Code: AGR NRC2 M04 LO-7 LG-16

TTLM Code: AGR NRC2 M04 TTLM 0919v1

**LO7: Prepare cuttings for planting
activity**



Instruction Sheet	Learning Guide # 16
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This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Preparing parent plant and applying suitable method to take the cutting which is appropriate to the species
- Clearing and cleaning work area to eliminate contamination in accordance with hygiene practices and organizational requirements
- Assessing cuttings visually and selecting for propagation in accordance with work order requirements
- Identifying and providing correct conditioning and storage procedures appropriate to species requirements to maintain maximum viability of cuttings
- Determining and applying method of cutting preparation without causing damage to parent plant and the cuttings
- Arranging and undertaking dispatch of cuttings in accordance with request specifications and site procedures
- Disposing discarded cutting material of in accordance with workplace waste disposal guidelines and organizational requirements

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:

- Prepare parent plant and applying suitable method to take the cutting which is appropriate to the species
- Clear and clean work area to eliminate contamination in accordance with hygiene practices and organizational requirements
- Assess cuttings visually and select for propagation in accordance with work order requirements
- Identify and provide correct conditioning and storage procedures appropriate to species requirements to maintain maximum viability of cuttings



- Determine and apply method of cutting preparation without causing damage to parent plant and the cuttings
- Arrange and undertake dispatch of cuttings in accordance with request specifications and site procedures
- Dispose discarded cutting material of in accordance with workplace waste disposal guidelines and organizational requirements

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below 3 to 6.
3. Read the information written in the information “Sheet 1, Sheet 2, Sheet 3, Sheet 4 and Sheet 5”.
4. Accomplish the “Self-check 1, Self-check t 2, Self-check 3 and Self-check 4” **in page -9, 12, 17, 20 and 24** respectively.
5. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1” **in page -25**.
6. Do the “LAP test” **in page – 26** (if you are ready).



1.1 Concept of cutting

A cutting is a vegetative plant part which is severed from the parent plant in order to regenerate itself, thereby forming a whole new plant.

There are two methods of propagation planting stocks in the nursery. These are:

- **Seed (or sexual) propagation**
- **Clonal (or asexual/vegetative) propagation**

The concept of vegetative propagation is that an **exact copy of the genome** of a mother plant is made and continued in new individuals. This is possible because plants, - unlike animals or humans, - have meristematic, undifferentiated cells that can differentiate to the various organs necessary to form a whole new plant. A piece of plant shoot, root, or leaf, can therefore, grow to form a new plant that contains the exact genetic information of its source plant.

Whereas sexual reproduction by seeds provides opportunity for variation and evolutionary advancement, vegetative propagation aims at the identical reproduction of plants with desirable features such as high productivity, superior quality, or high tolerance to biotic and/or abiotic stresses, and as such, plays a very important role in continuing preferred trait from one generation to the next.

The most important vegetative propagation techniques for tree species are the propagation by cuttings, layering, budding, grafting and micro propagation. The most important reasons for vegetative propagation are:

- Maintaining superior genotypes
- Problematic seed germination and storage
- Shortening time to flower and fruit
- Combining desirable characteristics of more than one genotype into single plant
- Controlling phases of development



- Uniformity of plantations.

The methods to propagate asexually plants are classified in two main and six sub categories:

i) Plant Union

- ✓ Propagation by Graftage
 - Bud Grafting (Budding)
 - Grafting

ii) Rooting

- ✓ Stock Division
- ✓ Propagation by Suckers
- ✓ Propagation by Runners
- ✓ Layering
- ✓ Propagation by Cuttings

1.1 Preparing cutting

A cutting is a piece of vegetative tissue (stem, root or leaf) that, when placed under suitable environmental conditions, will regenerate the missing parts and produce a self-sustaining plant. Used mainly in the clonal propagation of herbaceous and some woody ornamental species.

Preparing Cuttings should include the following activities:

Sanitation: The cutting propagation process not only requires conditions that favor the development of disease and insect problems, we also cut the plants. Open wounds are avenues through which pest problems can enter plants. Therefore, it is important that not only the cuttings be disease and insect free but the instruments used to prepare the cuttings, the area in which the cuttings are prepared and the area where they are rooting should also be kept as clean as possible.

The cutting preparation area should be cleaned before and after cuttings are prepared and stuck. So should the tools used in the process. Remove all plant material, growing media, etc. from the work area. The surfaces and tools being used in propagation should be cleaned with appropriate disinfectant solutions. Be careful not to damage



leaves and cuttings. Damaged cuttings are more likely to have problems in rooting both from disease and insects as well as from pre-mature aging of damaged tissue.

Wounding: Research has shown that some cuttings root better when the stems have been wounded. Sometimes the only wounding required is to remove the leaves from the stem. In the process of removing the leaves enough of a wound is created. However, on some more difficult to root woody species wounding enhances rooting. In these situations, please remember that you are wounding not doing major surgery. The wound should not remove large portions of bark and should not go deeper than just through the bark. Often scarring with a razor blade or knife just barely through the bark is all that is necessary.

Hormones: Plant hormones play an important role in the development of callus and the differentiation into new roots or vascular tissues. They are chemical substances, which occur naturally in plants in very low concentrations. In addition to the naturally occurring (endogenous) hormones, there are several synthetic or natural substances that have similar effects. These, together with the plant hormones, are commonly combined under the term plant growth regulators (PGR). There are five main groups of plant hormones and growth regulators that can be distinguished by their dominant effect. These are auxins, gibberellins, cytokinins, abscisic acid and a gaseous growth regulator, ethylene.

- ***Auxins***- The auxins are a group of natural and synthetic chemicals that are derived from Ltryptophan. The endogenous auxin is indole acetic acid (IAA). It is produced in the leaf primordia, young leaves and developing seeds, and moves basipetal (from tip to base). It influences many plant activities, such as bending towards light, apical dominance (inhibition of lateral buds by a strong terminal growth), formation of abscission layers in fruits and leaves, and activation of cambial cell growth. This latter activity is the most important for vegetative propagation as it has a direct effect on root formation in cuttings and wound healing in graft union formation.

There are a number of known synthetic auxins that have stronger effects than IAA and are used commercially in plant propagation, for example indole butyric acid (IBA) (1000, 3000, 8000 ppm IBA), and naphthyl acetic acid(NAA).



- **Gibberellins-** Gibberellins occur naturally in plants. They regulate shoot elongation through cell growth (as opposed to cell division).
- **Cytokinins-** Cytokinins occur naturally in plant endosperm. They regulate cell division and initiation of buds and shoots.
- **Abscisic acid-** Abscisic acid (ABA) is a growth inhibitor responsible for the formation of abscission layers in buds and leaves. It also regulates stomatal closure and controls water and ion uptake by roots. It is a natural antagonist of cytokinins and may play a part in plant propagation, however its role is not yet clear.

Ethylene- Ethylene is a gas that is produced by ripening fruits and senescing plants.

Hormones are needed by plants in very small quantities so they are sold in ready to use or ready to be diluted formulations mixed with something else. The most common forms are either mixed with talc and come in a powder form or can be purchased as a liquid either diluted in alcohol or water. There are plants that seem to root more successfully when powders or alcohol based or water based liquid solvents are used but toxicity from solvents is rare and almost always occurs when alcohol is the solvent used. Most of the time, any of the solvents can be used with the crop you wish to propagate.

The reasons hormones are used when stem rooting cuttings are:

- To make rooting possible when too little natural hormone exists,
- To increase the percentage of rooting,
- To increase the number of roots per cutting and
- To have cuttings root more rapidly and thereby shorten the length of time you need to keep your stem cutting alive before it can support itself.

1.2 Basic tools for cutting

- Cutting tape
- Cutting/grafting knife
- Pruning shares



1.3 Parent plant preparation for the cuttings

The success of a cutting is largely determined by proper selection of a mother plant. Every cutting, if successful, will produce a clone of the source plant, so choose a mother plant that reflects what you want to reproduce.

Only take cuttings from clean, healthy specimens (parent plants), free from insect pests and disease.

- Remove flowers and flower buds from cuttings to allow the cutting to use its energy and stored carbohydrates for root and shoot formation rather than fruit and seed production.
- To hasten rooting, increase the number of roots, or to obtain uniform rooting (except on soft, fleshy stems), use a rooting hormone, preferably one containing a fungicide.
- Prevent possible contamination of the entire supply of rooting hormone by putting some in a separate container for dipping cuttings.

Successfully growing plant cuttings starts with choosing the mother plant carefully and having clean equipments.



Self-Check -1	Written Test
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Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What are the two methods of propagation planting stocks in the nursery? (5points)
2. Write the basic tools for cuttings. (5points)
3. Write at least four reasons of vegetative propagation. (5points)

Note: Satisfactory rating – 15 points

Unsatisfactory - below 15 points

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

Answer Sheet

Score = _____
Rating: _____

Name: _____

Date: _____

Short Answer Questions



Information Sheet- 2	Clearing and cleaning work area
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2.1 Cleaning work area

Take cuttings with a sharp blade to reduce injury to the parent plant- dip the cutting tools in rubbing alcohol or a mixture of one part bleach: nine parts water to prevent transmitting disease from infected plant parts to healthy ones. Only take cuttings from clean, healthy specimens, free from insect pests and disease. Clean and sterilize all equipments that you will use in the cutting process. Introducing foreign substances or bacteria can doom your efforts to grow plant cuttings.



Self-Check -2	Written Test
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Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What is the material that we use to grow plan cutting? (8 points)
2. Why we need to clean work area during plant cutting? (7 points)

Note: Satisfactory rating – 15 points

Unsatisfactory - below 15 points

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

Answer Sheet

Score = _____

Rating: _____

Name: _____

Date: _____

Short Answer Questions



1.1 Types of Cuttings

There are three types of cuttings: leaf, stem and root. Different parts of the plant leaf, stem and root may be cut for rooting.

▪ **Rooted Cuttings**

This method is one of the most popular vegetative propagation techniques, due to its use on both fruit and vegetable plants (such as cassava). The stems, which are used for cloning, have to be harvested during the dormant stage from the mother plant. The cuttings, which originate from a piece of the mother plant, are then placed into the soil. Similar to layering, different techniques can be used for this propagation method. This always uses cuttings from the previous season's growth (more than one year old). There are three types of root cutting.

▪ **Simple Cuttings**

This simple cutting is done on a stem, which usually contains 4-6 buds. The top part of the stem is cut off at an angle. If the cutting originated from an evergreen plant, the bottom two leaves should be removed and planted immediately after being cut. The shoots will then grow from the buds above the soil and the roots will grow from the nodes in the soil. Typical examples for the use of this method are the Gooseberry, Currant, Quince, Fig and Olive.

▪ **Torn Cuttings**

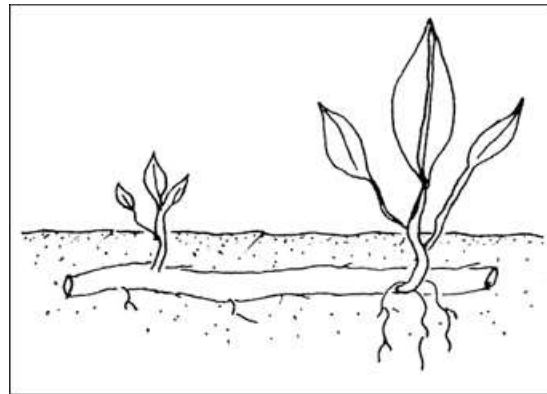
This cutting is performed at the bottom portion of the stem where there is a union with the mother plant. This is a very old technique and it is rarely used nowadays.

▪ **Hammer Cuttings**

In this case, a piece of twig is cut together with the stem. Some plant cuttings, like gooseberry cuttings, are difficult to root and the additional piece of twig helps to develop root system.



Technique: Take root cuttings about 1 meter away from the tree trunk. These cuttings should be 20- 25 cm long and 1-2 cm thick. Place these cuttings horizontally into the soil about 10 cm deep until they shoot. This technique is useful for propagation of guava, breadfruit, apple, blackberry and raspberry.



▪ **Stem cuttings**

Taking stem cuttings is perhaps the most common way to vegetatively propagate shrubs or trees. The process is relatively simple requiring only a limited area for reproduction, whilst a single mother- or stock plant can yield many cuttings. A large number of ornamental plants are propagated this way, but little is known about the use of this method for most agroforestry trees. Let us briefly describe some of the underlying principles of the cutting and rooting process, highlight the different factors influencing this and look at the different steps leading to the successful propagation of trees and shrubs through this technique.

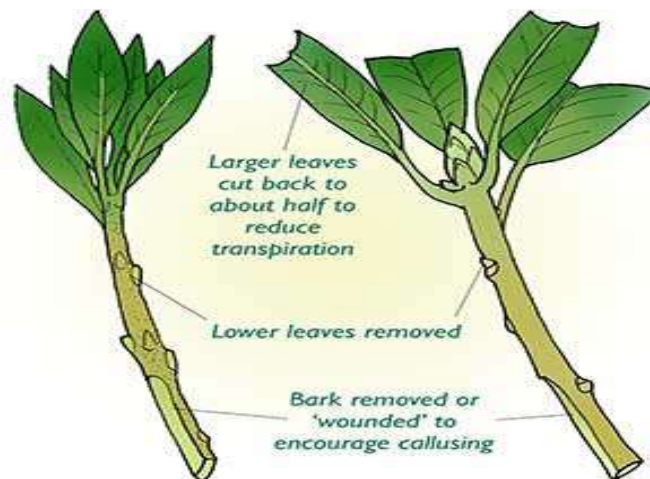
Technique: Usually a few leaves sometimes halved are left at the tip of the cutting, the number depending on growing conditions (shade, humidity, etc.). Leaves generally stimulate root growth, but cuttings are likely to dry out if the leaf area is large.

The tip of the shoot or twig is usually discarded, but a vigorous shoot can still yield several cuttings of 15 - 50 cm, the recommended length. Commonly, the diameter of cuttings ranges from pencil-thick to about 3 cm. The upper cut is oblique so rainwater runs. The lower cut is usually made just below a node, because rooting generally occurs mainly at the node.



Always use clean tools: disinfect your cutting tool in boiling water before use. Never use a blunt knife or machete for taking cuttings. If a cut is not smooth and clean, rot may lead to failure of the cutting; it can also infect the wound on the mother tree. Upright branches and twigs are preferred for cuttings, because they grow upright after rooting, forming a tree with a proper trunk. Cuttings taken from horizontal or drooping branches often do not grow upright.

If cuttings cannot be planted straight away they may be stored in a cool shaded place under damp jute bags, grass or leaves. Leafy cuttings should be planted without delay.

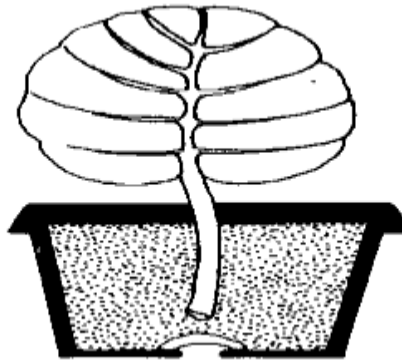


▪ Leaf cuttings

In most of these cuttings, adventitious shoots form along wound surfaces near vascular tissues. Propagation by leaf cuttings is virtually limited to some ornamental plants.

Technique:

- Remove leaf with 1-2 " of petiole
- Place leaf on media surface with petiole inserted into the medium.



1.2 Cuttings operations

Different steps leading to the successful propagation of trees and shrubs through these techniques are:

- Cuttings should be taken early in the morning before the sun is hot, as this will keep transpiration and thus drying out to a minimum.
- Trim leaves before the shoots are detached from the stock plants as this reduces waterloss. Leaf areas for optimum rooting vary with species, however, 50 cm² seems to be the recommended leaf area prior to full investigation on this factor for different agroforestry species. The leaf area should allow for a balance between photosynthesis and transpiration when cuttings are under the non-mist propagator.
- Use a polyethylene bag that is moistened inside to carry the shoots.



- Keep the collected shoots under shade, without throwing or squeezing the bags.
- If you are carrying the shoots over a longer distance, keep them in a cool box – but ensure that the shoots do not directly touch the cooling elements.



- In the nursery, have all equipment and tools ready and well arranged in advance in order to keep cuttings moist and transfer to propagators without delay. Delay can cause the cuttings to dry out and is often responsible for rooting failure of cuttings in arid and semi-arid zones.



Self-Check -3	Written Test
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Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Discuss types of cutting briefly? (10 points)

Note: Satisfactory rating – 10 points

Unsatisfactory - below 10 points

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

Answer Sheet

Score = _____

Rating: _____

Name: _____

Date: _____

Short Answer Questions



Information Sheet- 4

Identifying the correct conditioning and storage

1.1 Storage of cuttings

Many propagators prefer to collect propagules from stock plants early in the day when cuttings are still turgid. If the cuttings cannot be stuck immediately, they are misted to reduce transpiration and held overnight in refrigeration facilities at 4 to 8 °C and generally stuck the next day.

successful storage of unrooted cuttings depends on storage conditions, state of the cuttings, and species. It is important that dry matter losses and pathogens be minimized. Within the storage unit, it is best to maintain nearly 100 percent humidity, and temperature should be as low as the hardiness of the given species can tolerate.



1.2 Storage procedures in cuttings

- Insert cuttings into a rooting medium such as coarse sand, vermiculite and soil.
- It is important to choose the correct rooting medium to get optimum rooting in the shortest time.
- In general, the rooting medium should be sterile, low in fertility, drain well enough to provide oxygen, and retain enough moisture to prevent water stress. Moisten the medium before inserting cuttings, and keep it evenly moist while cutting are rooting and forming new shoots.
- Place stem and leaf cuttings in bright, indirect light.
- Root cuttings can be kept in the dark until new shoot appear.



If possible, cuttings should be planted immediately after being cut from the parent tree. If this is not possible, due to distance for example, the cuttings must be protected from drying out by wrapping them in a wet sack and keeping them in a cool place.

All these methods are simple and highly recommended since farmers can grow more trees without having to establish nurseries or buy seedlings. If a new species is to be introduced to an area it may be a good idea initially to grow cuttings in pots. These cuttings grown in nurseries are better able to withstand transportation and delays in planting than fresh cuttings. For species that can be propagated both from seeds and from cuttings, cuttings normally grow faster.



Self-Check -4	Written Test
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Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What are storage procedures in cutting? (8 points)
2. List the procedures in sorting and selecting cuttings? (7 points)

Note: Satisfactory rating – 15 points

Unsatisfactory - below 15 points

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

Answer Sheet

Score = _____
Rating: _____

Name: _____

Date: _____

Short Answer Questions



Information Sheet- 5	Disposing way of discarded cutting material
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5.1 Disposing way of discarded cutting material

If you sprayed any left over from cuttings you may mess up the proper cleaning program of the work place. So properly collect scraps (left over) from cuttings and dispose it in pit dug for this purpose or clean it from the area by burning.

Material is disposed of in accordance with workplace waste disposal and recycling regulations.



Self-Check -5	Written Test
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Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What is the material that we use to grow plan cutting? (8 points)
2. Why we need to dispose discarded material during plant cutting? (7 points)

Note: Satisfactory rating – 15 points

Unsatisfactory - below 15 points

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

Answer Sheet

Score = _____

Rating: _____

Name: _____

Date: _____

Short Answer Questions



Information Sheet- 6	Environmental effects of discarded cutting material
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6.1 Environmental effects of discarded cutting material

Since discarded cutting materials have negative impact on the work area as well as on the environment whole, environmental protection measures, such as hygiene of the area, relevant national, state and local legislation and regulations should be taken in order to minimize the effect and to install work and create safe work conditions.

Good attention and care should also given to contingencies for modifying operations during wet or other adverse weather conditions to make balance the disturbed environment.



Self-Check -6	Written Test
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Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What are environmental protection measures to take correction of discarded cutting materials effect? (8 points)

Note: Satisfactory rating – 8 points

Unsatisfactory - below 8 points

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

Answer Sheet

Score = _____

Rating: _____

Name: _____

Date: _____

Short Answer Questions



Operation Sheet-1	Preparing for cuttings
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Objective: To acquire the trainee to prepare cuttings.

Conditions: All tools and personal protective equipments should be available on time.

Procedure:

Step1: Organize and prepare tools and equipments for cutting operation.

Step 2: Clean the cutting preparation area before cuttings are stuck.

Step3: Remove all plant material, growing media, etc. from the work area.

Step4: Clean the surfaces and tools being used in cutting propagation with appropriate disinfectant solutions.

Step5: Remove the leaves from the stem and wounding.

Step6: Prepare plant hormones.



LAP Test	Practical Demonstration
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Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within 5 hour.

Task 1: Request and collect tools and equipment required and perform Prepare cuttings.