

NATURAL RESOURCES CONSERVATION AND DEVELOPMENT LEVEL II

Learning Guide -22

Unit of Competence: Assist Nursery Work

Module Title: Assisting Nursery Work

LG Code: AGRNRC2 M05 0919 LO1-LG-22

TTLM Code: AGRNRC2 TTLM 0919v1

LO 05: Carry out tending operations

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

- Preparing *tools and equipment*
- Recruiting and orienting labors for tend up seedling
- Scheduling Tending activities
- Following up and inspecting tending operation

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

- Require and prepare *tools and equipment* for tending up seedling according to the specification
- Recruit and orient the required labors for tending up seedling according to technical guidelines
- Carry *tending activities* out on schedules according to organizational work manuals
- Carry Tending up activities out at the required intervals based on organizational work manuals
- Follow up and inspect Tasks of tending up seedling persistently according to work manual

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 and Sheet 4”.
4. Accomplish the “Self-check 1, Self-check t 2, Self-check 3 and Self-check 4” in page -6, 9, 12 and 14 respectively.
- 5.If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1, Operation Sheet 2 and Operation Sheet 3 ” in page -15.
6. Do the “LAP test” in page – 16 (if you are ready).

Preparing materials, tools and equipment**❖ site clearance tools**

The type of tool used should be adapted to the kind of vegetation that is being cleared.

The following tools used for site clearing should be checked:

- Brush hook ,Machete ,Scythe ,Slashes ,Hoes

❖ *Soil working tools*

For ground preparation/soil working purpose, tools required such as hoes, mattocks, *gesso*, plow, etc. should be checked and arranged before starting the work activities in the field.

❖ *Laying out tools*

For laying out purpose, tools required such as hoes, mattocks, *gesso*, meters, pegs, ranging pole, water level, clinometers, compass, etc. should be checked and arranged before starting the work activities in the field.

❖ *Seedling Transporting Tools*

Seedlings, both bare rooted and containerized, should be safely transported and delivered to the planting site. Depending upon the location of planting site, transportation facilities such as arrangement vehicles should be done before stinting seedling transportation. For bare rooted seedlings, preparation of covering materials such as banana leaves or any suitable covering materials is important. Containerized seedlings should be transported by using trays and boxes and covering materials should be arranged to minimize damage to the seedling by sun and wind. All tools and equipment as well as materials should be handled according to the manufactures guidelines. Tools and equipment should be maintained regular and arranged in groups of similarity. Tools and equipment should be checked for any problem regularly. Broken tools should be identified, maintained and made ready for work.

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. Write the Site clearance tools and equipment? (5)**
- 2. Write Laying out tools (5)**

Answer Sheet

Score = _____
Rating: _____

Name: _____

Date: _____

❖ **Short Answer Questions**

1 _____

2 _____

➤ **Constructing basic nursery facilities**

The basic nursery facilities are fence, hedge, windbreak, beds, access road (working path) and irrigation system.

➤ **Fencing:** A nursery is usually surrounded with a fence or hedge to demarcate and to protect them against animals and some extreme winds. Fencing may be done in these ways:

- using barked or plain galvanized (zinc) wire
- wire mesh (chi ken net wire)
- wooden materials
- electric fencing
- stone wall

➤ **Hedges:** Can be considered as life fences. It is a one or two rows of seedlings which is/are planted in a straight line. It can serve as shelter belt in protecting seedlings against strong winds. It may take 2~3 years to grow it in full size. Need continuous and regular tending operation.

➤ (Hoeing, Weeding & watering)

※ Fast growing species are selected for making hedge.

E.g., *Cupressus lustranica*, *Casuarinas*, *Dodonea*, *Viscosa*...etc.

※ A fully grown *Cupressus* hedge can grow up to 1m height and 1m width at base (can be attained at 3~4 years age)

Procedure to construct a hedge

1. Allocate a 2.5-3m wide strip for the hedge along the boundary of the nursery.
2. Dig a 1m wide strip in the center of the strip in 30cm depth.
3. Make out 2 rows, 50cm apart, 25 cm from either side of the cultivated strips.
4. Plant vigorous seedlings (30cm in height) at 50cm interval along each line so that the seedlings in one row are staggered against the other rows.
5. Manage them properly (watering and weeding)
6. Start clipping lightly to form a shape of hedges wider at base and tapering upwards, when plants are 1.5m tall.

c) Wind breaks:

These are three or four rows of suitable trees and shrubs that are planted on wind ward sides of production areas, germination beds or around the nursery.

- ✘ They help to reduce drying, eroding, and abusive effect of winds on growing seedlings, and sometimes they protect the nursery from animals.
- ✘ Avoid selecting these species whose root systems compete with bare rooted seedlings for water and nutrients.
- ✘ Any insect or disease out of the wind breaks should be controlled quickly to reduce the risk of spreading to nursery seedlings.

d) Compartment division

- ✘ The basic production unit is the compartment with beds running parallel to the shortest side. Each bed should be 1m wide and 0.4~0.6m apart for working path, enabling laborers to reach the center of the beds during watering and weeding on both sides.
- ✘ one compartment can hold 10~20 beds. It is good if a single compartment can contain 10 beds to shorten the walking distance.
- ✘ Germination compartment building, as well as soil storage occupies one compartment each.
- ✘ for management purpose, several compartments can be combined to form blocks that can be framed by hedges.

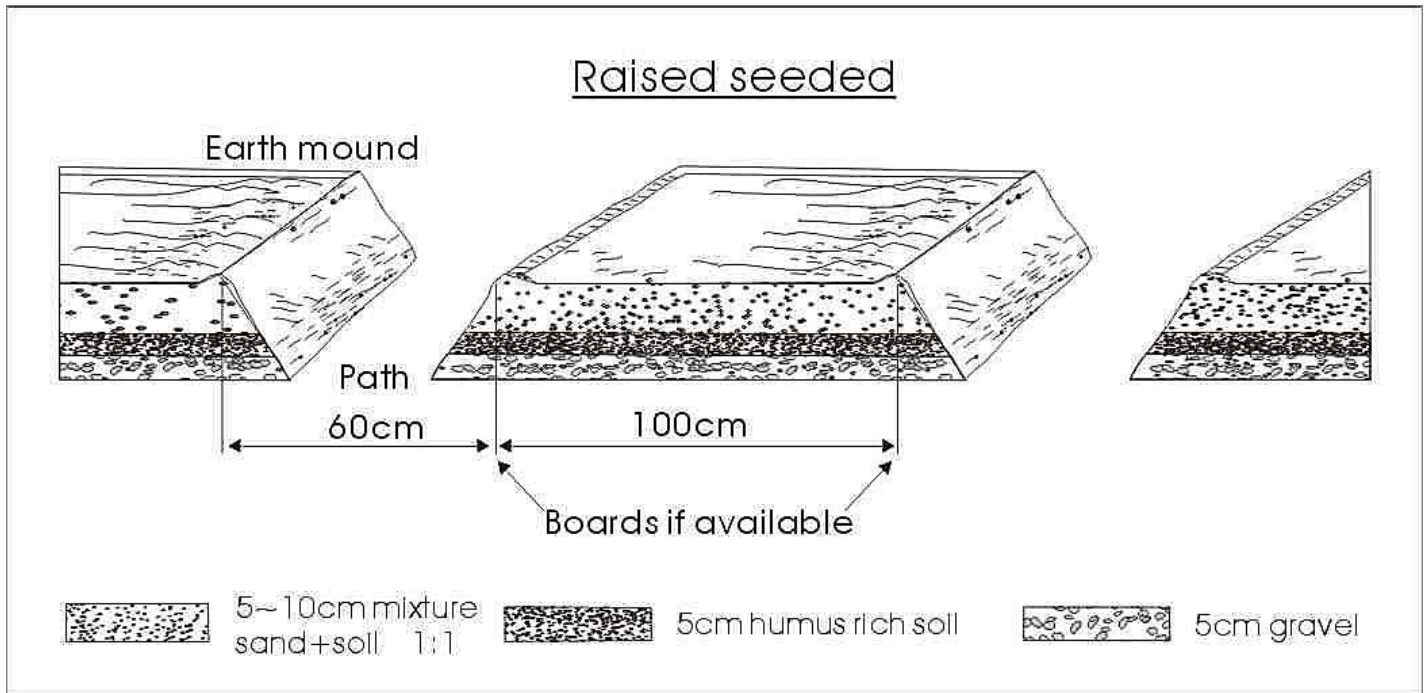
e) Bed construction

- ✘ seed beds are mostly 1m wide which enable people to reach the center of the beds during weeding and watering operations.
- ✘ the length of the bed could be vary from 5~20 m.
- ✘ usually 0.4~0.6 m paths are left in between the beds.

Procedures for seed bed construction

- 1) Level the site where bed is to be constructed and firm the soil.
- 2) Make out the required site and shape of beds with pegs and cords.
- 3) Erect reverting boards **15 m³~4cm** in size around the marked area.
- 4) Place a layer of gravel having **3cm** thickness or sand sieved to a depth of **5cm** in the bed followed by smoothing and pressing lightly with a flat board. Apply **2~3cm** thick layer of un-sieved forest soil on the top of gravel for good drainage, it acts as filter layer for seed bed to the top with seed bed soil that will be leached down.
- 5) Fill the remaining part of the seed bed to the top with seed bed mixture.
- 6) Level the soil with flat board.
- 7) Firm the soil on bed using hands to avoid any space unfilled with atmosphere.
Later, firm the soil using flat boards.
- 8) Protect the surface of beds with a thick layer of green grass and leaves.

9) Seed beds should be constructed orienting in east-western direction to have a



balanced sunshine effect

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



1. Write the Site clearance tools and equipment? (5)
2. Write *Laying out tools* (5)

Answer Sheet

Score = _____
Rating: _____

Name: _____

Date: _____

❖ **Short Answer Questions**

1. _____

2. _____

Tending operations

Definition: tending is defined as operations carried out for the benefit of a forest crop at any stage of its life between the seedling and mature stages. It is performed on the crop and also on the competing vegetations.

➤ **Beating up**

Beating up is a planting operation done shortly after major plantation establishment to replace failures occurred for various reasons. Mortality after the main planting activity is inevitable. This initial mortality may be due to:

- Deterioration of seedlings by mishandling
- Improper planting technique
- Occurrence of bad weathers after planting
- Attack by insect pests and diseases
- Seed competition
- Animal damage

Beating up is expensive as this involves larger holes, larger stock, and long distance per plant. Therefore, it is carried out if the established stocks considered to be unacceptably low.

Up to 20% mortality is accepted but if survival is less than 25% the plantation needs a complete replanting. It is also influenced by the pattern of mortality. If it occurs in an evenly distributed pattern, the need for beating up could be lesser. But if it is patchy creating scattered large gaps, we need to carry out beating up.

The time of beating up vary with the growth rate of the species. For fast growing species like eucalypts, the beating up needs to be done within the season- usually 3-4 weeks after planting.

For slow growing species, it can be done after a year or the next growing season. When it is done in the same season an extra amount of seedlings in the same stock must have been kept, so that they will be of the same size with the previously planted seedlings. Beating up should mainly consider areas of concentrated or continuous mortality. All single isolated failures need not necessarily be planted. Seedlings used must be robust healthy and having good root development.

➤ Weeding

Weeding is a tending operation done to eliminate or suppress all undesirable vegetation that could impair the growth of the plantation stock. The main objective of weeding is to promote the growth development of plantation crop, while keeping the costs of the operation within an acceptable limit. For this reason proper understanding on how weeds affect each particular crop is needed.

Most crops would benefit from a form of total weeding, but very often this is neither feasible nor economically justifiable.

A less intensive weeding regime may be adopted with species, which are to some degree tolerant of weeds. Tree species intolerant of weed competition require thorough and frequent weeding until the canopy closes.

Weeding methods

The main methods of weeding are suppression and elimination. Both can be done manually, mechanically or by chemical techniques. Weed suppression is done by beating down or crushing the weeds, or by cutting them back to near ground level weed elimination is achieved by killing the weeds, either by destroying the whole plant by cultivation or by the use of chemicals.

Weed suppression methods

a. Trampling: Simplest method, trample or beats down weeds away from plantation trees (in some countries 15cm x 3cm boards in section is used). It can be mechanized but such an implement cannot operate very close to the tree stem.

b. Slashing: The most common manual method of weed suppression is to cut the weed back by using such cutting tools as sickles and brush hooks. Also this operation can be mechanized by using tractor – powered machines. It is a usual practice to slash between hoed spots or strips.

Weed Elimination methods

a. Spot hoeing

- Hoeing is confined to a circle 1 – 2m in diameter around each plant.
- Wider hoeing in drier areas
- Most common because of its cheapness

b. Total (clean hoeing)

- ✓ Practiced with eucalyptus and cypress
- ✓ Recommended in dry area
- ✓ It is expensive, exposes soil surface to intense sunlight and increases the risk of erosion.

c. Strip hoeing

The operations confined to a strip about 75 cm wide along the rows of plants. It is practiced where ground cultivation was done by strip hoeing or ploughing.

d. Chemical methods

It involves the use of herbicides.

➤ **Climber control**

Climbers should be cut at early stage, before they damage or distort trees. Cutting is done at the base and the climber should be untwined from the tree stem as dead climbers can persist on trees for a long time.

➤ **Thinning**

Thinning is the process of removing part of the standing crop of trees to allow the remaining, selected trees to grow at their optimum rate to reach the size required by the objects of the plantation, within the period of rotation.

Time and intensity of thinning

Time of thinning: - optimum time will be when the effect of competition starts to show on those trees at or shortly after canopy closure (2 – 4 years). Live crown ratio of tree crop is a good indicator (30 – 40%). It is subject to change for economic reasons. If first thinning (pre-commercial) thinning is considered a profitable investment, heavier thinning will be made. Otherwise thinning will be postponed till trees reach merchantable size. For pure, very dense and uniform stands, thinning should be done to release at least the crop trees.

Timing of subsequent thinning depends on:

- Site quality or growth rate of the species or stand;
- Severity of previous thinning;
- Economic factors – logging cost, market opportunities, and minimum yield required per thinning.

Subsequent thinning are done at shorter intervals in younger stands or fast growing species, better sites, or if very light thinning has been done. Heavier thinning will result in fewer subsequent thinning at longer intervals. Ideally diameter growth of crop trees is the best indicator for the need to thin.

Economically, the best time will be when it is possible to make a profitable volume of harvest.

Intensity of thinning:

It indicates in numerical terms the extent to which the crop is thinned or the frequency at which thinning are carried out. It is a measure of the yield removed over a specified time.

The higher the thinning intensity heavier will be the thinning, the more trees will be removed and greater space will be available for the trees that remain. Up to a point the more the space provided for trees that are left, the greater would be their response. But if the stand is over thinned and too much space is given, the volume production will fall down. The maximum thinning intensity, which can be achieved with out loss in volume production, is known as the *marginal thinning intensity*.

➤ **Pruning**

Pruning is the removal of live or dead branches or multiple leaders from standing trees for the improvement of the tree or its timber. Pruning is classified in to two: - **natural and artificial**.

1. Natural pruning: The process of natural pruning consists of three steps:

(i.) Death of the branch (ii) shedding of the branch and

(ii). Occlusion or healing over of the branch stub.

The rate of dying of the lower branches in a tree is determined by the species, the density of the stand and the vigor of individual trees.

Hard wood species, for example eucalypts and *Aningeria* are good self-prunners: artificial pruning seldom needed. On the other hand, exotic conifers such as cypress and pines have their lower branches very persistent in the tree so that artificial pruning for the production of knot – free timber is an essential part of the tending program all over where these species are grown.

The denser the stand, the quicker the branches die and fall off. On the other hand, the more vigorous the tree, the slower branches die. When the branch dies, it is attacked by saprophytic fungi and insects and is weakened and eventually falls off. Occlusion is the healing over of the short stub left by the fallen branch. Occlusion is achieved by growth of new wood derived from the new cambium layer. The rate of occlusion depends largely on the rate of diameter growth of the stem and of the length of the stub.

2. Artificial pruning

If knot – free wood is the overriding interest in the management object, artificial pruning is required. Natural pruning can only be used for species with remarkable natural pruning ability. Otherwise very dense stocking is required that prolongs rotation.

For most species of conifer pruning is required. Since pruning is very costly and labor insensitive, it must be justified economically (costs of operation must be less than increase in value). Markets that differentiate between knot free and knotty lumber should exist. Artificial pruning should only be practiced for species with unsatisfactory natural pruning ability.

For species, which are sensitive to insect and fungi attack pruning should be done on the most vigorous trees and in good stands.

Pruning should be confined to crop trees (those trees which are retained for final harvesting).

3. Types of pruning

A .low pruning: a pruning done to a height of 2- 2.5m when mean stand height is 6m.

Main Objectives are:

- ✓ Provide access
- ✓ Reduce fire hazard
- ✓ Facilitate thinning operation
- ✓ Producing knot – free timber

b. High pruning: *pruning* done to out of reach of height (>2m) with main objective of producing knot – free wood and /or elimination of loose notes.

High pruning is required for species managed for:

- ✓ Veneer production
- ✓ High –graded construction material
- ✓ Transmission poles

High pruning is difficult and, hence, expensive than low pruning.

4. Pruning and wood quality

- Pruning removes defective knots (Loose or tight) that degrades the value of commercial wood
- Pruning hastens the transition from juvenile wood to mature wood.
- Pruned trees will be less tapered.

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. What is beating? (5)
- 2. Write pruning types (5)

Answer Sheet

Score = _____
Rating: _____

Name: _____

Date: _____

❖ Short Answer Questions

- 1 _____
- 2 _____

- *Care and tending*

Care and tending of seedlings comprises five activities:

- *Watering*

The single most important factor in germination and seedling production is water but too much water can be just as harmful as too little water. With seeds and tiny seedlings, it is not necessary to provide heavy doses of water as this not only leaches out the soil nutrients but can expose seed or wash out seed before germination begins. The answer to this problem is not to plant the seed any deeper, as is sometimes done, but to adjust the hose nozzles to allow a finer spray or cover the seed temporarily until they germinate.

Source: ILO 1989

Water the containers before sowing and immediately after covering the seed with the sowing medium or sifted sand. The sowing medium should not be allowed to get dry. Several light applications of water at this stage are far better than one or two heavy applications. Keep the soil moist but never sodden, watering preferably in the mornings and avoiding the mid-day period when the sun will cause excessive evaporation. Water deposited on the surface of leaves heats up readily in the overhead sunlight, causing the tender leaves to scorch.

- *Weeding*

Weeds take away light and water from the seedlings and increase the risk of fungi attacks. They have to be removed as they start to appear. When weeds become too tall, the roots of the seedlings are easily damaged during weeding and the work becomes more difficult, time-

consuming and costly. The workers should have a little stool to sit on during manual weeding to allow for a convenient working position.

Weeds should never flower and set fruit in the nursery or the surroundings.

Source: ILO 1989

➤ *shading*

In the early stages of their development - from sowing to some time after pricking out - seedlings are sensitive to full sunlight and high temperatures. During this phase, they must be protected by shading mats.

Source: ILO 1989

When the seedlings are more resistant, shading is reduced gradually from all day to around mid-day and later to none at all. For the last months in the nursery, seedlings should be exposed to full sunlight. Shade needs vary with species as well but observation of the plants will show what is needed. Shading mats can also be used at any stage to protect seedlings from heavy rains or hail which can otherwise damage seedlings badly.

➤ *Prevention and control of pests and diseases*

Small organisms like fungi, bacteria and viruses or animals like nematodes and insects can cause damage to seedlings. A very common disease in nurseries is caused by fungi and called "damping-off". It can cause seed to rot before germination, roots to decay before the shoot appears or the shoot to become thin at its collar and collapse.

Source: ILO 1989

Damping-off can often be prevented by:

- changing soil in seedbeds after some years;
 - immediately removing plants infected by fungi or attacked by pests and burning or burying them;
 - avoiding excessive watering;
 - allowing for good drainage (sand in seedbeds);
 - ensuring good air circulation;
 - removing weeds and lowering density of seedlings in beds;
 - reducing nitrogen content (less manure, no chemical fertilizer)
- *Root (and possibly shoot) pruning.*

Sometime after picking out (one to four months depending on climate and species), roots start to grow out of the bottom of the pots or the drainage holes. These roots have to be cut from time to time, roughly every 2 months.

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

1. Write at least five activities of tending of seedlings comprises? (10)

Answer Sheet

Score = _____
Rating: _____

Name: _____

Date: _____

❖ Short Answer Questions

1 _____

2 _____

Operation sheet

➤ prepare tools and equipment

Objectives:

The objects preparing materials, tools and equipment are designed to do a specific kind of work such as cutting or chopping by directing manually applied force or by means of a motor.

➤ **Materials required**

a. Site clearing tools

b. Soil working tools

c. Laying out tools

d. Seedling Transporting Tools

➤ **Procedures**

- For the preparation of materials, tools and equipment used for nursery work, go to the store and identify them.
- Check whether all materials, tools and equipment are functional.
- Follow correct manual handling during loading and unloading to take to the work site
- Prepare and list the uses of the tools and equipment commonly used for nursery work.

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 1 hour.

Task 1 Organize Site clearing tools

Task 2. Maintain soil working tools