

NATURAL RESOURCES CONSERVATION AND DEVELOPMENT LEVEL II

Learning Guide -20

Unit of Competence: Assist Nursery Work

Module Title: Assisting Nursery Work

LG Code: AGRNRC2 M05 0919 LO1-LG-20

TTLM Code: AGRNRC2 TTLM 0919v1

LO 03: Sow seeds in seed beds and polythene tubes

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

- Selecting and preparing viable and clean seeds
- Sowing seeds on seed bed
- Sowing seeds on polythene tubes
- mulching seedbed
- Watering
- labeling the sown beds
- Following up the germination and the development

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

- Select and prepare Viable and clean seeds according to work guideline
- Sow seed beds to get bare rooted seedlings based on organizational guidelines
- Sow Seeds on the arranged polythene tubes according to organizational work manual
- Cover the sown seeds by a thin layer of grass appropriately according to the technical guide line
- Apply Water on the sown seeds according to the required frequency and intensity
- label the sown beds according work guidelines
- make follow ups concerning the germination and the development for maturity level transplantation based on technical guideline

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, Sheet 5, Sheet 6 and Sheet 7”.
4. Accomplish the “Self-check 1, Self-check 2, Self-check 3, Self-check 4, Self-check 5 Self-check 6 and Self-check 7” in page -3, 5, 8, 10, 13, 16 and 19 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 -20, 21 and 22 respectively.
6. Do the “LAP test” in page – 23 (if you are ready).

3.1. **Selecting and preparing viable and clean seeds**

Seed quality is the sum of the **physical**, **physiological** and **genetic** properties of seeds. A seed lot to be used for planting is a "population" of many seeds. The seeds in a seed lot are not all uniform: normally they differ in maturity, size, shape, structure, and physiological characteristics. They also come from different seed mother trees, and therefore represent different genetic properties and grow and develop differently even under identical environmental conditions.

A) Physical and physiological quality

Physical and physiological quality of seeds is expressed in seed viability and vigor, as well as seed health. **Seed viability and vigor** are the ability of the seeds to germinate and produce healthy and vigorous plants. Seed health can affect viability and vigor, and if seeds harbor contagious diseases or pests the resulting plants in the nursery and in the final plantation will also be affected.

B) Genetic quality

The genetic quality of a seed lot is the extent to which the genetic properties of the seed mother trees are actually represented in the seed lot. This genetic quality is the most important factor because it is decisive for the **viability**, vigor and health of the trees in the final plantation. The way seeds are collected, transported, processed and stored, however, also greatly influences the overall quality of a seed lot in determining how those good genetic attributes are expressed in the plants that are grown from them. It is the job of those collecting, processing, storing and pre-treating seeds, as well as those using the seeds in the nursery, to ensure that the genetic quality of selected seed mother trees is transferred to the seedlings in the nursery to the greatest extent possible. This high quality will subsequently be expressed in the trees in the plantations, which is the ultimate aim of our nursery work.

- **Maintaining Seed Viability:** Some problem emanating from the seeds themselves.

Freshly collected seeds normally have moisture content of at least 15 %; then, the higher the moisture content and temperature, the higher will be the deterioration through the action of fungi, moulds and overheating.

The **higher the moisture content** of **recalcitrant** seeds, the higher the danger that they will die of suffocation, physiological breakdown and overheating if not properly stored, packed and transported

Preparing Seed for sowing

After collection, fruit and seed must be processed and stored. The main objectives are as follows:


- To reduce the bulk of the material collected and thus lower the costs of handling, transportation and storing by removing excessive debris and fruit parts;
- To remove debris and other material that could harbor diseases and pests;
- To bring all seeds to optimal maturity (after-ripening) where required.

As far as practically possible it is important to maintain the genetic quality of the collected seed throughout the stages of processing. This is achieved by avoiding unnecessary grading and by handling the fruits or seeds with great care. Always remember those fruits and seeds are living systems that do not tolerate excessive moisture, heat, beating or shaking. The fruits or seeds from different mother trees (different families) have different characteristics in respect of maturity, size, thickness of fruit shell or seed coat and, very importantly, different moisture contents. This means that seeds from different families may react differently to processing or storage conditions and may die if subjected to the wrong conditions for that type of seed.

There are various techniques and methods for processing of tree seed. The choice of method depends on factors such as morphology, ripeness, amounts to be processed, available equipment and staff.

The most important things to remember are:

- Do not pack moist fruits or seeds tightly and in closed containers; keep them in open, preferably small, baskets?
- Fruits with juicy pulp must be de-pulped, preferably before transportation if the journey will be prolonged;
- Seed lots with free water on the surface of the fruits or seeds must be air-dried so there is no free water visible before transporting;
- Fruits and seeds must not be stored in closed containers if the moisture content is higher than 7-9%.'

 **Cleaning:** seeds need to be cleaned of twigs, bark foliage and other impurities because they can carry fungus spores, invite insects)(by hand, floatation, vibrators).

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. **What is seed quality? (5)**

2. **Write how to Preparing Seed for sowing.(5)**

Note: Satisfactory rating - 18points

Unsatisfactory - below 18 points

Answer Sheet

Score = _____

Rating: _____

Name: _____

Date: _____

Short Answer Questions

1. _____

2. _____

Broadcast Sowing onto seedbeds

This is nowadays the most common method of sowing onto seedbeds. It is used to sowing seeds of all sizes, but is best suited to sowing of small seeds.

The bed should be well watered the day before sowing. The bed moisture is usually checked in the morning of the day of sowing to ensure that the correct moisture condition is maintained. The seeds are then broadcast sown as evenly as possible, either from hand or from a stiff paper packet. To get even distribution of seeds, the person who is sowing could first go across the bed over the allocated area then along the bed. Then mixing the seeds with an equal or double amount of fine sand and sowing makes sowing evenly possible. The seeds are then covered with seedbed soil mixture or with sand at a depth of about twice the thickness of the seed. The sand is firmed with a flat board to eliminate any air pockets between the seeds and the soil to void seed being washed by water during watering.

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. **What is Broadcast sowing onto seedbeds? (6)**

Note:¹ Satisfactory rating - 3 points

Unsatisfactory - below 3 points

Answer Sheet

Score = _____
Rating: _____

Name: _____

Date: _____

Short Answer Questions

1. _____

2. _____

Direct sowing onto the polythene tubes

As mentioned earlier, direct sowing onto pots has become increasingly popular. It eliminates the time consuming operation of transplanting which causes slowed growth and even seedling mortality. The seeds are placed in the middle of the pot, pressed down and covered with soil so that the covering layer is about the thickness of the seed. For large seeds, a hole is first pressed in to the soil by a pricking stick. Then the seed is put into it and then covered. Again it is important to see that no air pockets are left round the seed. Recommendations on the amount of seed that should be placed in one pot are presented in the following table

<i>Cupper suslusitarica</i>	6-8 seeds per pot
<i>Eucaliptuscamaldulesis</i>	10 grams per 1000 pots
<i>E.citriodora</i>	2-3 seeds per pot
<i>E.grandis, E.saligna</i>	10 grams per 1000 pots
<i>E.globulus</i>	2-4 seeds per pot
<i>Pinus species</i>	2-3 seeds per pot

The aim in direct seeding is to raise at least 2 seedlings per pot initially. The best one from the two seedlings will be retained to grow the whole season

Planting the seedlings in pot

- Factors determining whether a seedling withstands transplanting/transferring.
 - the retained amount of root system during transplanting
 - the capacity of retained roots to absorb water
 - the rate of new root formation

Ways of planting seedlings in pots:

- 1) Take care not to break the roots of seedlings when you lift them
- 2) Choose seedlings that grow best (avoid stunted and poor looking seedlings)
- 3) Prepare the seedlings by trimming off part of the roots and leaves
- 4) Moist the soil to be worked upon enough (not wet enough to be sticky)

- 5) Make holes with a dibbler.
- 6) Plant the seedlings into holes and bury the roots up to the crown
- 7) Pack the soil down well around the plant
- 8) Take care not to disturb the roots
- 9) Water the planted seedlings thoroughly.

Water the empty pots lightly for a couple of days before transplanting, so as to promote the germination of weeds' seeds which will be removed soon.

Procedures for Transplanting Into Pots

- 1) Erect a large portable shade.
- 2) Water the seed bed to be moistened.
- 3) The translators sit on small low stool to work in pairs on opposite sides of the bed.
- 4) A hole is made with the dibble in the center of each pot.
- 5) The roots of seedlings are placed carefully in the hole without twisting, and soil is push forwards the root with the dibble to make sure that no air is left around the root.
- 6) The seedlings are placed at the same depth or slightly deeper than they were in the seedbed.
- 7) Firm the soil around the seedlings gently and smoothed with fingers so that no depression is formed around the stem.

Transplanting is a crucial stage in the life of a plant. It always causes a shock to the seedlings even when done carefully and bad transplanting easily kills the seedlings. So cares must be taken during transplanting operation.

Cut the roots of seedlings which are very long using sharp knife

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. Describe Procedures for Transplanting Into Pots? (5)
2. Write the Ways of planting seedlings in pots. (5)

Note: Satisfactory rating - 18points

Unsatisfactory - below 18 points

Answer Sheet

Score = _____
Rating: _____

Name: _____

Date: _____

Short Answer Questions

1. _____
2. _____

Mulching

Mulching may be defined as any artificial modification of the soil surface. It can be done in many ways, such as mulching by ordinary cultivation and covering of grass, leaves straw sawdust, sand etc. The primary purpose of mulching is to conserve soil moisture by lowering soil temperature and by physically blocking the loss of water in areas where watering is necessary through the year, mulching helps to reduce both the frequency of watering and the amount of water needed.

To be effective, a layer of mulching should be 1-2 cm thick. Water is applied in large enough quantities that will sink through the mulch and soak the soil. Light watering is ineffective as a high proportion of water is trapped by the mulch and evaporated off without any marked effect on the condition of the soil under the mulch.

Soil surface of pots or beds should not be covered in rainy areas as soil aeration would be reduced and risk of damping off would be increased.

Grass mulching of Sowings

In Ethiopian nurseries sown seeds both in seedbeds and in pots are covered with a layer of grass. The reason is to prevent the soil surface and seeds from being washed aside in watering, as local watering cans have very rough sprinklers and the drop size is large. The grass mulch has got some disadvantages. It may bring into pots or beds weed seeds and insects. Introduce of fine-hose watering cans could bring about considerable improvements in nursery techniques in Ethiopia.

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. What is primary purpose of mulching? (5)

2. What is mulching. (5)

Note: Satisfactory rating - 18points

Unsatisfactory - below 18 points

Answer Sheet

Score = _____

Rating: _____

Name: _____

Date: _____

Short Answer Questions

1. _____

2. _____

Watering

The main objective of watering seedling is to maintain enough moisture to the rooting zone to enable the seedlings grow satisfactorily. The frequency and amount of watering depend on the rate at which water is absorbed by the roots and the water holding capacity of the soil. The rate of absorption depends on species, size of seedling, density of seedling, and on weather conditions. For these reasons, it is impossible to establish very general rules about watering. Every nursery manager should find best possible watering regime himself/herself.

A fine- hose watering can should be used when seedlings are still small. Gradually, the frequency of watering is reduced while at the same time the amount of water applied at each watering are increased, so that the total amount of water during a day is slowly increased. A watering can is with a coarse hose which produce large drops of guarantees that water penetrates through the foliage to reach the soil.

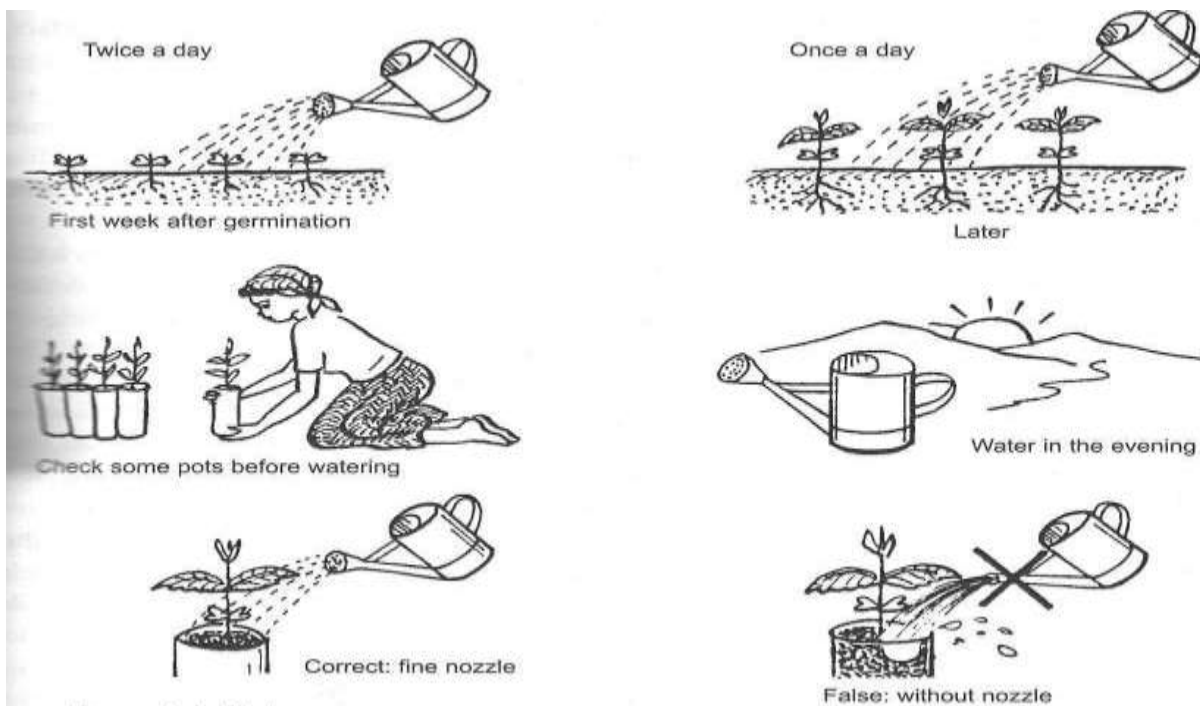


Figure 1 watering the seedling

➤ **Watering of Seedbeds**

Watering should be done frequently, at least twice a day, in small quantities. The amount and frequency of watering depends on the soil mixture in the bed and on weather. A very approximate recommendation for total amount of watering per day is equivalent 8 mm of rainfall. This means 8 liters of waters/sq.m of seedbed.

If the seedbed is covered with mulch grass, the moisture of the soil surface should be frequently checked. Some of the water is absorbed and evaporated by the grass, which, on the other hand, slows down evaporation from the bed surface. For these reasons, watering is done less frequently but in greater quantities than to bed without grass mulch

➤ **Watering of Transplants**

When seedlings are grown in containers, watering should wet the soil to the base of pot. If the seedlings are properly watered the roots can be made to grow within a shallow surface zone.

Seedlings are watered immediately after transplanting. Therefore light watering is carried out 2-4 times a day depending on the progress of the seedlings.

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. What is the main objective of watering seedling? (6)

Note: Satisfactory rating - 3points

Unsatisfactory - below 3 points

Answer Sheet

Score = _____

Rating: _____

Name: _____

Date: _____

Short Answer Questions

1. _____

2. _____

Information Sheet-6	labeling the sown beds
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The area for nursery beds should be level, or nearly so. A slight slope (2% maximum) is beneficial for better surface drainage, but slopes greater than 2% can cause erosion, necessitating expensive control measures, and may cause undesirable translocation of soluble fertilizer salts [9]. Furthermore, all mechanical equipment used in forest nurseries operates best on level ground. Moderate slopes and small rough areas may be leveled by terracing and grading, but these operations can be expensive and usually expose infertile subsoil that can cause future seedling-growth problems

Level bed – use for raising for species whose water requirement is moderate and cannot tolerate standing water such beds are level to the ground.

Bed can also further classified in to two

1. Seed beds—should be 1m width to reach the center of the bed from either side of the bed. They can be length of 10m and usually 1m paths are left in between two beds.

2. Transplant beds

Three types of beds can be constructed for transplanting potted seedlings depending on soil drainage condition and pruning needs.

- A. Storage area for pots or ground level— in nurseries where drainage is good, it is sufficient to prepare storage bed for seedlings by merely leveling and firming the ground. The pots are stacked there side by side, usually to form a bed one meter in width and of any convenient length. These beds are usually framed with bricks or timber, with poles of split bamboo, which makes the beds look neat. This protects the edge pots from drying and also falling away.
- B. Storage beds with drainage layer--- in nurseries where drainage is poor, an area 1m width and some length can be dug down to about 8cm depth. A 5cm thick layer of small stones (less than 3cm in size) is placed in the bottom. A 3cm layer of rough forest soil is leveled on top of the gravel layer. The filled pots are stacked on top on the forest soil layer.
- C. Storage bed with a reverting board frame or raised bed--- in both storage beds discussed above, pruning is meant to be done with a knife or secateurs. If piano-wire pruning is intended, a reverting board frame is needed to guide the wire and hold the pots in place during root pruning by wire. A soft layer of fine sieved sand or transplant soil mixture under the pots allows the wire pass easily.

Two types of bed can be constructed for transplanting of bare rooted seedlings

1. Traditional bed--- is prepared like a bed for vegetables using the soil in the nursery. However, the soil can be improved by adding well- decayed manure or compost. Seedlings are transplanted at somewhat wider spacing to ensure good growth of roots and to avoid entangled roots. The old recommendation for spacing of transplants is 20-25cm between rows and 5-10cm between seedlings in the rows. Root pruning using a spade is possible in traditional beds if distance between rows is possible in traditional beds if distance between rows is wide enough.

2. Swaziland bed--- this is an improved way of producing seedling in beds. The greatest advantage of this system is that root pruning can be done in all directions (both under cutting and side pruning) and for this reason it is possible to produce seedlings with well developed, dense and compact root system. Reverting borards,15-18 wide and 3-4 thick, straight and smooth in the lower edge are erected a long the perimeters by a filter layer of rough unlived forest soil is put in to a depth of 10cm can be added if there is a drainage problem. In a well-drained nursery drainage layer is not necessary. The bed is filled with transplant soil mixture to the level of the reverting board, firmed and leveled

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 two types of bed for transplanting of bare rooted seedlings? (5)
2. What is labeling? (5?)

Note: Satisfactory rating - 5points

Unsatisfactory - below 5 points

Answer Sheet

Score = _____

Rating: _____

Name: _____

Date: _____

Short Answer Questions

1. _____

2. _____

Germination : the emergence and development of the seedling to a stage where the aspect of its essential structures indicate whether or not it is able to develop further in to a satisfactory plant under normal conditions in soils.

- The process of germination

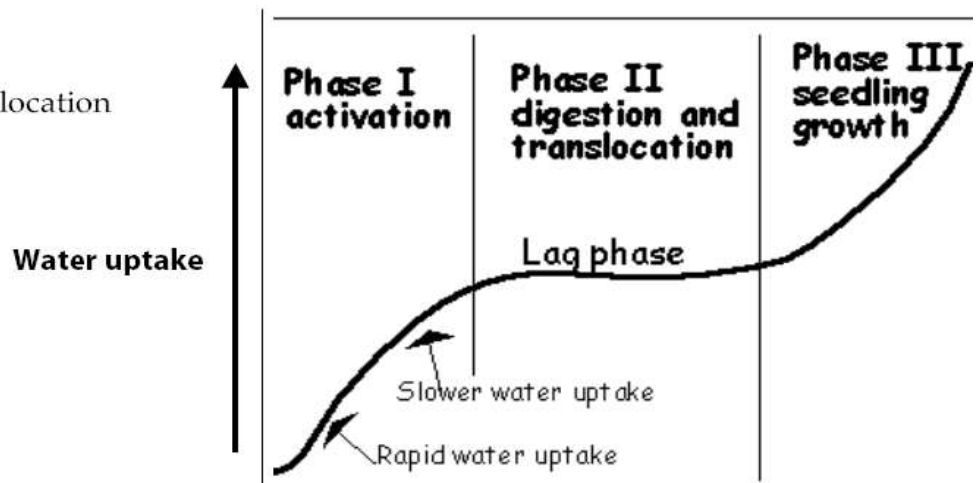
It has three phases.

Imbibitions (activation): water getting through micropyle and swelling of the seed

Metabolic and physiological activities (digestion and translocation): swelling of protoplasm which was previously crowded, reappearance of organelles

Emergency of radical (seedling growth): this is the first indicator of germination, i.e. the radical swell after rapid imbibitions, and it breaks of the seed coat. Then other parts emerge.

1. Activation
2. Digestion and Translocation
3. Seedling growth



Phase I Activation	Phase II Digestion and translocation	Phase III Seedling growth
Seed volume increases	Much physiological activity Protein synthesis Metabolism of storage reserves Enzyme synthesis for cell wall loosening	Radicle emergence 1. Cell elongation 2. Cell division
Imbibition 1. Uptake of water 2. Increased respiration 3. Enzymes produced 4. Cell elongation and emergence of radicle	Log phase 5. Mobilization of food materials from endosperm or cotyledons	Seedling growth 6. Cell # increases 7. FW and DW increase

Figure 6. 1. 1: The process of germination

There are two types of germination based on the position of cotyledon.

- Hypogeal : cotyledons remains underground
- Epigeal : cotyledons lifted aboveground

Factors that affect germination

Seed quality: it entails

- ✓ the right species and provenance
- ✓ genetic and physiological quality
- ✓ reliable seed source

Specifically, quality in seeds implies/ includes:

- ✓ Viability: able to germinate or develop normally
- ✓ germ inability
- ✓ healthiness
- ✓ purity
- ✓ true-to-type
- ✓ resistance to disease and drought
- ✓ collected from trees with desirable attributes
- ✓ collected from a diverse gene pool

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 types of germination based on the position of cotyledon? (5)
2. What germination? (5?)

Note: Satisfactory rating - 18points

Unsatisfactory - below 18 points

Answer Sheet

Score = _____

Rating: _____

Name: _____

Date: _____

Short Answer Questions

1. _____

2. _____

Operation sheet -1

- **Seed collection**

- ❖ Objectives

- To store right kind of seed (provenance); good quality; sufficient amount and available at the right time.

2. Materials required

- Binoculars
- Canvas
- Basket
- Rope
- Ladder
- Overall
- Safety shoes
- Long handled shear/sow

3. Procedures

Selecting good parent plant for seed

- Select straight and vigorously growing parent plant
- Select disease resistant and disease free parent plant
- Select productive parent plant
- Select parent plant that processes all qualities of the grower demand
- Select mother plant adapted to the cultural methods and climate of the area
- Select healthy parent plant which produces healthy offspring
- Select parent plant which possess only well ripened fruits
- Collect seeds of trees producing fine fruits and those with fruits that open at maturity when the fruit is still attached to the tree

NB

For large seeded trees, seeds can be collected on the forest floor. Ideally, it is best to collect seeds before they fall from the tree because seeds on the ground are already contaminated with bacteria and fungi that may damage the seeds.

Operation sheet .2

- Sowing seed, mulching and watering

- ❖ material

- bring water to the boil (about 20 l for 5 kg of seed)
- take the water off the fire
- immerse the seed
- allow to cool overnight
- rinse with clean water
- Materials required
- Seeds of various species and sizes
- Watering can
- Watering hose
- Filled pots with soil mix
- Grass mulch
- Overall
- Shoes
- Sun hat

3. Procedures

- For sowing in pots, place a number of seeds into each pot depending on the germination (G) rate. Accordingly, if $G\% = 35-50\%$, sow three seeds; $G\% = 51-80\%$, sow two seeds and $G\% > 80\%$, sow one seed
- For sowing in seedbeds, the seed is best put in rills running across the bed.
- Place seeds at the right depth; mix small seeds with sand
- Cover the seeds with sand or soil and gently press
- Water the seedbeds or pots with cans with fine nozzles
- Finally, cover the seedbeds or pots with shading material/mulching

Operation sheet - 3

Sowing seed, mulching and watering

1. Materials required

- Seeds of various species and sizes
- Watering can
- Watering hose
- Filled pots with soil mix
- Grass mulch
- Overall
- Shoes
- Sun hat

2. Procedures

- For sowing in pots, place a number of seeds into each pot depending on the germination (G) rate. Accordingly, if $G\% = 35-50\%$, sow three seeds; $G\% = 51-80\%$, sow two seeds and $G\% > 80\%$, sow one seed
- For sowing in seedbeds, the seed is best put in rills running across the bed.
- Place seeds at the right depth; mix small seeds with sand
- Coverer the seeds with sand or soil and gently press
- Water the seedbeds or pots with cans with fine nozzles
- Finally, cover the seedbeds or pots with shading material/mulching

LAP Test -1	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. Identify good parent plant for seed

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 Water the seedbeds

LAP Test -3	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. Use all over personal protective equipment and watering the seedbeds.