# Natural Resources Conservation and Development

# Level II

# Learning Guide-13

**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-4 LG-13**

**TTLM Code: AGR NRC2 M04 TTLM 0919v1**

## LO4: Process and store seed

| Instruction Sheet | Learning Guide # 13 |
|---|---|

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

- Separating seeds from other materials, weighing and storing in accordance with species requirements and site procedures
- Applying Seed treatment to prevent deterioration in accordance with seed species and site procedures
- Packaging seeds for storage in accordance with industry, organizational and legislative requirements
- Accurately recording seed information in accordance with site procedures
- Recording and reporting seed collection information and results in accordance with site procedures

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:

- Separate seeds from other materials, weighing and storing in accordance with species requirements and site procedures
- Apply Seed treatment to prevent deterioration in accordance with seed species and site procedures
- Package seeds for storage in accordance with industry, organizational and legislative requirements
- Accurately record seed information in accordance with site procedures
- Record and report seed collection information and results in accordance with site procedures

**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 -12, 16, 18 and 20** respectively.
5. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1” **in page -24.**
6. Do the “LAP test” **in page – 25** (if you are ready).

| Information Sheet-1 | Separating and storing Seeds |
|---|---|

## 1.1 concept of Seed extraction/processing

To get cleaner and better quality seeds, immerse seeds in a container of water for one to several hours. Discard those that float. Drain and redry the remaining seeds well. Avoid soaking seeds for too long as this may cause fermentation. Soaking should also be avoided for seeds which rapidly expand to avoid damage. When seeds are to be planted immediately, re drying may be omitted.

Seed extraction/processing are the separation of fruits from seeds. This is necessary to:

- reduce weight and volume
- enable more rapid drying
- for storage under low risk of fungal attack
- Eliminate the negative impact of fruit chemistry on germination.

## 1.2 Separation methods

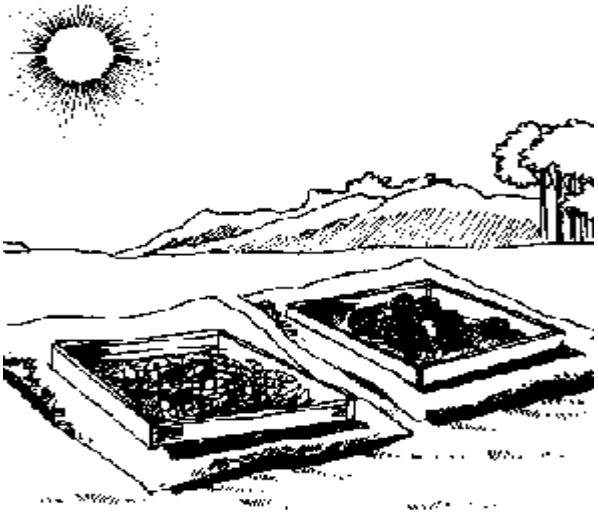
The methods of extracting seeds from fruits are determined mainly by the characteristics of the fruits. Fleshy fruits are treated by a depulping process which usually involves a combination of soaking in water with pressure or gentle abrasion. Cones and other woody or leathery fruits are first dried until cone scales open or seeds become detached from the placenta of the fruit, and then treated manually or mechanically by tumbling or threshing in order to separate the dry seeds from the dry fruits.

- **De-pulping:** for fleshy fruits such as *Podocarpus, Olea, Azadirachta, Melea, Prunus, Juniperus*. For such species the pulp must be removed soon to avoid fermentation and heating.

  The technique involves: Soaking the fruit, then the flesh hand squeezed or mashed by wooden blocks, rolling pin or fruit press; or macerating flesh by rubbing it against or through a screen. In maceration, the fruits are placed in water in a warm place to soften the pulp, which is then broken down by vigorous stirring or rubbing against

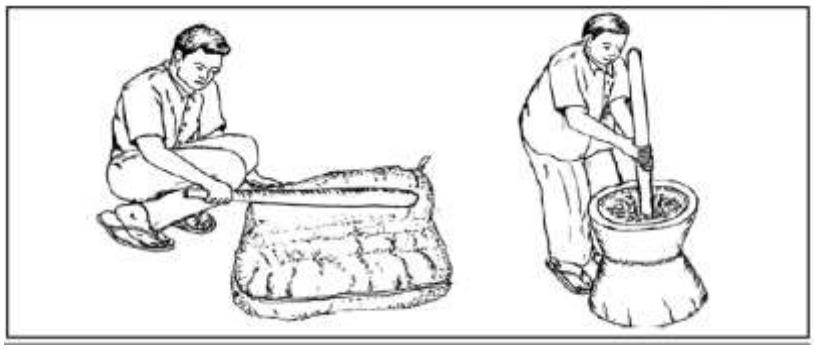
wire screening. HCl can soften pulp, and NaOH can cut resin when Juniper berries are being treated.

- **Extraction by Drying*:*** It uses natural or artificial heat source. Drying can be: under cover, sun drying or kiln drying.
  - ✓ ***Drying under cover***: used as an extraction method for species that cannot withstand direct sun light, and must be stored at relatively high moisture content. Good ventilation required. The time required depends on the relative humidity. This method can offer uniform drying to prevent case hardening.
  - ✓ ***Sun drying***: For species that can withstand high temperature (e.g many dry land species); covering may become necessary when fruits/ cones are still fresh, and under very intense sunshine.



Picture 1

Some pods do not crack even if we dry them in the sun. In this case, we should crush them by stepping on them with our feet, or by putting them into a sack and beating them a pestle. These species include *Peltophorum dasyrrhachis*, *Albizia lebbeck*, and *Dalbergia bariensis*.



Picture 2

- ✓ **Kiln drying**: Problems encountered when trying to control humidity and temperature may complicate drying by natural methods. Then we resort to artificial methods:
    i. when large amount of seeds have to be processed,
    ii. When regulation of temperature and moisture is required (often, natural drying may not be sufficient to achieve the desired moisture content)
    iii. When we want to save time.

### 1.3 seeds processing

The following are the most important operations between extraction and storage.

- Cleaning and separation
- Species related moisture content for storage
- Grading

The following are some of the methods of cleaning and separation.

- **De-winging**: especially when the wing is greater than the seed. It is done manually or by machine (cement mixer, mechanical de-winger), by tumbling, or threshing.

The characteristics by which sound seeds may be distinguished from inert matter including sterile and empty seeds are: *size, shape, colour, texture and specific gravity*.

The first three are the major criteria for visual separation, while seed-cleaning machines employ size and specific gravity.

- **Screening or sieving**
  - **Blowing**: This includes falling, floatation, rising, winnowing

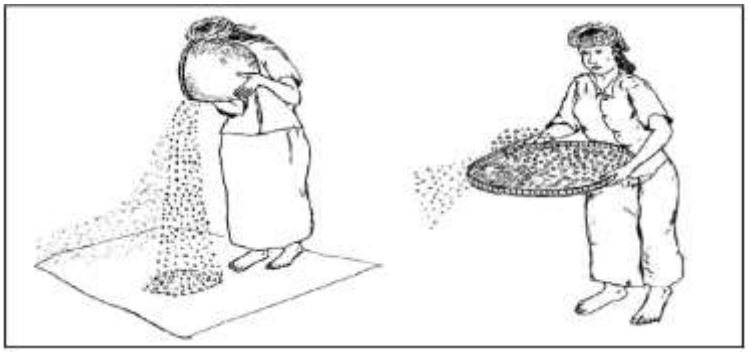


Figure 3

  - **Liquid floatation*:*** the cleaning by flotation relies on the principle that the density of the seed of a given species is specific both for filled and unfilled seed.

Figure 4

- **Drying/ moistening for storage**

Appropriate species related drying for storage of orthodox seeds, or moistening recalcitrant seeds to the required moisture content.

Drying is achieved if the surrounding air is drier than the seed (seeds are hygroscopic), and the drying process is a game between moisture content of the seed, Relative Humidity of air and temperature.

The drying process requires a regular control of moisture content because:

- Above 45-60 % ……. Germination begins
- 18-20 %……...Seeds may heat up because of a rapid rate of respiration
- 12-14 %……Fungus may grow
- Below 8-9 %…… ……insect activity reduced
- 4-8 %……Air tight storage is safe

**Seed drying for long storage**

## 1.4 Seed storage and maintenance

Storage may be defined as the preservation of viable seeds from the time of collection until they are required for sowing. When seed for afforestation can be sown immediately after collection, no storage is needed. The best sowing date for a given species being raised in a nursery depends on

- The anticipated date of planting, itself dependent on seasonal climate
- The time needed in the nursery for planting stock of that species to reach the right size for out-planting.

Only rarely does best sowing date coincide with the best date for seed collection. More often it is necessary to store the seed for varying periods which may be

- ***Up to one year*** when both seed production and afforestation are regular annual events, but it is necessary to await the best season for sowing.
- ***1 – 5 years or more*** when a species bears an abundant seed crop at intervals of several years and enough seed must be collected in a good year to cover annual afforestation needs in intermediate years of poor seed production.

- ***Long-term storage*** for purposes of conserving genetic resources. The period of storage will vary according to the seed longevity of the species and the storage conditions, but will be measured in decades in species which are easy to store.

Today two major classes of seed are recognized:

- ***Orthodox***. Seeds which can be dried down to a low MC of around 5% (wet basis) and successfully stored at low or sub-freezing temperatures for long periods.
- ***Recalcitrant***. Seeds which cannot survive drying below relatively high moisture content (often in the range 20–50% wet basis) and which cannot be successfully stored for long periods.

Initially, you should understand the types of seed that have natural characteristics to enable long-term storage. Seeds that rot quickly (Recalcitrant) cannot be kept for long and you have to grow them immediately after harvest.

**1.5 Processing of recalcitrant seeds**

Recalcitrant seeds are species that have fleshy fruits which do not dry out on the tree, and which are dispersed just before or during the rains.If possible, extract seeds only upon arrival at the collection center. Do not delay extraction for too long and never store fruits piled-up and undisturbed, as heating and fermentation may kill the seeds or reduce their quality.

Seeds in fleshy fruits may be extracted manually or made to undergo a depulping process. This process entails the following steps:

1. Immerse fruits in water for 1-2 days until the fleshy tissue becomes soft.
2. Scrape, crush or nub lightly with hands to separate seeds thoroughly from pulpy flesh, but avoid injuring the seeds.
3. Discard all floating seeds and pulp (most seed species are sinkers.
4. Drain seeds, rewash and air-dry for 1-2 days before sun-drying.
5. Winnow to dean.

Examples of species with fleshy fruits that need depulping are: Aleurites spp., Canarium ovatum, Syzygium cumin), Gmelina arborea, Azadirachta indica, Ocotea usembarensis and Cinnamomum camphora.

For some species which have seeds covered only by thin layer of flesh (e.g., Vitex parviflora), the fruit itself may be kept intact, dried and directly sown. However, germination may be further improved by removal of the pulp.

**1.6 Drying of seeds**

Sun-dry the extracted, cleaned seeds for 1-3 days (depending on the weather and on how wet the seeds are) if seeds will be stored for future use. Air dry washed or wet seeds for 1-2 days before sun drying.

1. Lay a mat, canvas, light-colored plastic sheet, winnowing basket or screen on the ground where the sun shines all day.
2. Spread the seeds thinly **and** evenly.
3. Stir and turn the seeds 4-5 times a day for uniform drying. If possible, keep seeds (especially moist ones) shaded during intense heat (noon to 2:00 p.m.).
4. Before it rains or gets dark, take the seeds indoors.

The same drying procedure may be used for seeds of most fruit trees.

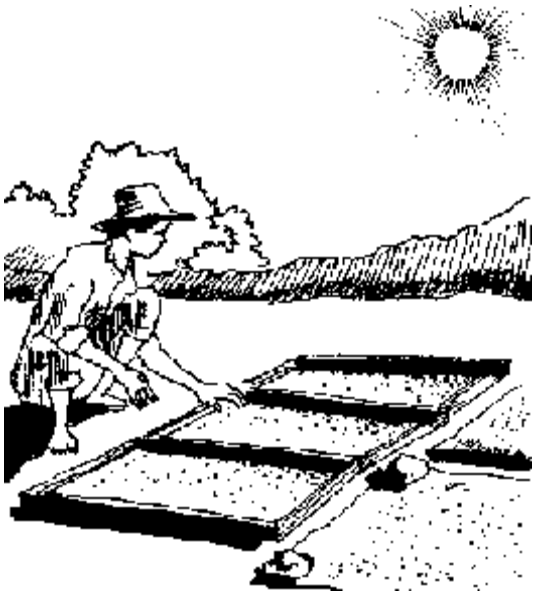


Figure 7

**1.7 Seed storage**

If you are sowing the seeds immediately after processing (within a few days), put them in a cloth bag and keep them cool. Never use a sealed container such as a polythene bag, glass jar or tin, as the seed will be too moist and will quickly get warm and moldy.

If you are keeping the seeds for more than a week (often several months or even a year may be required), store them properly to avoid loss of viability. When the seeds have dried sufficiently, leave them in the sun until the afternoon, and then put them immediately into a container that can be properly sealed, thus keeping them dry. Do not leave packing until the morning, as the seeds will absorb moisture overnight.

The simplest container is a thick polythene bag, or two thin ones, one inside the other. Squeeze out the excess air, and then tie the neck tightly with string or wire. It is often a good idea to put the bag in a tin box to protect it from being punctured and from rodents that may try to eat the seed. Label and number the containers of seed.

Keep the containers in a cool, dry room. The best place is a well-ventilated ground-floor room on the north side of a two-storey building. Keep the containers off the ground,

preferably on shelves half way up the wall. Do not put them in the eaves of a roof, as this will become warm during the day; or directly on a ground floor as this may be damp.

### 1.8 Recalcitrant seeds

Most seeds have to be dried before storage and are called 'orthodox'. But some species have seeds that must be kept moist if they are to remain viable. They are called 'recalcitrant'. If they are dried they will quickly die. These seeds are often found in species that have fleshy fruits which do not dry out on the tree, and which are dispersed just before or during the rains.

Always sow this type of seed as soon as possible. If it has to be stored for more than a week, use the following method. Extract the seed from the flesh, do not dry it, but mix it with twice its volume of damp sand. Put this mixture in a tin with a lid, whose sides and bottom have at least 20 small holes (2 mm diameter), made with a nail. After putting in the sand/seed mixture, fill it to the top with damp sand. Dig a 1m deep hole in a sheltered and well-drained place. Cover the bottom with a layer of damp sand, and put the seed containers on it. Then cover with more damp sand, and fill the rest of the hole with the excavated soil. Mark the spot with a stick. When you require the seed, dig it out. Remove the seed from the sand carefully, as some of it may have started to germinate.

| Self-Check -1 | Written Test |
|---|---|

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

1. What is orthodox seed?(5 points)
2. What is recalcitrant seed? (5 points)
3. For which species sun drying possible? (for orthodox, or recalcitrant) (5 points)
4. Sealed container such as a polythene bag, glass jar or tin are good storage materials for seed (5 points)

   A/TRUE B/FALSE
5. List down seed separation methods.(5 points)

***Note:*** **Satisfactory rating - 25 points** **Unsatisfactory - below 25 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 | Appling Seed treatment |
|---|---|

## 2.1 Treating seed dormancy

After carrying out the test, we may come up with a significant % of sound but dormant seeds, i.e., many seeds will not germinate even when supplied with optimum conditions: they remain dormant. There are different methods of seed pre-treatment depending on the type of dormancy. Very often, a method for a certain type can also do for another type so as to hit 'two birds with one stone'.

### I) Physical/ mechanical Methods

For seeds with exogenous dormancy (impermeable, hard seed coat), common techniques include Scarification which involves rubbing the seed against a rough surface (file, sand paper, concrete mixers, seed scarifiers or any other abrasive material), or nipping**/** nicking so as to make a very small 'hole' sufficient to allow water. This method is more applicable to seeds with seeds coat dormancy, but not for resinous or pulpy fruits. However, nutcrackers can be used for such fruits with hard coats/ nuts.

### II) Hot/Cold water treatment

Such treatments combine the effects of softening hard seed coats and leaching out chemical inhibitors. Some seeds that have little resistance to germination may respond well to soaking for 24 hours in water at ambient temperature. A more effective treatment, especially in hot climates, is alternate wetting and drying of seeds. (e.g. one day's soaking , 3-4 day's drying).

- In hot water treatment seeds are usually placed in to boiling water which is immediately removed from the heat source and left to cool gradually, the seeds remaining in the water for about 12 hrs.
- The ratio of water to seeds can be determined by experiment, and may vary considerably according to species; **2-3 time, 4-5 time, 5-10 times.** By and large, the volume of water should be much higher.

***NB:*** Care should be taken not to damage the embryo by excessive heat; especially if the seed coat is permeable.

**III) Chemical treatment/Acid treatment**

Concentrated **$H_2SO_4$ (95%)** is commonly used to treat dormancy especially for seeds that have been kept in store for a long time.

**Materials**: Acid (SG= 1,84, 95% pure), acid resistant containers, screens for handling draining & washing seeds, abundant supply of water for rinsing.

Steps: 1. Allow seeds to come to air temperature

2. Thoroughly mix seeds
3. Immersed seeds in the acid (Duration based on experiment)
4. Remove seeds from acid, rinse seeds with abundant water (5 to 10 min)
5. Spread the seed in a mat for drying.

Care is required in handling acid (safety); excessive application of acid may damage the seed. It requires skill.

**IV) Cold stratification**

- Usually applied to treat physiological dormancy
- Mainly for temperate species, but also effective for some tropical highland species. Stratification (strictly) refers to the method of placing seeds in layers alternating with layers of a moisture retaining medium such as sand/peat and keeping them at a cool temperature for a certain period, which is commonly between **20-60 days** but varies considerably from species to species.
- It might involve soaking in cold water/moisture medium at temperature of **3-5 $^0$C**.

**V) Biological methods**

Natural mechanisms can be copied by man to overcome dormancy. Sheep & goats in particular may be fed with pods & fruits, and using the natural acidity of the digestive tract the seed coat may be softened or 'chemically' treated inside.

**VI) Heat & Fire**

In nature, fire plays an important role in breaking dormancy while reducing seed coat impermeability & stimulating germination.

It involves spreading seeds in thin layers (bed) over which a grass layer is spread, and the grass set in fire. After burning, the seedbed is sprinkled with water and the nuts are pushed 2cm deep in to the soil and watered thoroughly. However, fire needs exercise.

**VII) Seed Dressing**

Dressing seeds with a mixture of: repellents, chemicals such as Fungicides to protect infection, $GA_3$ to stimulate germination).

By and large a combination of one or more treatments is more effective than any single.

| Self-Check -2 | Written Test |
|---|---|

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

1. What are seed treatment methods to prevent seed from deterioration?(3 point)
2. Cold stratification is (3 point)

   A/ Chemical treatment B/ Mechanical treatment

   C/ Biological D/None

3. How sheep and goat serve as a biological treatment agent? (3 point)
4. What is the process of chilling seeds, which is required for good germination of some seeds and the production of healthy seedling? (3 point)
5. If insects are the main seed deteriorating agent. How we prevent it? (3 point)

***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- 3 | Packaging Seeds for storage |
|---|---|

## 3.1 concept of seed packaging

Packaging; is keeping the seed in to the container for storing.

Seeds are packaged for storage in accordance with industry, legislative and organizational requirements.

Packaging may include; Vacuum sealing, use of inert atmospheres such as nitrogen and carbon dioxide, control of packing, Environment (temperature, light and moisture).

| Self-Check -3 | Written Test |
|---|---|

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

1. What is packaging? (2 point)
2. List down the inert atmosphere gases used for packaging.(2 point)
3. What is the environment packaging may include? (3 point)

***Note:*** **Satisfactory rating – 5 points** **Unsatisfactory - below 5 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 | Recording Seed information |
|---|---|

## 4.1 **Recording Seed information**

*Seed information that must be recorded* includes; details of time/date of harvest, time/date of receipt into store, weight, species, place or origin of seed, container identifier.

Some information recorded for documentations are:-

- the species
- location seed was collected including latitude and longitude
- environmental factors such as rainfall, temperature range, and elevation
- number of trees collected from
- date
- collector's name
- seed lot number
- recommended scarification technique
- germination percentage if available
- the weight of seed in each container

| Self-Check -4 | Written Test |
|---|---|

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

1. Why we need recording seed information? (10 point)
2. What information should be record? (10 point)
3. Recording place of origin as seed information is important. Why? (5 point)

***Note:*** **Satisfactory rating – 25 points** **Unsatisfactory - below 25 points**

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

**Answer Sheet**

Score = _____

Rating: _____

Name: _____ Date: _____

| Information Sheet- 4 | Recording and reporting Seed collection information and results |
|---|---|

### 4.1. Determining optimal harvest time

The optimal time to harvest is when a large amount of viable, germinable seeds can be collected. This is when most fruits and seeds are mature but only few have been lost to predation, dispersal and (for ground collection) germination or deterioration. Species can be grouped into 3 categories:

1. Trees with more or less continuous reproduction throughout the year but often with one or two peaks.
2. Trees with definite, sometimes short, seed maturation season and early dispersal, predation and/or short physiological viability.
3. Trees with a definite maturation season but with prolonged persistence on the tree before dispersal.

### 4.2. Seed maturity

The seed collector must be able to judge, preferably on fruit appearance, when the largest quantity of good seeds can be collected. Normally, the earliest possible collection is when seeds are germinable; the latest possible collection is before abscission (dispersal). The interval between, which for some species is very short, is the potential harvest period. In some cases it is necessary, or practical, to collect fruits before full maturity

Maturity indices vary according to fruit type and species and should be learned for the particular species to be collected. Change of colour, moisture content and development of abscission zones occur in most types. Dehiscent fruits often develop visible aperture structures prior to dispersal, i.e. lines where the fruit will eventually split open. Dehiscence lines of the operculum of eucalypt capsules are an example of a good maturity index for that genus (For. Com. 1994).

For species where harvesting can be done without significant loss of seeds and where the trees can be kept under observation, collection may be postponed until natural

dispersal has commenced, hence dispersal in itself is an indication of seed maturity. This can be observed either directly, on opening of dehiscent fruits or falling seeds, or indirectly on e.g. frugivores visiting trees with animal dispersal. The majority of seeds of species with a relatively short maturation season are normally mature when the first ones are released. Typically, however, seeds of poor quality (e.g. underdeveloped or infected) are shed before the main crop (Owen 1995).

In species with a very short dispersal period and small seeds that are easily lost, e.g. some eucalyptus, the commencement of dispersal may be too late for collection. Artificial drying of early picked fruits may speed up dehiscence with the practical interpretation: 'if the fruits will open upon desiccation, they are mature and ready to be collected, if not, harvest should be postponed' (For. Com. 1994). This check is especially practical if cold or moist weather delays natural dehiscence although the seeds are physiologically mature, e.g. Gliricidia, Sesbania, and some Eucalyptus and Acacia spp.

Direct examination of the seeds is applicable for species with relatively large seeds. Cutting tests reveal the development of the embryo and the firmness of seedcoat and endosperm. The endosperm, where present, should be firm and not milky (except coconut). The size of the embryo varies with species. In some species e.g. several conifers and Taxus spp. the embryo continues to enlarge up to the time of full maturity and its development can be used as a reliable maturity index (Dobbs et al. 1976). Cutting tests should be conducted on average seeds and not on early fallen ones, which may have inferior quality.

### 4.3 recording and reporting seed information

Information about seed collection must be recorded. These information may consist of; date of collection, collection site, stand, environmental information, ownership of the stand, and so on. After these information are recorded they are reported to the concerning body. This information helps for the next process of the collected seed. Recording information also uses for identification of the seed species. It can be done by; maintained by electronic data base, card index, data sheets, and filing systems manual,

using a computer-based system or another appropriate organizational communication system.

Information or data that should be record and report in seed collection include:

- Name of collector:_____
- Date of collection:_____
- Name of species:_____
- Location (distance, Altitude):_____
- Site characteristics:_____
- Tree and stand characteristics:_____
- Collection methods:_____
- Amount or weight of seed (kg):_____
- Signature of collector:_____

| Self-Check -4 | Written Test |
|---|---|

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

1. What is the use of recording seed collection information? (5 point)
2. What information should be recorded? (6 point)
3. How seed collection information recorded and reported? (4 point)

***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**

| Operation Sheet-1 | Techniques of determining actions/requirements to take client by the referral source |
|---|---|

**Methods to determine actions/requirements to take client by the referrals:**

**Step** 1- Identify client's needs and gaps

**Step 2**- Explore referral service providers and their services delivered

**Step 3**- State pros and cons about the referral services to clients

**Step 4-** Determine detailed actions plan

**Step 5-** Establish set of actions Share the results to all concerned body/supervisor

**Step 6-** Completing agreement formats (MoU) with theses providers

| LAP Test | Practical Demonstration |
| --- | --- |

Name: _____ Date: _____

Time started: _____ Time finished: _____

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

**Task 1-** Determine actions/requirements to take client by the referral sources