



## FOREST NURSERY & MANAGEMENT

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### 1. Introduction of Nursery

A **nursery** is a place where plants are propagated and grown to plantable size. To make a good plantation, good nursery stock is essential. Major mortality of seedlings in their plantations is due to the wrong size or poor health of the seedlings at the time of planting. In addition, poor seedlings are likely to have slower growth, to be less able to compete with weeds, and to be more liable to damage by insects and pests. Further, in a poor nursery, fewer seedlings will be raised from a given quantity of seed, and there will be considerable waste of money and time. After planting, the plants are immediately exposed to a harsh environment, and are at their most susceptible to damage from drought, grazing, fire, insects etc. Thus sound nursery practice is the foundation of a successful plantation scheme.

### 2. Nursery Site selection

- **Introduction & Importance:** The selection of an appropriate nursery site is the most important decision for efficient production of good quality plants. It must start from a well defined statement of the objectives of the nursery, which must include details such as:
  - the number of plants to be produced each year
  - the species
  - the type and size of plants
  - the location of the plantations and villages to be supplied,
  - the expected life of the nursery etc.

The selection needs to be agreed upon at least six months before the first seed is sown.

The following are some of the technical factors which need to be considered:

- **Water supply:** A reliable and adequate source of water supply is essential for all forest nurseries. The ideal situation is where there is perennial stream at a higher level than the nursery, and fairly close to it, so that water can be diverted from the stream to the nursery in high density polythene pipe (which should be buried 15 cm deep). Also essential to know whether the water is used by other farmers for irrigation to avoid conflict. Water requirements will vary with the climate and the species to be grown. It is estimated that 1000 *Eucalyptus* plants in polypots requires 30 liters of water every day during dry season. Thus a nursery raising 20,000 plants will require 600 liters of water per day. This may be slightly less in hills.
- **Availability of labor:** A lot of labor is required for the construction of the nursery and later on periodically for tasks such as soil transportation and pot filling. The nursery should be located where it is possible to obtain labor without great difficulty at most of the times of the year. Siting a nursery on a main trail near a village will also increase awareness among common people and will participate in reforestation programme.

- **Availability of suitable soil:** In nursery where plants are to be raised in polypots, large quantity of sandy loam or loam soil with well drain property, preferably forest top soil will be required. But if we have only heavy soils like clay, then sand mixture is also required. For bare root nursery, a deep loamy soil with well drain property is necessary. To fill 20,000 pots of 3 inch \* 7 inch size, we need 6 m<sup>3</sup> of soil and for 4 inch \* 7 inch pots we need 11m<sup>3</sup> of soil mixtures. The weight of the soil in one pot is about 300 gm, so a nursery raising 20,000 plants in 3/7 inch pots each year will need 6 tonnes of soil mixture, which is equivalent to 240 *doko* loads. For raising pine trees, we need additional mycorrhizal soil, which is available from pine forest only.

**Simple example:** If the source of soil and sand are close to the site so that 6 loads can be delivered in one man-day then 10 people could complete the work in less than 4 days, but if it is so far away that only 2 loads can be delivered in a day, it would take 30 people to complete in 4 days. At a rate of Rs 100 per day the cost would be Rs 4000, for nearer soil and Rs 12,000 for distance soil (3 times more cost). This will clearly show the importance of site selection.

- **Access:** The nursery should be as close as possible to the centre of the area where plants are to be planted later. It may be necessary to construct a short access road to connect the nursery to the main road; if possible this access road should be usable at all seasons of the year.
- **Aspects:** Slopes facing south are much warmer than those facing north. So at high altitude, above 1200 m, south facing slope is preferable. Also we should find out if the area is shaded in the morning or evening by adjacent hills or ridges. The higher the nursery site, clear of obstruction from shade.
- **Slope:** Completely flat land should be avoided to prevent from logging during monsoon rains. Otherwise good drainage system should be constructed. Even at high altitudes, flat areas are more likely to frost than gentle slopes. The ideal slope is about 5 degrees, which is enough to allow; proper drainage. Avoid very steep slopes, to prevent erosion. Average slopes should be terraced wide enough to accommodate a normal nursery bed of a meter in width, plus paths on each side to allow access to the beds. Also a stepper sloping nursery means that laborers spend a good deal of energy climbing up and down.
- **Exposure to frost, strong winds and flooding:** At high altitudes, sites which are particularly liable to frost damage should be avoided. Such areas with frost chances are valley bottoms and other sides where the downward flow of cold night air is common due to dense belt of trees or shrubs below the site. Other natural hazards should also be avoided. Areas threatened by landslides, subject to flooding or strong winds must be avoided.
- **Availability of land:** It is important that at the site chosen for the nursery there should be enough land to raise the number of seedlings needed, and if possible room for expansion. A very small nursery raising 20,000 plants in 3/7 inch pots, and keeping the plants in a nursery for a year could require one *ropani* (500m<sup>2</sup>) of land , this includes potting beds, 20% extra for losses and damage, paths between the beds, soil storage, thatched shelter, compost making area etc. But for sloping sites the land requirement may be double say 2 ropani. The size of the nursery greatly depends upon the number of plants to be produced, the time they will remain in the nursery, as well as the quality and slope of the site. It is also important to ascertain who owns the land. If it is government, an application must be made for nursery set up. If it's a permanent nursery, there is also a provision for transfer to panchayat or committee for certain period of time. If it a privately owned land it is important to formalize the use of the land by

obtaining a letter from the owner agreeing to its use as a forest nursery for certain period of time.

### 3. Nursery design and construction:

➤ **Design:** The nursery design will vary according to the type of plants to be raised, topography of the land (terraces/ slopes) etc. Before construction starts, draw a sketch plan, as possible. Measurements should be preferably be made with a tape, or a distance can be paced. The plan must include:

- Fence or wall
- Internal paths
- Water tanks & distribution system
- Seedbeds
- Soil storage shelter
- Working area
- Compost making area etc.

➤ **Construction:** The land must first be cleared of all rocks, stumps, trees and shrubs. While working for the terraces, drains should be built as early as possible to prevent rain from damaging the works.

➤ **Drains:** Great attention must be given to drainage system, especially in nurseries on steep slopes. The object is to minimize erosion, while directing excess water away from the site. Drains should be built along the top edge and down the sides of the nursery. Terraces should slope very gently inwards and with a slight “fall” along their length, so that water flows to the back of the terrace and then along it into a main drain. If drained outward, there is great chance for soil slipping down.

➤ **Fence or wall:** It is necessary that all animals are totally excluded from the nursery, so a fence or wall must be built. A stone wall 1.8m high is ideal. It should be about 60 cm below ground and 120 cm above, when measured from the outside, and with a layer of thorny shrubs on top of it. A stone wall is effective and long lasting. A very simple entrance gate is recommended to avoid chances of being left open.

➤ **Nursery beds:** Ideal size of the bed is 1-1.2m It should not be wider than 1.2 m because of the difficulty of reaching into the centre for weeding, watering, manuring etc. while beds narrower than 1m is wastage of land. The length of the bed is relatively less important, though 5-10m may be convenient for drain purpose. If possible, the beds should be oriented from East to West to provide better shade against the midday sun. Paths should be 50 -60 cm wide, which provides adequate space to squat and work from. This means on terraced land the terraces should be Atleast 2 m wide. When the area for the beds has been leveled, mark out the corners and the edges with wooden sticks and strings. Flat stones can then be set on edge in trenches along these boundary lines to support the beds. Stones should be 10-12cm protruding above soil level. Compact the ground around the stones to prevent them falling over. Sometimes, half split bamboo or poles are also commonly used to support nursery beds. Sunken beds should not be used, because of the risk of water logging.

➤ **Other structures:** A water proof thatched soil storage shelter is needed which is large enough to store all the potting mixture requirements and to provide some working space. Soils should be stored under this shade to prevent running out due to rain. In larger and permanent nursery, 2.5 m high shade house is very important for filling pots, seed storage, pricking out small seedlings and can also serve as an office for stock record maintenance.

### ❖ Check list of expandable materials for tree nurseries:

- Seeds, Soil, Sand, Compost
- Polypots: 3/7 inch & 4/7 inch
- Heavy gauge polybags for seed storage

- Wire, strings, mesh wire, nails
- Soap
- Pens, pencils, water proof marker pens
- Registers: Nursery, Seed. Visitor
- Pate kuto, Chuche kuto, Sickle, Kodalo, Knife, Khukri, Axe, Doko, Scissors, Secateurs, Germination trays, Plant carrying trays, Soil and sand sieves, Hammer etc.
- Watering can with roses.

#### 4. Planning & Record Keeping

- **Objective:** Planning of nursery should be done at community level, visit the planting sites and discuss the reason for planting, what are the species to be planted (try to limit the number to a maximum of 4), start by growing local spp. with which the people are familiar.
- **Time of seed collection & Sowing:** One or the main constraints on nursery plans is the availability of seed. Each and every seeds have different collecting seasons. The plan of seed collection is very essential. The plan can be set out as in the table given below:

**Table: Example of Seed time for Nursery at 1200 to 1400m**

Species	Collecting season	Sowing time	Months in nursery
<i>Alnus nepalensis</i> -Utis	Nov-Mar	Aug	11
<i>Pinus roxburghii</i> - Khote salla	Jan-Mar	Aug	11
<i>Quercus gluaca</i> – Phalant	Oct-Dec	Feb	17
Dudhilo- <i>Ficus neriifolia</i>	Jun-Aug	Aug	11
Lapsi- <i>Choerospondias</i> <i>axillaries</i>	Oct-Jan	Feb	5
<i>Juglans regia</i> -Okhar	Sep-Dec	Feb	5
Seto chuletro- <i>Brassaiopsis</i> <i>hainla</i>	May-June	May-June	13-14
<i>Litsea monopetala</i> - Kutmiro	May-Aug	May-Aug	11-14

Also Appendix 1: details of seed collection

- **Planning seed supplies:** The quantity of seed required must be calculated, the sources identified, arrangements made for collection, and the cost estimated. Prepare a table as follows:
  - List the number of healthy plants, of acceptable size required at the planting site.
  - Assume that 20% of all pots sown or planted will not produce usable seedlings; this means that the above number must be multiplied by 100/80, or 5/4.
  - In the absence of germination test results, assume that for every four seeds sown; only one plantable seedling will be produced.
  - Find the number of seeds per gram.
  - Calculate the weight of seeds to be sown in grams.

Datas	Utis	Khote salla	Phalant	Dudhilo	Lapsi	Okhar	Seto chuletro	Kutmiro
<b>1. Number of plants needed</b>	5000	5000	200	1200	300	400	1000	1000

<b>2. No. of plants to be produced =(1)*5/4</b>	6250	6250	250	1500	375	500	1250	1250
<b>3. No. of seeds needed =(2)*4</b>	25000	25000	1000	6000	1500	2000	5000	5000
<b>4. Seeds/kg</b>	1M	10000	700	1.5M	1500	70	30000	5000
<b>5. Seeds/gm</b>	1000	10	0.7	1500	1.5	28000	30	5
<b>6. Total grams needed=(3)/(5)</b>	25	25000	1428	4	1000	28000	170	1000
<b>7. Size of pot</b>	3/7	3/7	4/7	4/7	4/7	4/7	4/7	4/7

- **Supplies of other materials:** We can calculate on information given on table for quantity of polypots, soil, sand and compost.

a) **Polypots:**

12500 pots 3/7 inch= 19.5 kg

6625 pots 4/7 inch= 13.0 kg

b) **Potting mixture:**

A ratio of

3:1 soil : sand mixture for utis and Khote salla (Pine).

3:1:1 soil: sand: compost for all other species.

12500 pots 3/7 inch = 3.4 m<sup>3</sup>

6625 pots 4/7 inch = 3.2 m<sup>3</sup>

**Table: Calculation of potting mixture (in Cubic meters)**

<b>Pot size(Inch)</b>	<b>Total</b>	<b>Soil</b>	<b>Sand</b>	<b>Compost</b>
3/7	3.4	2.55	0.85	0
4/7	3.2	1.92	0.64	0.64
<b>Total</b>	<b>6.6</b>	<b>4.47</b>	<b>1.49</b>	<b>0.64</b>

- **Calendar of operations:** By making a comprehensive calendar that includes all activities for all species, it is easy to see how much labor and materials are needed at each each season. This calander forms the basic of the budget. It also indicates when extra labor is needed and materials must be ordered that cannot be obtained locally.

**Table: Calendar of operations for Chuletro (*Brassaiopsis hainla*)**

December-January	Order polypots and other materials
Feb-May	Explore seed availability, arrange for collection
Feb-April	Collect soil & sand
April	Prepare potting mixture
April-May	Fill pots
May	Collect material for mulch
June	Clean and sow seed
July-Aug	Remove mulch, transplant extra plants into

	empty pots
July-Sept	Collect vegetation for compost making
Aug-Oct	General maintenance, weed, water, turn compost
Nov	Prepare and erect shades for winter frost protection
Nov-Feb	Erect shades daily in evening, remove early in morning
March	Space n root prune
April-July	Root prune
April-May	If necessary, prepare shades in readiness for hail
June-July	Prepare plants for transport