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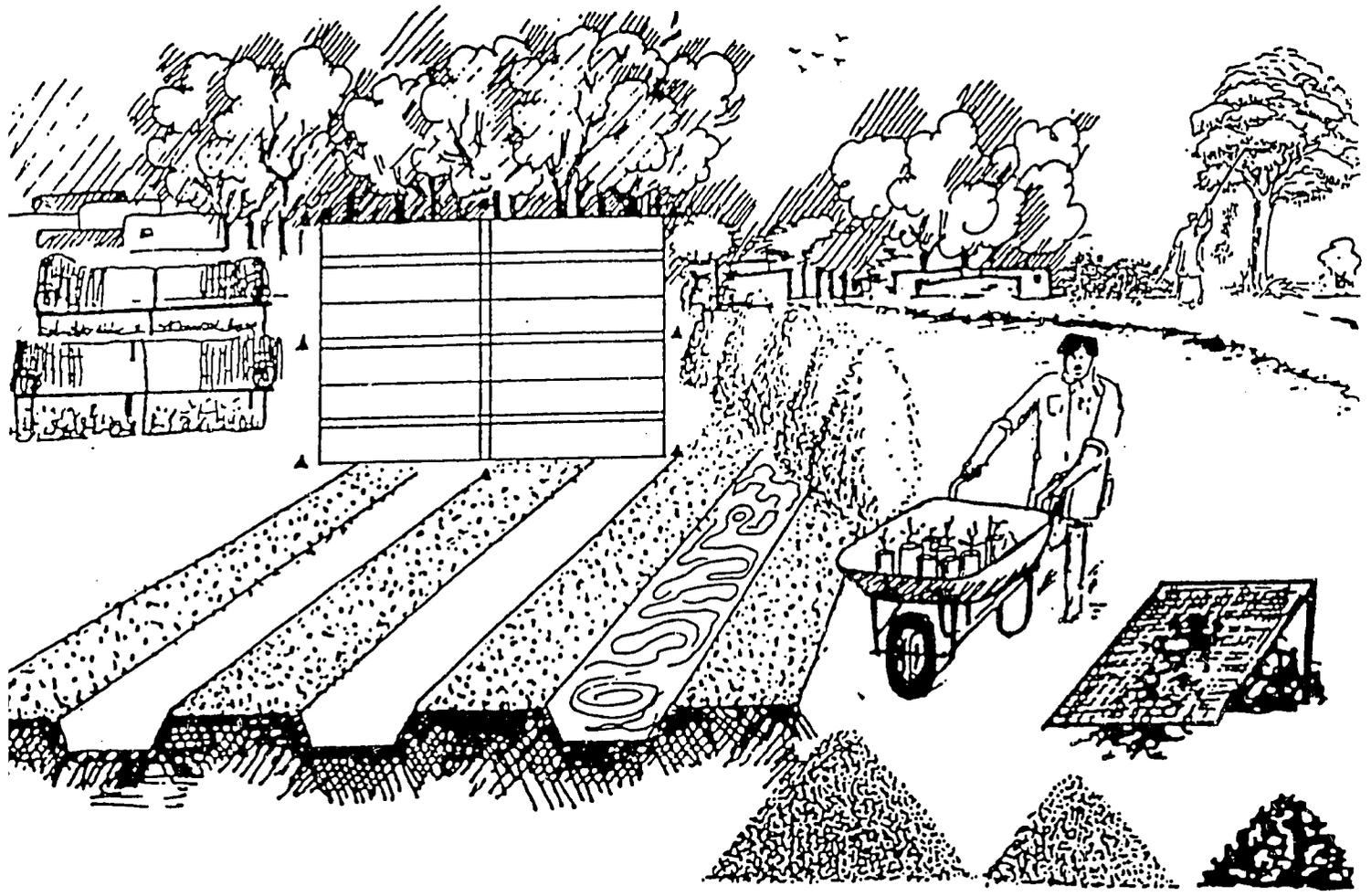


FORESTRY PLANNING & DEVELOPMENT PROJECT

Government of Pakistan-USAID



RAISING OF NURSERIES



TECHNICAL NOTE

FPDP No.5

RAISING NURSERIES

By

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1. INTRODUCTION

To make an afforestation/reforestation campaign a success, a well stocked and managed nursery is a prerequisite. Besides the adverse biotic and edaphic factors, failure of most of the planting campaigns in the country can generally be traced back to poor stock raised in ill-equipped and badly managed nurseries from the seed collected from indifferent sources by the staff which is often ignorant of the modern techniques of nursery raising and its management. The result is that the planting material produced is not upto the mark. It is weak, whippy, diseased and sometimes even totally unfit for planting. Thus, although millions of plants are planted, on the whole, percentage of survival and success is not satisfactory. It is, therefore, highly imperative that maximum attention is paid to raising of nurseries on scientific lines.

2. TYPES OF NURSERIES

Several types of nurseries are raised in Pakistan to grow the planting stock for large scale tree planting and distribution. These include: raised bed nurseries; trench-berm nurseries, polythene tube nurseries and nurseries raised from cuttings.

3. SITE SELECTION FOR NURSERIES

The best piece of land has to be selected for a nursery. Gravelly, stony, saline and waterlogged soils should be rejected. Site should be easily accessible for carriage of materials and plants. It should be well supplied with water, whether from canal, tube well, country well, or from hand water pumps. If hand watering is to be done a small cemented tank is essential to store water for watering. Hand trolleys or pipes are a help to bring water from other adjacent sources once the site has been selected.

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The following steps should be taken to prepare the nursery site.

- All shrubs, roots, grasses, stones must be removed
- The land is ploughed, followed by another collection of stones, pebbles and roots. The clods are broken and the land is levelled.
- Layout 3 feet wide inspection paths.

The site is now ready to layout the nursery of your choice and requirement.

4. RAISED BED NURSERIES

Raised bed nurseries (Fig. 1) are prepared when demand for planting stock is not very heavy and a limited number of plants, upto 10,000, is required. Following steps are involved in the formation and seeding of raised bed nurseries.

- Mix nursery soil, sand and farm yard manure/humus in the ratio of 3:2:1 for clayey or loamy nursery soil. Do not add more than 1 part well rotted farm yard manure as it produces heat and can injure the seed/seedling.
- If necessary, screen the mixture to remove stones or other extraneous matter.
- Prepare raised beds, 3 to 6 feet long, 2 to 3 feet wide and 6 inches high.
- Level and shape the beds using a wooden plank.
- Make 6 inch deep trenches around each raised seed bed.
- Do trial irrigation to see the extent of seepage of water into the bed.
- Firm up beds once again.

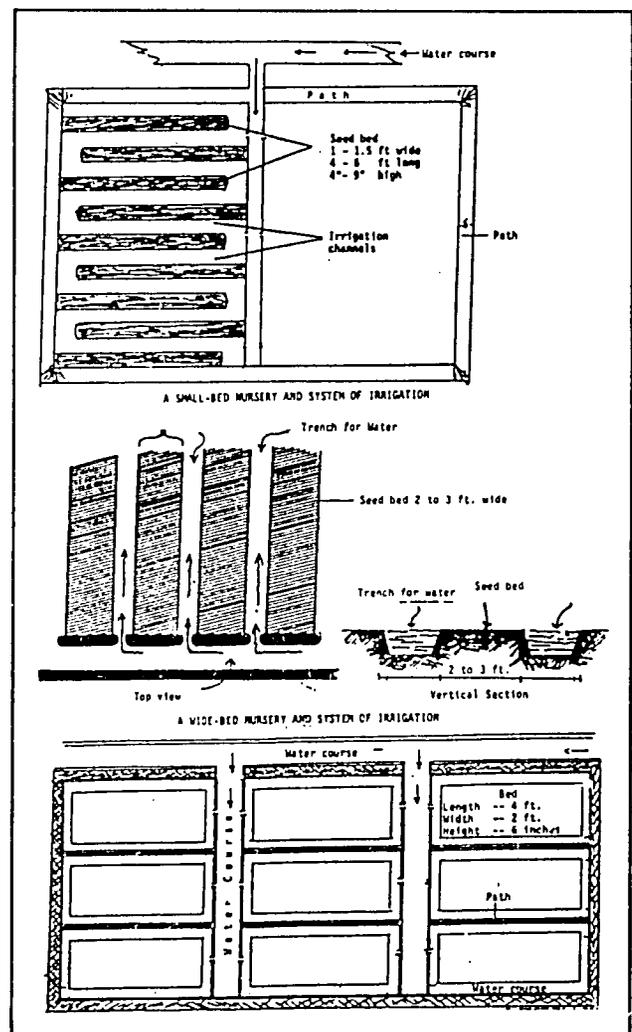


Fig 1. Layout of different kinds of nurseries

- Make 6 to 12 inches wide straight lines in each bed for sowing of larger seeds like Melia azedarach (bakain), Sapindus mukorossi (retha), Zizyphus mauritiana (ber), and Juglans regia (akhrot). Sow seeds 2 to 6 inches apart.
- In case of Eucalypts (Sufeda, Lachi), Alnus nitida (Sharole) and Platanus orientalis (Chanar) where seed is very small, mix the seed in sand at the rate of half seed and half sand. Sprinkle this mixture on the bed. Next, dust a mixture sand and ash to cover the seed.
- January is an appropriate month for sowing in the winter. August is a good month for sowing in the monsoon season.
- Release water. Let it stand around the beds for a couple of days till the seed starts germinating. If a rose can is used, water should come in a fine mist spray. Spray pumps are better. Nozzle should point upwards. Afterwards irrigate on alternate days.
- During the first two months it may be necessary to protect the young seedlings from heat or cold. Section (5) identifies ways to provide this protection.

As sowing is done at closer spacing, it becomes necessary to space the seedlings after 1-3 months depending on their rate of growth. This enables the seedlings to develop a better root and shoot proportion. The seedlings may be pricked out either in early February or during the month of October depending on a January or August seeding date. Pricked out seedlings should be planted at 15x15 cm on the beds prepared in the same manner as described above. Irrigation has to be provided immediately after transplanting. It would be preferable to do transplanting on cloudy days, keeping the roots of the seedlings in a moist bag. Plants such as that of Aesculus indica (Ban Akhor), Juglans regia (Akhrote), Acers (Sum), Quercus (Oak), Alstonia scholaris (Chattian), Bischofia javanica (Bischofia), Cordia myxa (Lasura), Embllica officinalis (Amla), Cupressus (Saru), Dillenia indica (Dillenia), Diospyros lotus (Amlok), Gmelina arborea (Gumhar), Mimusops hexandra (Khirni) and Sapindus mukorossi (Retha) can be raised in this manner.

5. TRENCH-BERM NURSERIES

Trench-berm nurseries (Fig. 4) are usually raised in irrigated plantations for use in the annual government planting programs as well as for distribution to private individuals. These are established in major irrigated plantations, in smaller village plantations, and on roadsides and

canal-sides, so that the planting stock is available at the door step of individuals who need it. Such nurseries are now being encouraged on private lands and farmers have shown lot of interest in them. Species such as Dalbergia sissoo (shisham), Morus alba (tut), Melia azedarach (dhrek), Albizzia spp. (siris) and Bombax ceiba (simal), are raised in this manner.

Following steps are involved in the formation and seeding of these nurseries:

- Dig water course 4 ft from the top, 3 ft at the bottom with a depth of 1 to 1.5 ft. Water courses of this size are prepared for a nursery of 5-10 acres. It can be reduced to one ft from the top, 9 inches at the bottom with a depth of 6 inches in the case of small nurseries of half an acre or so.

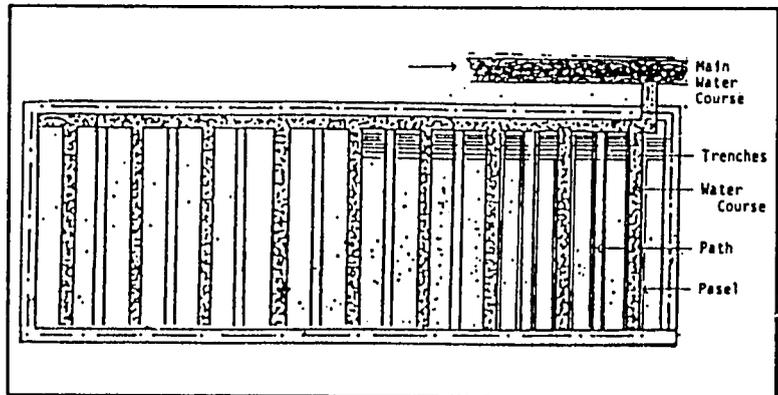


Fig 2 Raising of nursery on trench berms

- Lay out a "Center" and dig trenches 3, 5, 6 or 10 ft apart. Trench size would be 12 inches wide from top, 9 inches at bottom and 9 inches deep.
- Dig a connecting channel known as "pasel" for flow of water from the water course to trenches. It is usually deeper than the trenches i.e. about one ft and is either of the same width as the trench or slightly bigger.
- Clean upto one foot on both the sides of the trench with a kassi. This will form a berm.
- Do trial irrigation to check the level of water on the berm. Scrape or fill the berm to make its whole length absolutely level.
- When dry, hoe the bed lightly and spread the seed, as described in Section 4, preferably in lines 4 - 6 inches apart, in January-February or July-August.

- Release flow water and let it stand in the trenches for a couple of days or irrigate daily till germination starts.
- Take care that the berm gets water only by seepage from the trench. Under no circumstances should water cover either the seed bed or the germinating seedlings. If it happens, the soil will form a hard crust when water recedes and seed will need extra time and force to break the hard surface. It could also rot the seed in the process. If the water stands on the germinating seedling on sunny days, all the seedlings will die.
- Quantity of seed required would depend on the nursery size. About 3 maunds (120 kg) of seed per acre would be needed to raise 50,000 Shisham plants which would be ready for use in 6 to 12 months.
- In the case of mulberry rub the fruit with hands in water to remove the fleshy portion of the fruit. Since the seed is sweet it is taken away by ants or even licked out by jackals. It should be smeared with kerosene oil or some other insecticide before sowing.
- Irrigate on alternate days for two months. Afterwards weekly irrigation is sufficient.
- Do 4 - 5 weedings to remove all competing plants. Deeper weeding will give hoeing effect also. Try to pull out the weeds with roots to save repeated weedings. After 6 months take out the stock which is fit for planting. It should be the size of a big finger/thumb at the collar -i.e., junction of root and shoot. Make into root-shoot cuttings using a sharp Toka/Dhau, pruning scissor or bill hook (Fig 9, i - iii). Leave the remaining thin seedlings for another 3-6 months.
- If it is proposed to plant entire bare rooted plants of different deciduous species mentioned above, root and shoot cuttings should be made from the first year nursery, replanted at 6x6 inches or 1x1 ft. spacing and allowed to grow in the nursery for another year. This is called a "second stage nursery"; one year shoot, 2 year root. This would have a strong collar and well-developed root-system and give a much better survival percentage when planted out.

6. NUMBER OF PLANTS OBTAINED FROM A BED NURSERY

Punjab Forest Department has estimated the following production of plants from a bed nursery raised on the berms of trenches. Production varies by trench spacing as shown in Table 1.

Table 1. Production from bed nurseries/acre

Species	Trench Spacing (ft.)		
	10x10	5x5	3x3
		(1000 plants)	
<u>Albizzia lebbek</u> (siris)	15-20	30-45	45-60
<u>Dalbergia sissoo</u> (shisham)	20-25	40-50	60-75
<u>Leucaena leucocephala</u> (ipil ipil)	20-25	40-50	60-75
<u>Melia azedarach</u> (bakain)	15-20	30-40	45-60
<u>Morus alba</u> (mulberry)	20-25	40-50	60-75
<u>Bombax ceiba</u> (simal)	15-20	30-40	45-60

7. POLYTHENE TUBE or POLY BAG NURSERIES

Twenty years back, plants were raised in clay pots. Because pots were heavy and fragile, transportation was costly. Cost of clay pots also gradually became prohibitive. Use of polythene tubes was therefore introduced. Black/white polythene of 0.002 gauge and tube sizes of 7 to 9 inch length and 3 to 4 inch diameter are used. A detailed pamphlet titled "Nursery in Polythene Tubes" has been prepared and is available from provincial Forest Departments, from Farm Forestry Officers. The following steps are involved in raising seedlings in tube nurseries:

- Punch 24-36 holes in the poly tube for proper aeration. Use a specially made press for the purpose or just a nail.
- Fill the tubes with 3:2:1 soil, sand, manure mixture as described in Section 4.
- Arrange the tubes upright as shown in Figure 3.

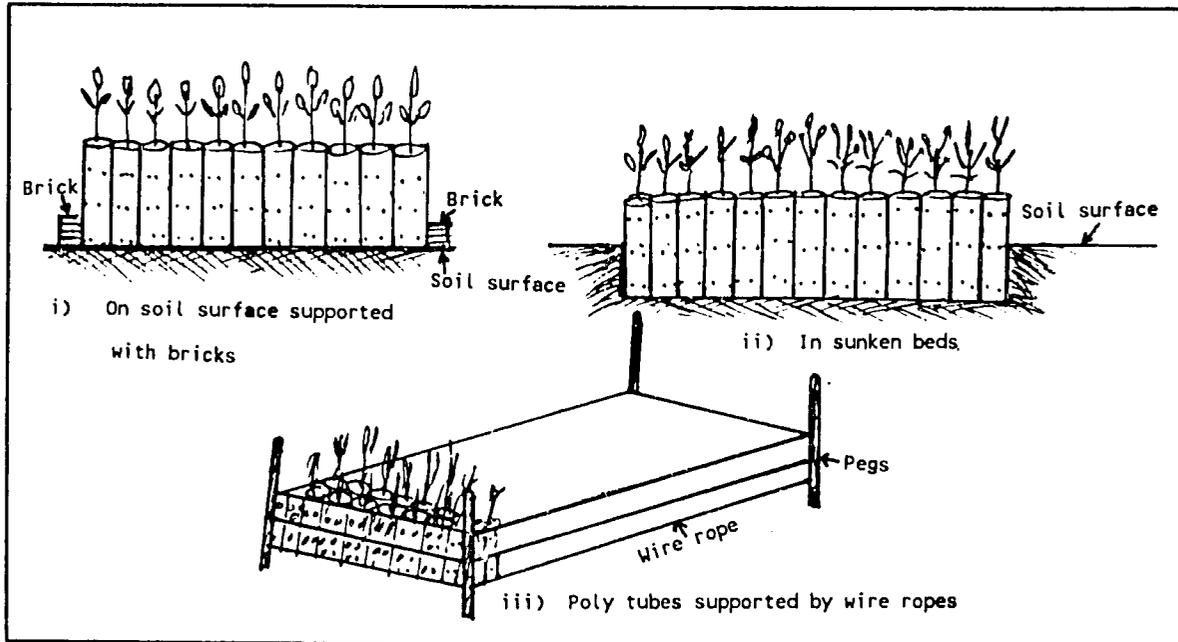


Fig 3 Arrangement of polythene tubes in a nursery

- On soil surface with support of bricks (Fig. 3 i).
- In sunken beds prepared for the purpose (Fig. 3 ii). Make sure that the sunken beds are not deeper than 4 inches; otherwise when flow irrigated, the tubes get submerged and plants if small die. Also when it rains, run off from adjoining land brings lot of soil with it which gets deposited on the tubes.
- On soil surface with pegs on all the four sides and a wire rope around for support. (Fig. 3 iii).
- The seed can be sown directly in the poly bags using the same procedures as that used to sow raised beds (Section 4).
- Alternatively prick the seedlings from sowing containers when they have 2-4 pairs of leaves and plant in the tube using a pencil thick stick. Raising seedlings in sowing containers is described later in this section.

- See that the hole made is long enough to accommodate the root system without curling.
- Press thoroughly from all sides.
- Do pricking under shade, in the afternoon or when it is cloudy. Provide shade after pricking for 7-10 days.
- Prepare placement beds on a higher ground. If in depression the beds get deluged in heavy rains or flooding and the entire stock is lost.
- Water with a rose can or flow irrigate (when in sunken beds), twice every day in summer; once in the evening in winter.
- In case of direct seeding such as, Acacia nilotica (babul), Azadirachta indica (nim), Melia azedarach (bakain), Albizia lebbek (siris), Tamarindus indica (imli), Zizygiun cumini (jaman), Zizyphus mauritiana (ber), Sapindus mukrossi (retha), Prosopis cinerara (jand), Parkinsonia aculeala (parkinsonia) sow the seed upto a depth equal to the thickness of seed. Cover with soil-sand mixture and irrigate.
- Shift the poly tubes in the nursery when roots start going into the soil. Do root pruning with a sickle, pruning scissors or a sharp trowel (ramba) (Fig.4) or place the tubes on a cement floor, on a plastic sheet or a wire mesh (Fig.5). This will prevent root formation outside the polythene bag.

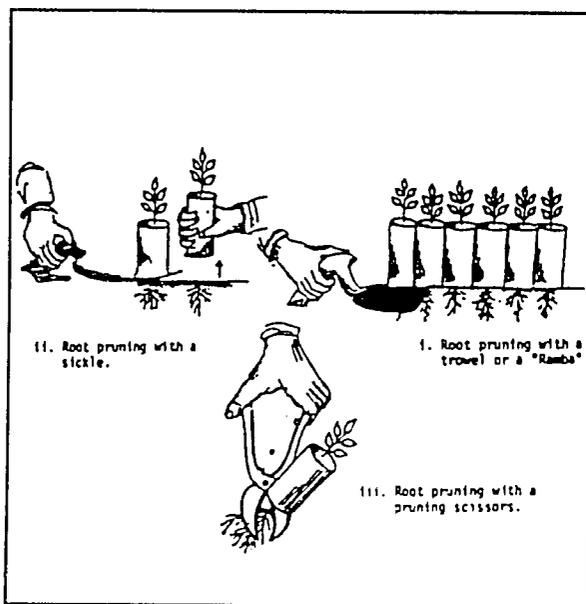


Fig 4. Various methods to prune the roots

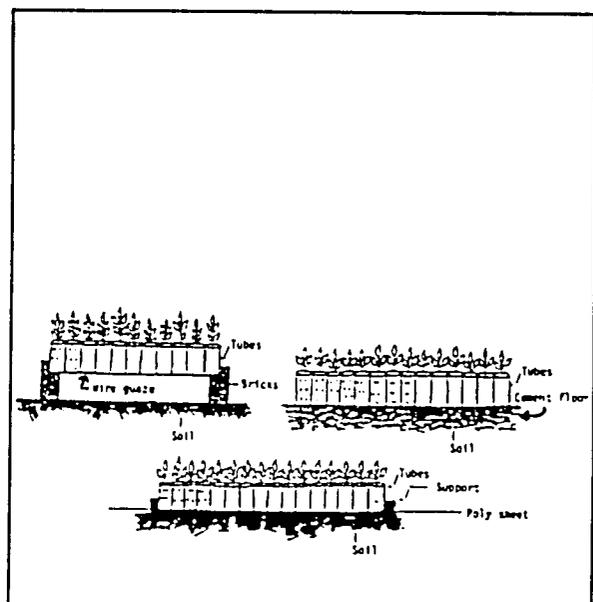


Fig 5. Use of wire gauze, cemented floor or polythene sheet to prevent root formation outside the poly bag.

- Irrigate immediately after shifting and root pruning.
- After about two months of pricking some seedlings in the same bed will be smaller than the rest. At this stage sorting is necessary. Seedlings of the same size should be shifted in one plot so that there is no mutual suppression.
- Discard unbalanced, whippy, diseased, damaged stock in the nursery, and do not send it for field planting (Fig. 6). This essential process known as grading helps in obtaining stout and sturdy planting stock with a strong collar.

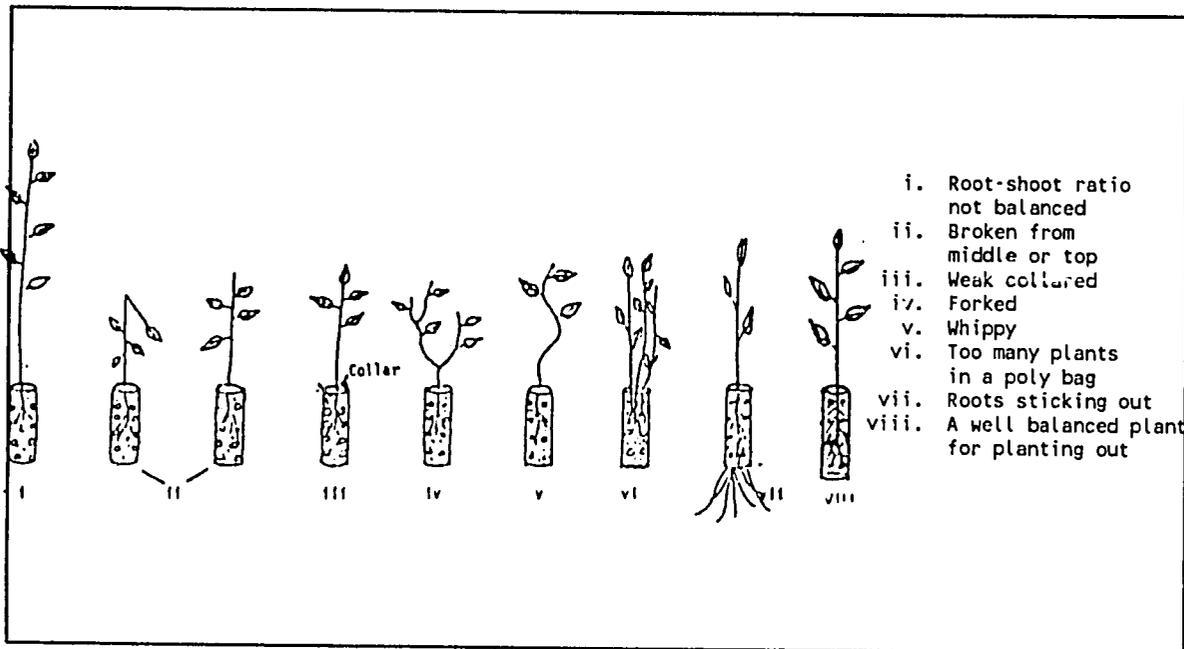


Fig 6. Grade the nursery stock before distribution. Discard the undesirable plants (i-vii) above

Apart from beds, eucalypt seed may be sown in clay troughs, clay bowels, large poly bags of 6 inches diameter and small poly bags of 3 inches diameter (Fig. 7). Seedlings after 20-30 days are pricked from the first 3 types of containers and planted in poly bags. It has been observed that in the case of fourth type of sowing only one or two seedlings are kept in the small poly bag. The rest are pricked out and thrown away. Similarly some times 8-10 seedlings in a poly bag continue to grow for 4 - 5 weeks. At that stage only one which is more vigorous is left and the rest are used to plant in the empty bags in the nursery. Obviously these seedlings are very weak and whippy due to suppression and do not become a good planting stock. This is rather wasteful method in view of the fact that it is becoming increasingly difficult to get good quality seed which may cost Rs.200-250 per kg. This practice should be discouraged.

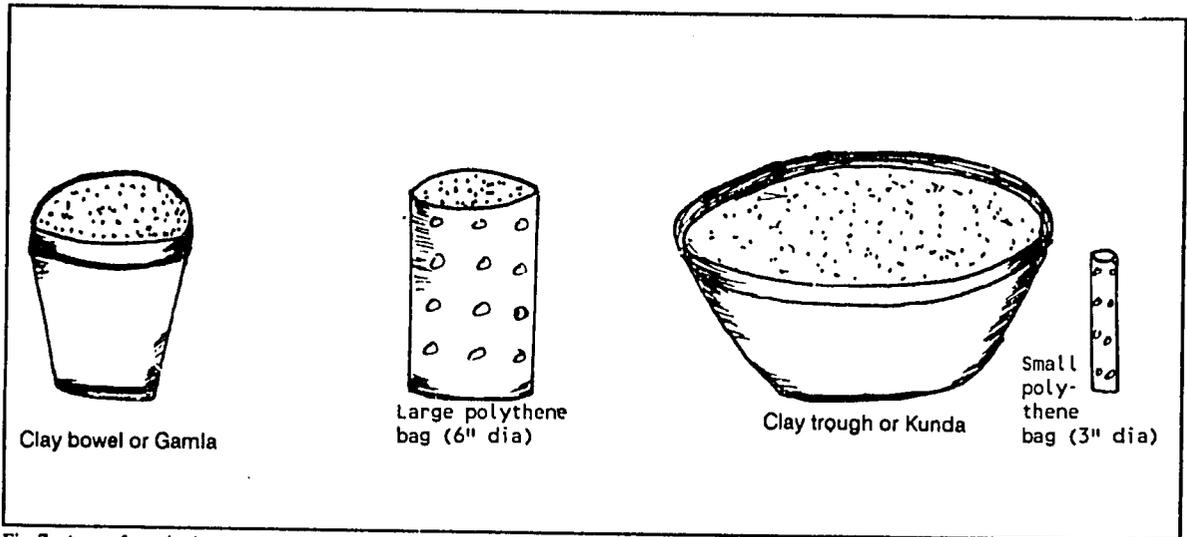


Fig 7. Apart from beds, eucalypts seed is sown in containers of various sizes.

8. PROTECTION FROM HEAT AND COLD

Whether the plants are raised in a bed or in poly bags, at a stage they have to be protected from heat or cold, hot winds or frost. Kana (*Saccharum munja*) reeds tied together and called "chiks" are used very effectively for this purpose. These chiks are supported on 2 feet long stakes held together with cross poles or wire. Kana chiks are rolled back and forth as and when shade is required (Fig.8). Shade has to be removed for short intervals to enable the plants to get adequate light and heat. Once seedlings are about a month old the shade can be totally removed. This will harden the plants and prepare them to come over the planting shock and environmental stresses. This is called hardening and is induced in the plants by reducing irrigation gradually during the month prior to planting out and total removal of shade. However the plants should be given a good irrigation before lifting from the nursery for planting out. This stored moisture, helps the plant to tide over unfavorable conditions of the field.

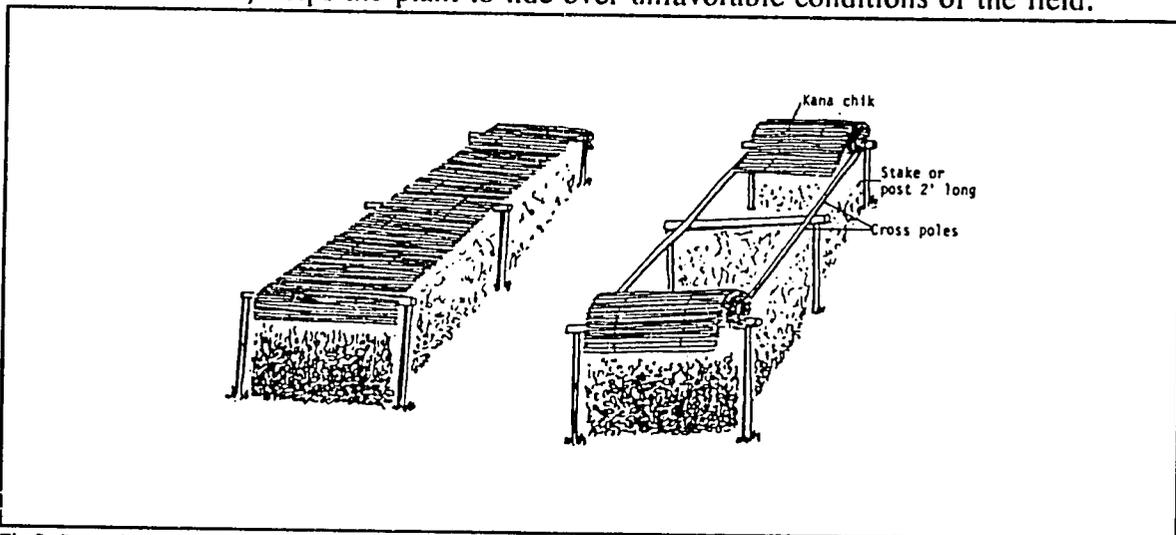


Fig 8. Protection of seedlings from heat and cold with kana chiks

9. NURSERIES RAISED FROM CUTTINGS

Several species can be multiplied from branch cuttings. When planted in soil, these take root to become plantable in a year, during the dormant season. Populus deltoides (poplar), Salix spp (willow), Morus alba (mulberry), Tamarix aphylla (farash) and many ornamental species can be planted this way. Proceed as under:

- Select a suitable piece of land according to the procedure outlined in Section 3.
- Plough the site thoroughly 3 or 4 times.
- Remove all stones, roots, etc.
- Level the site with a piece of wood or a leveller (sohaga) tied to a tractor or do it manually depending on the size of the area.
- Form the site into manageable plots of 30x30 feet to 50x50 feet. Make strong watts (embankment) one foot high, 2 feet wide at the bottom and one foot wide at the top.
- Make water course of prescribed size and irrigate to check higher grounds or depressions; re-level if the water is unevenly distributed.
- Collect dormant branches from plus trees in winter/early spring and make 9 inch long cuttings of finger/thumb thickness (Fig. 9). Give an oblique cut at the lower end which goes into the soil (Fig. 9 iv).

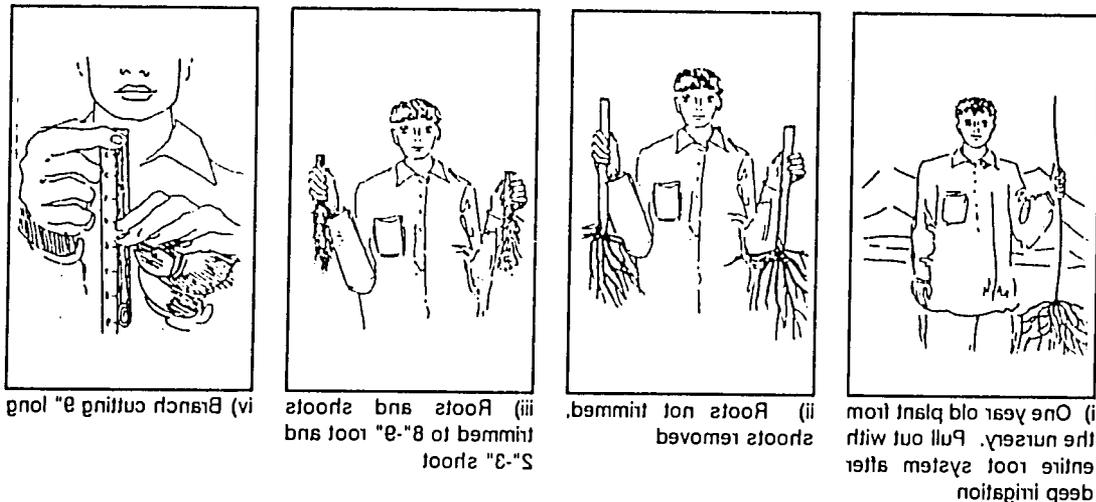
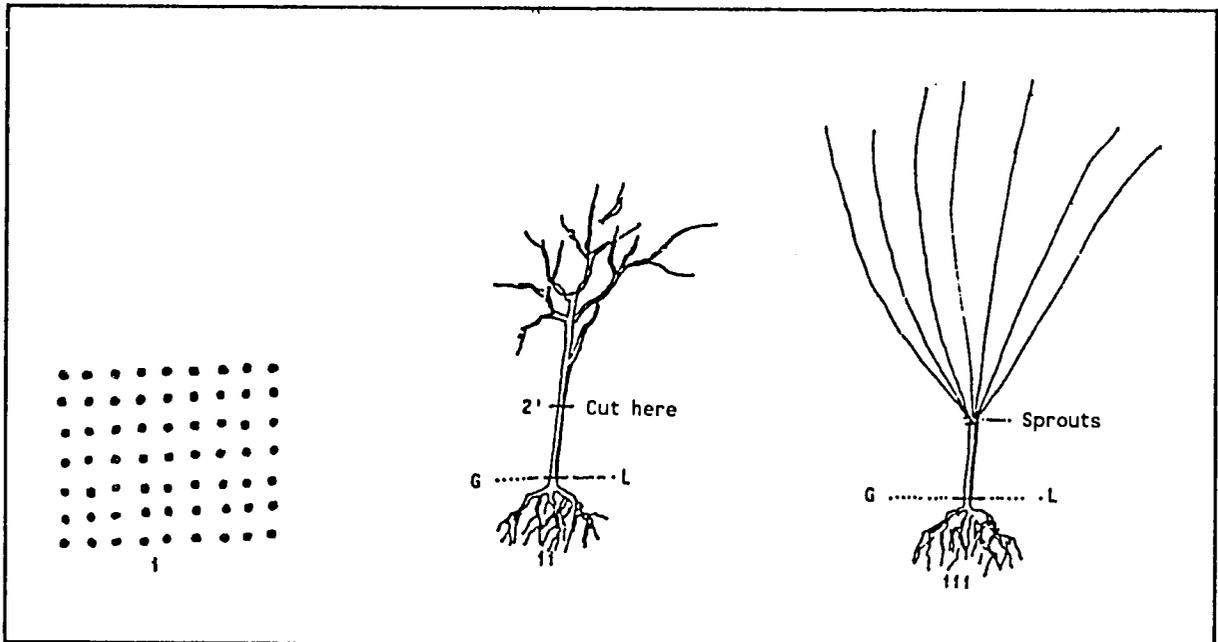


Fig 9. Making of cuttings

- Plant at 3 x 3 ft. spacing (Fig 10,i) Soil should be soft enough to enable the cutting to go down only with hand pressure and should not require striking with a mallet or brick to drive in.



i) Plant cutting at 3x3ft in Jan-Feb

ii) Cutting point after 1 year iii) Sprouts available after 1 year to make cuttings

Fig 10. Establishment of a "Cuttings Bank"

- Do not leave more than half inch stub of the cutting out side the soil. Take care that only the lower (proximal) end of the cutting goes into the soil.
- Irrigate immediately, quite deep but do not allow the water to stand on top of cuttings. Drain off water if by chance too much water is given.
- Irrigate daily for 2 weeks and then on alternate days for one month. Subsequently twice a week is sufficient.
- Do 2-3 weedings/hoeings during the year.
- Cut at 2ft from ground level after one year. Several branches will sprout from the cut ends (Fig 10, ii).
- From these sprouts, well grown, healthy and stout cuttings would be available for use in the next spring (Fig 10, iii).

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