T.R.I. ADVISORY CIRCULAR No.PN 2

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TEA NURSERY MANAGEMENT

1. Introduction

Nursery management is an most important operation for successful tea cultivation in the field. The success of tea plantation depends largely on the vigour and the quality of nursery plants used. The primary objective of nursery management is to raise healthy, vigorous and uniform plants from suitable cultivars with minimum casualties over an appropriate period of time at a minimum cost. A plant raised in the nursery of about 30 cm height comprising approximately 15 leaves with 2 - 3 side shoots, and a well developed root system is considered as suitable for planting. Good Nursery Practices (GNP) including advance planning, correct and timely implementation of nursery operations are essential to produce healthy and uniform plants in a nursery as described below.

2. Schedule of operations

Nursery activities for different tea growing regions are shown in Table 1.

Table 1. Nursery activity schedule for different planting regions/ monsoon sectors

Activity	Up country/ South-west	Uva/ North-west	Low country/ South-west
Pruning mother bushes (4 - 6 months prior to planting)	Nov - Dec	May - Jul	Apr - May
Soil collection, preparation, fumigation and bagging	Feb - Mar	Jul - Aug	Jul - Aug
Planting of cuttings	May - Jun	Nov - Dec	Aug - Sep
Supplying casualties (2 weekly intervals)	Jun - Aug	Dec - Jan	Sep - Oct
Fertilizer application (2 weekly intervals)	Aug - Sep	Jan - Feb	Oct - Nov
Disbudding (4 - 5 leaf stage)	Aug - Sep	Feb - Mar	Nov - Dec
Thumb nailing (7 - 8 leaf stage)	Sep - Oct	Mar - Apr	Dec - Jan
Restacking (4 - 5 month stage)	Oct - Nov	Apr - May	Dec - Jan
Hardening (5 - 7 month stage)	Dec - Jan	May - Jun	Mar - Apr
Field planting Up country & Uva: in 10 - 12 months Low country: in 8 - 9 months	May - Jun	Oct - Nov	Apr - Jun

3. Selection of site

A nursery site must be centrally located to facilitate easy and constant supervision. The size of the site depends on the annual requirement of plants and the lie and slope of the land. Factors to be considered in the selection of a site are;

- Proximity to a source of water
- Good drainage
- Protection from wind
- Proximity to the source of soil
- Proximity to the source of planting material
- Absence of over hanging branches of trees

4. Preparation of beds

The ideal size of a bed should be about 1.0 m wide (3.5 ft) and could be of any convenient length of about 20 m (65 ft), with a pathway of 60 cm (2 ft) on either side for carrying out nursery operations. Beds are built in a north-south direction to receive sunlight throughout the day. The beds should be raised to

about 15 cm (6 inches) for helping drainage and to avoid contamination of bags with nematodes subsequently through running water and, to avoid possible operational damages to the plants.

5. Selection of soil

The growth of nursery plants largely depends on the texture (the proportion of sand, silt and clay) of the soil. Loamy soils containing sufficient fine particles (clay and silt) to hold up water together with sand to facilitate excess water to drain out are suitable for nurseries. The pH of the soil should be within a range of 4.5 and 5.5, preferably around 5 for successful rooting and growth. The soils chosen for bagging should be sieved using a No. 4 mesh to remove stones, pebbles and large root particles. The sources of soil suitable for nurseries are as follows.

5.1 Grass soil

A soil where *Guatemala* or *Mana* grass has been grown for a period of year or two with a substantial amount of un-decomposed roots that make the soil friable with good drainage and adequate aeration.

5.2 Patana soil

Soil collected from *patna* lands where grasses, ferns and shrubs have grown naturally.

5.3 Jungle soil

Soil with suitable texture from natural jungles, *Eucalyptus* or *Pinus* plantations/blocks can be used. The surface organic matter (decaying leaves and twigs) should be removed prior to use.

5.4 Sub soil

This is obtained from a depth beyond 30 cm from the soil surface. After sieving (with No. 4 mesh), its texture should be improved by adding fine sand proportionately (one part of fine sand with four to six parts of soil depending on clayiness of the soil).

6. Soil treatment

Soil should not be collected for nursery when it is too wet or dry in order to preserve the desired structure. Soil collected should be heaped in an enclosed area and protected from rain by thatching/ covering until it is used.

Soils collected from all tea growing areas should be fumigated before use to eradicate nematode pests in soil. Please refer Advisory Circular No PM 11 for current recommendations of the fumigants, dosages and application methods.

As an alternative to soil fumigation, soil solarization is also possible in areas where at least five hours of sunshine per day is available for a minimum period of six consecutive weeks. As solarization is subjective to local conditions it is necessary to obtain advice on soil solarization methods from the TRI by submitting weather records such as the number of rainy days and daily sunshine hours for the last three years.

7. Alternate soil media

When soil is scarce, organic materials such as tea waste, paddy husk and coir dust may be used along with soil. These alternate media will also help improve the quality and vigour of nursery plants. Other comparative benefits include reduction of soil requirement, labour use and cost and easy transportation due to the light weight of such materials.

7.1 Organic materials

Organic materials with the following requirements should be selected depending on their accessibility and availability.

Organic material	Specifications and requirements
Refuse tea	Well decomposed under natural conditions
Paddy husk	Fresh or partially decomposed; wastes obtained preferably from Japanese huller and free of bran and grain pieces
Coir dust	Fresh or decomposed; not from coastal areas

7.2 Methods of use

Different alternate media could be used either in layer arrangement or as mixtures. The soil used for layers and/or mixtures should be fumigated as specified in the Advisory Circular No. PM 11. The organic material and soil should be lightly watered and mixed thoroughly prior to making the mixture.

7.2.1 Layer arrangement

The top one-third (1/3) of the nursery bag should be filled with soil to facilitate early rooting with minimum causalities. The bottom two-third (2/3) should be filled with a mixture of organic material and soil in the ratios given below which will help establish roots and growth.

Organic material	Ratio of organic material : soil	Remarks
Refuse tea	1 : 1	100% refuse tea could also be used
Paddy husk	1 : 1 or 1 : 2	1 : 2 for areas where prolonged dry weather is expected
Coir dust	1 : 1	100% coir dust could also be used

7.2.2 Mixture arrangement

The whole nursery bag should be filled with 1 : 1 refuse tea: soil or 1 : 1 paddy husk: soil or 1 : 1 coir dust: soil mixtures.

7.3 Special considerations

Special attention should be paid to give optimum water requirement when using the above growing media. As paddy husk retains less water, frequent watering may be required whereas refuse tea requires less water as it retains more water.

8. Filling the polythene sleeves

Guage of the polythene should be 150. Standard size of a sleeve is 10 cm or 4 inches in diameter (12.7 cm or 5 inches layflat) and 23 cm or 9 inches long and, about 400 such sleeves can be made from 1 kg of polythene sleeve of 150 gauge. The bottom end of the bag is left open, and a few holes punched on the sides of the bottom half to facilitate drainage. About one cube of soil is required to fill about 1000 sleeves.

Bigger polythene sleevs of 30 cm or 12 inches long and 15 cm or 6 inches wide (layflat) are used to raise bigger plants for infilling purposex as they are kept longer duration (15 - 18 months) in the nursery.

When filling the sleeves, a small layer of lightly wet soil is gently rammed at the bottom to make it hold on to the sleeve. Then fill by gently pressing the soil in but not ramming it hard, to avoid formation of a hard layer that may impede root development. No air pockets should be left in the soil while filling as it could result in sagging of the bag.

9. Source of planting material

Vegetatively propagated plants are raised from internodal cuttings consisting of one leaf of the shoot. The choice of cultivars, both for replanting and infilling, will depend on the desired characters. Please refer TRI Advisory Circular PN 1 for details on selecting suitable cultivars. Cuttings should be obtained from properly managed multiplication plots (mother bushes) as described below.

9.1 Preparation of mother bushes and planting of cuttings

It is recommended to remove the terminal buds, about 2 - 3 weeks before taking shoots off the mother bushes and then followed by a foliar application of Zinc Sulphate and Urea at 2 - 3% each in order to break dormancy of axillary buds and stimulate growth. Please refer TRI Advisory Circular No. SP 4 for details on fertilizing mother bushes.

9.2 Collection of shoots

Shoots must be obtained from pruned bushes over four years in age. Vigorously grown erect shoots will be available for collection about four months after pruning in the low country and six months after pruning in the up country. However, this period may vary with weather conditions, elevation and cultivar. Generally 3 - 5 suitable cuttings per shoot (depending on the quality of shoot) and 15 - 25 shoots could be obtained from a well maintained mother bush. Approximately 70 - 100 cuttings could be obtained from a bush. Shoots should be collected early in the day.

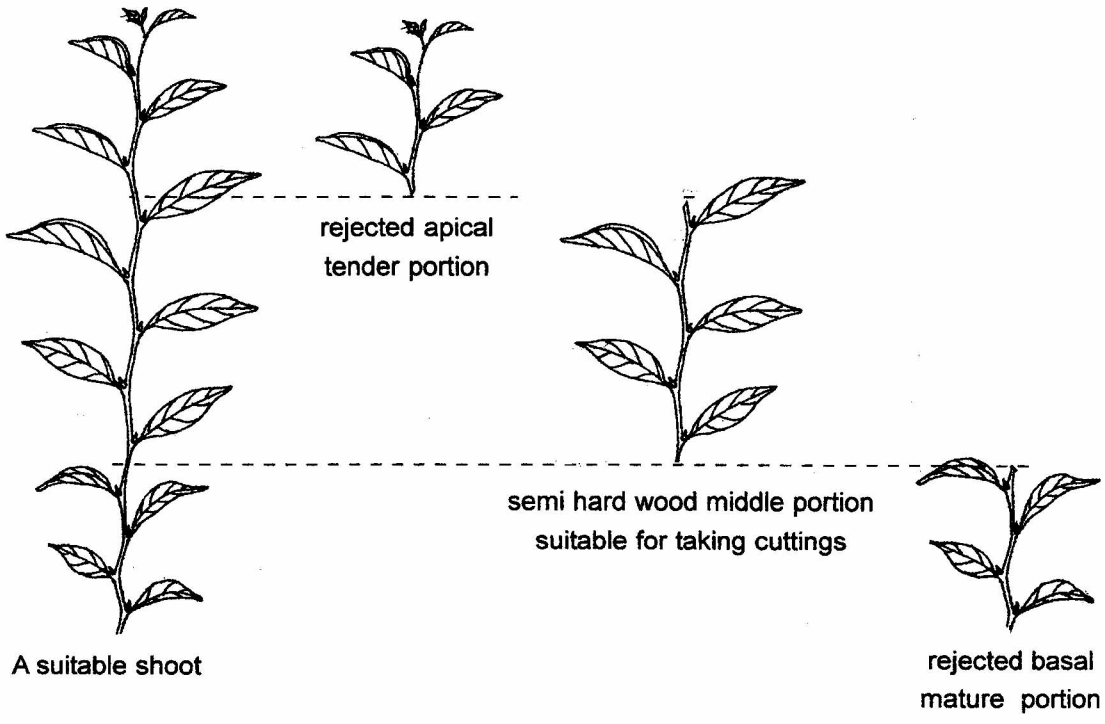

Figure 1: Selection of suitable portions for taking single node cuttings

9.3 Transportation of shoots

Once shoots are removed from mother bushes they should be kept in a shaded place preferably in a container filled with water to avoid drying up. Adequate measures should therefore be taken to minimize drying up and sun scorch of shoots during transportation.

9.4 Method of taking cuttings

Only single node cuttings from a suitable shoot (Figure 2) are recommended. Cuttings should be taken from the middle portion (Figure 1) of the shoot leaving the apical tender portion and the basal mature portion (Figure 1). Cuttings with axilliary flower buds, overgrown shoots and damaged mother leaf (Figure 3) should be discarded. When obtaining single node cuttings, the upper cut should

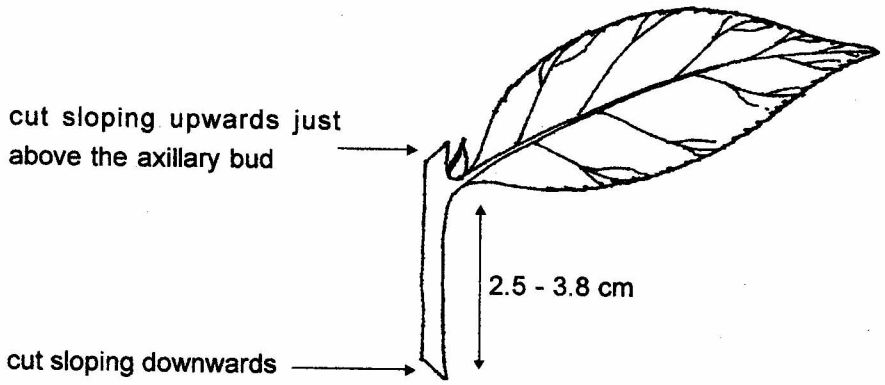

Figure 2. A suitable single node cutting

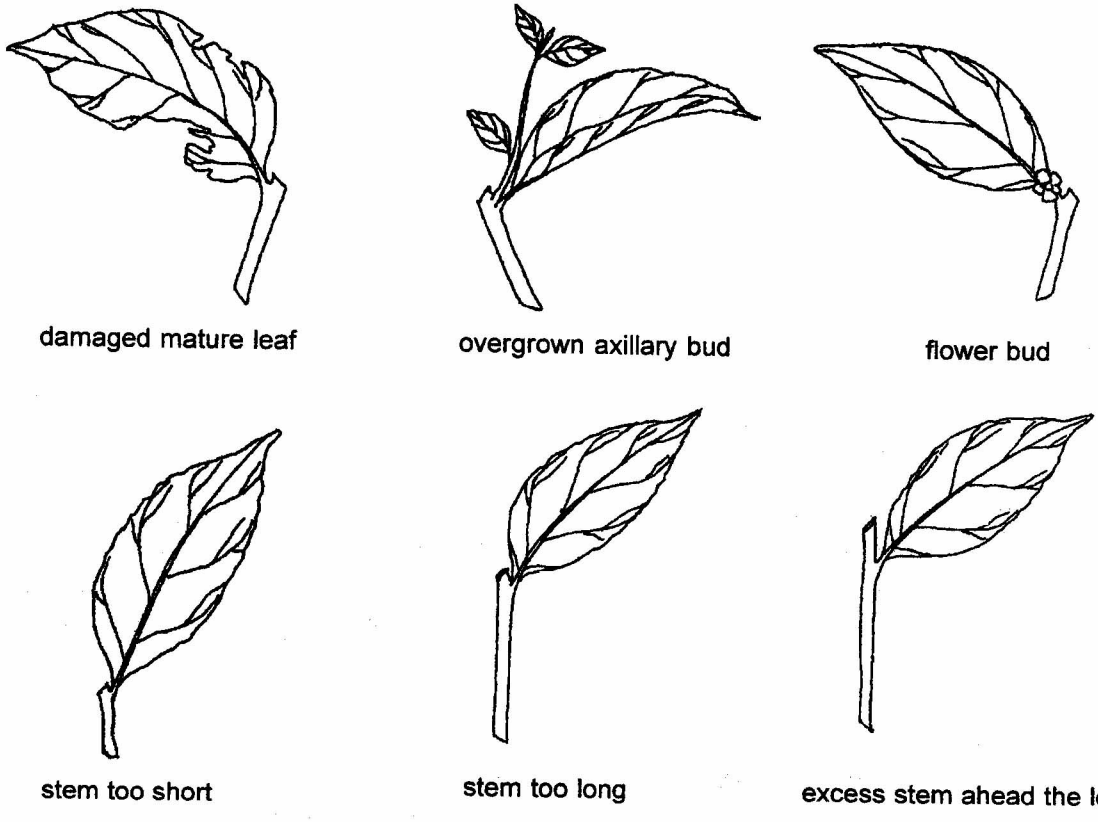

Figure 3. Unsuitable cuttings

always be made in the shoot closer to the axilliary bud without damaging it (Figure 2). The second cut should be made 2.5 - 3.8 cm below the node, in an upward slope by rotating the shoot between fingers. The cuttings should be dropped into a water container immediately after the cut and planted soon as possible without leaving them to dry out.

9.5 Planting of cuttings

Soil in the polythene bags should be lightly watered and gently pressed prior to inserting cuttings. Only one cutting should be planted per bag by inserting vertically down into the soil. Planting of cuttings should be done in the manner the leaves are oriented in one direction at an angle to the row. The soil around the cutting should be gently pressed by fingers to ensure firm anchorage. Cuttings of different cultivars should be planted separately and labeled.

9.6 Promotion of rooting of cuttings

In order to enhance callusing and rooting of cuttings particularly in the case of slow rooting cultivars, the basal ends of the cuttings may be treated with a quick dip of a growth hormone by immersing the cuttings up to 1.5 cm in Indol Butric acid (IBA) solution of 6000 ppm (6g IBA/L of water).

9.7 Propagation under sealed polythene

Propagation could be done under a sealed polythene tunnel to have considerable savings on water and labour. After cuttings are planted, the bags as well as beds are given a through watering and covered immediately with a transparent, 300 gauge polythene sheet, resting on semi-circular iron or bamboo hoops. The edges of the sheet are buried well on all four sides and made air-tight to create a propagating environment.

No watering is required in the tent as the water applied initially would be adequate for internal circulation within the tent. If the moisture in the tent is inadequate, the plants should be watered and sealed again. When the water is condensed inside the tent, they should be placed back in the potted bags by gently tapping the surface of the tent at frequent intervals especially in the mornings.

The cover could be retained for $1^1/_2$ - 3 months, depending on the rate of growth, and removed in stages extending over a few days. This system brings about a relatively fast vegetative growth of the cuttings, especially in slow-growing cultivars as well as in nurseries in exposed or cold areas.

10. Shade for nurseries

Cuttings should not be exposed to direct sunlight and diffused or indirect sunlight of about 20 - 25% light is adequate. The different types of nursery shade are described below.

10.1 Low shade with bracken fern

Bracken fern (*Gleichenia linearis*) can be inserted in clusters of about 2 - 3 fern shoots between polythene sleeves. The fern stalk should be free from leaves up to 25 cm from bottom and shade should be provided by the fern canopy above this height. Uneven shading and difficulty in supervision are drawbacks of this type of shade.

10.2 Low shade with coir matting

Coir matting of 6mm mesh, with a standard size of 9 m x 3 m (30" x 9") is laid on a frame of iron or bamboo hoops, fixed across the length of the bed at 2 m apart. Rods, 2 m long with loops at the end, are used to link the hoops together and provide additional support.

10.3High shade with coir matting

Though the initial cost is high, this type of shade is preferred as it allows easy walking in and carrying out nursery operations under the permanent structure. The frame (wood, galvanized piping or concrete posts) is erected slightly sloping to receive more of the morning sunlight, and also to prevent excessive drip during heavy rains. Posts are 2.4 m high, spaced 3.5 m x 3.5 m apart, and the frame stands 2 m above the bed after erecting. Coir matting of 6mm mesh should be used as shade material. Alternatively synthetic nettings could be used in high elevation estates.

11. Aftercare operations

11.1 Watering

In the early stages, regular watering two to three times a day is necessary and watering should be regulated depending on the weather. Wetting the coir matting will help retention of moisture in the nursery.

11.2 Fertilizer applications

Fertilizer should be applied only after the cuttings have been rooted, which would be between six to eight weeks in the Low country and ten to twelve weeks in the Up country. Please refer Advisory Circular No. SP 1 for details of fertilizer application.

11.3 Restacking plants

For easy management of the nursery and to obtain plants uniform in size, the plants should be separated by restacking them into two to three height classes during the fourth to fifth month. A second restacking could be done during the fifth to seventh month. While restacking, the moss and hard crust formed in the surface soil of the nursery bags should be loosened by gently dibbling in with a pointed stick to permit better percolation of water and fertilizer. This leaves the soil in a friable condition.

11.4 Hardening of plants

As more leaves are formed, plants need exposure to more sunlight for better growth. This must be done gradually as sudden exposure may lead to leaf scorch. Between the fourth and sixth month (based on the elevation), the side of the coir matting should be raised and the plants should be exposed to indirect sun until the shade is completely removed.

11.5 Encouraging early spread

For maximum gain, plants should be encouraged to form a low spread at an early stage. The following operations would encourage formation of lateral branches from the lower level of the main stem.

Disbudding: To induce effective lateral branching, the terminal bud should be removed at four to five leaf stage. This should be repeated on the axillary shoots also as they grow.

Thumb-nailing: At about seventh to eighth leaf stage, after the root system is well developed, the terminal bud and the two leaves immediately below should be pinched off to induce growth of lateral branches.

11.6 Pest and disease control

Common pests found in nurseries are the tea tortrix and the yellow mite. When the nursery period is extended, shot hole borer can become a problem in susceptible cultivars. Mealy bugs may

become problematic under ill-drained and clayey soil conditions. Blister blight and black blight disease (in the Low country) on young leaves during monsoon condition also can be a problem. Please refer TRI PM and DM series of Advisory Circulars for current recommendations on control of insect and mite pests and, leaf diseases in nurseries.

With proper timing of operations along with good management practices, nursery tea plants with appropriate quality standards can be produced within a period of 10 - 12 months in Up country and Uva regions, and 8 - 9 months in Low country regions.

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