

**AN EVALUATION OF NURSERY PRACTICES IN TEA
ESTATES IN THE NUWARA ELIYA DISTRICT**

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INTRODUCTION

Nurseries are the starting point of commercial tea production and therefore, the nursery is essentially an integral part of achieving success in agribusiness. Almost 90% of the tea estates have their own nurseries to produce healthy tea plants for replanting and infilling which almost a routine practice taking place in tea estates. A company owned tea estate in the up-country, as an average, plants about 40,000 cuttings a year, spending more than Rs. 100,000 for nursery up keep year. By adopting proper nursery practices one could obtain healthy, vigorous tea plants within a minimum time period. Time spent by the plants in the nursery is money spent in their maintenance. It has been observed that good plants show a greater degree of success in the field and reach production stage earlier.

The aim of nursery management should be to obtain healthy, vigorous, uniform plants with minimum casualties, properly trained and sufficiently hardened in a reasonable period of time. It has been observed, that there are some common problems faced in nurseries of the tea estates in the area under survey such as prolonged dormancy of cuttings, flowering buds, leaf scorch, over callusing, shallow rooting and poor root distribution, retarded growth and poor lateral branch development resulting in tea plants being unsuitable for field planting. When such plants are planted in the field, performance has been poor. For instance, shallow rooted plants tend to die even in a shorter period of drought. Formation of pot bound root system, and poor frame

development have also been observed. Weak plants are unlikely to withstand field conditions successfully. All these ultimately may result in high casualty rate in the clearing and take a longer period to become productive.

The objectives of this study are:

- i. To find out the nursery practices that lead to unsuitable nursery plants, in the up-country.
- ii. To use this information as a guide by the extension personal in drawing up extension programmes in nursery management.
- iii. To provide feed back information for researchers.

METHODS

Sampling techniques:

The target group of this survey is the company owned tea estates in the Nuwa Eliya district. There are 110 company owned high grown tea estates in the district. Among those, 18 estates were selected as the study group, which is 16% of the target group. The study group was selected by " Multiple stage sampling procedure" consisting of four sampling methods such as

1. Stratified sampling
2. Quota sampling
3. Random sampling
4. Purposive sampling

Variables and measures:

Under the following nursery practices variables were studied.

1. Source of planting material (multiplication plots, mature clonal fields, extent/number of bushes, age, yield, availability of TRI 3000 and TRI 4000 series clones).

2. Preparation of mother bushes (number of bushes pruned, style and time of pruning, staggered/entire pruning, weed management, fertilizer, pest and disease management and shade management).
3. Preparation of cuttings (removal of terminal buds before harvesting; type of cuttings, month and time of harvesting shoots, number of shoot harvests, shoot per bush and cuttings per shoot, size and quality of cuttings).
4. Preparation of soil (soil type and depth from which soil is collected, testing the pH, sieving, mixing with sand, fumigation, polythene sleeves, month/s of soil preparation and filling the sleeves).
5. Planting the cuttings and shading (planting month/s, callus beds, planting angle, handling the cuttings while planting, type and quality of shade, stage of thinning out and complete removal of shade).
6. Watering, fertilizing, pest and disease control (watering method and frequencies, fertilizer application rates and frequencies, soaking and grinding the fertilizer, stepping up the rates, liquied fertilizers/hormones, pest and disease outbreaks and its management).
7. Training the plants (age of disbudding and thumb nailing, amount of foliage in the plant before and after disbudding/thumb nailing, any other methods of training).
8. Restacking and hardening (stage and frequencies restaking, thinning out and complete removal of the shade, any other hardening practices).
9. Percentage of success and cost factor (number of cuttings planted and number of plants obtained/discarded, quality of plants, duration of nursery period, cost components of labour and material inputs for different practices).

Data collection and data analysis:

This is a descriptive and analytical type of study. The data collected are both qualitative and quantitative. The data were collected in 1995 by a combination of several survey techniques. Combining different techniques maximizes quality of the data and reduce the chances of bias resulting from the effect of interviewer on interviewee, personal attributes of both the observer and the respondent. The following survey techniques were used.

Interviews:

Oral questioning of respondents with the help of a prepared questionnaire. This was the major techniques used to collect data in this study. The respondent was the Nursery Kangani of the estate who is directly in charge of the nursery. The Nursery Kangani was interviewed in the presence of the Superintendent, or Assistant Superintendent or a Senior Field Officer delegated by the Superintendent.

Non participant observation:

This refers to collection of data by systematic observation and recording. Data were collected from the estate files available at the Advisory and Extension Division of all the estates in the study group.

Through key informants:

Ideas and opinions of key informants such as Superintendents, Field Officers and Nursery Kanganees were also collected.

After collecting the data, they were tabulated for analysis which was done by percentages, central tendency and dispersion, and by ranking.

RESULTS AND DISCUSSION

Source of planting material (cuttings):

The major source of planting material in all the estates under this study is mature clonal tea fields. However, few estates have multiplication plots in small extent and some of those are abandoned and some are recently planted with TRI 3000 and 4000 series clones in small numbers (about 150 to 500 plants). In other estates TRI 3000 and TRI 4000 series clones issued by the TRI, are planted in new clearing with other clones. In some of the estates the 3000 and 4000 series clones are not labeled for future identification and not separately treated as a multiplication plot.

The age of the mature clonal tea fields from which cuttings are obtained varies from 10 to 30 years and the yields are in the range of 1600 to 2600 kg/ha/annum. The clones that are used widely for nursery planting are TRI 2025, DT 1, DN, CY 9, N 2 and K 145. TRI 2025 and DN seem to be widely used in the Udapussellawa planting district. The other clones used for nursery planting are TRI 3017, TRI 3013, TRI 2024, TRI 2142, GT 7/1 and WT 26.

Preparation of mother bushes to obtain cuttings:

Pruning of mother bushes is done from April to July in the North-east monsoonal region (Maturata and Udapussellawa planting districts) and from November and December in the South-west monsoonal region (Nuwara Eliya, Dimbula, Dickoya, Ramboda, Maskeliya planting districts). However, few estates of the North-east monsoon region prune from November to December and few estates of the South-west monsoon region prune in May which appears to be in contradiction to the TRI recommendations. Resting of the mother bushes prior to pruning is done for 1 to 1 1/2 months.

It was observed that one estate prunes about 2000 bushes to obtain cuttings from mature clonal fields, expecting about 50 cuttings per bush. As an average an estate plants about 60,000 cuttings depending on the availability of resources like skilled labour, weather

condition, availability of shading material, etc. It was found that about 50% of the sampled estates prune the required number of mother bushes all at once without pruning them batch by batch, which is referred to as staggered pruning.

Unless the mother bushes are staggered pruned, the cuttings obtained during the latter part of the planting season will be over matured and the axillary bud overgrown. This could be one of the reasons for planting over matured cuttings in nurseries, planting over matured cuttings would result in high casualty rates in the nursery.

Mostly, weed control in the mother bush areas is done manually. The soil is forked 3 months after pruning. However, in a few estates forking is done a few weeks after pruning.

Mother bushes are fertilized with T 200 mixture at the rate of 30 to 45 g (1 to 1.5 oz) per bush with mostly only one application. Some estates do apply twice. Also, it was found that some estates apply U 709 mixture instead of T 200 mixture while 2 to 3% $ZnSO_4$ and Urea are also given as a foliar spray fortnightly in 2 to 6 applications.

The terminal buds of the growing shoots are usually removed 1 or 2 weeks prior to harvesting shoots to break dormancy of the bud in the leaf nodes.

Blister blight and pest damages due to tea totrix, mites and aphids in the mother plots are controlled by spraying.

Preparation of cuttings:

Cuttings from the mother bushes obtained after about five months from prune. The number of shoots harvested from a mother bush varies from 4 to 25 shoots per bush, with an average of 12 shoots per bush in two batches. If the mother bushes are vigorous and treated well, about 25 vigorous shoots are harvested. Generally, 3 to 5 cuttings are taken from one shoot depending on the vigour of the shoot but in a few estates 6 to 7 cuttings are taken from a shoot. Unless the shoot is vigorous the chances of taking tender or mature cuttings is greater. All

the estates take single node cuttings with a full leaf and with a stem 2.5 cm to 3 cm (1" to 1 1/4") in length. In most of the estates there were considerable number of poor quality cuttings like over matured cuttings and cuttings with dormant buds.

Obtaining soil and soil preparation:

Guatamala or Mana clearings and subsoil areas are the major sources of obtaining soils for nurseries. Soils from patana land and jungle clearings (mostly gum clearings) are also used for nurseries in the Maturata and Udupussellawa planting districts. Soils are obtained at a depth of 30 to 60 cm (1 to 2 feet) from Gutamala / Mana clearings and at 45 to 75 cm (1 1/2 to 2 1/2 feet) from patana and jungle clearings. The physical character of nursery soils is satisfactory in some estates. However, there are considerable number of estates where cuttings are planted in clayey or clayey and gravelly soils. Some times the soil is packed too tightly in the polythene sleeve. Some commonly observed problems in the early stages of nurseries are over callusing, stem rot, poor root development is due to the use of poor soil and packing the soil too tightly in the polythene sleeve.

Generally, most of the estates have tested the pH of the soil prior to soil collection. However, some estates check the pH only after the soil collection is completed. The soil pH values of three nurseries were less than 4.5. Fumigation is done by using Methyl Bromide at recommended rates and only one estate under study was found to be using Dazomet. A greater preference to use Methyl Bromide is due to its ease of application within a shorter period of time. Fumigation with Methyl Bromide is done before filling the soil in the polythene sleeves. It has been reported that fumigation with Methyl Bromide *in situ* (to the soil filled bags on the bed) was faced with various practical problems like, shortage of polythene tents, type of terrain of the nursery site, unpredictable weather conditions, etc. Soil is sieved before fumigation using a mesh or the pebbles are removed by hand if the soil is good. The fumigated soil is then filled in 150 gauge polythene sleeves. The size of the polythene sleeve varies from estate to estate like 12.5* 22.5cm (5"* 9"), 15* 22.5 cm (6"x 9"), 15 * 30 cm (6"* 12"), 10 * 30 cm (4"* 12"), 12.5 * 30 cm (5"*12") and 7.5 *

* 22.5 cm (3"*9"). The bottom of the sleeve is kept opened with or without perforations on the sides. The number of perforations was found to be in the range of 6-24. It was visually noticed that the plants in 10* 30 cm (4"* 12") bags had deeper root system.

Planting cuttings and shading:

Planting is done directly in the soil filled bags. One cutting is planted in each bag and sometimes, the bags at the edges of each bed are planted with two cuttings. Such additional cuttings are later removed to replace the casualties that occur in a bed during the early stages. In a few nurseries some cuttings are planted in callusing beds and are usually kept for 1 1/2 to 3 months for the purpose of replacing the casualties, which occur in the bags during the initial period.

It was observed that less attention is paid in improving the drainage of nursery beds. The nursery beds are not raised sufficiently or not raised at all, from the ground level.

Brakern fern is the most commonly used shading material (as a low shade) in all the estates under study except one estate where coir mat is used. High shade (with coir mats) seems to be established only in a few estates due to the high cost materials and construction. Brakern is inserted in clusters (about three ferns in a cluster) in between bags or sometimes in the bag itself at a spacing of 20 to 30 cm (8" - 12"). In certain nurseries a thin layer of fern is spread on the inserted brakern canopy in order to get an even shade. However, in some estates brakern shade is not evenly spread and as a result sun scorch on the mother leaves is noticed in places where direct sunlight falls through hollows. Thinning out of brakern shade commences at different times in different estates, in some cases it is as early as 1 1/2 months after insertion while in other cases it taken 5 months. Complete removal of the shade (Brakern or coir mat) is also done at different stages varying from 5 to 7 months or even sometimes at 12 months. In beds where brakern in thinned out in the early stages (1 1/2 months), death of cuttings due to sun sorch and water loss is widely noticed.

Watering, fertilizing, pest and disease control:

Watering is generally done twice a day, in the morning and evening, manually, with a rubber hose or with watering cans. About 2-3 additional labour is employed for watering daily, during dry season. Of the estates under study 50% had no proper sedimentation tanks or sometimes the outlet pipe of the sedimentation tanks located too close to the bottom of the tank leading to a greater risk of contamination with pathogenic nematodes from the irrigation water.

In all estates under study, nursery plants are fertilized with T 65 mixture. The application commences at different times varying from 45 to 90 days after planting of cuttings. The dosage at commencement also varies from 15 g to 30 g in 4.5 l (1/2 oz to 1 oz in 1 gal) of water for 100-120 plants. Subsequent applications are given fortnightly, mostly at a dosage of 30g/4.5 l water (1 oz/1 gal water) for 100-120 plants. Some of the estates are found to be applying 15 g (1/2oz) even for the 2nd application. The dosage is stepped up at different stages like the 4th, 5th or 6th month to about 60 g (2 oz) for 100-120 plants. There are a few estates where the dosage is maintained at 45g/4.5 l water (1 1/2 oz/1 gal water) for 100-120 plants, throughout the nursery period. Of the estate sampled, 40% do not soak the fertilizer overnight and do not grind the fertilizer before application and the sediments of the fertilizer solution is thrown out. In addition to T 65, liquid fertilizers like Maxicrop, Jeewan are generally applied. However, $ZnSO_4$ or $ZnSO_4$ with urea is applied in few estates. In general the occurrence of Nitrogen and Magnesium deficiency symptoms, fertilizer scorch symptoms on leaves are widely noticed.

Loosening the soil in the bag:

Less attention is paid by most of the estates in loosening of the soil in the bag, when hard crusts or moss layer or lichens are formed on the soil surface. However, loosening the soil in the bag by crushing the polythene sleeve while restacking seems to be a common practice and by doing this, part of the soil drops down through the bottom opening of the bag. On such occasions, the bag is again filled with soil

through the bottom opening, causing damage to the roots, which are either broken or curled upwards.

Training:

Training operation is generally done by disbudding (pinching of the terminal bud) at 4-5 leaves stage or in 3 to 5 months age and by thumb nailing (breaking the terminal shoots with 2-3 leaves) at 7-8 leaves stage or in 5-8 months. In some estates, the main stems of the plant are given a hard cut at 15 cm (6") in about 9 months. It is also observed in some estates that plants are given a cut across with a pair of scissors at about 22 cm (9") in 10-12 months.

Restacking and hardening:

Restacking operation is generally done twice, grouping the plants into three sizes. In most cases the first restacking is done when the plants are 3 to 4 months of age and the second restacking is when they are 6 to 7 months of age. However, in some estates the first restacking is done at 6 - 8 months of age and the second at the 10-12 months of age. Some restack the third time as well at 14 months, when the plants have to be kept for longer periods in the nursery for infilling. In such cases there were a fair amount of root damage and curling of root upwards, during restacking especially at later stages. Such damages and disturbance to the roots are high when the plants are handled roughly like pulling them hard from the bed or transferring the plants to another bed by throwing from hand to hand.

Shade is removed completely in 5 to 8 months after planting or sometimes, in 12 months in case of high shade nursery. Also in latter stages of the nursery the frequency of watering is reduced to once a day or once in two days:

Success of nursery plants and cost factor:

The size of the nurseries under study, varied from 25,000 cuttings to 125,000 cuttings in the 1993/94 planting season with an average of 60,000 cuttings. Percentage of success (the number of plants

obtained with respect to number of cuttings planted), according the estate office records, is 80% to 98% (average 97%). However, it was observed that many plants, which are not suitable for field planting such as shallow rooted plants, plants with pot pound root system, stunted plants. Therefore success of the nursery in terms of suitable plants for field planting is much lower than the above figure. In most of the estates part of these unsuitable plants have been planted in clearing and in some estates such plants are left in the nursery for several months or more than a year and then used for infilling.

The cost of raising a twelve-month-old plant in the nursery is in the range of Rs. 1.75 to 3.65 . Average cost of a fifteen-month-old plant is Rs. 3.30. The cost of the plant is coupled with a number of factors such as size of the nursery (No of plants raised), age of the plant, cost of inputs, number of wet days or dry days, labour used and casualty rate, etc. Among the labour cost component, watering seems to be a more labour intensive operation. Other than watering, soil collection and soil preparation, filling polythene sleeves, preparation and planting of cuttings and restacking are also labour intensive.

General:

According to this survey study conducted in the selected eighteen company owned tea estates in the Nuwa Eliya districts, the following salient problems have been observed (listed in descending order of occurrence).

- i. Prolonged dormancy of the cuttings and flowering buds during the early stages of nurseries.
- ii. Over callusing or ball formation.
- iii. Planting matured cuttings and stem rot.
- iv. Use of clayey soil.
- v. Root damage during restacking and during transporting the plants to the field.
- vi. Shallow rooting and poor root distribution.
- vii. High cost of plants.
- viii. General yellowing and stunted growth.
- ix. Inadequate development of lateral branches.

- x. Sun scorch and fertilizer scorch on leaves mostly during the early stages.

Improper nursery practices adopted previously is one of the cause for failures of young tea in new clearings. When planted, weak nursery plants in the clearing would be the ones that would pack up for the first signs of adverse weather conditions. By this time it is far too late to even remember the nursery technique that was adopted at that time. Adoption of proper nursery techniques, which have been planned well ahead and timed correctly, would go a long way in producing a batch of healthy plants, which would not be problematic in the clearing. The ideal to be achieved in the nursery should be a high percentage of cuttings successfully rooted healthy vigorous plants 10 to 12 inches high in 9 to 10 months, with low cost of producing a plant.

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