Rubber Planters' Conference, India 2002, pp. 148 - 151.

ROOT TRAINER PLANTING TECHNIQUE FOR *HEVEA*

20

T.A. Soman, C.K. Saraswathyamma* and J.G. Marattukalam*
Rubber Research Institute of India, *Hevea* breeding substation Paraliar, Kanyakumari District, Tamil Nadu.
*Rubber Research Institute of India, Kottayam 686 009, Kerala.

The raising of planting materials of *Hevea* in root trainers helped in avoiding coiling of root system often seen in plants raised in polybags. Though the initial height and girth of root trainer derived plants were less, within one year of field planting the growth was comparable to that of polybag derived plants. The cost of planting material could be reduced considerably by adopting root trainer technique.

INTRODUCTION

Advanced planting materials of *Hevea* are traditionally raised in polybags. Compared to stump planting polybag plants are helpful in shortening the immaturity period by about one year. Facility for the selection of vigorous plants of uniform growth and less casualty on field planting are the other advantages of using polybag plants. However, polybag planting materials have some disadvantages as well. Coiling of taproot and spiralled growth of lateral roots are the most important drawbacks of polybag plants. Coiled and spiralled growth of roots result in root strangling and distortion and leads to slow growth, poor drought tolerance and lack of wind fastness. The options available while planting in the field are total rejection of plants with coiled taproot, or removal of the coiled roots before planting. Both these suggestions are not feasible as the former reduces the availability of planting material while the latter leads to poor development of root system.

Polybag planting technique is labour intensive. The heavy polybags are often inconvenient to handle in the nursery, transport to the planting site and to carry out the planting. A root trainer planting technique was attempted with the aim of standardizing an alternative technique to overcome the drawbacks of polybag plants.

MATERIALS AND METHODS

The root trainers used in the present study were made of polypropylene and had an inner diameter of 7.5 cm at the top tapering and ending in a drainage hole at the bottom. Total length of the container was 30 cm with a holding capacity (volume) of 800 cc. The inner wall of the container was provided with eight vertical ridges, which end near the hole at the bottom. The potting medium used was prepared by mixing sieved coir pith and powdered charcoal in the ratio 9:1. Powdered rock phosphate, was also added and thoroughly mixed with the potting medium. The containers were tightly filled with the mixture leaving sufficient space (about 3 cm) at the top for watering. Polybags of size 55 X 25 cm filled with topsoil were also included as control. The technique used has been described earlier (Soman and Saraswathyamma, 1999).

Green budded stumps of clone RRII 105 were planted in root trainers and polybags and arranged in trenches in randomized blocks with five replications. The root trainers were drenched with a 2% solution of NPKMg (10:10:4:1.5) on every alternate day. After the development of two whorls of leaves (at 4-5 months) the root trainer plants were lifted from the trench and the roots grown out of the container were carefully pruned with a knife. Then they were transferred to carriers made of bamboo splints and kept suspended in the air for a minimum period of 8 weeks for hardening. Cultural operations for polybag plants were done as per standard procedure. The root trainer and polybag plants were transplanted to the field at 2-3 whorls stage in adjacent blocks of 300 plants each during June 2001.. Height and diameter (at the bud union) of plants were recorded just before transplanting. Observations on growth parameters were again recorded one year after field planting.

RESULTS AND DISCUSSION

Observations on different growth parameters of plants raised in root trainers and polybags recorded at the time of transplanting to the field (7 months of growth) are presented in Table 1. Plants raised in root trainers showed lower values for height and diameter. The wide difference in the quantity of potting medium and the space available in root trainers and polybags may be the reasons for these differences in the height and diameter. However, the plants raised in root trainers were more sturdy than polybag plants as indicated by the height/diameter ratio, which helps in promoting early and vigorous growth on field planting. The number of lateral roots were also noticed to be significantly higher for plants raised in root trainers.

Table 1. **Growth of advanced planting materials (at 2-3 whorls stage)**

	Root trainer plant	Polybag plant
Mean height (cm)	66.75 ± 5.21	78.10 ± 6.02
Mean diameter at bud union (mm)	9.87 ± 0.84	10.42 ± 0.71
No. of lateral roots (mean)	18.09 ± 2.09	5.61 ± 1.46
Sturdiness quotient (height/diameter ratio)	67.02	74.47

A defective growth of the shoot of an advanced planting material can be corrected at any stage in the nursery and even after field planting, but an improper structural development of the root system can never be corrected at a later stage. In polybags the taproot was noticed to reach bottom of the bag in 6 to 7 weeks after planting the budded stumps and it started coiling thereafter. This coiling was noticed to remain as such even several years after field planting. The coiled taproot never attains its normal growth but leads to root strangling and distortion subsequently. The structure and shape of the root trainer container were so designed as to ensure proper growth and orientation of the root system avoiding coiling of taproot.

The poor development of lateral roots in polybags may affect the binding of the soil core. Severe root damage and casualty on planting in the field are often noticed in such plants. The poorly aerated topsoil used for filling the polybags may not favour the proper development of lateral roots. In root trainers the topsoil was substituted with coir pith mixed with powdered charcoal allowing aeration and hence there was a significant increase in the number of lateral roots developed. A well-developed lateral root system is very important because survival rate and subsequent growth of a transplanted young plant are directly correlated with the growth and development of lateral roots. The lateral root development in root trainers was further improved by the hardening process. When the plants are suspended in air the roots resumed growth in a few days and undergoes 'air pruning' (cessation of growth) near the hole at the bottom. The temporary stress due to the air pruning of the taproot induced emergence of a large number of lateral roots into the well-aerated potting medium. The vertical ridges in the container help in directing these roots downwards and thus prevents its circular growth within the container.

Out of the 300 polybag plants transplanted, coiling of tap root was observed in 287 plants and the tap root was seen outgrowing the polybag in the remaining 13 cases. The average number of lateral roots was 5.61 per plant. Most of the lateral roots were found to grow circularly within the polybag. A total of 14 plants dried in the field, of which 11 occurred due to the damage caused to the soil core at the time of extraction of the polybag from the trench, transportation and planting. The roots, which had penetrated the polybag, were lost at the time of extraction of plants from the trench. This shock due to the sudden loss of a considerable portion of the root system was identified as the reason for the remaining three casualties observed in the field.

Root system of a hardened root trainer plant was found to consist of a single, branched taproot and an average of 18.09 lateral roots, properly oriented within the container. Coiling of taproot was observed in none of the 300 plants. The root plug, formed on touching the rigid container, resumed growth within 36 hours after transplanting to the soil. This quick growth of the root system is very important because the ability of the root system to promptly regenerate new roots (root growth potential) is directly related to the initial establishment and subsequent growth of a young plant. In

Table 2. **Growth parameters recorded one year after field planting**

	Root trainer	Polybag plant
Mean height (cm)	259.5 ± 9.7	244.8 ± 11.26
Mean girth* (cm)	6.43 ± 0.84	6.11 ± 1.12

*at a height of 125 cm

the present study all the 300 transplants established successfully in the field.

The growth parameters of root trainer and polybag plants recorded one year after transplanting to the field are presented in Table 2. The initial lower values of height and diameter of root trainer plants were made up in a few months in the field and they showed an edge in growth rate over polybag plants within one year after transplanting. There are several reports indicating better survival and growth rate of plants grown in root trainer than in polybag plants for other plants (Khedkar and Subramanian, 1997). Due to the well-developed root system root trainer derived plants were also reported to survive prolonged drought better than polybag plants.

Cost of a nursery plant is mainly decided by the labour charges and the expenditure incurred towards the initial planting material, container, potting medium, fertilizer, insecticides and fungicides. A root trainer required approximately 360 g of coir pith as against 10 to12 kg of topsoil required for filling the polybag. The cost of the potting medium was less for root trainers and the labour required for filling and stacking also could be reduced significantly. In the root trainers the use of water, fertilizer and pesticides are more efficient than in polybags. As root trainers can be reused for several years the investment towards the cost of the container is low. The plants raised in root trainer are thus economical also. Wilson (1986) has estimated that advanced planting materials of teak could be raised in root

Table 3. **Cost of transportation, distribution and field planting (for 1000 plants).**

Item	Labour (man days)		Cost (Rs)	
	Polybag	Root trainer	Polybag	Root trainer
Extraction of plants from trench, transport to vehicle and stacking	8	2	636.80	159.20
Unloading, distribution and field planting	24	8	1910.40	636.80
Charges for vehicle	-	-	952.00	200.00
Total	32	10	3499.20	966.00
Cost per plant	-	-	3.50	1.00

trainers at six-times cheaper rates than polybag plants.

The low cost of transportation, distribution and out planting are the most attractive aspects of root trainer planting technique. Due to the compact size and light weight upto 75% of the cost of transportation and distribution could be saved by using root trainers compared to polybags. For field planting a hole can be made in the refilled pit by pressing the empty root trainer container itself. The root plug separated from the container is inserted into this hole and the soil from the sides are pressed towards the root plug. The entire process of field planting is so simple and easy that a worker can easily plant up to three times the number of plants compared to polybag planting. A rough estimate of the cost required for transportation, distribution and field planting of 1000 nos. each of root trainer and polybag plants are furnished in Table 3. The overall savings in the cost of production of advanced planting materials, transportation and planting are of special significance in reducing the cost of production.

Due to various limitations of polybag plants the root trainer nursery technique is being widely used for other plants in developed countries. However, the container, potting medium and cultural operations are different for each species. Because of the clonal propagation and various other aspects specific to the crop, root trainer planting technique had to be standardized for *Hevea*. In the present study size and shape of the container, potting medium, cultural operations, method of transplanting etc. were standardized taking into consideration the situations prevailing in India. However, further refinement of cultural operations based on practical experience and modifications based on the local situations are required to derive the maximum advantages out of this modern planting technique.

REFERENCES

Khedkar, M.H. and Subramanian, K., (1997). Trials on raising treak (*Tectona grandis*) planting stock in root trainers. The Indian Forester, **123** (2): 95-99.

Soman, T.A., and Saraswathyamma, C.K., (1999). Root trainer nursery for *Hevea*. *Indian Journal of Natural Rubber Research*, **12**(1 & 2): 17-22

Wilson, P.J. (1986). Containers for tree nurseries in developing countries. *Commonwealth Forestry Review*, **65**(3): 233-240. ■