Indian Journal of Natural Rubber Research, 12(1&2) : 17-22, 1999

ROOT TRAINER NURSERY FOR *HEVEA*

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

The first ever attempt to raise advanced planting materials of *Hevea* in root trainers is described. Root trainers were found to be helpful to avoid coiling and spiralling of roots which can sometimes become serious defects of polybag plants currently used as planting material. Aerial pruning of roots was found to induce prolific emergence of biologically desirable lateral roots. Three month old plants raised in root trainers showed better growth than those raised in polybags. The advantages of plants raised in root trainers over polybag plants are described.

Key words : *Hevea*, Nursery, Polybag plants, Root development, Root trainer

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INTRODUCTION

To raise plantations, budded stumps of *Hevea* are grown in polythene bags and transplanted to the field at 2-3 whorl stage. Facility for the selection of vigorous plants of uniform growth and lesser casualty on outplanting are the major advantages of advanced planting material raised in polybags leading to reduction in the immaturity period of *Hevea*.

However, polybag plants have a few defects also, coiling and spiralling of roots being the most important among them. Coiled and spiralled growth of roots results in root strangling, slow growth, poor drought tolerance and lack of windfastness on field planting (Wilson, 1986; Sharma, 1987; Josiah and Jones, 1992). Also, the roots often penetrate the polybag and grow into the soil below. These roots break off when the plants are extracted from the nursery trenches. This sudden loss of a considerable portion of the root system imparts severe shock to the young plants causing considerable delay in their recovery and growth on transplanting and may reduce the initial survival rate. Polybag planting technique is labour intensive and handling of the heavy polybags in the nursery and while planting in the field are difficult. Use of root trainer containers aim at overcoming the above mentioned handicaps of polybag plants. A brief account of a trial conducted on raising advanced planting materials of *Hevea brasiliensis* in root trainers is given in this communication.

MATERIALS AND METHODS

The root trainers used in the study were 26 cm long and had a volume of 600 cc. These rigid containers, made of polypropylene had a diameter of 7.5 cm at the top and tapered downwards ending in a hole of diameter 1.5 cm. The inside

Fig.1. Three month old plant in polybag

Fig.2. Three month old plant in root trainer

wall was provided with eight vertical ridges which end near the hole at the bottom. The potting medium consisted of sieved coir pith and cowdung in the 1:1 ratio. Basal doses of neem cake (500 g), phorate 10G (10 g), mancozeb 75 WP (10 g) and superphosphate (250 g) were also added per $0.028m^3$ of potting medium. Uniformly mixed potting mixture was filled in the root trainers and kept upright above the ground using carriers made of bamboo splints. Green budded stumps of RRII 105 were planted in root trainers (50 nos). The polybags for planting control plants were filled with top soil. Care was taken to plant budded stumps of identical size and similar pattern of primary and secondary root system in both the containers. Watering was done twice daily and manuring with 10:10:4:1.5 NPKMg 2 per cent solution at biweekly intervals. A proprietary micronutrient preparation containing Zn (5.5%), Fe (1.0%), Cu (0.15%), Bo (0.50%) and Mo (0.01%) was sprayed at a dilution of 2.5 ml per litre water. The spraying was done at weekly intervals from the leaf maturation in the first whorl. One litre of spray fluid was sufficient to cover nearly 100 plants. The root trainers were given a gentle tap on the sides to facilitate easy extraction of the plant at the time of planting.

In another set of experiments, germinated seeds were subjected to a preliminary culling and the selected seedlings were planted in root trainers. These stock seedlings were subjected to early budding at 2-3 whorls stage and the successful bud grafts were cut back while in the container itself. The scion was allowed to develop in root trainers till it attained the desired growth.

RESULTS AND DISCUSSION

The budded stumps sprouted 7 to 20 days after planting both in root trainers and in polybags. Time taken for maturation of the first whorl of leaves was also more or less similar (5 to 7 weeks) in both the containers. The growth measurement of plants raised in root trainers and polybags, three months after planting, is shown in Table 1.

Quality of an advanced planting material is decided by two components, genetic constitution and physical quality. In order to improve physical quality, root trainer containers have been in use in many countries from 1970. In other countries like India, advanced planting materials are produced in polybags mainly because it is easily available and the polybag nursery technique is popular (Josiah and Jones, 1992). In *Hevea*, the tap root reaches the bottom of the polybag 6 to 7 weeks after planting and it starts coiling thereafter. Such coiling severely hampers further growth of the primary root system. Planting of seedlings with coiled roots is a waste of resources as such plants do not grow into normal trees (Sharma, 1987; Shankar, 1994).

A defective growth of shoot can be corrected at any stage in the nursery and even after outplanting. An improper structural development of the root system, on the other hand, can never be corrected at a later stage. The structure and shape of root trainer containers, therefore, are carefully designed to ensure proper growth and orientation of the root system. The specific features like the tapering shape, vertical ridges in the container wall and the drainage hole at the bottom are all incorporated with the purpose of properly training the structural development of roots at nursery stage and hence the container is termed as root trainer. In root trainer nursery system, height and girth of shoot are given lesser importance because a properly developed root system will ensure better shoot growth on transplanting to the field. In root trainers the tap root was found to grow downwards. The root growth is limited temporarily near the hole at the bottom. This aerial pruning helps to avoid coiling of tap root by limiting its growth within the container.

The poorly aerated top soil used for filling polybags in the nursery, is not favourable for the proper development of lateral roots (Josiah and Jones, 1992; Khedkar and Subramanian, 1995). Poorly developed lateral roots affect the binding force of the soil core which will cause root damage during transport and field planting. The initial survival rate and subsequent growth of a transplanted young plant are directly correlated with the growth and development of lateral roots (Mexal and Burton, 1978; Landis *et al.*, 1990). A comparative study on the root system of plants raised in polybags and root trainers have shown marked difference in the number of lateral roots (Table 1) and their structural development. A representative sample each of the root

Table 1. Growth parameters of three month old plants (RRII 105) grown in root trainers and polybags

Type of Container	Percentage of stumps sprouted	Mean height (cm)	Mean girth (mm)	Mean number of lateral roots
Root trainer	85.6	22.87 ± 3.61	17.0 ± 2.8	21.7 ± 9.26
Polybag	82.4	23.14 ± 3.31	18.1 ± 3.3	4.16 ± 2.19

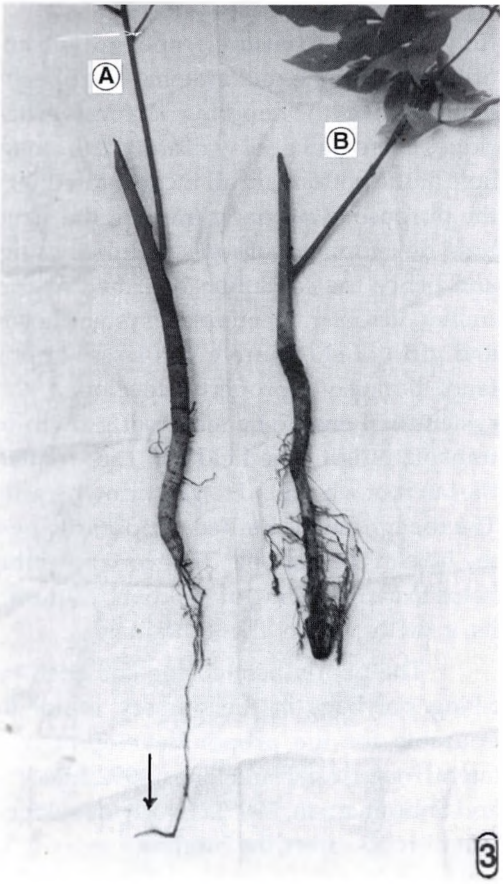

Fig.3. Root system of 10 week old plants of RRII 105. (a) Polybag plant (Note the initiation of coiling of tap root); (b) Root trainer derived plant

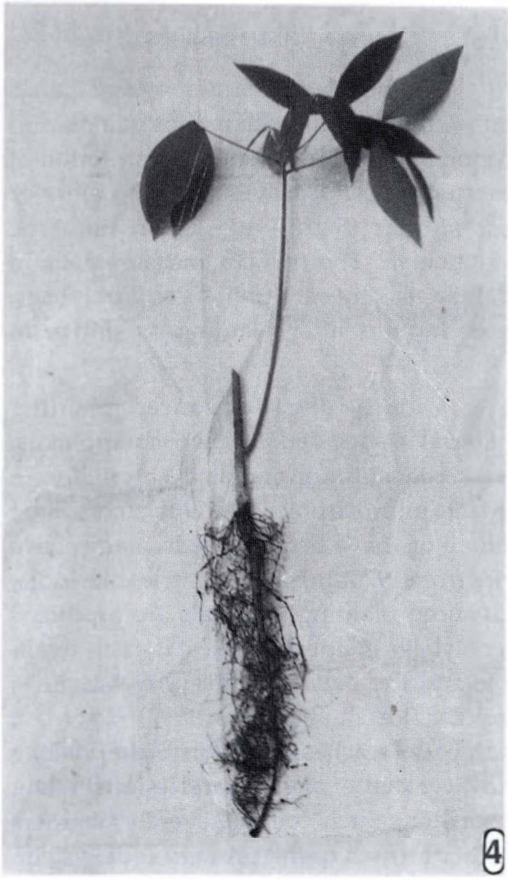

Fig.4. A plant with well developed root system produced by planting germinated seed direct in root trainer, budgrafted and the scion allowed to develop, six weeks after cut back

system of polybag and root trainer derived plants, 10 weeks after planting, are presented in Fig. 3. The vertical ridges on the inside of container wall directs the lateral roots downwards and thus helps to avoid circular growth within the container. Subsequently, these lateral roots are also subjected to aerial pruning near the hole at the bottom. As a result, at the time of field planting, the root system of the root trainer derived plants was found to consist of a central tap root and a large number of small and properly oriented lateral roots (Figs. 5 and 6), in sharp contrast to coiled tap root and circularly grown lateral roots in polybags. The well oriented root system of the root trainer plants will grow to a biologically desirable natural form right from planting to maturity (Josiah and Jones, 1992).

High quality planting materials could be produced in half the time required for the conventional method of polybag nursery. The well developed root system was found to possess excellent physical qualities also (Fig. 4).

There are several reports clearly indicating better survival and growth rate of other trees after transplanting of plants

Fig.5. Soil core of a root trainer plant, six months after planting

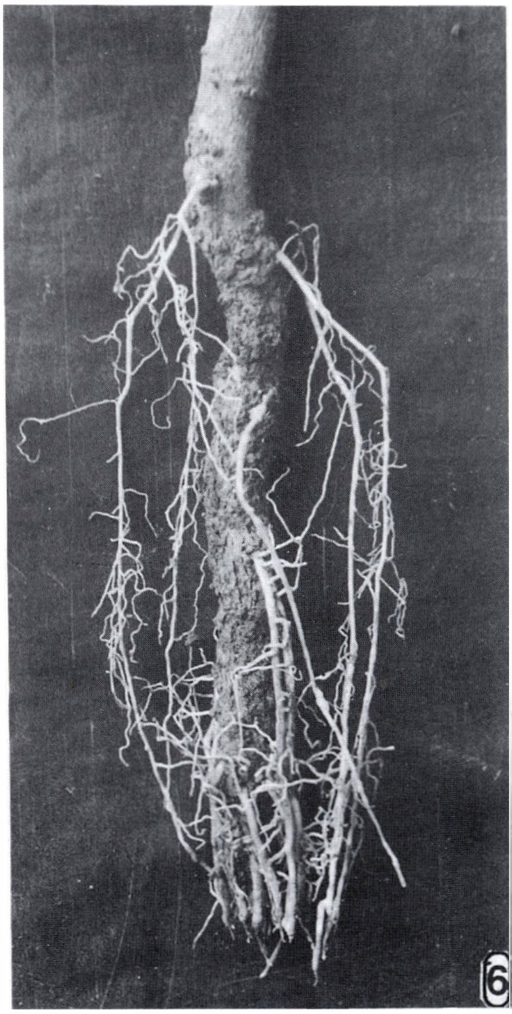

Fig.6. Root system of a root trainer developed plant, six months after planting

generated in root trainers than in polybags (Wilson, 1986; Josiah and Jones, 1992; Subramanian and Jha, 1995; Khedkar and Subramanian, 1997). Richardson and Powell observed (Wilson, 1986) that roots of teak plants raised in root trainers have grown four times faster than those in polybag plants. A comparative study on the growth performance of plants raised in polybags and root trainers is yet to be made. However, preliminary observations have indicated that root trainer plants were quicker to resume growth in the field than polybag plants.

The major cost components of nursery plants are labour charges and the expenditure incurred towards the container, potting medium, fertilizers, pesticides, *etc.* Compared to polybags, root trainers are much smaller and hence the labour requirement in the nursery, for transport and field planting, is much less than polybag plants. Root trainers could be reused for several years and hence the initial investment towards the cost of containers could be realised in a few years. Root trainers require approximately five per cent of the quantity of potting medium used for filling polybags and water, fertilizer, pesticides *etc.* can be used more effectively than polybags. Suspension of root trainers above the ground simplifies weed and disease management. Considering the cost towards the container and planting materials as same, it was roughly estimated that the advanced planting materials of *Hevea* could be raised in root trainers at one third to one fourth the cost of production of polybag plants. It is estimated (Wilson, 1986) that root trainer plants of teak could be raised six times cheaper than polybag plants. Since they could be reused for several years, root trainers are more environment friendly than polybags.

Successful introduction of root trainers for *Hevea* requires changes in the nursery practices adopted for the conventional polybag nursery. It is a novel propagation technique having great potentials in improving the physical quality of root system as well as reducing the time and cost required for the production of advanced planting materials. However, more detailed studies are required before the root trainer nursery system is adopted for *Hevea* on a large scale.

ACKNOWLEDGEMENT

The authors are grateful to Dr. N. M. Mathew, Director, Rubber Research Institute of India, for providing necessary facilities for the study.

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