ELEPHANT DUNG: A PROMISING POTTING MEDIUM FOR ROOT TRAINER PLANTS OF *HEVEA BRASILIENSIS*

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Received: 22 July 2015 Accepted: 28 December 2015

Thomas, V. and George, S. (2016). Elephant dung: A promising potting medium for root trainer plants of *Hevea brasiliensis*. *Rubber Science*, **29**(1): 58-61.

Nursery practices in rubber have been revolutionalised with the recent introduction of root trainer plants grown in containers with soil-less media. After conditioning for 2-3 months, coir pith is used as potting medium in root trainer cups. Presence of high amount of phenolic compounds, lengthy pretreatment and less nutritive value are some of the limitations of coir pith as a potting medium. Partially dried elephant dung was tried as an alternative to coir pith, either alone or in combination with coir pith or soil to fill the root trainer cups. Brown budded stumps of *Hevea*, clone RRII 430 were used for planting. Bud sprouting, length and diameter of the shoot and number of leaf whorls were recorded periodically. Among the treatments, plants grown in elephant dung in combination with soil in equal proportion by volume showed superiority in early bud sprouting, shoot length, diameter and number of leaf whorls. Shoot length, diameter and number of leaf whorls were higher for elephant dung + soil followed by elephant dung + soil + coir pith media which were comparable to coir pith alone or a mixture of coir pith and soil (1:1). The study indicated that elephant dung can be utilized as a medium for root trainer plants in rubber nurseries as an alternative to coir pith or in combination with coir pith.

Keywords: Bio-waste utilization, Elephant dung, *Hevea brasiliensis*, Potting medium, Root trainer plants

Root trainer plants of rubber in soil-less media has revolutionalised the plantation industry in India, and its adoption has been initiated in other rubber growing countries. Soman and Saraswathyamma (1999) have identified treated coir pith as the suitable potting medium for root trainer (RT) plants of rubber. The wide popularity of RT plants is due to certain unique advantages of this technique over polybag plants *viz.*, well established root system without tap root coiling, easy transportation and handling, better and early establishment and uniformity in growth (Soman *et al.*, 2002; Gireesh *et al.*, 2012; Thomas *et al.*, 2013). Even though coir pith is considered as a good potting medium, it has certain limitations *viz.*, pretreatment by soaking in water for a period of one to two months for removing the phenolic contents that are deterrent for proper root growth and non availability in non traditional rubber growing regions of India particularly in north-eastern states and North Konkan regions.

Elephant dung, as an underutilized bio-waste is currently posing a burden to the owners of domesticated elephants. In Kerala nearly five hundred domesticated elephants

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are available and are distributed primarily in various Devaswom Boards of Kerala and with private parties. An elephant consumes on an average 200 kg day^{-1} fibrous food material comprising of palm and coconut leaves, stem of plantain and grass. About three-fourth of the food consumed will come out as dung per day. It is disposed either by putting in fire or dumping in an isolated area which is a costly affair and poses environmental issues. A pilot study to utilize elephant dung as an alternate potting medium to coir pith for root trainer plants of rubber was undertaken and the results are discussed.

The experiment was taken up as nursery study and carried out in Rubber Research Institute of India during 2013-14. Elephant dung alone and in combination with pretreated coir pith and top soil were used as potting medium for root trainer plants of rubber (Table 1) and the experiment was arranged in completely randomized design with fifty plants for each treatment. Fresh elephant dung collected during summer period was kept under shade for two to three days, raked and the fibrous material together with the dry slurry was used for filling the root trainer cups. Coir pith used for the study was kept immersed in water for about two months to remove the excess phenolic contents. Potting medium of root trainer plants was prepared as per recommendations (Soman *et al.*, 2008; Thomas and Soman, 2013) and filled in 800 cc root trainer cups.

Table 1. **Potting media used in root trainer cups**

Treatment	Potting medium
T1	Elephant dung (ED)
T2	ED + Soil (1:1)*
T3	ED + Soil + CP (1:1:1)*
T4	Coir pith (CP)
T5	CP + Soil (1:1)*
T6	ED+CP (1:1)*

* by volume

Fifty numbers of brown budded stumps of clone RRII 430 were used as planting material for each treatment. After planting, the root trainer cups were kept on metallic stands under shade net for sprouting with the bottom of the cups covered with soil for facilitating plant growth. Along with the cup the plants with one mature leaf whorl were pulled out from the soil and suspended on metallic stands under shade net for hardening process for a period of three weeks. Watering was carried out on daily basis.

Nutrient content of elephant dung and coir pith (Piper, 1966) and soil (Jackson, 1973) were assessed. Prophylactic measures against termite attack were and fungial diseases were taken as per the recommendations of the Rubber Board. Bud sprouting success (%) was recorded at 15, 20 and 30 days after planting. Similarly, shoot length, diameter and number of leaf whorls were recorded at 90 days of growth and the data were subjected to statistical analysis using Duncan's Multiple Range Test (Gomez and Gomez, 1976).

Sprouting success of brown budded stumps in different treatments was recorded at 15, 20 and 30 days after planting (Table 2). It is evident that the highest sprouting success (%) was noticed in elephant dung + soil for all the recordings (26 to 54) followed by elephant dung (8 to 42), elephant dung + soil + coir pith (16 to 38) and coir pith(14 to 38). The least sprouting success was observed for coir pith + soil (6 to 18). In general, elephant dung as such or in combination with other medium showed better sprouting success throughout the period under observation. Among the treatments, the combination of elephant

Table 2. **Periodic bud sprouting in root trainer cups**

Treatment	Bud sprouting (%) (Days after planting)		
	15	20	30
ED	8	30	42
ED + Soil	26	38	54
ED + Soil + CP	16	30	38
CP	14	26	38
CP + Soil	6	12	18
ED+CP	4	18	26

dung and soil in equal proportion recorded early sprouting as well as the highest sprouting percentage through out which implies that potting medium might have some role in early bud sprouting.

Shoot length, diameter and number of leaf whorls of plants grown in different potting medium are given in Table 3. Shoot length (cm), diameter (mm) and number of whorls were significantly higher for elephant dung + soil (44.34; 6.8; 1.76) followed by elephant dung + soil + coir pith (38.13; 6.44; 1.52). Lowest values for shoot length and its diameter and number of whorls were registered by elephant dung alone (32.17; 5.77; 1.2).

Table 3. **Effect of potting media on shoot characteristics of root trainer plants**

Treatment	Shoot length (cm)	Diameter of shoot (mm)	No. of leaf whorls
ED	32.2 ^{b}	5.8 ^{c}	1.2 ^{c}
ED + Soil	44.4 ^{a}	6.8 ^{a}	1.8 ^{a}
ED + Soil + CP	38.1 ^{b}	6.4 ^{ab}	1.5 ^{ab}
CP	34.2 ^{b}	6.0 ^{bc}	1.5 ^{ab}
CP + Soil	33.0 ^{b}	6.0 ^{bc}	1.4 ^{bc}
ED + CP	35.4 ^{b}	5.9 ^{bc}	1.5 ^{b}

Means followed by a common letter are not significantly different at P< 0.05.

Chemical analysis of the potting media for nutrient status revealed that NPK content was high for elephant dung compared to coir pith (Table 4). Calcium and Mg content was high in for coir pith. The soil used was high in organic carbon (3.4%) and available P (31.3 $mgkg^{-1}$) and medium in available K (68.05 $mgkg^{-1}$). High amount of fibre together with nutrients in the elephant dung contributed positively for the growth of plants.

In the present study potting mixture containing elephant dung as one of the component gave better result than individual ones. Nazari *et al.* (2011) and Tariq *et al.* (2012) observed that a combination potting medium of sand and coco peat have the highest water use efficiency and better plant growth compared to single medium in ornamental plants. Dole and Wilkins (2005) opined that to balance the low bulk density of many soil-less mixes a component with high bulk density is needed.

The potting media selected for container grown plants should have good water holding capacity and proper drainage, less phenolic content, high nutrient status, good aeration *etc.* Substrates such as peat moss, bark, perlite, styrofoam, vermiculite, sand, rock wool, or natural field soil are utilized generally in the production of containerized crops (Bunt, 1988). High amount of cellulose fibre, better NPK status, good aeration, less tannin content and direct use without preconditioning are the major advantages that could be attributed to

Table 4. **Nutrient composition of elephant dung and coir pith**

Medium	Nutrient contents (%)				
	N	P	K	Ca	Mg
ED	0.93	0.16	0.84	0.40	0.09
CP	0.30	0.09	0.50	1.53	0.30

elephant dung as potting medium for RT plants. One ball of elephant dung together with soil is enough to fill 2 to 3 RT cups. Being treated currently as a waste material, a system for continuous collection of the elephant dung has to be ensured for utilization in rubber nursery sector.

Potting medium has a major role in root establishment and plant growth. It is evident from the present study that the elephant dung can be used as potting medium in combination with soil and growth attributes of rubber plants grown in this medium are superior or comparable to the rest of the potting medium including coir pith. In the combination, properties of both the medium were augmented. The new finding has the dual advantages of effective utilization of a bio-waste and thereby saving the cost involved in its disposal. The technique has immense scope for raising RT rubber planting materials where coir pith is not available.

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