



## Effect of root pruning and size of poly bag on the growth and vigour of coffee seedlings

M.M. Venkatesha, S. Kamala Bai and C. Babou\*

Division of Agronomy, Central Coffee Research Institute, Coffee Research Station Post -577 117, Chikmagalur District, Karnataka, India

(Manuscript Received: 21-06-13, Revised: 19-10-13, Accepted: 04-11-13)

**Keywords:** Coffee seedlings, root pruning, poly bag, transplanting

Coffee being a perennial crop, it is very important to plant healthy and vigorous seedlings in the main field at the time of establishment of new plantations. Production of vigorous seedlings is the first step in achieving higher production and productivity (Srinivas Reddy *et al.*, 2001). Based on the past studies, the nursery practices in coffee have been standardized many years ago which include raising of seedlings in 22.5 x 15 cm size poly bags up to six months in nursery, before transplanting in the main field. However, in recent years due to erratic rainfall pattern, aberrant weather condition, soil situation and practice of nipping of tap root at the time of transplanting into poly bags may hinder the normal growth of root system and thereby making the seedlings vulnerable to long dry spells after transplanting (Srinivas Reddy *et al.*, 2001; Salakinkop *et al.*, 2010). In view of the above, the management steps in a rising coffee seedlings in the nursery to produce healthy and vigorous seedlings for transplanting was analysed.

A nursery trial was conducted for a period of two years (2008 and 2009) at Central Coffee Research Institute, Chikmagalur, Karnataka to study the growth and vigor of seedlings in nursery when grown in different poly bag size and to observe the performance of the seedlings with and without nipping tap root at the time of transplanting. The study may also lead to evaluate the vigor and performance of the seedlings.

The experiment was laid out at Central Coffee Research Institute, Chikmagalur in randomized

complete block design with four treatments in five replication. The treatments include were with ( $T_1$ ) and without ( $T_2$ ) nipping of tap root, grown in 22.5 cm x 15 cm poly bags. Plants with ( $T_3$ ) and without ( $T_4$ ) nipping of the tap root grown in 30 x 12.5 cm poly bag were another set of treatments. Nipping of tap root 0.5 cm was imposed as per the recommendation at the time of transplanting coffee seedlings from germination bed (tope stage) to poly bags. Subsequently, after imposing the nipping treatments, seedlings were transplanted to different poly bag size of 22.5 x 15 cm and 30 x 12.5 cm as per the treatment. The trial was carried out on two important varieties of *Arabica* coffee viz., Chandragiri and Selection 5B and a variety of *Robusta*, C x R.

Nursery was maintained under shade net as per the recommendations of Coffee Guide (Anonymous, 2000) and observation on stem girth (mm), tap root length (cm), root volume (cc), and total dry weight ( $\text{g plant}^{-1}$ ) were recorded at 90 and 180 days after transplanting in to poly bags in all three varieties. Girth of main stem was measured with the calipers at 15 cm above the ground level from the five randomly selected plants. Five plants were taken for estimation of dry matter production, where each plant along with the poly bag soil was taken. All the plant parts were oven dried at  $65 \pm 5^\circ\text{C}$  to constant weight. The dry weights of stem, leaf and roots were recorded separately at 90 and 180 days after transplanting. The total dry matter was

\*Corresponding Author: kcbabou@gmail.com

**Table 1.** Effect of root pruning and size of nursery bag on the growth and vigour of coffee seedlings at 90 days after transplanting in different varieties (Pooled data of 2 years)

Treatments/ Varieties	Stem girth (mm)	Tap root length (cm)	Root volume (cc)	Total dry weight (g)
<b>Chandragiri</b>				
T <sub>1</sub>	2.4	16.7	0.560	0.459
T <sub>2</sub>	2.4	18.0	0.656	0.640
T <sub>3</sub>	2.3	21.9	0.722	0.655
T <sub>4</sub>	2.4	24.7	0.840	0.769
S Em±	0.1	1.5	0.039	0.032
CD @ 5%	NS	4.6	0.119	0.099
<b>Sln 5b</b>				
T <sub>1</sub>	2.4	14.5	0.440	0.48
T <sub>2</sub>	2.4	16.6	0.380	0.51
T <sub>3</sub>	2.4	22.7	0.560	0.72
T <sub>4</sub>	2.4	23.7	0.680	0.80
S Em±	0.1	1.2	0.042	0.01
CD @ 5%	NS	3.7	0.130	0.05
<b>C X R</b>				
T <sub>1</sub>	2.5	15.5	0.740	0.79
T <sub>2</sub>	2.6	16.7	0.900	0.90
T <sub>3</sub>	2.4	21.6	0.950	0.56
T <sub>4</sub>	2.7	23.6	1.090	0.62
S Em±	0.1	1.0	0.045	0.03
CD @ 5%	NS	3.0	0.140	0.08

**Table 2.** Effect of root pruning and size of nursery bag on the growth and vigour of coffee seedlings at 180 days after transplanting in different varieties (Pooled data of 2 years)

Treatments/ Varieties	Stem girth (mm)	Tap root length (cm)	Root volume (cc)	Total dry weight (g)
<b>Chandragiri</b>				
T <sub>1</sub>	3.8	14.7	2.00	5.34
T <sub>2</sub>	4.0	17.5	2.62	5.14
T <sub>3</sub>	4.6	20.8	3.12	6.51
T <sub>4</sub>	4.6	27.0	3.74	6.37
S Em±	0.2	0.9	0.17	0.25
CD @ 5%	0.7	2.6	0.53	0.76
<b>Sln 5b</b>				
T <sub>1</sub>	3.3	13.2	1.84	4.63
T <sub>2</sub>	3.2	17.0	2.26	5.03
T <sub>3</sub>	3.8	21.5	2.50	5.59
T <sub>4</sub>	4.1	24.0	3.04	5.77
S Em±	0.2	1.3	0.17	0.35
CD @ 5%	0.5	4.2	0.53	NS
<b>C X R</b>				
T <sub>1</sub>	3.8	17.7	2.70	6.06
T <sub>2</sub>	4.2	18.7	2.88	6.58
T <sub>3</sub>	4.5	24.0	3.94	5.48
T <sub>4</sub>	5.1	26.9	4.32	5.97
S Em±	0.2	0.8	0.11	0.32
CD @ 5%	0.5	2.6	0.34	NS

T<sub>1</sub>: With nipping in 22.5 cm x 15 cm polybag, T<sub>2</sub>: Without nipping in 22.5 cm x 15 cm polybag, T<sub>3</sub>: With nipping in 30 cm x 12.5 cm polybag, T<sub>4</sub>: Without nipping in 30 cm x 12.5 cm polybag

calculated by adding all the dry weight of plant tissue parts namely, stem, leaf and root and expressed in gram per plant. Root volume was determined by displacement method. Roots were immersed in a container full of water and the volume of displaced water was measured and expressed in centimeter cube. The data was analyzed using standard statistical method (Sundararaj *et al.*, 1972).

Pooled data for two years (2008 and 2009) showed that mean tap root length, root volume, and total dry weight recorded significant differences at 90 days after transplanting. However, stem girth did not vary significantly in all the three varieties. Among the three varieties, Chandragiri variety responded better to the treatments at the early stage (90 days after transplanting) compared to other two varieties (Table 1).

Tap root length, root volume and dry weight was found significantly high in T<sub>3</sub> and T<sub>4</sub> treatment where bigger size of the poly bag was used, implying the survival and further growth of plants at later stage. However, irrespective of the nipping, plant responded well to the different size of the poly bags. The results are in corroboration with the findings of Srinivas Reddy *et al.* (2001) and Salakinkop *et al.* (2010).

Mean data on the growth parameters at 180 days after transplanting on stem girth, tap root length, root volume and root dry weight recorded varied significantly for all the three varieties (Table 2). Stem girth recorded at 180 days after transplanting was superior in treatments where bigger poly bags (30 cm x 12.5 cm) was used in comparison with smaller poly bags (22.5 cm x 15 cm). The availability of

space, nutrients as well as growth media could have played an important role in vigorous growth of seedlings, further, bigger poly bags can retain more amount of moisture for longer time which resulted in better growth of seedlings than normally recommended poly bags. This study is in line with the findings of Salankinkop *et al.* (2010).

Seedlings grown in treatments  $T_3$  and  $T_4$  of bigger poly bag size recorded highest tap root length and root volume at 180 days after transplanting in all the three varieties viz., Chandagiri, Selection 5B and C x R. This is mainly due to availability of more space and nutrients compared to  $T_2$  and  $T_1$  treatments. This results corroborates with the studies of Xuaguifang and Jiangpeikan (2002) that longer primary root helps to absorb more water and nutrients which helps in producing healthy and vigorous seedlings.

At 180 days after transplanting all the three varieties, Chandagiri, Selection 5B and C x R recorded good growth and responded significantly when grown in bigger poly bag compared to normal poly bag size irrespective of the nipping treatments, implying the least influence on the nipping treatment at the time of transplanting (Salankinkop *et al.*, 2010).

The above study indicated that, in all the three varieties the growth parameters and dry matter per plant did not differ significantly among the treatments at 90 days after transplanting in the nursery. However, at 180 days after transplanting when the seedlings were ready for field planting, all the three varieties recorded significantly higher growth in big sized poly bags of 30 cm x 12.5 cm when compared to normally recommended standard size poly bags irrespective of whether the tap root is nipped or not at the time of transplanting. Hence,

it can be concluded that nipping of roots at the time of transplanting does not have any influence on the growth of coffee seedlings. However, size of poly bags used for transplanting have significant effect and known to influence the growth of seedlings, which further helps to produce vigorous and healthy coffee seedlings in nursery.

## Acknowledgment

The authors gratefully acknowledge the help of the Director of Research, Coffee Board of India for the facilities and critical comments. Senior author sincerely thank Dr. Y. Raghuramulu, Joint Director of Research, Coffee Board of India for his encouragements and valuable suggestions during research period.

## References

- Anonymous. 2000. Coffee Guide, Central Coffee Research Institute, Coffee Research Station, Chikmagalur district, Karnataka, India.
- Salakinkop, S.R., Shivaprasad, P., Biradar., I.B, D'Souza, M.V., Raghuramulu, Y. and Jayarama. 2010. Influence of volume of growth media and dimension of nursery bags on vigour of coffee seedlings and their performance in the field. *Journal of Plantation Crops* **38**(1): 47-52.
- Srinivas Reddy, D.V., Naresh Kumar, S. and Prabhu, S.R. 2001. Evaluation of alternative media to potting mixture for raising coconut seedlings in poly bags. *Journal of Plantation Crops* **29**(1): 62-65.
- Sundararaj, N., Nagaraju, S., Vengataramu, M.N. and Jagannath, M.K. 1972. Design and analysis of field experiments, Misc. series No. 22, University of Agricultural Science, Bangalore.
- Xuaguifang and Jiangpeikan. 2002. Study on biological properties of root region soil under different ages of *Phyllostachys pubescens* plantation. *Indian Forestry* **128**: 533-537.

