EFFECT OF POLYBAG SIZE ON INITIAL GROWTH OF *ACACIA AURICULIFORMIS* AND *CHIKRASSIA TABULARIS* SEEDLINGS IN THE NURSERY

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ABSTRACT

An experiment was established at the Institute of Forestry Campus in order to standardize an optimum container size for raising quality seedlings of *Acacia auriculiformis* and *Chickrassia tabularis*. Five different sizes of polybags were tried for three months time in the nursery. The parameters of seedlings like total height, collar diameter, root length, root diameter, dry weight of root and shoot etc. were measured at the end of the experiment. The finding showed that the polybags of T4 treatment (30.5×15cm size) produced quality seedlings of both the species within three months time and the size may be used in quality seedling production purposes for a short time. But, for large scale plantations, the polybags of T2 treatment (23×15cm size) is the optimal size for raising quality seedlings of *Acacia auriculiformis* and the polybags of (30.5×15cm size) is optimal size for *Chickrassia tabularis*.

INTRODUCTION

The tree planting programme is gaining momentum throughout the country and the demand of quality seedlings of different forest tree species is increasing day by day. The Forest Department started plantations since 1871 (Anon, 1993) and initially seedlings were raised either by seed broadcasting or by bare-rooted seedlings in the nursery beds. However, later on the polybags are getting preferences over nursery beds for seedling raising programmes, since the polybag seedlings provide tall, healthy and uniform seedlings in the nursery (Matin and Banik, 1993). Different sized polybags are available in the market but it needs to standardize an optimal size for quality seedling of some important afforestation/reforestation species. With a view to find out a standardized polybag size, an experiment was carried out in the nursery of Institute of Forestry, University of Chittagong and the paper describes the findings of the experiment.

MATERIALS AND METHODS

Five different size of polythene bags were used in the study and the traditional 15×10cm size polybag was considered as the control one. The following treatments and sizes of polybags were used in the experiment.

T_0 = 15×10 cm size = 6×4 inch
T_1 = 20×10 cm size = 8×4 inch
T_2 = 23×15 cm size = 9×6 inch
T_3 = 30.5×10 cm size = 12×4 inch
T_4 = 30.5×10 cm size = 12×6 inch

All the polybags used were of 0.06 mm and the colour of the polybags were white, transparent. The study was conducted for raising the seedlings of *Acacia auriculiformis* and *Chickrassia tabularis*.

The seeds were collected from the Silvicultural Research Division of Bangladesh Forest Forest Research Institute (BFRI). The potting media were forest top soil and cowdung in a ratio of 3:1. The randomized block design with 3 replications and 30 plants for each treatment were used in the study.

As the seed coat of *Acacia auriculiformis* species is hard, the seeds were treated with the standard procedures of hot water treatment (Das, 1986) and the next day, (that was at the end of 24 hours) seeds were sown directly in the polybags. The seeds of *Chickrassia tabularis* were sown in the seed germinating trays and then the uniform young seedlings were transferred into different sized polybags. The pricked out seedlings were kept under a moist cover for a short time and then the bags were placed in the nursery and were watered as required.

Observation on height growth of the seedlings were recorded at periodical intervals. At the end of 14 weeks time, the final data of the seedlings were recorded for height and diameter growth and oven dry weight of root and shoot to compare the performance and they quality of seedlings in different size polybags.

Finally, the quality index (QI) of the seedlings were calculated by using the formula of Dickson *et al* (1960).

$$QI = \left[\frac{Seedlings\ dry\ weight\ (g)}{\left\{\frac{Height\ (cm)}{Diameter\ (mm)}\right\} + \left\{\frac{Shoot\ dry\ weight\ (g)}{Root\ dry\ weight\ (g)}\right\}} \right]$$

RESULT AND DISCUSSION

The height growth of *Acacia auriculiformis* seedlings recorded at one week interval up to 10th week and at two weeks interval up to the 14th week is shown in Table 1. The seedlings of the 30.5×15 cm size (T4) attained significantly higher height growth in comparison to all other treatments. The height growth among the treatments T3, T2 and T1 are not signifciantly different (Table 1), but T0 has significantly lowest height growth.

Representative seedlings of each treatment were harvested and the mean shoot height, collar diameter and oven dry shoot weight of the seedlings are shown in Table 2. In all the cases, T4 attained the highest growth and T0 the lowest. The collar diameter shows that the seedlings grown in polybags of T4 size has significantly higher diameter growth than all other treatments. Though there are some variations among the treatments T3, T2, T1 but these are not significantly different. The mean root length, root diameter and root oven dry weight are also presented in Table 2. In all cases, treatment T4 shows higher root development followed by T2 treatment. However, in all cases T0 shows the poor growth performance.

Treatment T0, the widely used polybag shows significantly higher root/shoot ratio than all other treatments (Table 2). The analysis also shows that the differences in root/shoot ratio among T1, T2 and T3 are not signifciant. It also indicates that the amount of shoot growth was more than root growth in the T4 treatment. However, in considering the quality index, treatment T4 offerred the highest performance (2.92) than all other treatments (Table 2).

The height growth of *Chickrassia tabularis* seedlings of all the treatments were recorded after one week of pricking out to up to 10th week and at two weeks interval up to 14th week and are presented in Table 3. The larger polybags (T4

treatment) attained significantly higher height growth in comparison to all other treatments (Table 3) and T0 treatment produces the lowest height growth.

Analysis of the different components of harvested seedlings in Table 4 shows that treatment T4 gave the best shoot height (60.99 cm) as compared to all other treatments, though there is no significant difference among T4, T3, T2 or between T3, T2 treatments. Though T1 treatment attained higher height growth in comparison to T0 treatment, but it is not significant.

Considering the collar diameter, T4 treatment has significantly higher diameter followed by T2, T3 and T1. To has significantly lower diameter in comparison to all other treatments (Table 4). Similarly, in case of shoot dry weight, seedlings grown in T4 resulted significantly highest shoot weight.

Root development was also found satisfactory in T4 as represented by highest root length, root diameter and root oven dry weight, in comparison to all other treatments. However, treatment T1 shows significantly higher root/shoot ratio but the difference between treatments T1 and T0 are not significant, and perhaps this is because of the bigger size polybags - shoot growth was higher than root growth, resulting in a lower root/shoot ratio. Considering the quality index, seedlings grown in T4 treatment shows highest seedling quality index (4.80) followed by T3, T1, T2 and T0 respecively (Table 4).

The total height and collar diameter growht of all the seedlings of both *Acacia auriculiformis* and *Chickrassia tabularis* are significantly affected by the size of polybag, i.e., by soil volume. In all cases, treatment T4 have the highest growth as compared to all other treatments. However, *Acacia auriculiformis* seedlings raised in polybags of T0 treatment (15×10cm size) showed the higher root/shoot ratio, and *Chickrassia tabularis* showed higher root/shoot ratio in the polybag sizes of 20×10cm size (T1 treatment).

The results agree with the findings of Matin and Banik (1993), where they find height and diameter growth of the seedlings of Silkoroi, chapalish, Gamar, Champa and Teak increased with the increase of polybag sizes. Similarly longer containers was shown to have significantly influenced the survival and height growth of *Pinus* spp. (Barnett, 1974). Increasing container volume, particularly container diameter increased planting stock size of conifer species (Carlson and Endeen, 1976; Hocking and Mitchell, 1975). Hafeez (1973) also reports similar findings for the seedlings of *Eucalyptus camaldulensis* and Bruzon and Serna (1980) for *Shorea polysperma*. Ghosh *et al* (1977) have tested polybags of different sizes for raising seedlings of *Pinus patula* and *P.caribaea* and found that differences in seedling growth was significant throughout. Singh *et al* (1985) also found similar findings.

This larger size (T4), may be selected as potential size for achieving maximum seedling growth capacity of both the fast and slow growing species and hence may be recommended to raise the quality seedlings in short time, specially in raising seedlings for early evaluations. But this bigger size is hardly recommended for large scale plantations due to it's higher cost involvement. The polybags of T2 (23×15cm) size also showed appreciably better performance for raising the seedlings of *Acacia auriculiformis*. For successful afforestation and reforestation programs and maximum survival of seedlings in the field, the bigger size polybags as well as the quality seedlings are necessary. So, after keeping cost factors in consideration, polybag of 23×15 cm size may be preferred for raising fast growing short rotation species.

For successful growth of long rotation slow growing species, i.e. *Chickrassia tabularis*, the polybags of T4 treatment (30.5×15cm size) may be recommended as the quality index of the seedlings are closely related to field performance ranking (Ritchie, 1984). However, the same trial may be extended for some other potential species and the field performance of the different seedlings will be evaluated before going to raise large scale seedlings.

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Table 1. Effect of different polybag size on height growth (cm) of *Acacia auriculiformis* seedlings

Treatment	Age in weeks time											
	1	2	3	4	5	6	7	8	9	10	12	14
T0	4.6	6.3	8.1	11.2	13.2	15.4	17.7	18.9	19.9	20.6	26.1	34.4d*
T1	6.4	7.2	10.8	14.7	16.6	20.3	24.4	24.5	27.7	30.1	35.5	59.9b
T2	6.3	7.9	10.7	15.1	17.6	23.4	27.1	29.9	31.2	40.2	47.7	55.2bc
T3	6.9	9.3	13.7	18.9	21.0	24.6	28.5	31.6	33.1	40.6	47.2	56.4bc
T4	6.3	8.5	12.8	20.8	26.2	32.8	39.8	44.6	51.7	58.4	71.9	83.1a

* Figure followed by the same letter(s) do not vary significantly at the 5% probability level, Duncan's Multiple Range Test (DMRT).

Table 2. Mean value of some characteristics of *Acacia auriculiformis* seedlings grown in different sized polybags.

Treatment	St ht (cm)	Cllr dia (cm)	St dry wt (gm)	Rt lng (cm)	Rt dia (cm)	Rt dry wt (gm)	Rt/St Ratio	Quality Index
T0	38.88c*	0.35c	2.39d	30.6cd	7.37d	0.8d	0.33a	0.78
T1	63.29b	0.55b	6.97c	34.67bcd	8.84cd	1.85c	0.26b	1.79
T2	83.74ab	0.62b	11.39b	41.45ab	10.78ab	2.53ab	0.22bcd	2.38
T3	80.18b	0.58b	8.14c	36.44bc	9.78bc	2.03bc	0.25bc	1.89
T4	92.30a	0.77a	16.86a	46.22a	12.06a	3.01a	0.18d	2.92

* Means within characteristics followed by the same letter(s) are not significantly different ($P < 0.05$), Duncan's Multiple Range Test (DMRT).

Table 3. Effect of different polybag size on height growth (cm) of *Chickrassia tabularis* seedlings

Treatment	Age in weeks time											
	1	2	3	4	5	6	7	8	9	10	12	14
T0	5.5	7.9	9.8	14.0	17.4	19.5	21.5	22.5	23.5	24.6	26.0	29.1d*
T1	4.9	7.7	10.4	13.8	18.3	21.5	24.4	26.2	27.8	29.0	31.4	34.4c
T2	5.5	7.5	9.8	14.2	17.9	21.0	24.6	26.7	29.2	33.5	39.6	47.9b
T3	6.0	7.3	10.5	15.6	19.3	22.1	26.6	29.2	31.0	35.9	41.8	49.4b
T4	5.3	7.5	9.8	15.0	19.2	23.4	29.8	34.0	37.3	43.3	53.4	62.0a

* Figure followed by the same letter(s) do not vary significantly at the 5% probability level, Duncan's Multiple Range Test (DMRT).

Table 4. Mean values of some characteristics of *Chickrassia tabularis* seedlings grown in different sized polybags

Treatment	St ht (cm)	Cllr dia (cm)	St dry wt (gm)	Rt lng (cm)	Rt dia (cm)	Rt dry wt (gm)	Rt/St Ratio	Quality Index
T0	30.91c*	0.53d	3.05e	17.72d	5.89d	1.11d	0.37ab	1.25
T1	38.47c	0.62c	4.52d	25.00c	6.50cd	1.91bc	0.43a	2.15
T2	53.78ab	0.72b	8.47b	23.59c	8.22b	2.03bc	0.24cd	2.13
T3	54.54ab	0.70b	6.76c	30.05b	7.30bc	2.12b	0.31bc	2.24
T4	60.99a	0.87a	14.69	36.22a	10.80a	4.47a	0.30bcd	4.80

*. Means within characteristics followed by the same letter(s)

are not significantly different ($P < 0.05$), Duncan's Multiple Range Test (DMRT).