Effect of container and potting media on raising quality seedlings of *Acacia auriculiformis* in the nursery

MD. ARIFUL ISLAM*, MD. RAYHANUR RAHMAN**, MOHAMMED KAMAL HOSSAIN***

*1Institute of Forestry and Environmental Sciences, University of Chittagong, Chittagong-4331, Bangladesh. Tel.: +880 1551807579.
**email: arifulcu2007@gmail.com; ***rayhanur.pavel@gmail.com; ***mkhossain2009@gmail.com


Abstract. Islam MDA, Rahman MDA, Hossain MK. 2019. Effect of container and potting media on raising quality seedlings of *Acacia auriculiformis* in the nursery. *Asian J Agric* 3: 26-32. The study elucidates the effect of container and potting media on raising quality seedlings of *Acacia auriculiformis* in the nursery of the Institute of Forestry and Environmental Sciences, University of Chittagong to find out a suitable container and potting media for raising large scale quality seedlings. The seedlings were evaluated by five container and seven potting media treatments for eight months. A Completely Randomized Block Design (CRBD) was adopted for the study with three replications for each treatment. The Analysis of variance (ANOVA) and Duncan’s Multiple Range Test (DMRT) was tested for the analysis to explore the possible treatment variations. However, the study reveals nodulation with growth parameters; shoot and root dry biomass production and quality index were highest in 20 cm × 15 cm size polybags whereas the highest root length and shoot-root ratio was observed in 15 cm × 10 cm and 15 cm × 13 cm size polybag respectively. Considering the potting media, highest nodulation, growth parameters, shoot and dry fresh weight, shoot- root ratio and biomass were found in combination of soil + cow dung + phosphorus (0.16 g/polybag). Highest root length, root fresh and dry weight, and quality index were found in the combination of soil + cow dung (3:1). Therefore, it is recommended that containers of 20 cm × 15 cm size polybag and with a potting media of soil + cow dung + phosphorus (3 parts soil, 1 parts cow dung + 0.16 g/polybag) combination produce quality *A. auriculiformis* seedlings in the nursery.

Keywords: Akashmoni, Bangladesh, quality index, nodulation, shoot- root ratio

INTRODUCTION

Demand for different land uses and continual deforestation are responsible for decreasing natural forestland. As a result, continuous supply of wood from natural forests is becoming very difficult for different purposes (Asif et al. 2017). Plantations of fast-growing species must be established as a compensation package for the declining supply from natural forests (Sharma et al. 2011).

Akashmoni (*Acacia auriculiformis* A. Cunn. ex Benth.) is an evergreen, exotic, heavily branched, forked bole species, mostly planted on roadsides and railway embankments, parks and gardens because of its ornamental and shade bearer values in Bangladesh (Das and Alam 2001; Hossain et al. 2009; Girijashankar 2011; Islam et al. 2013). It is a multipurpose tree species and considered as one of the most promising plantation species because of its ability to survive on a wide range of degraded environmental conditions (Alam et al. 1991; Das and Alam 2001; Jahan et al. 2008). Globally, on good soil condition the species can reach at a height up to 35 m (Orchard and Wilson 2001), where in consequences, transmission pole and post can be made from rounded timber (Sattar et al. 1999). Considering the growth, short rotation, non-palatability to grazing animals, nowadays, *A. auriculiformis* is also preferred for afforestation, reforestation, and agroforestry purposes in Bangladesh (Hossain et al. 1994; Uddin et al. 2007; Azad et al. 2011). Good quality durable heartwood of *Acacia* is suitable for attractive figure in furniture, door, window and can be used as other constructional purposes (Pinyopusarerk 1990). In addition, *Acacia* wood is ideal for fuelwood, charcoal making and it has also proved as a good pulpwood species (CABI 2013; Islam et al. 2013). To fulfill the high demand, many organizations are producing akashmoni seedlings in the nursery in Bangladesh to supply those in the plantation programs (Khan et al. 2014). However, the productivity of the plantations is not up to the mark where the main reason for lower productivity includes declining soil fertility and suppression of growth due to competing of seedlings especially in the nursery (Hulikatti and Madiwalar 2011).

Nursery establishment is the first and foremost obvious task in raising a successful plantation. Direct seeding results in wastage of improved seeds while planting in the nursery including losses and possible mortalities (Adu-Berko et al. 2011; Adu-Yeboah et al. 2015). In current forest nursery practices, container size of all dimensional feature like, volume, height, diameter and shape with different pre-sowing treatment are required to get a good germination, required and desired quantity of seedlings in the nursery (Annapurna et al. 2004; Farhadi et al. 2013; Mozumder et al. 2018).

A lot of studies have been conducted to determine enhanced germination, growth performance and survivability of seedlings using different pre-sowing treatments (Napier 1987; Palani et al. 1995; Alamgir and Hossain 2005; Iqbal et al. 2007; Khan et al. 2014; Mridha et al. 2016) and container (Bharathia 1999; Natarajan 1999;
Annapurna et al. 2004; Biradar et al. 2014) of different species. But detailed experiment on both (container and potting media) the aspect of A. auriculiformis had not been conducted yet. Therefore, present study was aimed to evaluate the suitable shape and size of containers and potting media to ensure production of quality seedlings of Acacia auriculiformis in nursery.

MATERIALS AND METHODS

Study site

The study was conducted from April 2017 to December 2017 in the nursery of Institute of Forestry and Environmental Sciences, University of Chittagong (IFESCU), Bangladesh. It lies approximately at the interaction of 91°50´E longitude and 22°30´N latitude (Figure 1) (Hossain et al. 2005). The altitude of this area is 14 m to 87 m above from the mean sea level (Mridha et al. 2016). The nursery site enjoys tropical monsoon climate characterized by hot, humid summer and cool, dry winter. The average annual rainfall of this area is about 2500-3000 mm which mostly takes place between June and September. The climate is tropical monsoon with a mean monthly maximum temperature of 29.75°C and a monthly minimum of 21.24°C. The highest temperature usually occurs on May as 32.60°C and minimum in January as 14.10°C (Peel et al. 2007).

Seed collection and experimental design

Seeds of A. auriculiformis were collected from Seed Production Areas (SPAs) of Institute of Forestry and Environmental Sciences, University of Chittagong, Chittagong, Bangladesh. The soils used in the experiment were collected from the forest floor of the University campus. To determine suitable container for A. auriculiformis seedling, the soil was sieved well (<3 mm sieve) and mixed with dried cow dung in a ratio of 3:1. For another experiment soil, cow dung, sand, sawdust, and phosphorus were used where polybags (15 cm × 13 cm) were filled with different combinations of mixture. To facilitate aeration and proper drainage, holes were made in the polybag by punching before filling with prepared mixture of soils. A Completely Randomized Block Design (CRBD) was adopted for the study with three replications for each treatment. There were five treatments of different containers and seven treatments of different mixtures used for the experiment. The treatments and containers type and size and their combination are given in Table 1 and Table 2.

Seed treatment and sowing

Seeds of A. auriculiformis were treated by soaking in hot water for 30 seconds followed by leaving in cold water overnight before sowing in the pre-filled polybags and root trainer. Seeds were sown in the polybags and root trainers filled with growing media. Two seeds were sown in each polybag and root trainer directly. Seeds were dibbed to 0.5 cm under the soil by pressing them with thumb. After that, they were covered with thin layer of soil.

Assessment of physiological growth performance

Three seedlings from each treatment were randomly selected and uprooted carefully during harvesting the seedlings. All three seedlings were used to assess nodule number and to estimate growth. After taking records of shoot length, root length, collar diameter, fresh weight of shoots and roots separately, then oven-dried at 70°C for 24 hours. After then dry weight of shoots and roots were taken. Average height of the seedlings for each treatment was also recorded. All the data were recorded monthly from the three months till to the eight months.

Figure 1. Map shows the location of the nursery of Institute of Forestry and Environmental Sciences, University of Chittagong (IFESCU) in Bangladesh where the experiment was conducted (Hathazari Upazila 2018; Google Maps 2019)
RESULTS AND DISCUSSION

Physical parameters of the seedlings, e.g., height was recorded monthly from the age of three months and continued to eight months. At the end of 8-month average height, shoot length, root length, collar diameter, nodule number, shoot fresh weight, root fresh weight, shoot dry weight, root dry weight and shoot-root ratio, biomass, and quality index of the seedlings of A. auriculiformis were measured and calculated.

Height of the seedlings grown in different containers

Initial height (cm) growth was taken after three months of sowing the seeds. Treatment T₄ showed highest height (37 cm) at the age of three months followed by treatment T₃. However, T₄ showed the average maximum height growth starting from three months till the end of the experiment, whereas it reached an average height of 136.2 cm at the end of the experiment followed by the treatment T₃ (129.6 cm) and T₂ (117.3 cm) (Figure 2).

Height of the seedlings grown in different potting media

For potting media used in the nursery, the study revealed the difference between the average height of the seedlings with the respective treatment at the age of 8 months (Figure 3). At the age of 3 months, Treatment T₃ attained maximum height (27.2 cm) followed by T₆ (26.5 cm). However, T₅ showed the average maximum height (128.9 cm) from the beginning of the measurement to till the end of the experiment followed by the treatment T₆ (115 cm) (Figure 3).

Morphological growth parameters of the seedlings grown in different containers

The 8 months old seedlings grown in different containers showed highest shoot length (137.5 cm) in T₄ followed by T₃ (125.2 cm) and was significantly (P<0.05) different with others where the lowest shoot length (81.1 cm) was found in T₅ (Table 3). Considering the growth of root length, highest root length was also recorded in T₄ (38.1 cm) followed by T₂ treatment (29.6 cm). However, similar trends of results observed for collar diameter and nodule number count whereas the highest collar diameter was found in treatment T₄ (9.5 mm) followed by T₃ (7.3 mm) and maximum nodule number (71) was observed in the treatment T₁ followed by T₃ (55 mm).

Effects of containers on fresh and dry matter production of the seedlings

Fresh and dry matter production, e.g., shoot fresh weight, shoot dry weight, root fresh weight and root dry weight of 8 months old A. auriculiformis seedlings are shown in Table 4. Maximum shoot fresh weight (56.16 g) was found in treatment T₄ followed by T₃ (36.83 g) which is significantly different from other treatments except for T₅. Besides, Maximum root fresh weight (12.66 g) was found in treatment T₄ followed by T₂ (6.83 g) In case of dry weight, shoot dry weight was maximum (26.10 g) in T₃ followed by T₅ (16.38 g) where maximum root dry weight (6.80 g) was found also in T₄ followed by T₂ (3.43 g) and T₃ (3.28 g).

Collection of root and shoot samples

During harvesting, soil around the seedling was loosened using hand softly, and all fine and coarse roots were collected carefully from the ground. To avoid damage, collected roots with adhered soil were immersed in water in a white clean bowl to allow soil particles to separate away. Water was changed several times for a complete wash.

Shoot-root ratio

Shoot-root ratio is the value obtained by dividing shoot (leaf and stem) with the root.

Quality index

The quality index (QI) as developed by Dickson et al. (1960) to quantify seedlings morphology was calculated as follows:

\[
QI = \frac{\text{Total seedlings dry weight (g)}}{\text{Shoot height (cm)} + \text{Shoot dry weight (g)} + \text{Collar diameter (mm)} + \text{Root dry weight (g)}}
\]

Statistical analysis

Recorded data related to seed germination and seedling growth attributes were analyzed statistically by using computer software SPSS ver.20.00. The Analysis of variance (ANOVA) and Duncan’s Multiple Range test (DMRT) was tested for the analysis to explore the possible treatment variations.

Table 1. Treatments and container type and size used to carry out the experiment

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Containers type and size</th>
<th>No. of replication</th>
<th>No. of seedlings</th>
</tr>
</thead>
<tbody>
<tr>
<td>T₁</td>
<td>13 cm × 10 cm (polybag)</td>
<td>3</td>
<td>60</td>
</tr>
<tr>
<td>T₂</td>
<td>15 cm × 10 cm (polybag)</td>
<td>3</td>
<td>60</td>
</tr>
<tr>
<td>T₃</td>
<td>15 cm × 13 cm (polybag)</td>
<td>3</td>
<td>60</td>
</tr>
<tr>
<td>T₄</td>
<td>20 cm × 15 cm (polybag)</td>
<td>3</td>
<td>60</td>
</tr>
<tr>
<td>T₅</td>
<td>Root trainer (20 cm × 5 cm)</td>
<td>3</td>
<td>60</td>
</tr>
</tbody>
</table>

Table 2. Treatments and their combination used to carry out the experiment

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Combination</th>
<th>No. of replication</th>
<th>No. of seedlings</th>
</tr>
</thead>
<tbody>
<tr>
<td>T₁</td>
<td>Sand only</td>
<td>3</td>
<td>60</td>
</tr>
<tr>
<td>T₂</td>
<td>Soil only</td>
<td>3</td>
<td>60</td>
</tr>
<tr>
<td>T₃</td>
<td>(Soil: Cowdung = 3:1)</td>
<td>3</td>
<td>60</td>
</tr>
<tr>
<td>T₄</td>
<td>Sawdust only</td>
<td>3</td>
<td>60</td>
</tr>
<tr>
<td>T₅</td>
<td>Soil + Cowdung + Phosphorus (0.16 g/polybag) @ 120 kg/ha</td>
<td>3</td>
<td>60</td>
</tr>
<tr>
<td>T₆</td>
<td>Soil + Phosphorus (0.16 g/polybag) @ 120 kg/ha</td>
<td>3</td>
<td>60</td>
</tr>
<tr>
<td>T₇</td>
<td>(Soil: Cowdung = 4:1)</td>
<td>3</td>
<td>60</td>
</tr>
</tbody>
</table>
Effects of container on shoot-root ratio, biomass (g) and quality index

The highest shoot-root ratio was found in treatment T3 (5.05) followed by T2 (4.10) and was significantly different (P<0.05) from other treatments. Biomass production of 8 months old A. auriculiformis seedlings was highest (32.90 g) in T4 treatment followed by T3 (19.67 g). Similarly, the highest value of quality index was found in treatment T4 (1.81) followed by T3 (0.89) and it was significantly different from other treatments (Table 4).

Morphological growth parameters of the seedlings grown in different potting media

For 8 months old seedlings, shoot length was highest (133.8 cm) in T3 followed by T6 (121.6 cm) and is significantly different (P<0.05) with other treatment (Table 5). Considering the root length, highest root length was recorded in T3 (40.1 cm) followed by T5 (39 cm). In addition, the highest collar diameter was recorded in T3 treatment (7.9 mm). However, T6 (7.4 mm) and T3 (7.3 mm) showed promising growth performance for collar diameter where the least was recorded in T4 (5.1 mm). Similarly, maximum nodulation was observed in T5 (68) followed by T3 (61) and T6 (55) respectively (Table 5).

Effect of potting media on fresh and dry weight (g) of shoot and root of the seedling

Maximum shoot fresh weight (45.16 g) was recorded in T3 followed by T5 (37.16 g) (Table 6) while root fresh weight was maximum (9.16 g) in T3 followed by T5 (8.83 g). Almost similar trends of result found for shoot dry weight production and highest value (19.22 g) was found in T5 treatment followed by T3 (16.87 g). However, maximum root dry weight (4.72 g) was found in T3 treatment followed by T5 (4.64 g).

Table 3. Effect of containers on shoots and root length, collar diameter and nodule number of 8 months old A. auriculiformis seedlings

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Shoot length (cm)</th>
<th>Root length (cm)</th>
<th>Collar diameter (mm)</th>
<th>Nodule number</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>93.4&lt;sup&gt;abc&lt;/sup&gt;</td>
<td>26.4&lt;sup&gt;b&lt;/sup&gt;</td>
<td>6.4&lt;sup&gt;b&lt;/sup&gt;</td>
<td>37&lt;sup&gt;bc&lt;/sup&gt;</td>
</tr>
<tr>
<td>T2</td>
<td>117.9&lt;sup&gt;b&lt;/sup&gt;</td>
<td>29.6&lt;sup&gt;b&lt;/sup&gt;</td>
<td>7.0&lt;sup&gt;b&lt;/sup&gt;</td>
<td>45&lt;sup(bc&lt;/sup&gt;</td>
</tr>
<tr>
<td>T3</td>
<td>125.2&lt;sup&gt;a&lt;/sup&gt;</td>
<td>26.2&lt;sup&gt;b&lt;/sup&gt;</td>
<td>7.3&lt;sup&gt;b&lt;/sup&gt;</td>
<td>55&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>T4</td>
<td>137.5&lt;sup&gt;a&lt;/sup&gt;</td>
<td>38.1&lt;sup&gt;a&lt;/sup&gt;</td>
<td>9.5&lt;sup&gt;a&lt;/sup&gt;</td>
<td>71&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>T5</td>
<td>81.1&lt;sup&gt;c&lt;/sup&gt;</td>
<td>24.4&lt;sup&gt;b&lt;/sup&gt;</td>
<td>6.0&lt;sup&gt;b&lt;/sup&gt;</td>
<td>42&lt;sup&gt;bc&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

*Means followed by the same letter (s) in the same column do not vary significantly at P<0.05, according to Duncan’s Multiple Range Test (DMRT)

Table 4. Effect of containers on fresh and dry weight of shoot and root, shoot- root ratio, biomass (g) and quality index of 8 months old A. auriculiformis seedlings

<table>
<thead>
<tr>
<th>Treatment name</th>
<th>Fresh weight (g)</th>
<th>Dry weight (g)</th>
<th>Biomass (g)</th>
<th>Shoot: root</th>
<th>Quality index</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Shoot</td>
<td>Root</td>
<td>Shoot</td>
<td>Root</td>
<td>Shoot</td>
</tr>
<tr>
<td>T1</td>
<td>23.50b&lt;sup&gt;a&lt;/sup&gt;</td>
<td>5.16b</td>
<td>10.80b</td>
<td>2.78b</td>
<td>13.58b</td>
</tr>
<tr>
<td>T2</td>
<td>31.83b</td>
<td>6.83b</td>
<td>14.39b</td>
<td>3.43b</td>
<td>17.82b</td>
</tr>
<tr>
<td>T3</td>
<td>36.83ab</td>
<td>6.33b</td>
<td>16.38b</td>
<td>3.28b</td>
<td>19.67b</td>
</tr>
<tr>
<td>T4</td>
<td>56.16a</td>
<td>12.66a</td>
<td>26.10a</td>
<td>6.80a</td>
<td>32.90a</td>
</tr>
<tr>
<td>T5</td>
<td>17.33b</td>
<td>4.83b</td>
<td>7.34b</td>
<td>2.62b</td>
<td>9.97b</td>
</tr>
</tbody>
</table>

*Means followed by the same letter (s) in the same column do not vary significantly at P<0.05, according to Duncan’s Multiple Range Test (DMRT)
Effect of potting media on shoot-root ratio, biomass (g) and quality index

In case of 8 months old seedlings, highest shoot-root ratio was found in T₃ (4.05) followed by T₂ (3.93) but not significantly different with other treatments (Table 6). Similarly, biomass production was highest (23.86 g) in T₃ followed by T₄ (21.59 g) and maximum (1.16) quality index was found in T₁ treatment followed by T₃ (1.06).

Table 6. Effect of potting media on fresh weight and dry weight of shoot and root of 8 months old A. auriculiformis seedlings

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Shoot length (cm)</th>
<th>Root length (cm)</th>
<th>Collar diameter (mm)</th>
<th>Nodule number</th>
</tr>
</thead>
<tbody>
<tr>
<td>T₁</td>
<td>88.8c</td>
<td>36a</td>
<td>6.9ab</td>
<td>47ab</td>
</tr>
<tr>
<td>T₂</td>
<td>92.6bc</td>
<td>37.7a</td>
<td>5.7bc</td>
<td>33b</td>
</tr>
<tr>
<td>T₃</td>
<td>118.7ab</td>
<td>40.1a</td>
<td>7.9a</td>
<td>61a</td>
</tr>
<tr>
<td>T₄</td>
<td>66.6c</td>
<td>32.6a</td>
<td>5.1c</td>
<td>37b</td>
</tr>
<tr>
<td>T₅</td>
<td>133.8a</td>
<td>39a</td>
<td>7.3ab</td>
<td>68a</td>
</tr>
<tr>
<td>T₆</td>
<td>121.6ab</td>
<td>32a</td>
<td>7.4a</td>
<td>55ab</td>
</tr>
<tr>
<td>T₇</td>
<td>109.6ab</td>
<td>26.2a</td>
<td>6.4ab</td>
<td>48ab</td>
</tr>
</tbody>
</table>

Note: *Means followed by the same letter (s) in the same column do not vary significantly at P<0.05, according to Duncan’s Multiple Range Test (DMRT)

Discussion

Successful germination and raising seedlings are mandatory steps for conservation and enlargement of plant communities (de Melo et al. 2015). A vital ingredient for the success of plantation programs is the availability of adequate supplies of quality seedlings. However, the present study indicates that the growth parameters (shoot and root length, collar diameter, fresh and dry weight of shoot and root, shoot root ratio, quality index and biomass) and nodule number of seedlings recorded from different combinations of container and potting media treatments in A. auriculiformis varied significantly compared to control.

Considering the container type and size, the present study revealed that the average maximum height of A. auriculiformis seedlings from 3 months was found in T₄ treatment of 20 cm × 15 cm polybags. Seedlings at the age of 3 months attained a height of 37 cm and 136.2 cm at the age of 8 months. Similarly, the study revealed longest shoot length (137.5 cm), root length (38.1 cm) and collar diameter (9.5 mm) in T₄ treatment. Venkatesh et al. (2002) reported collar diameter of 5 months old Acacia nilotica seedlings was 7 mm (7 cm) in 25 × 15 cm polybag and not supported by present study. Maximum nodule number (70) was also found in 20 cm × 15 cm size polybag. This is because T₄ treatment contains much growing media which supplies more nutrients to the seedlings and the results support the findings of Hossain et al. (2009).

In case of dry matter production, maximum shoot weight (26.10 g) and root weight (6.80 g) was also recorded in the same treatment (T₂). However, the result also coincided with Venkatesh et al. (2002) who reported highest shoot and root dry weight of 5 months old Acacia nilotica seedlings were 6.68 g and 3.42 g in 25 × 15 cm polybags. Moreover, it is also found that if polybag size increase then the value of fresh and dry matter also increases.

The shoot-root ratio was highest (5.05) in treatment T₃ (15 cm × 13 cm size polybag). The biomass 32.9 g and quality index 1.81 of the seedlings was highest in T₄ and are significantly different from other treatments whereas Annapurna et al. (2004) reported highest biomass and quality index was 3.08 g and 0.37 of 6 months old sandalwood seedlings in root trainer (black) which partially support the present study.

In the study, except shoot-root ratio, all the parameters showed best performance in 20 cm × 15 cm size polybag. However, several researchers found suitable container size for particular species, such as 30 cm × 20 cm for Cocoa (Keshavachandran and Larson 1985), 30 cm × 13 cm for Santalum album (Karivaradharaaju et al. 1999), 26 cm × 12.6 cm for Azadirachta indica (Bharathia 1999) and 25 cm × 15 cm for Albizia lebbeck (Nataraj 1999).

The seedlings raised on good media will ensure better establishment and growth when planted to the main field. The ultimate advantage of good potting mixture is good drainage, water holding capacity and thereby, it gives excellent disease-free growth of the seedlings (Noble 1993). In case of a balanced potting mixture, the present study indicates that the average maximum height of A. auriculiformis seedlings from 3 months till the end of the experiment was found in treatment T₃, soil + cow dung + phosphorous (0.16 g/polybag) mixture. In treatment T₅, at the age of 3 months, highest height was 27.2 cm and at the age of 8 months, it was 128.9 cm. Ramesh (2007) reported highest seedling height (36.36 cm) of 4 months old Pongamia pinnata in Black soil + Black sand + Vermicompost mixture where the media was different from present study.
More shoot length (133.8 cm), nodule number (68), shoot fresh weight (45.16 g), shoot dry weight (19.22 g), shoot- root ratio (4.05) and biomass (23.86 g) was found in T₅ soil + cowdung + phosphorus (0.16 g/polybag) mixture. Hussain et al. (2009) found highest shoot length (79.7 cm), shoot fresh weight (24.85 g), shoot dry weight (24.85 g) and nodule number (46) in soil and residual sludge combination 2:1 of 3 months old A. auriculiformis. Uddin et al. (2007) reported highest shoot length (57.67 cm) and nodule number (56.67) was found in 80 days old fertilized seedling of A. auriculiformis. However, the present result shows the similarity with their findings. Similarly, Uddin et al. (2012) found a positive correlation between seedling growth and the different doses of organic fertilization. So, it can easily understand that phosphorus enhances the seedlings growth as well as seedling quality in the nursery.

In other cases, more root length (40.1 cm), collar diameter (7.9 mm), root fresh weight (9.16 g), root dry weight (4.72 g) and quality index (1.16) was found in T₃ (soil: cow dung = 3:1). Uddin (2007) also reported highest root length (28.33 cm) and collar diameter (7 mm) was found in 80 days old fertilized seedling of A. auriculiformis. Belen (1987) reported phosphorus fertilization increased the total P, Mg content and P uptake, where the study agreed with the present results.

In conclusion, availability of planting stock in proper time with adequate quantity and proper quality is a challenge for plantation establishment. To overcome the problems of poor quality seedlings, the study of container and effect of mixture growing on seedling in the nursery is of great importance. Quality seedlings can ensure better survival and successful establishment of plantations, acclimation to variable environment and reduce rotation by increased yield. Therefore, the study revealed maximum growth parameters including nodule formation was highest in 20 cm × 15 cm polybag than other types and size of container and containing soil + cow dung + phosphorus (0.16 g/polybag) mixtures than other potting media. However, the people of our country are hardly conscious about the impact of container and potting media on quality seedling raising programs in nursery. So, there is a need to have further investigation of established plantation raised with quality seedlings of A. auriculiformis by using the present containers and potting media.

ACKNOWLEDGEMENTS

The authors are highly thankful to the Institute of Forestry and Environmental Sciences, University of Chittagong (IFESCU), Bangladesh for providing seeds, creating space and opportunity to do this research.

REFERENCES


Bharatia A. 1999. Studies on handling, management, and storage of Neem Azadirachta indica A. Juss. [Dissertation]. Seed Science and Technology, Tamil Nadu Agricultural University, Coimbatore, India.


Natarajan S. 1999. Investigations on seed source variations, standardization of seed testing procedures and nursery techniques in Albizia lebbeck (L) Benth. [Dissertation]. Tamil Nadu Agricultural University, Coimbatore.


Ramesh N. 2007. Studies on provenance, nursery mixture and pre-sowing treatments on seed quality and characterization in Pongama. [Thesis]. Department of Seed Science and Technology College of Agriculture, Dharwad University of Agricultural Sciences, Dharwad, India.


