

## COMPARATIVE GROWTH PERFORMANCES OF TEA SAPPLINGS RAISED IN THE POLY AND GUNNY BAGS

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Polythene or poly bags (plastic bags) are widely used for raising young plants in the nursery which are cheap, light weight, extremely durable and widely available. Plastic bags are principally used to raise tea saplings/seedlings in the nursery. The drawback of the plastic bags made the planters think to find out alternate eco-friendly materials for raising tea saplings. Jute fiber, which comes from a plant called jute (*Corchorus spp.*) is mostly consisting of cellulose, is 100% bio-degradable and recyclable and thus environmentally friendly (FAO, 2015). Jute has gained an advantage as being an eco-friendly option instead of poly and paper bags. Poly bags are non-biodegradable and manufacturing paper bags requires large quantities of wood. Jute has none of these problems but higher cost is a setback for it. Some other disadvantages of jute may include a decreased strength when wet, and also becomes subject to microbial attack in humid climates. For tree nurseries in general, physiological quality criteria are prioritized for seedling establishment after planting (Villar-Salvador *et al.*, 2004). Though the effect of different management practices (e.g., pot size, substrate, fertilizer supply, and planting density) are reported to greatly affect the physiological quality of tree nursery seedlings (Ahmad *et al.*, 2012) effect of potting materials (materials to support the plant growth medium) specially the effect of jute bags on seedling growth is scarcely reported. Considering the above facts an attempt has been made in the nursery of Bangladesh Tea Research Institute to observe the growth performances of tea saplings raised in the poly and gunny (jute) bags as well as the durability of both types of bags to investigate the potential of the gunny bags to be used in the nursery for raising tea saplings.

The experiment was conducted at the main farm nursery of Bangladesh Tea Research Institute (BTRI), Srimangal, Moulvibazar from January 2005 to January 2006. Sixty uniform sized saplings (rooted cuttings) were planted both in poly and gunny bags in each month from January to August in 2005. Both types of bags were of the same size (15 cm × 23 cm) and contained same plant growth medium i.e. soil. A randomized complete block design with three replications was used in this study where each replicate consisted of 20 bags with one sapling per bag. Intercultural operations like watering, manuring, weeding, pest control, and shading were done as and when necessary. Data on plant growth parameters were collected on January 2006. Therefore, at the time of data collection, the saplings planted in January, February, March, April, May, June, July and August were of 12, 11, 10, 9, 8, 7, 6 and 5 months old, respectively. Fifteen plants were selected randomly from each plot to collect data on different parameters under study. All the data were collected separately according to the planting months. The physiological growth parameters studied included plant height, base diameter, number of primary branches and total number of leaves. The fragility (%) of the bags was also roughly noted down based on the visual observation and applied mechanical stress by hand. Data were analyzed and means were compared by Duncan's multiple range test (DMRT), using the statistical package MSTAT (Russell, 1994).

A large variations were observed in the plant height due to the type of bag used (i.e. poly or gunny) to support the plant growth medium and it was observed that gunny bags favored plant growth compared to the poly bags (Table 1). Heights of the saplings planted in different months were different but the height of the saplings raised in the gunny bags were always higher than the poly bags. The height differences were significant in the saplings planted on January, February, March, June and July.

Table 1. Effect of different types of bag and planting time on the plant height of tea saplings

| Treatment                  | Plant height (cm) |          |         |       |       |         |         |        |
|----------------------------|-------------------|----------|---------|-------|-------|---------|---------|--------|
|                            | January           | February | March   | April | May   | June    | July    | August |
| Jute bag (T <sub>1</sub> ) | 36.00 a           | 31.40 a  | 28.20 a | 16.20 | 28.20 | 29.60 a | 19.00 a | 15.40  |
| Poly bag (T <sub>2</sub> ) | 31.40 b           | 25.80 b  | 23.60 b | 15.40 | 27.00 | 27.00 b | 14.80 b | 15.00  |
| Level of significance      | 0.01              | 0.01     | 0.01    | NS    | NS    | 0.01    | 0.01    | NS     |
| CV (%)                     | 9.80              | 9.25     | 10.06   | 31.96 | 7.82  | 8.00    | 13.25   | 18.84  |

In a column, figures without letter do not differ significantly by DMRT ( $P>0.05$ ).

Base diameter of the saplings planted in January to July were also found higher when raised in the gunny bags than the poly bags and in case of February the differences in diameter were significant (Table 2). Saplings planted in August showed opposite trend and significantly higher base diameter was obtained when raised in the poly bags.

Table 2. Effect of different types of bag and planting date on the base diameter of tea saplings

| Treatment                  | Base diameter (mm) |          |       |       |       |       |       |         |
|----------------------------|--------------------|----------|-------|-------|-------|-------|-------|---------|
|                            | January            | February | March | April | May   | June  | July  | August  |
| Jute bag (T <sub>1</sub> ) | 37.80              | 38.00 a  | 34.80 | 26.20 | 34.60 | 32.60 | 25.80 | 22.40 b |
| Poly bag (T <sub>2</sub> ) | 36.00              | 34.40 b  | 34.40 | 24.00 | 35.00 | 32.40 | 25.20 | 24.40 a |
| Level of significance      | NS                 | 0.01     | NS    | NS    | NS    | NS    | NS    | 0.05    |
| CV (%)                     | 8.61               | 8.15     | 8.91  | 14.13 | 8.75  | 9.51  | 9.63  | 11.85   |

In a column, figures without letter do not differ significantly by DMRT ( $P>0.05$ ).

Average numbers of leaves per plant were higher in the saplings raised in the gunny bags than those in the poly bags in most of the planted months, and the differences were significant in the months of February, March, April and July (Table 3). Similar in base diameter, opposite trend was also observed in the saplings planted in August, and the number of leaves per plant was higher in the saplings raised in the poly bags than those in the gunny bags, though the difference was not significant.

Table 3. Effect of different types of bag on the number of leaves of tea saplings planted different month

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| Treatment                  | Number of leaves per sapling |          |         |        |       |       |        |        |
|----------------------------|------------------------------|----------|---------|--------|-------|-------|--------|--------|
|                            | January                      | February | March   | April  | May   | June  | July   | August |
| Jute bag (T <sub>1</sub> ) | 12.80                        | 14.40 a  | 10.60 a | 8.40 a | 11.60 | 10.60 | 8.40 a | 7.20   |
| Poly bag (T <sub>2</sub> ) | 11.60                        | 9.60 b   | 9.40 b  | 5.80 b | 10.40 | 11.00 | 7.00 b | 7.40   |
| Level of significance      | NS                           | 0.01     | 0.05    | 0.01   | NS    | NS    | 0.01   | NS     |
| CV (%)                     | 18.84                        | 17.90    | 14.78   | 34.09  | 17.45 | 16.93 | 15.83  | 20.38  |

In a column, figures without letter do not differ significantly by DMRT. NS: Not significant ( $P>0.05$ ).

No specific trend was obtained due to the use of different types of bags on the generation of primary branches from the tea saplings. Among the data, 25% data showed gunny bags favored the generation of primary branches, 25% data showed poly bags favored the generation of primary branches and rest of the data showed non-significant (Table 4). Therefore, no conclusion could be drawn to understand which type of bag favored the generation of primary branches, and requires further investigation.

Table 4. Effect of different types of bag and planting time on the number of primary branches of tea saplings

| Treatment                  | Number of primary branches per sapling |          |        |        |        |        |        |        |
|----------------------------|--|----------|--------|--------|--------|--------|--------|--------|
|                            | January                                | February | March  | April  | May    | June   | July   | August |
| Jute bag (T <sub>1</sub> ) | 0.13 b                                 | 0.60 a   | 0.13   | 0.27   | 0.47 a | 0.13   | 0.07 b | 0.13   |
| Poly bag (T <sub>2</sub> ) | 0.47 a                                 | 0.20 b   | 0.27   | 0.07   | 0.13 b | 0.33   | 0.40 a | 0.13   |
| Level of significance      | 0.05                                   | 0.05     | NS     | NS     | 0.05   | NS     | 0.05   | NS     |
| CV (%)                     | 147.29                                 | 115.73   | 204.12 | 222.97 | 147.29 | 182.31 | 172.45 | 263.90 |

In a column, figures without letter do not differ significantly by DMRT ( $P>0.05$ ).

It was observed that the differences in fragility (%) between the poly and gunny bags were significant in all of the planted months (Table 5). The fragility of the gunny bags after 6-7 months of planting were so much higher (>33-53%) that the tea saplings may probably be damaged severely during transportation due to the breakage of 'pindi' (ball of earth with root system). After the same period (6-7 months) of planting, poly bags showed very low fragility (<4-6%). After 11-12 months of planting, poly bags showed less than 15-18% fragility whereas, the gunny bags after that period were found completely damaged (> 94- 97% fragility).

Table 5. Flimsiness of the bags (% damage) after different periods of use

| Treatment                  | Bag damaged (%)   |                    |                 |                |              |               |               |                 |
|----------------------------|-------------------|--------------------|-----------------|----------------|--------------|---------------|---------------|-----------------|
|                            | January<br>(12 M) | February<br>(11 M) | March<br>(10 M) | April<br>(9 M) | May<br>(8 M) | June<br>(7 M) | July<br>(6 M) | August<br>(5 M) |
| Jute bag (T <sub>1</sub> ) | 97.73 a           | 94.80 a            | 90.13 a         | 81.20 a        | 71.73 a      | 53.40 a       | 33.93 a       | 20.60 a         |
| Poly bag (T <sub>2</sub> ) | 17.40 b           | 14.87 b            | 11.93 b         | 10.20 b        | 8.27 b       | 5.80 b        | 3.53 b        | 1.87 b          |
| Level of significance      | 0.01              | 0.01               | 0.01            | 0.01           | 0.01         | 0.01          | 0.01          | 0.01            |
| CV (%)                     | 3.69              | 4.60               | 4.03            | 6.95           | 9.23         | 11.63         | 11.35         | 16.60           |

In a column, figures bearing dissimilar letters differ significantly. M=Months after planting.

Significant variations in the growth characteristics of the tea saplings raised in the poly and gunny bags. Almost all of the studied characters including plant height, base diameter, and number of leaves were found higher in the saplings raised in the gunny bags than those in the poly bags with few exceptions. Better growth of the saplings raised in the gunny bags is probably due to the fact that gunny bags provided better aeration to keep the soil granulated that facilitated better root growth. From the weather data of the experimental site it was observed that rainfall started to decline from October and the next two months were rainless with low relative humidity (%). This suggests that poly bags might have helped to preserve more soil moisture than the gunny bags in the next dry spells, and as the root system was not so well developed the condition favored the saplings raised in the poly bags.

Considering the durability of the bags, it was observed that after about 11-12 months of planting, the gunny bags were completely spoiled but the poly bags were still tolerable to transfer the saplings to the field. As tea saplings/seedlings are required to maintain in the nursery for about 9-12 months and in most of the cases the matured saplings are transported a far away from the nursery, the durability of the bags is considered to be the key issue for determining their potential to be used as a supporting material for the plant growth medium. As the jute bags showed a high degree of fragility after a 6-7 months period of usage, this excludes the possibility of using gunny bags in the tea nursery. This finding urges further research to extend the durability of the gunny bags up to a year to help the planters in raising high quality tea seedling/sapling in the nursery in an eco-friendly manner.

Based on the study it may be concluded that gunny bag favors the growth of the tea saplings than the poly bag in raising tea sapling in the nursery. However, as tea saplings/seedlings are required to maintain in the nursery for about 9-12 months, low durability (high fragility) of the gunny bags was identified as the key issue that excludes the possibility of using gunny bags in the tea nursery.

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Table 1. Weather data of the experimental site for the year 2005

| Month     | Temperature (°C) |              | Rainfall (mm) | RH (%) |
|-----------|------------------|--------------|---------------|--------|
|           | Mean maximum     | Mean minimum |               |        |
| January   | 24.97            | 9.76         | 0             | 67.32  |
| February  | 28.94            | 14.44        | 71            | 58.26  |
| March     | 30.46            | 19.29        | 161           | 67.33  |
| April     | 32.80            | 21.09        | 239           | 68.11  |
| May       | 31.28            | 21.37        | 613           | 77.27  |
| June      | 33.40            | 25.40        | 277           | 77.68  |
| July      | 31.98            | 25.07        | 357           | 81.31  |
| August    | 32.29            | 25.24        | 277           | 80.24  |
| September | 32.97            | 24.75        | 310           | 79.92  |
| October   | 31.75            | 22.97        | 109           | 97.47  |
| November  | 29.59            | 15.80        | 0             | 73.93  |
| December  | 28.03            | 11.96        | 0             | 68.99  |