

## Standardization of Soilless media on establishment and growth of warm and cool season grasses in Pro-tray

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### Abstract

Urbanization is a significant process in which the flora and fauna of cities around the world are startlingly similar, despite geographic and temperature differences. In this context, temperature preference, establishment type, cultural practices, care, and the ability to resist summer and heavy rainy days all have an impact on plant species selection. Turf grasses are a significant plant species in every landscape garden, and customers have recently begun to practice do-it-yourself (DIY) lawn establishment. For this purpose, two turf species, panama bermuda grass (*Cynodon dactylon*) and perennial rye grass (*Lolium perenne* L.) are commercially used in landscaping industries around the world. The literature available in soilless media with various crop plants has prepared the path for a unique investigation in panama bermuda grass and perennial rye grass. There is an opportunity to address the difficulties raised by commercial nursery producers who practice regular or conventional establishment. As a result, the current experiment was designed to assess the effectiveness of various soilless media and the role of pro-tray in lawn establishment. The study was designed on a Factorial Completely Randomized Design (FCRD). The experiment comprised of twelve different soilless media mixes. For both panama bermuda grass and perennial rye grass, the media combination (T<sub>10</sub>) consisting of Coir pith (70%)+ Enriched Organic Manure (15%)+ Paddy Husk (15%) yielded the best results in terms of days taken for germination (3.06 days & 3.27 days respectively), days taken for fifty per cent germination (7.97 days & 8.03 days respectively) and germination percentage (64.89 % & 65.94 % respectively) and the same combination was recorded the best results viz., plant height, root length (8.88 cm & 8.12 cm respectively), shoot length (16.14 cm & 15.54 cm respectively) at 45 days after sowing. Similarly, the media combination (T<sub>10</sub>), was observed the best results in leaf characters viz., number of leaf blades per plant (5.48 & 4.78 respectively), leaf blade length (11.94 cm & 11.04 cm respectively), leaf blade width (0.61 cm & 0.55 cm respectively), leaf area (3.97 cm<sup>2</sup> & 3.87 cm<sup>2</sup> respectively), total chlorophyll content (3.38

mg g<sup>-1</sup> & 22.78 mg g<sup>-1</sup> respectively), dry weight of shoot (14.64 g & 12.64 g respectively), dry weight of root (9.84 g & 8.44 g respectively) and turf density (2234.82 plants / sq.ft & 2118.82 plants / sq.ft respectively) whereas lowest values were recorded in all the above characters with T<sub>1</sub> (Red Earth + FYM + Sand) in pro-tray.

**Key words :** Panama Bermuda Grass, Perennial Rye Grass, Soilless Media, Coir pith, Enriched Organic Manure, Paddy Husk, Wood wool, Pro-tray, Lawn Establishment and Turf Grasses.

**G**rasses, monocotyledon plants in the Poaceae family, are becoming increasingly essential in garden design due to their capacity to generate uniformity and keep a green carpet appearance all year<sup>10</sup>. Among the turf species, panama bermuda grass (*Cynodon dactylon*) is perfect for lawns and turfs where a low growing, fine textured appearance is needed for great in warm climates and has excellent drought and frost tolerance, and perennial rye grass (*Lolium perenne* L.) is native to Europe and Asia, as well as being commercially utilized in the landscape industries around the world. It can minimize noise, regulate soil erosion, and boost environmental advantages while also playing an important role in improving mental health among resident communities. It includes 30-55% of green open areas in cities, including private gardens, public parks, cemeteries, golf courses, and motorways; however, their selection in gardening depends on aspects such as climatic preference, establishment type, cultural practices, and maintenance skills, etc. It influences the homeowner's enthusiasm in gardening and vegetation development in tiny places. The current investigation was conducted using soilless material due to the desires of the homeowners. Several literatures on soilless medium with various horticulture plants have paved the road for use in panama bermuda

grass and perennial rye grass. According to Sapna Kaushal and Poonam Kumari<sup>27</sup>, growth media is an essential component of most horticultural production methods. When selecting media, the grower must strike the right balance between their needs and the plants to be grown. Coir pith has a C:N ratio of 20:1, making it perfect for soilless media, and its low E.C with ideal P<sup>H</sup> favours growing conditions<sup>4</sup>. Nutrient enriched organic manure is less expensive and more environmentally friendly, and it can be utilized as soilless media to increase crop output and system sustainability<sup>21</sup>. Paddy husk is a byproduct of the rice milling industry that is widely available in the market. Despite its small weight and it is very effective at improving drainage and aeration. Similarly, new age soilless media known as wood wool is an excellent alternative to paddy husk since it is highly lightweight and provides the same benefits at a lower cost<sup>2</sup>. According to Arnon<sup>5</sup>, a plant cannot complete its life cycle due to macro and micronutrient shortages; these deficiencies can only be remedied by giving the element in formulae or by directly involving the element in the plant's metabolism. With an expanding aim to broaden the scope of soilless media in pro-tray method<sup>11</sup>. The current study was conducted with the goal of determining the soilless media combination for the establishment

and growth of warm and cool season grasses in pro-tray.

The experiment was carried out at Floriculture Unit, Department of Horticulture, Annamalai University, Annamalai Nagar, Tamil Nadu during June to July, 2023. Panama Bermuda Grass (*Cynodon dactylon*) and Perennial Rye Grass (*Lolium perenne* L.) seeds for the current study were obtained from a commercial lawn consultant in Bangalore. The seeds are lightweight and compact in size, with one gram containing 820-850 numbers of panama bermuda grass seeds and 540-560 numbers of perennial rye grass seeds. The experiment was conducted using a Factorial Completely Randomized Design (FCRD) with three replications, each with twelve treatments. The experiment was consisted with twelve different soilless media combinations viz., T<sub>1</sub>– Red earth + FYM + Sand (1:1:1), T<sub>2</sub>– Coir Pith (100 %) T<sub>3</sub> – Enriched Organic Manure (100 %) , T<sub>4</sub> – Coir Pith (90%) + Enriched Organic Manure (5%) + Paddy Husk(5%), T<sub>5</sub> – Coir Pith (90%) + Enriched Organic Manure (5%) + Wood Wool (5%), T<sub>6</sub> – Coir Pith (90%) + Enriched Organic Manure (10%), T<sub>7</sub> – Coir Pith (80%) + Enriched Organic Manure (10%) + Paddy Husk(10%), T<sub>8</sub> – Coir Pith (80%) + Enriched Organic Manure (10%) + Wood Wool (10%), T<sub>9</sub> – Coir Pith (80%) + Enriched Organic Manure (20%), T<sub>10</sub> – Coir Pith (70%) + Enriched Organic Manure (15%) + Paddy Husk(15%). T<sub>11</sub> – Coir Pith (70%) + Enriched Organic Manure (15%) + Wood Wool (15%) and T<sub>12</sub> – Coir Pith (70%) + Enriched Organic Manure (30%). The prepared soil media and soilless media mixtures were filled in the pro-tray according to the

proposition for each treatment. The pro –tray was made – up of standard plastic materials with multiple drainage holes under the pro – tray and its obtained from local source at Chidambaram and utilized in the experiment. The measurement of pro-tray at 60cm (length) x 30cm (width) x 3cm (depth) and total area consist of two square feet per pro-tray. After that, uniform broadcasting of seeds (10g per sq.ft) over the pro-tray was done and they were placed on the beds in shade house conditions. All pro-trays were covered with 75% shade net for 7 days, and life irrigation was done using a rose can. Throughout the experiment, irrigation was done twice a day with a rose can (morning and evening) and foliar application of 19:19:19 (1%) at 15 DAS and 25 DAS were followed at regular intervals.

The germinated seeds in each treatment were counted on randomly selected area (10 cm x 10 cm = 100 cm<sup>2</sup>) at 20 days after sowing, Total numbers of germinated seeds were subtracted from total number of seeds sown and percentage of germination was calculated and it was expressed in percentage (%) per sq. ft. Germination percentage (%) = Number of seeds germinated / Total number of seeds sown x 100. The leaf area was calculated by using the following formula and it was observed in 45 days after sowing and expressed in cm<sup>2</sup>. Leaf area = L x B x K Where, L = Leaf length, B = Leaf breadth, K = Constant (0.60). The turf density was calculated at 20 DAS from each treatment by calculating number of plants in an area of 900 cm<sup>2</sup> (30cm x30 cm) by placing a wooden frame (10 cm x 10 cm) at random in each treatment. The average value was computed and expressed in no. of plants per square feet. There are three strips of mat with the size 30

cm x 30 cm were cut at each treatment at 45-50 days after sowing for measuring the dry mat weight. The same three strips of dry mat sample irrigated with one liter of water and two hours later, weight of the wet mat was computed and expressed in kg per sq. ft. from seed sowing to termination of the experiment, the recommended nursery management practices done at regular intervals. Observations were on the three random samples each treatment for every biometric character and fix up the judicious soilless media for producing the quality of turf mat.

#### *Germination attributes :*

In the present study, germination attributes viz., days taken for seed germination viz., Panama bermuda grass (3.06 days), perennial rye grass (3.27 days), days taken for fifty per cent of the germination (7.97 days and 8.03 days respectively), germination percentage (67.34% and 65.45 % respectively) were significantly influenced by the treatment T<sub>10</sub> followed by T<sub>12</sub> and T<sub>11</sub> whereas the treatment T<sub>1</sub> consistently recorded the highest days taken for above traits. The results were in accordance with the findings of Arvind<sup>7</sup> in papaya. This might be due to soilless media combination, it provides aeration and moisture supply as well as sufficient porosity which permit gaseous exchange between media and seed. Gurusarathan *et al.*<sup>14</sup> reported that combination of Coir pith + Vermicompost + Paddy husk (1:1:1) along with nutrient consortium showed earliness in seed germination, fifty percentage of the germination and germination percentage in perennial rye grass. In the current study, instead of coir pith, enriched organic manure and paddy husk to

increase the medium's water and nutrient retention capacity and improving the turf's water usage ability. According to Tanya Thakur<sup>31</sup> the soilless media was ideal with better plant morphological development and also sustained quality of flower production in *Chrysanthemum* cv. Anmol. Similar results were also reported by Rivai *et al.*<sup>26</sup>. Coir pith when amended with organic manure suits as the best media having good physical characteristics<sup>12</sup> and also successfully tested as a growing medium in ornamentals<sup>33</sup>. (Table-1).

#### *Seedling parameters :*

With regards to seedling characters, viz., bermuda grass and rye grass plant height 25 DAS (10.12cm & 9.75cm), 35 DAS (13.43cm & 11.93cm) and 45 DAS (16.83cm & 15.13cm), shoot length (16.14cm & 15.54cm) and root length (8.88cm & 8.12 cm), fresh weight of plant (121.17g & 110.12g) and dry weight of plant (23.68g & 19.68g) bermuda grass weight of plant, fresh and dry weight of shoot (82.21g & 14.64g) and rye grass (68.23 g & 12.64g) and root (42.32g & 9.84g) and (38.32 g & 8.44 g), the present study revealed that different growing media significantly influenced the seedling parameters in Panama Bermuda grass and perennial rye grass. The treatment T<sub>10</sub> consistently recorded higher values for the all these traits, closely followed by T<sub>12</sub> and T<sub>11</sub>. Whereas the treatment T<sub>1</sub> consistently observed the lower values for these traits. This result is in agreement with the findings of Compos Mota *et al.*<sup>9</sup> suggested that coir pith generally with low in nutrients when it is mixed with enriched organic manure, provides a better growth for

plant establishment. Similarly, Swetha *et al.*<sup>34</sup> reported that higher nitrogen content available to plants through soilless medium could be the reason for greatest plant height. Coir pith and paddy husk allows air, nutrients and water to reach bottom of root surface, which may be another reason for the rapid and vigorous growth. Such phenomenon is decided by gibberellins within the plant. The promoter effect imparted by the particular growth media warrants that these components favour production of natural growth promoting substance like auxins, cytokines and gibberellins<sup>24</sup>. But a number of reports on favourable response with coir pith, enriched organic manure and paddy husk in other crops like carnation by Renuka and Sekhar<sup>25</sup> and in *Coreopsis tinctoria* support the usefulness as found in the present study.

#### *Leaf parameters :*

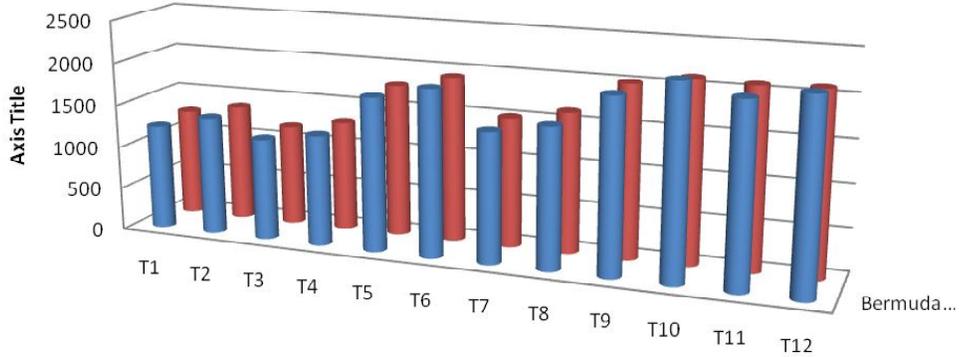
From the investigation, leaf attributes of panama bermuda grass and perennial rye grass *viz.*, number of leaf blades per plant (5.48 & 4.78), leaf blade length (11.94cm & 11.04cm), leaf blade width (0.61cm & 0.55cm), leaf area (3.97cm<sup>2</sup> & 3.87cm<sup>2</sup>) and total chlorophyll content (3.38 mg g<sup>-1</sup> & 2.78 mg g<sup>-1</sup>) were significantly influenced by the treatment T<sub>10</sub> followed by T<sub>12</sub> and T<sub>11</sub>. Whereas the treatment T<sub>1</sub> consistently recorded the highest values for these traits when compared to other treatments. The finding of Arunesh<sup>6</sup> is in accordance with the present investigation. According to Gawankar *et al.*<sup>13</sup>, combination of soil + coir pith + enriched organic manure + paddy husk was reported to be the best media for jack fruit seeds. Similarly, Anandamurthy *et al.*<sup>3</sup> found that maximum leaf area and maximum number

of leaves in ridge gourd was reported by application of 19:19:19 (1%) as foliar spray. This might be due to maximum absorption and translocation of nutrients, which resulted in increased cell size, cell elongation, cell multiplication and enhanced net assimilation rate. Nitrogen is being a very important constituent of chlorophyll, proteins and enzymes and has a prominent role in cell division which produces a greater number of leaves and leaf area. Phosphorus is being a very essential nutrient for root development. The results accordance with Padhiyar *et al.*<sup>22</sup> and Kameshwari *et al.*<sup>16</sup> in *Chrysanthemum*. Further, the findings of Khandaker *et al.*<sup>17</sup> support the usage of coir pith and enriched organic manure in ornamental plants establishment. Nazari *et al.*<sup>20</sup> reported that the effect of potting media on growth flowering and physiological characteristics including higher total pore space and water holding capacity coir pith is good moisture retentive materials, inmost cases particularly bulbous plants, aerations is a pre-requisite as well. (Table-2).

#### *Turf quality attributes :*

Any turf establishment, there could be serious consideration on quality stuff *viz.*, turf density and turf mat weight. It has greater importance towards marketable price. From this present investigation, there were lots of outcomes in these traits. The present study revealed that different growing media significantly influenced these traits in panama Bermuda grass and perennial rye grass. The treatment T<sub>10</sub> consistently recorded higher values in the turf density (2234.82 no. of plants/ sq. ft and 2118.82 no. of plants/ sq. ft ) depicted through

**Fig:1 Effect of Soilless media on turf density (no.of plants / Sq.ft) of Perennial Rye Grass and Pannama Bermuda Grass in Pro-tray**



|                 | T1     | T2     | T3     | T4     | T5     | T6     | T7     | T8     | T9     | T10    | T11    | T12    |
|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| ■ Bermuda Grass | 1232.8 | 1386.9 | 1192.6 | 1295.2 | 1789.6 | 1939.1 | 1516.7 | 1634.6 | 2022.7 | 2234.8 | 2094.8 | 2198.1 |
| ■ Rye Grass     | 1262.8 | 1368.6 | 1182.6 | 1292.2 | 1782.6 | 1931.1 | 1516.3 | 1635.4 | 2012.6 | 2118.8 | 2093.8 | 2110.1 |

**Fig:2 Effect of Soilless media on wet & dry weight of turff mat (kg/sq.ft) Perenninal Rye grass and...**

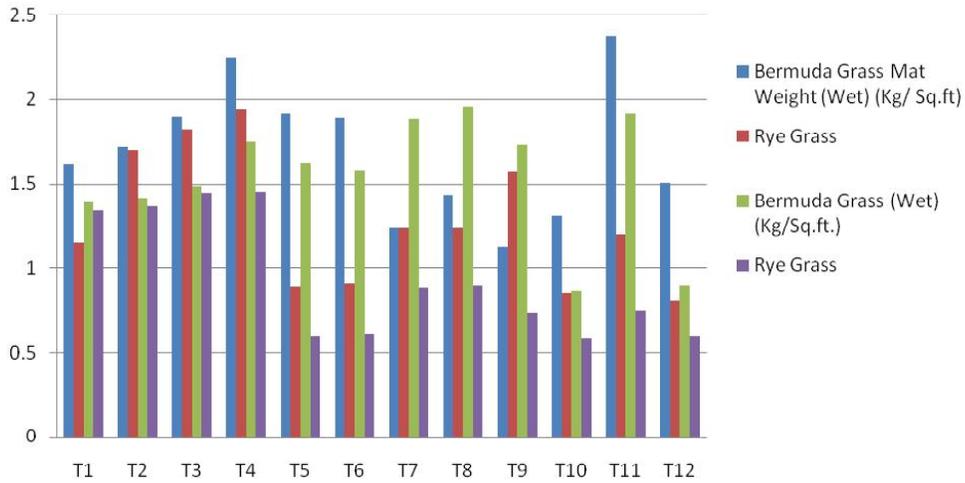


Table-1. Standardization of soilless media on days taken for germination, days taken for fifty per cent germination, germination percentage @ 20 DAS, turf density, plant height, of Panama Bermuda grass (*Cynodon dactylon*) and perennial rye grass (*Lolium perenne* L.) in pro-tray.

| Treatments      | PB grass                          |  | PR grass                            |                       | PB grass          |        | PR grass |        | PB grass |       | PR grass |  | PB grass |  | PR grass |  |
|-----------------|-----------------------------------|--|-------------------------------------|-----------------------|-------------------|--------|----------|--------|----------|-------|----------|--|----------|--|----------|--|
|                 | Days taken for germination (Days) | Days taken for fifty per cent germination (Days) | Germination percentage @ 20 DAS (%) | Turf Density (Sq. ft) | Plant height (cm) | 25 DAS | 35 DAS   | 45 DAS |          |       |          |  |          |  |          |  |
| T <sub>1</sub>  | 5.81                              | 10.01  | 36.77                               | 1232.81               | 1262.81           | 4.91   | 5.44     | 7.96   | 8.06     | 9.91  | 10.36    |  |          |  |          |  |
| T <sub>2</sub>  | 4.18                              | 9.31   | 42.39                               | 1386.96               | 1368.69           | 6.18   | 6.38     | 8.32   | 8.92     | 11.22 | 11.32    |  |          |  |          |  |
| T <sub>3</sub>  | 4.10                              | 9.14   | 36.20                               | 1192.60               | 1182.60           | 5.14   | 4.97     | 7.59   | 7.63     | 10.06 | 9.89     |  |          |  |          |  |
| T <sub>4</sub>  | 4.02                              | 8.99   | 38.96                               | 1295.28               | 1292.28           | 5.95   | 5.91     | 8.69   | 8.49     | 10.65 | 10.85    |  |          |  |          |  |
| T <sub>5</sub>  | 3.87                              | 8.94   | 54.21                               | 1789.61               | 1782.66           | 7.91   | 7.79     | 10.41  | 10.21    | 12.72 | 12.77    |  |          |  |          |  |
| T <sub>6</sub>  | 3.71                              | 8.84   | 58.72                               | 1939.16               | 1931.16           | 8.60   | 8.26     | 10.84  | 10.64    | 13.15 | 13.25    |  |          |  |          |  |
| T <sub>7</sub>  | 3.55                              | 8.59   | 46.17                               | 1516.71               | 1516.31           | 6.75   | 6.85     | 9.85   | 9.35     | 11.91 | 11.81    |  |          |  |          |  |
| T <sub>8</sub>  | 3.33                              | 8.51   | 49.76                               | 1634.68               | 1635.48           | 7.52   | 7.32     | 9.88   | 9.78     | 12.59 | 12.29    |  |          |  |          |  |
| T <sub>9</sub>  | 3.31                              | 8.31   | 61.49                               | 2022.73               | 2012.67           | 8.74   | 8.73     | 11.17  | 11.07    | 13.82 | 13.72    |  |          |  |          |  |
| T <sub>10</sub> | 3.06                              | 7.97   | 65.94                               | 2234.82               | 2118.82           | 10.12  | 9.75     | 13.43  | 11.93    | 16.83 | 15.13    |  |          |  |          |  |
| T <sub>11</sub> | 3.28                              | 8.21   | 63.65                               | 2094.85               | 2093.85           | 9.31   | 9.21     | 11.56  | 11.51    | 14.31 | 14.21    |  |          |  |          |  |
| T <sub>12</sub> | 3.15                              | 8.11   | 64.81                               | 2198.11               | 2110.11           | 9.89   | 9.39     | 12.61  | 11.61    | 15.92 | 14.92    |  |          |  |          |  |
| CD              | 0.21                              | 0.18   | 2.42                                | 83.50                 | 70.23             | 0.43   | 0.34     | 0.45   | 0.32     | 0.56  | 0.39     |  |          |  |          |  |
| S.Ed            | 0.11                              | 0.09   | 1.20                                | 41.73                 | 34.33             | 0.21   | 0.16     | 0.22   | 0.15     | 0.27  | 0.19     |  |          |  |          |  |

T<sub>1</sub>–Red earth + FYM + Sand (1:1:1) in direct soil, T<sub>2</sub>–Coir Pith (100%) T<sub>3</sub> – Enriched Organic Manure (100%), T<sub>4</sub> – Coir Pith (90%) + Enrich Organic Manure (5%) + Paddy Husk (5%), T<sub>5</sub> – Coir Pith(90%) + Enrich Organic Manure (5%) + Wood Wool (5%), T<sub>6</sub> – Coir Pith (90%) + Enrich Organic Manure (10%), T<sub>7</sub> – Pith (80%) + Enrich Organic Manure (10%) + Paddy Husk (10%), T<sub>8</sub>- Coir Pith(80%) + Enrich Organic Manure (10%) + Wood Wool (10%), T<sub>9</sub> – Coir Pith (80%) + Enrich Organic Manure (20%), T<sub>10</sub> – Coir Pith (70%) + Enrich Organic Manure (15%) + Paddy Husk (15%) T<sub>11</sub> – Coir Pith (70%) + Enrich Organic Manure (15%) + Wood Wool (15%)and T<sub>12</sub> – Coir Pith (70%) + Enrich Organic Manure (30%).

PB – Panama Bermuda Grass and PR – Perennial Rye Grass

Table-2. Standardization of soilless media on leaf parameters, root and shoot length and total chlorophyll content of Panama Bermuda grass (*Cynodon dactylon*) and perennial rye grass (*Lolium perenne* L.) in pro-tray

| Treatments      | No. of Leaf blades per plant |      | Leaf Blade length (cm) |       | Leafblade Width (cm) |       | Leaf Area (cm <sup>2</sup> ) |      | Root Length (cm) |      | Shoot Length (cm) |       | Stem Thickness (cm) |       | Vigour Index |         | Total Chlorophyll content (mg g <sup>-1</sup> ) |      |  |
|-----------------|------------------------------|------|------------------------|-------|----------------------|-------|------------------------------|------|------------------|------|-------------------|-------|---------------------|-------|--------------|---------|---|------|--|
|                 | PB                           | PR   | PB                     | PR    | PB                   | PR    | PB                           | PR   | PB               | PR   | PB                | PR    | PB                  | PR    | PB           | PR      | PB  | PR   |  |
| T <sub>1</sub>  | 4.01                         | 4.11 | 5.11                   | 5.21  | 0.36                 | 0.38  | 1.18                         | 1.29 | 3.11             | 3.24 | 10.12             | 10.36 | 0.220               | 0.207 | 529.68       | 524.55  | 1.09  | 1.20 |  |
| T <sub>2</sub>  | 4.10                         | 4.20 | 5.39                   | 5.81  | 0.35                 | 0.40  | 1.38                         | 1.48 | 4.16             | 4.26 | 11.22             | 11.32 | 0.224               | 0.227 | 576.47       | 653.27  | 1.51  | 1.47 |  |
| T <sub>3</sub>  | 4.15                         | 4.16 | 5.40                   | 5.14  | 0.40                 | 0.39  | 1.51                         | 1.35 | 2.72             | 2.73 | 9.79              | 9.89  | 0.234               | 0.186 | 587.64       | 456.84  | 1.16  | 1.11 |  |
| T <sub>4</sub>  | 4.19                         | 4.15 | 6.44                   | 6.41  | 0.39                 | 0.40  | 1.62                         | 1.72 | 3.51             | 3.75 | 10.75             | 10.85 | 0.254               | 0.217 | 698.41       | 571.74  | 1.80  | 1.38 |  |
| T <sub>5</sub>  | 4.45                         | 4.35 | 8.25                   | 8.22  | 0.48                 | 0.42  | 2.48                         | 2.38 | 6.41             | 6.31 | 12.72             | 12.77 | 0.241               | 0.261 | 890.23       | 830.70  | 1.62  | 1.74 |  |
| T <sub>6</sub>  | 4.37                         | 4.40 | 8.81                   | 8.81  | 0.43                 | 0.43  | 2.51                         | 2.61 | 6.72             | 6.52 | 13.15             | 13.25 | 0.233               | 0.263 | 789.27       | 756.94  | 1.73  | 1.83 |  |
| T <sub>7</sub>  | 4.35                         | 4.25 | 7.10                   | 7.01  | 0.40                 | 0.41  | 1.96                         | 1.93 | 4.81             | 4.76 | 11.91             | 11.81 | 0.241               | 0.238 | 821.45       | 763.38  | 1.76  | 1.56 |  |
| T <sub>8</sub>  | 4.40                         | 4.30 | 7.71                   | 7.61  | 0.42                 | 0.41  | 2.35                         | 2.15 | 5.48             | 5.28 | 12.49             | 12.29 | 0.254               | 0.243 | 890.35       | 870.77  | 1.75  | 1.65 |  |
| T <sub>9</sub>  | 4.49                         | 4.45 | 9.42                   | 9.42  | 0.41                 | 0.44  | 2.96                         | 2.86 | 6.91             | 6.81 | 13.82             | 13.72 | 0.267               | 0.253 | 958.21       | 941.61  | 1.93  | 1.92 |  |
| T <sub>10</sub> | 5.48                         | 4.78 | 11.94                  | 11.04 | 0.61                 | 0.55  | 3.97                         | 3.87 | 8.88             | 8.12 | 16.14             | 15.54 | 0.291               | 0.283 | 1382.37      | 1365.44 | 3.38  | 2.78 |  |
| T <sub>11</sub> | 4.54                         | 4.50 | 10.41                  | 10.01 | 0.46                 | 0.45  | 3.19                         | 3.11 | 7.51             | 7.31 | 14.71             | 14.21 | 0.279               | 0.263 | 1192.14      | 1269.12 | 2.31  | 2.01 |  |
| T <sub>12</sub> | 5.11                         | 4.61 | 11.42                  | 10.82 | 0.56                 | 0.49  | 3.81                         | 3.41 | 8.60             | 7.80 | 15.82             | 14.92 | 0.286               | 0.277 | 1284.23      | 1252.12 | 2.93  | 2.43 |  |
| <b>CD</b>       |                              |      |                        |       |                      |       |                              |      |                  |      |                   |       |                     |       |              |         |   |      |  |
| <b>(p=0.05)</b> | 0.12                         | 0.06 | 0.57                   | 0.45  | 0.02                 | 0.02  | 0.20                         | 0.21 | 0.40             | 0.40 | 0.45              | 0.44  | 0.006               | 0.009 | 68.05        | 34.38   | 0.09  | 0.12 |  |
| <b>S.E.d</b>    | 0.06                         | 0.02 | 0.28                   | 0.23  | 0.004                | 0.007 | 0.09                         | 0.11 | 0.17             | 0.19 | 0.23              | 0.21  | 0.002               | 0.004 | 33.08        | 16.36   | 0.04  | 0.23 |  |

T<sub>1</sub>–Red earth + FYM + Sand (1:1:1) in direct soil, T<sub>2</sub>–Coir Pith (100%) T<sub>3</sub> – Enriched Organic Manure (100%), T<sub>4</sub>–Coir Pith (90%) + Enrich Organic Manure (5%) + Paddy Husk (5%), T<sub>5</sub> – Coir Pith(90%) + Enrich Organic Manure (5%) + Wood Wool (5%), T<sub>6</sub> – Coir Pith (90%) + Enrich Organic Manure (10%), T<sub>7</sub> – Pith (80%) + Enrich Organic Manure (10%) + Paddy Husk (10%), T<sub>8</sub>- Coir Pith(80%) + Enrich Organic Manure (10%) + Wood Wool (10%), T<sub>9</sub> – Coir Pith (80%) + Enrich Organic Manure (20%), T<sub>10</sub> – Coir Pith (70%) + Enrich Organic Manure (15%) + Paddy Husk (15%) T<sub>11</sub> – Coir Pith (70%) + Enrich Organic Manure (15%) + Wood Wool (15%) and T<sub>12</sub> – Coir Pith (70%) + Enrich Organic Manure (30%).  
PB – Panama Bermuda Grass and PR – Perennial Rye Grass

Table-3. Effect of soilless media on fresh and dry weight of root, shoot and plant and wet and dry weight of turf mat of Panama Bermuda grass (*Cynodon dactylon*) and perennial rye grass (*Lolium perenne* L.) in pro-tray

|                 | PB grass                 |                         | PR grass                 |                        | PB grass                  |                         | PR grass                  |                         | PB grass                     |                              | PR grass                     |                              | PB grass                     |                              | PR grass                     |                              |
|-----------------|--------------------------|-------------------------|--------------------------|------------------------|---------------------------|-------------------------|---------------------------|-------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|
|                 | Fresh Weight of Plant(g) | Dry Weight of Plant (g) | Fresh weight of Root (g) | Dry weight of Root (g) | Fresh weight of Shoot (g) | Dry weight of Shoot (g) | Fresh weight of Shoot (g) | Dry weight of Shoot (g) | Mat Weight (Wet) (kg/sq. ft) | Mat Weight (Dry) (kg/sq. ft) | Mat Weight (Wet) (kg/sq. ft) | Mat Weight (Dry) (kg/sq. ft) | Mat Weight (Wet) (kg/sq. ft) | Mat Weight (Dry) (kg/sq. ft) | Mat Weight (Wet) (kg/sq. ft) | Mat Weight (Dry) (kg/sq. ft) |
| T <sub>1</sub>  | 45.39                    | 33.39                   | 6.97                     | 4.65                   | 21.73                     | 9.99                    | 3.79                      | 2.09                    | 29.46                        | 19.71                        | 4.92                         | 2.43                         | 1.613                        | 1.145                        | 1.387                        | 1.343                        |
| T <sub>2</sub>  | 56.89                    | 55.89                   | 9.50                     | 9.00                   | 23.23                     | 19.23                   | 3.91                      | 3.51                    | 39.66                        | 36.66                        | 5.89                         | 5.49                         | 1.713                        | 1.695                        | 1.416                        | 1.366                        |
| T <sub>3</sub>  | 46.39                    | 29.70                   | 7.75                     | 5.67                   | 24.21                     | 11.33                   | 3.87                      | 1.47                    | 29.89                        | 22.06                        | 5.83                         | 3.42                         | 1.896                        | 1.816                        | 1.487                        | 1.441                        |
| T <sub>4</sub>  | 49.33                    | 48.33                   | 7.87                     | 7.47                   | 17.47                     | 16.77                   | 3.19                      | 2.91                    | 33.16                        | 31.56                        | 4.89                         | 4.59                         | 2.238                        | 1.938                        | 1.748                        | 1.448                        |
| T <sub>5</sub>  | 78.81                    | 78.21                   | 14.61                    | 13.95                  | 29.89                     | 29.12                   | 5.89                      | 5.49                    | 49.79                        | 49.09                        | 8.81                         | 8.46                         | 1.916                        | 0.890                        | 1.620                        | 0.590                        |
| T <sub>6</sub>  | 83.68                    | 85.68                   | 14.57                    | 15.57                  | 29.72                     | 30.72                   | 5.82                      | 6.12                    | 53.61                        | 54.96                        | 8.65                         | 9.45                         | 1.890                        | 0.906                        | 1.576                        | 0.606                        |
| T <sub>7</sub>  | 63.27                    | 63.27                   | 10.71                    | 10.71                  | 23.95                     | 23.95                   | 4.16                      | 4.16                    | 39.32                        | 39.32                        | 6.48                         | 6.48                         | 1.229                        | 1.229                        | 1.883                        | 0.883                        |
| T <sub>8</sub>  | 71.74                    | 70.74                   | 12.83                    | 12.33                  | 27.63                     | 26.63                   | 4.91                      | 4.81                    | 46.11                        | 44.11                        | 7.87                         | 7.47                         | 1.431                        | 1.234                        | 1.956                        | 0.896                        |
| T <sub>9</sub>  | 94.15                    | 93.15                   | 17.99                    | 17.19                  | 35.31                     | 34.31                   | 7.80                      | 6.82                    | 57.84                        | 58.84                        | 11.44                        | 10.44                        | 1.125                        | 1.573                        | 1.730                        | 0.733                        |
| T <sub>10</sub> | 121.17                   | 110.12                  | 23.68                    | 19.68                  | 42.32                     | 38.32                   | 9.84                      | 8.44                    | 82.21                        | 68.23                        | 14.64                        | 12.64                        | 1.304                        | 0.851                        | 0.865                        | 0.581                        |
| T <sub>11</sub> | 110.13                   | 100.53                  | 20.63                    | 18.63                  | 40.90                     | 37.90                   | 9.61                      | 7.62                    | 68.63                        | 62.63                        | 13.34                        | 11.34                        | 2.376                        | 1.198                        | 1.915                        | 0.741                        |
| T <sub>12</sub> | 116.13                   | 107.13                  | 19.92                    | 18.92                  | 41.38                     | 38.04                   | 9.72                      | 7.92                    | 79.12                        | 65.12                        | 13.87                        | 11.87                        | 1.503                        | 0.803                        | 0.892                        | 0.592                        |
| CD (p=0.05)     | 6.28                     | 6.35                    | 1.09                     | 1.22                   | 1.60                      | 2.31                    | 0.42                      | 0.52                    | 4.21                         | 4.03                         | 0.72                         | 0.84                         | 0.06                         | 0.04                         | 0.05                         | 0.06                         |
| S.Ed            | 3.00                     | 3.18                    | 0.47                     | 0.63                   | 0.73                      | 1.18                    | 0.19                      | 0.25                    | 2.01                         | 2.00                         | 0.34                         | 0.41                         | 0.03                         | 0.02                         | 0.02                         | 0.02                         |

T1-Red earth + FYM + Sand (1:1:1) in direct soil, T2-Coir Pith (100%) T3 - Enriched Organic Manure (100%), T4 -Coir Pith (90%) + Enrich Organic Manure (5%) + Paddy Husk (5%), T5 - Coir Pith(90%) + Enrich Organic Manure (5%) + Wood Wool (5%), T6 - Coir Pith (90%) + Enrich Organic Manure (10%), T7 - Pith (80%) + Enrich Organic Manure (10%) + Paddy Husk (10%), T8- Coir Pith(80%) + Enrich Organic Manure (10%) + Wood Wool (10%), T9 - Coir Pith (80%) + Enrich Organic Manure (20%), T10 - Coir Pith (70%) + Enrich Organic Manure (15%) + Paddy Husk (15%) T11 - Coir Pith (70%) + Enrich Organic Manure (15%) + Wood Wool (15%) and T12 - Coir Pith (70%) + Enrich Organic Manure (30%).  
PB - Panama Bermuda Grass and PR - Perennial Rye Grass

(fig. 1), closely followed by T<sub>12</sub> and T<sub>11</sub>. Whereas soil media treatment combinations T<sub>1</sub> consistently observed on par lower values for these trait. A contrast observation was found on turf mat weight (dry & wet basis) in the present investigation. The treatment combinations, T<sub>6</sub> followed by T<sub>5</sub> and T<sub>11</sub> were consistently observed lesser turf mat weight (dry & wet basis) depicted through (fig. 2) whereas T<sub>3</sub> followed by T<sub>4</sub>, T<sub>2</sub> and T<sub>1</sub> were consistently observed nearer or on par higher values for this trait. This is because of bulk density of soilless media, it could be the reason for lesser weight and gives more volume to fill the space in pro-tray when compared to soil mixtures (Table-3).

The findings of Kulveer Singh and Anurag Bajpay<sup>18</sup>, support the pro-tray intervention in the present study. Further, reported that pro-tray nursery is a popular technique for quality seedling production where seedlings are produced under shade net and open field condition. Such seedlings have better germination and vigour in growth and establishment. They are all free from pest and diseases and develop a good root system within 25-45 days. The findings observed by Ashkiani *et al.*<sup>8</sup> and Marie *et al.*<sup>19</sup> accordance with present investigation, reported that maximum dry matter weight in panama Bermuda grass and perennial rye grass. The findings of Sherya<sup>28</sup> in onion and Soundhararajan<sup>29</sup> in annona corroborated the findings of the present study.

Hence, the treatment T<sub>10</sub> - Coir pith (70%) + Enriched organic manure (15%) + Paddy husk (15%) could be recommended for maximising growth and establishment of

Panama Bermuda grass and perennial rye grass in pro-tray. Further, the present investigation revealed that there is a major scope for future thrust area to investigate like high-tech nursery establishment, high density turf mat, standardization of soilless media, nutrients and microbial consortium, pro-tray nursery protocol, more area coverage, efficient post care, cost economics and do-it-yourself lawn at home.

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