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Effect of different growing media on germination and growth of *Terminalia mantaly* L. under lath house conditions

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Terminalia mantaly is considered as one of the best plant for reforestation and its wood contains tannins, which is used for dyeing purposes (Fern, 2018). Propagation is the basic activity to create new plants and media plays an important role in it. Therefore, present study was designed to evaluate the response of *terminalia* seeds grown in different types of media (FYM, coco-peat and garden soil) in a randomized complete block design (RCBD). Weekly data was recorded on days to germination, days to 50 % germination, germination percentage and survival percentage while growth attributes including plant height, number of leaves, leaf length, and stem diameter. Results showed that coco-peat media recorded least days to germination and days to 50 % germination while highest survival percentage (94.44%), seedling height (20.50 cm), leaf length (8.45 cm), and stem diameter (3.17 mm). Farmyard manure media recorded highest germination percentage (47.20) and leaf width (5.45 cm) of terminalia seedlings. Least values were recorded for all parameters except number of leaves seedlings^{-1} (16.55), when grown in garden soil (control). Thus, concluded that coco-peat media is effective in both germination and growth of *Terminalia mantaly*.

Keywords: *Terminalia mantaly*, growing media, germination, growth

INTRODUCTION

Umbrella Tree (*Terminalia mantaly*) belonging to the family of *Combretaceae* is a deciduous or evergreen tree with conspicuously layered

branches, growing 10-20 metres tall. Terminalia species are widely distributed in the southern Asia, Himalayas, Madagascar, Australia, and the tropical and subtropical regions of Africa.

It grows in semi-arid to moist tropics, also grows best in areas having maximum and minimum annual temperatures within the range of 20-28 °C, and even can tolerate 15-36 °C. Adequate annual rainfall required for it ranges from 500 to 1200 mm but can tolerate rainfall from 300 to 1500 mm range. Terminalia prefers sunny spot with well-drained and medium to light soil having pH of 5.5-7. It is drought resistant plant when established (Fern, 2018).

Terminalia mantaly is more acceptable ornamental tree along streets, roadsides and in parks due to its formal and neat look, especially if planted in masses. Beside its ornamental use, terminalia plants in Southern Asia have been intensively studied phytochemically due to their wide usage in Asian traditional medicine (McGaw et al. 2001). The tree is harvested for local use as a medicine and source of dyes and tannins. Tannins from root of *T. mantaly* are used in leather preparation and its trunk act as a source of gum, if treated well can be utilized in chemical industry. It is believed that a modified form of the gum from *T. mantaly* can be used to treat rheumatoid arthritis, osteoarthritis and ankylosing spondylitis (Michael et al. 2017). Terminalia mantaly supplements may support normal heart functioning, manage chest discomfort, manage blood clot by decreasing platelet activation, and that it exhibits antioxidant activities.

Coco-peat is a by-product of coconut and it is extracted by blending the coconut husks (Abad et al.2002). It is used as a growing medium, having the capability to produce a number of crop species with desirable quality in the tropical regions (Yau et al. 2000). Coco-peat media have passable pH, electrical conductivity, and other chemical components (Abad et al. 2002). Coco-peat possesses many physical properties i.e. maximum pore spaces, high water retention capability, low shrinkage, low bulk density and slowly biodegradable (Evans et al. 1996). The coco-peat has been observed as best growing media for roses and gerberas, when used alone or added with garden soil (Labeke and Dambre, 1998) also recommended as best media for many potted plants (De Kreij and Leeuven, 2001; Treder and Nowak, 2002) and is also beneficial for growing vegetables. Fresh coco-peat contains high level of potassium and sodium, so it is suggested that fertilization program should be carried out with care to fulfil the need of the plant. When coco-peat is used as a seedling tray media for germination of seeds, prior to this activity, coco-peat should be washed many times to lower potassium and sodium chloride levels.

Farmyard manure (FYM) is common form of animal manure (Dittmar et al. 2000). It is physically composed of plant stuff (straws), animal faeces and urine. Cattle manure contains all the nutrients required by a plant body (Webb et al. 2017) but nitrogen as well as organic carbon are also main constituents (Bernal et al. 2009). It has been used as a fertilizer in farming for centuries. It improves soil structure, porosity, moisture and nutrient holding capability etc. Animal manure also promotes soil microbial activity that supplies the soil's trace mineral and thus improves plant nutrition.

Based on the need of horticultural plants for landscaping, plantation drive etc in this pollution full environment, compel us to design an experiment on production of quick and healthy plants. For this purpose, we compared FYM, coco-peat and garden soil for their compatibility with *Terminalia mantaly* seeds germination, growth, survival, and development. The main objective of this study was to identify the best growing media for terminalia plants production.

MATERIALS AND METHODS

This study was conducted at Agricultural Research Station Swabi, Pakistan during the year 2020-21. Seeds of *Terminalia* were bought from a vendor at Pattoki, Punjab. Coco-peat was purchased from a shop at Lahore city, Punjab while remaining components were available at the Research Station. Growing media i.e. farmyard manure (FYM), Coco-peat, and Garden soil were used to evaluate the performance of seed germination and then growth attributes of terminalia. Two seeds were sown in 8 inches plastic pot. This experiment was laid out under lath house in Randomized Completer Block Design (RCBD) having three replications. Initially data was collected on days to germination, days to 50 % seeds germination and percentage of seeds germination of terminalia in each media. Later, the data on growth parameters i.e. plant height, leaf length, stem diameter, leaves plant $^{-1}$ and survival percentage were recorded after two months of seeds sowing.

Statistical Analysis

Statistix 8.1 software was used to test the significance of results and analyze the data.

Means were compared by using LSD test at probability level of less than 5 percent (Steel et al. 1997).

RESULTS AND DISCUSSION

Days to germination

Growing media has significant results regarding days to germination of terminalia seeds at (P≤0.05) level of significance (Table 1).

Means table shows that farmyard manure and garden soil (control) took more number of days (22 and 25 days) in seed germination while coco-peat was quick (16 days) in terminalia seeds to germinate.

Results revealed that coco-peat was superior media for terminalia seeds to germinate as compared to other growing media (FYM and garden soil). This surprising effect of coco-peat might be due to higher organic carbon contents, good aeration, drainage and humic acid contents of coco-peat, which lead to increased mineral availability and enhanced water holding capacity (Sharma et et al. 2004; Negi & Singh, 1995).

Days to 50 % germination

Table 1 shows that growing media has significant effect on days to 50 % germination of terminalia seeds at (P≤0.05) level of significance (Table 1).

Table 1: Seedling emergence & growth parameters of Terminalia mantaly affected by different growing media

Parameter	FYM	Coco peat	Garden soil	P-value
Days to germination	22.00[a]	16.33[b]	25.67[a]	0.01
Days to 50% germination	33.67[b]	31.67[b]	47.00[a]	0.05
Germinaiton %	47.20[a]	44.42[a]	27.77[b]	≤0.01
Survival %	88.89[a]	94.44[a]	92.87[a]	0.87

[a, b] = superscript letters within row, differ significantly from each other at P ≤0.05 or P≤0.01

Means value shows that maximum days (47 days) to 50 % germination was observed in seeds sown in garden soil (control) while results of FYM and coco-peat were statistically similar, that took least number of days (34 and 32 days) to 50 % germination.

Results revealed that coco-peat and FYM took less time is 50 % seeds germination but coco-peat was even better than FYM. Our findings are supported by (Bhardwaj, 2014), who recorded short germination period of papaya seeds when sown in media having coco-peat. Garcia and Daverede (1994), also reported that coconut coir along with organic manure makes superior media due to good physical properties of coconut coir.

Germination percentage (%)

Table 1 shows that growing media has significant effect on germination percentage of terminalia seeds at (P≤0.01) level of significance.

Means value indicates that maximum germination percentage (47.20 %) of terminalia seeds was recorded in FYM, which was statistically at par with compost having germination percentage of 44.42 % while worst germination percentage (27.77 %) was recorded in garden soil (control).

Results showed higher seed germination percentage of terminalia seeds in coco-peat media. Similar results for seed germination and growth behaviour was observed in papaya seeds sown in coco-peat media (Bhardwaj, 2014).

Survival percentage

Growing media has non-significant effect on survival percentage of terminalia seeds at (P≤0.05) level of significance.

Means table indicates that all three growing media have statistically same survival rate, but numerically coco-peat had highest seedling survival rate (94%) than other media (92 % for garden soil and 89 % for FYM).

The reason behind high survival percentage of terminalia seedlings in coco-peat media is due to its water retention capability along with some nutrients provision capability that fulfils the basic need of the seedling.

Seedling height (cm)

Growing media has non-significant effect regarding seedling height of terminalia at (P≤0.05) level of significance (Table 2).

The heights of survived seedlings are presented below in table 2. Seedling heights were statistically same for all three media, but relatively higher plants (20.5 cm) were observed in coco-peat media while FYM and garden soil (control) recorded seedling height of 18.87 and 15.66 cm, respectively.

However, results were non-significant for all the three media but coco-peat was superior among them. This improved seedling height in coco-peat media was also observed by Bhardwaj (2014) in 'Red lady' cultivar of Papaya fruit plant which strongly supported our findings of maximum seedling height in media that was top-dressed

with coco-peat.

Leaves seedling^{-1}

Growing media has non-significant effect regarding number of leaves seedling^{-1} of terminalia at (P≤0.05) level of significance (Table 2).

Means table shows that number of leaves seedling^{-1} were also statistically at par for all the three media i.e., FYM, garden soil and coco-peat. Numerically, maximum leaves seedling^{-1} (16.55) was produced by seedling standing in garden soil (control), which was then followed by FYM and coco-peat media (12.55 and 10.77 leaves seedling^{-1}).

Results indicate that maximum number of leaves were produced by seedlings grown in garden soil (control). Mahmoud et al. (2019) is strongly corroborative with our findings that garden soil can increase the number of leaves seedling^{-1} of Pistachio. Findings of Bhardwaj (2014) are also in lined with ours, who found that showed that soil media consisting of coco-peat had moderately increased the rate of leaf numbers as compared to other growing media.

Leaf length (cm)

Growing media has non-significant effect regarding leaf length of terminalia seedlings at (P≤0.05) level of significance (Table 2).

Means table indicates that longest leaf (8.45 cm) was observed in terminalia seedlings when grown in coco-peat media and then followed by leaf length of 6.72 cm in FYM grown seedlings. Shortest leaves (6.34cm) were observed in seedlings grown in garden soil (control).

Results revealed that there was no significant difference in leaf length of terminalia seedling as affected by growing media but coco-peat recorded maximum leaf length. Our results are in lined with the findings of Awang et al. (2009), who reported that maximum leaf along with other growth attributes were recorded in *Celosia cristata* seedlings when grown in media having 70 percent of coco-peat content.

Leaf width (cm)

Table 2 shows that growing media has non-significant effect regarding leaf length of terminalia seedlings at (P≤0.05) level of significance.

Leaf width of terminalia seedlings were statistically similar for all types of growing media as presented below in table 2. The widest leaves (5.45cm) in terminalia seedlings were recorded when grown in FYM media and then followed by leaf width of 4.93 cm, produced by seedlings raised in coco-peat. Least leaf width (4.73cm) was recorded in seedlings grown in garden soil (control).

Results revealed that farmyard manure and coco-peat were better than control regarding leaf width of terrninalia seedlings. FYM contains all the essential nutrients required by the plant body to grow and develop. Increased leaf growth could be associated with presence of all the essential nutrients required by the plant body to grow and develop. Ikram et al. (2012) also recorded the increase in leaf of area of tuberose plant when grown in media containing coconut and FYM. Similar findings of improved leaf width of Aglaonema plant in coco-peat media was also recorded by Swetha et al. (2014).

Stem diameter (mm)

Table 2 shows that growing media has significant effect regarding leaf length of terminalia seedlings at (P≤0.05) level of significance.

Table 2: Seedling development parameters of *Terminalia mantaly* under different growing media

Parameter	FYM	Coco peat	Garden soil	P-value
Seedling height (cm)	18.87^{a}	20.51^{a}	15.66^{a}	0.11
Leaves seedling^{-1}	12.55^{a}	10.77^{a}	16.55^{a}	0.47
Leaf length (cm)	6.72^{a}	8.45^{a}	6.34^{a}	0.15
Leaf width (cm)	5.45^{a}	4.93^{a}	4.73^{a}	0.48
Stem diameter (mm)	2.85^{b}	3.17^{a}	2.71^{a}	≤0.01

$^{a, b}$ = superscript letters, within row, differ significantly from each other at P≤0.05 or P≤0.01

Significant difference among growing media was recorded regarding stem diameter of terminalia seedlings. Thickest stem (3.17 mm) was observed in seedlings raised in coco-peat media and then followed by seedlings (2.85mm stem girth) grown in control pots. Terminalia seedlings raised in FYM media recorded least stem girth (2.71 mm).

Our results showed an increase in the stem girth of seedlings when raised in coco-peat. This improved rate of stem diameter by coco-peat media might be associated with the better provision of nutrients and other characters. This assumption is also strongly supported by the findings of Gopikumar and Chandran (2003) who concluded that stem diameter is associated with better provision of nutrients and other physical

characteristics of the soil. Sardoei and Shahdadneghad (2015) also found an increase in the stem girth of *Zinnia elegans* plants when grown in media having coconut compost as its component.

CONCLUSION

Coco-peat media recorded least days to germination and days to 50 % germination while highest survival percentage (94.44%), seedling height (20.50 cm), leaf length (8.45 cm), and stem diameter (3.17 mm). Farmyard manure media recorded highest germination percentage (47.20) and leaf width (5.45 cm) of terminalia seedlings. Least values were recorded for all parameters except number of leaves seedlings^{-1} (16.55), when grown in garden soil (control). Thus, concluded that coco-peat media is effective in both germination and growth of *Terminalia mantaly*.

RECOMMENDATION

In view of the conclusion, it has been recommended that coco-peat is the best growing media for terminalia to propagate via seeds and for growth of the seedlings as well.

CONFLICT OF INTEREST

The authors declared that present study was performed in absence of any conflict of interest.

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AUTHOR CONTRIBUTIONS

SRK and GN Concieved and designed the experiments: SRK, MAK and MA performed the experiments: AM, MZA, HU, RI, MA and MB Contributed materials/ analysis/ tools: Wrote the paper AAK, IU, and ASK.

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