Evaluation of growth performance of *Terminalia tomentosa* under different potting media

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ABSTRACT

The present investigations on evaluation of the growth performance of *Terminalia tomentosa* under different potting media were conducted at the College of Forestry, Dapoli, Ratnagiri, Maharashtra during 2020-21 in completely randomised block design with seven treatment combinations comprising control (soil), control (cocopeat), control (vermicompost) and soil, vermicompost and cocopeat in the ratios of 2:1:1, 1:1:1, 1:2:2 and 1:2:2. The findings indicated that among the different growing media having soil, vermicompost and cocopeat (1:1:1) increased the overall plant growth of *T tomentosa* with higher germination, shoot length, root length, collar diameter and fresh shoot and root weight.

Keywords: Potting media; germination; *Terminalia tomentos*a; seedling

INTRODUCTION

Growing media is defined as the mean where the roots of cultivated plants grow (Kampf 2000) and the primordial function gives support to growing of plant (Kampf 2000, Robert 2000). Growing media should be considered as an essential part of the propagation system because rooting competency depends on the type of medium used (Chadha 2007, Mehmood et al 2013). Rooting medium directly effects quality and percentage of rooting (Loach 1988). The growing media should be porous, uniform in texture, hold sufficient moisture and should be well drained (Sardoei et al 2014) which provides physical support, aeration and water (Hartmann et al 2011, Larsen and Guse 1997, Bhardwaj 2014). According to Loach (1988) the rooting medium should be considered as an integral part of the propagation system; percentage rooting and the quality of the roots produced are directly influenced by the medium. The type of rooting media and their characteristics are of greatest importance for the quality of rooted cuttings (Khayyat et al 2007). The selection of the proper media components is critical to the successful production of seedlings (Robins and Evans 2011) because media play an important role in seed germination and directly affect the development and later maintenance of the extensive functional rooting system (Bhardwaj 2014).

The genus *Terminalia* is the second largest genus of the Combretaceae family with about 200 species. These plants are distributed in tropical regions of the world with the greatest genetic diversity in southeast Asia (Lima et al 2012). *Terminalia tomentosa* Roxb is a large deciduous tree, 20-35 m high and 1 m in diameter (Nadkarni 1976, Nair and Henry 1983, Rastogi and Mehrotra 1991, Shetty and Singh 1987). It is commonly known as Ain, Asan, Indian Laurel and silver grey wood and is casually called crocodile bark tree due to its characteristic bark pattern. It is a primary host plant for the larvae of tropical tasar silkworm reared for commercial production of cocoon.

The bark is bitter and stypic, useful in vitiated conditions of pitta, ulcers, vata, fractures, haemorrhages, bronchitis cardiopathy, strangury, wounds, haemoptysis, dysentery, cough, verminosis, leucorrhoea, gonorrhoea and burning sensation (Kirtikar and Basu 1935, Warrier et al 1993). Phytoconstituents such as tannins like arjunic acid, arjunolic acid, arjunetin, ellagic acid, gallic acid and triterpenoids like oleanolic acid, betulinic acid and steroid

like β-sitosterol have been reported to be present in *T tomentosa* (Row and Rao 1962, Mallavarapu et al 1980, Mallavarapu et al 1986, Anjaneyulu et al 1986, Srivastava et al 2001). The plant is known to possess many pharmacological properties like antifungal (Shinde et al 2011), antioxidant (Jain et al 2010), anti-hyperglycaemic (Alladi et al 2012), anti-diarrhoeal and anti-leucorrheal (Hedge et al 2009). The multipurpose tree species *T tomentosa* is grown generally on field bunds in Konkan region of Maharashtra. Apart from its economic value the tree is important silviculturally as being one of the commonest of Indian forest trees and being suitable for afforesting clayey ground.

It is absolutely determined that use of appropriate growing medium helps in the production of quality planting material with better root system and enhances final survival of tree species. This further helps in lowering the cost of planting material that successfully is going to be helpful for the farmers. Therefore keeping in view the above facts, the present study was undertaken.

MATERIAL and METHODS

Seeds were collected form superior trees of *T tomentosa* (10-15 years old) from biodiversity park of College of Forestry, DBSKKV, Dapoli, Maharashtra (latitude 17°452 N, longitude 73°122 E, altitude 250 m amsl) in the month of March 2021. Dapoli is located in the Konkan region of Maharashtra and is confined in between Sahyadri hills in the east and Arabian Sea in the west. Dapoli represents more or less tropical climate having average humidity of 78 per cent throughout the year. The climate is hot, humid with well-expressed three seasons viz summer (March to May), rainy (June to October) and winter (November to February). The average minimum and maximum temperature is 18.5 and 30.8°C respectively with an average annual precipitation of 3,500-4,000 mm which is generally received from June to October.

The experimental treatments comprised seven treatment combinations consisting of different combinations of growth media. There were seven treatments viz T_1 [Control (soil)], T_2 [Control (cocopeat)], T_3 [Control (vermicompost)], T_4 [Soil:vermicompost:cocopeat (2:1:1)], T_5 [Soil:vermicompost:cocopeat (1:1:1)], T_6 [Soil:vermicompost:cocopeat (1:2:2)] and T_7 [Soil:vermicompost:cocopeat (1:1:2)] with three replications. The experiment was laid out in complete randomized design. There were 10 polythene bags in each replication having the size of 12.5 cm x 25 cm. Polythene bags were kept moist by sprinkling water and kept free from weeds. To protect the polythene bags from fungal diseases, drenching of carbendazim (@ 2 g/l was done in alternate weeks. The seed germination was monitored daily. The seed germination was calculated using the following formula

$$\text{Germination (\%)} = \frac{\text{Number of germinated seeds}}{\text{Number of seeds sown}} \times 100$$

At the end of the experiment, five seedlings per replication were randomly selected and carefully uprooted without breaking the roots for seedling growth studies.

Shoot length was measured from leading shoot tip to the collar region of the seedling. Root length of tap root was recorded by placing it horizontally on the ground. Collar diameter of the seedling was measured by the vernier caliper. Fresh root and shoot weight was calculated with electronic balance. Root-shoot ratio was calculated by dividing root length by the shoot length of the seedling. Vigour index and sturdiness were worked out using the following formulae:

$$\text{Vigour index} = \text{Germination (\%)} \times (\text{root length} + \text{shoot length})$$

$$\text{Sturdiness} = \frac{\text{Plant height (cm)}}{\text{Collar diameter}}$$

ANOVA was applied by using the statistical package SYSTAT (9.0). When the treatment effect was found significant, the least significant difference (LSD) was calculated to compare treatment means. The graphs were prepared by using MS Excel.

RESULTS and DISCUSSION

The data given in Table 1 show that germination was maximum in treatments T_5 [Soil:vermicompost:cocopeat (1:1:1)] (76.67%) and T_6 [Soil:vermicompost:cocopeat (1:2:2)] (70.00%) which were at par followed by T_7 [Soil:vermicompost:cocopeat (1:1:2)] (60.00%) as compared to T_1 [Control (soil)] (36.67%). Collar diameter was recorded maximum in T_5 (2.92 mm)

Table 1. Effect of different potting media on germination and seedling growth of *Terminalia tomentosa*

Treatment	Germination (%)	Collar diameter (mm)	Shoot length (cm)	Root length (cm)	Root-shoot ratio	Vigour index	Fresh shoot weight (g)	Fresh root weight (g)	Sturdiness
T_1: Control (soil)	36.67	1.34	5.90	7.73	1.33	502.00	0.67	0.35	4.41
T_2: Control (cocopeat)	53.33	1.57	8.83	8.50	0.96	928.00	0.93	0.39	5.62
T_3: Control (vermicompost)	50.00	1.55	7.77	8.27	1.07	801.67	0.90	0.39	5.02
T_4: Soil:vermicompost:cocopit (2:1:1)	56.67	1.78	9.13	8.93	0.98	1,021.00	1.07	0.40	5.14
T_5: Soil:vermicompost:cocopit (1:1:1)	76.67	2.92	12.40	12.60	1.02	1,915.67	1.42	0.54	4.25
T_6: Soil:vermicompost:cocopit (1:2:2)	70.00	2.61	10.40	11.70	1.13	1,541.63	1.36	0.47	3.98
T_7: Soil:vermicompost:cocopit (1:1:2)	60.00	2.25	10.13	9.53	0.94	1,180.00	1.20	0.43	4.51
$CD_{0.05}$	10.112	0.2195	1.147	0.953	0.187	203.676	0.196	0.0628	0.493

followed by T_6 (2.61 mm) and minimum in T_1. Shoot length was also maximum in T_5 (12.40 cm) followed by 10.40 cm in T_6 and minimum in T_1 (5.90 cm). Root length was recorded maximum in T_5 and T_6 (12.60 and 11.70 cm respectively) both being at par as against minimum in T_1 (7.73 cm). However root-shoot ratio was highest in T_1 (1.33) followed by 1.13 in case of T_6. Vigour index was also recorded maximum in T_5 (1,915.67) followed by 1,541.63 in T_6 and minimum in T_1 (502.00). Fresh shoot weight was recorded maximum in T_5 (1.42 g) and T_6 (1.36 g) the two being at par followed by 1.20 g in T_7 and minimum in T_1 (0.67 g).

In case of fresh root weight T_5 (0.54 g) recorded maximum fresh root weight followed T_6 (0.47 g) as against the minimum in T_1 (0.35 g). Maximum sturdiness was recorded in T_2 [Control (cocopeat)] (5.62) and T_4 [Soil:vermicompost: cocopeat (2:1:1)] (5.14) followed by 5.02 in T_2 [Control (cocopeat)]. From the observations it is apparent that among the seven treatments, T_5 was found significantly superior treatment as compared to others.

The type of rooting media and their characteristics are of utmost importance for the quality of rooted cuttings (Khayyat et al 2007). The effects of different pot mixtures on plant growth and development have been previously investigated (Douglas et al 2000, Nowak and Strojny 2003, Samartzidis et al 2005). Singh and Mann (1976) planted the seedlings of trifoliate orange (*Poncirus trifoliate)* in seven different planting media and after eight and twelve months they found maximum number of leaves 29.5 and 48.8 respectively in soil treatment. Parasana et al (2013) found that soil + sand + farmyard manure mixture (2:1:1) was most effective for better germination (77.33%) of mango stones as well as growth of mango seedlings.

Vermicompost provides adequate nutrients and enhances both physical properties and water holding capacity of the soil. Combined application of vermicompost and cocopeat has shown significant effect on seedling growth and plant biomass, perhaps due to the synergistic effect of these two. The findings are as per the observations made by Abirami et al (2010) who reported that since coir dust is low in nutrients, mixed with vermicompost it provides a better growth medium for plant establishment. However cocopeat has been recognized as having relatively low levels of mineral nitrogen (N) and micronutrients such as calcium (Ca_2^+) and magnesium (Mg_2^+) (Evans et al 1996, Abad et al 2002).

REFERENCES

Abad M, Noguera P, Puchades R, Maquieira A and Noguera V 2002. Physico-chemical and chemical properties of some coconut dust for use as peat substitute for containerised ornamental plants. Bioresource Technology **8(3):** 241-245.

Abirami K, Rema J, Mathew PA, Srinivasan V and Hamza S 2010. Effect of different propagation media on seed germination, seedling growth and vigour of nutmeg (*Myristica fragrans* Houtt). Journal of Medicinal Plants Research **4(19):** 2054-2058.

Alladi S, Prakash DS, Malothu R, Nalini M and Rao KS 2012. Anti-hyperglycemic activity of the leaves of *Terminalia tomentosa* against normal and alloxan-induced diabetic rats. Research Journal of Pharmacy and Technology **5(12):** 1577-1584.

Anjaneyulu ASR, Reddy AVR, Mallavarapu GR and Chandrasekhara RS 1986. 3-acetylmaslinic acid from the

root bark of *Terminalia alata*. Phytochemistry **25(11):** 2670-2671.

Bhardwaj RL 2014. Effect of growing media on seed germination and seedling growth of papaya cv Red Lady. African Journal of Plant Science **8(4):** 178-184.

Chadha KL 2007. Handbook of horticulture. Directorate of Information and Publications of Agriculture, Indian Council of Agricultural Research, New Delhi, India.

Douglas MH, Smallfield BM, Parmenter GA, Burton LC, Heaney AJ and Johnstone PD 2000. Effect of growing media on the production of ginseng (*Panax ginseng*) in Central Otago, New Zealand. New Zealand Journal of Crop and Horticultural Science **28(3):** 195-207.

Evans MR, Konduru S and Stamps RH 1996. Source variation in physical and chemical properties of coconut coir dust. HortScience **31(6):** 965-967.

Hartmann HT, Kester DE, Davies FT Jr and Geneve RL 2011. Hartmann and Kester's plant propagation: principles and practices. 8th edn, Prentice Hall.

Hedge K, Thakker SP and Joshi AB 2009. Isolation and characterization of chemical constituents from the roots of *Carissa carandas*. Asian Journal of Chemistry **21(7):** 5399-5402.

Jain VC, Patel NM, Shah DP, Patel PK and Joshi BH 2010. Antioxidant and antimicrobial activities of *Terminalia crenulata* Roth bark. Pharmacologyonline **2:** 204-217.

Kampf AN 2000. The substrate commercial production of ornamental plants. Farm Progress Agriculture, Guaba, Brazil, 254p.

Khayyat M, Nazari F and Salehi H 2007. Effects of different pot mixtures on Pothos (*Epipremnum aureum* Lindl and Andre Golden Pothos) growth and development. American-Eurasian Journal of Agricultural and Environmental Sciences **2(4):** 341-348.

Kirtikar KR and Basu BD 1935. Indian medicinal plants. Vol II, Lalit Mohan Publication, Allahabad, Uttar Pradesh, India, pp 1347-1348.

Larsen FE and Guse WE 1997. Propagating deciduous and evergreen shrubs, trees and vines with stem cuttings. Pacific Northwest Cooperative Extension Publication, Washington, USA.

Lima GRDM, de Sales IRP, Filho MRDC, de Jesus NZT, Falcao HDS, Barbosa-Filho JM, Cabral AGS, Souto AL, Tavares JF and Batista LM 2012. Bioactivities of the genus *Combretum* (Combretaceae): a review. Molecules **17(8):** 9142-9206.

Loach K 1988. Controlling environmental conditions to improve adventitious rooting. In: Adventitious root formation in cuttings (TD Davis, BE Haissig and N Sankhla, eds) Dioscorides Press, Portland, pp 248-273.

Mallavarapu GR, Rao SB and Syamasundar KV 1986. Chemical constituents of the bark of *Terminalia alata*. Journal of National Production **49(3):** 549-550.

Mallavarapu GR, Rao SB, Muralikrishna E and Rao GSRS 1980. Triterpenoids of the heartwood of *Terminalia alata heyne* ex *roth*. Indian Journal of Chemistry, Sec B-Organic and Medicinal Chemistry **19(8):** 713-714.

Mehmood T, Ahmad W, Ahmad KS, Shafi J, Shehzad MA and Sarwar MA 2013. Comparative effect of different potting media on vegetative and reproductive growth of floral shower (*Antirrhinum majus* L). Universal Journal of Plant Science **1(3):** 104-111.

Nadkarni KM 1976. Dr KM Nadkarni's Indian materia medica-with Ayurvedic, Unani-Tibbi, Siddha, allopathic, homeopathic, naturopathic and home remedies, appendices and indexes. 3rd edn, Popular Prakashan Pvt Ltd, Bombay, Maharashtra, India.

Nair NC and Henry AN 1983. Flora of Tamil Nadu. Botanical Survey of India, Coimbatore, Tamil Nadu, India, 184p.

Nowak JS and Strojny Z 2003. Effect of different container media on the growth of gerbera. Acta Horticulturae **608:** 59-63.

Parasana JS, Leua HN and Ray NR 2013. Effect of different growing medias mixture on germination and seedlings growth of mango (*Mangifera indica* L) cultivars under net house conditions. Bioscan **8(3):** 897-900.

Rastogi RP and Mehrotra BN 1991. Compendium of Indian medicinal plants. Central Drug Research Institute and Publications and Information Directorate, Lucknow, Uttar Pradesh, India, 405p.

Robert R 2000. Horticultural substrates: possibilities and limits of its composition and use, examples of research, industry and consumption: substrates for plants the basis of plant production in containers. Genesis Publications, Port Alegre, Brazil, pp 209-215.

Robins JA and Evans MR 2011. Growing media for container production in greenhouse or nursery. Cooperative Extension Service, University of Arkansas, US Dept of Agriculture and County Governments Cooperating.

Row LR and Rao GSRS 1962. Chemistry of *Terminalia* species-VI: the constitution of tomentosic acid, a new triterpene carboxylic acid from *Terminalia tomentosa* Wight and Arn. Tetrahedron **18:** 827-838.

Samartzidis C, Awada T, Maloupa E, Radoglou K and Constantinidou HIA 2005. Rose productivity and physiological responses to different substrates for soil-less culture. Scientia Horticulturae **106(2):** 203-212.

Sardoei AS, Fahraji SS and Ghasemi H 2014. Effects of different growing media on growth and flowering of zinnia (*Zinnia elegans*). International Journal of Advanced Biological and Biomedical Research **2(6):** 1894-1899.

Shetty BV and Singh V 1987. Flora of Rajasthan. Vol I, Botanical Survey of India. Calcutta, West Bengal, India, 315p.

Shinde SL, Wadje SS, More SM and Junne SB 2011. The antifungal activity of five *Terminalia* species checked by paper disc method. International Journal of Pharmaceutical Research and Development **3:** 36-40.

Singh J and Mann MS 1976. Effect of various planting media on the growth of the trifoliate orange seedlings. Andhra Agriculture Journal **16(3-4):** 108-112.

Srivastava SK, Srivastava SD and Chouksey BK 2001. New antifungal constituents from *Terminalia alata*. Fitoteapia **72:** 106-112.

Warrier PK, Nambiar VPK and Ramankutty C 1993. Indian medicinal plants- a compendium of 500 species. Vol 1, Arya Vaidya Sala, Kotakkal, Kerala, India, 379p.