Plant Archives Vol. 24, Special Issue (GABELS), 2024 pp.39-44 e-ISSN:2581-6063 (online), ISSN:0972-5210

Plant Archives

Journal homepage: http://www.plantarchives.org

DOI Url : https://doi.org/10.51470/PLANTARCHIVES.2024.v24.SP-GABELS.006

STANDARDIZATION OF GROWING MEDIUM FOR GROWTH OF *AZADIRACHTA INDICA* SEEDLINGS IN SEMI-ARID REGION OF RAJASTHAN, INDIA

Manju Attri[1*], S.B.S. Pandey[1] and Manoj Kumar Yadav[2]

[1]Department of Silviculture and Agroforestry, College of Horticulture & Forestry, Jhalrapatan, Jhalawar, Rajasthan- 326023, India

[2]Agricultural Research Station, Keshwana, Jalore, Rajasthan, 343001, India

[*]Corresponding Author E-mail: attrimanju24@gmail.com

ABSTRACT

A field experiment comprised of eighteen treatments of four growing medium viz.; soil, sand, FYM and vermicompost in different ratio was conducted to find out the best growing medium for Neem (*Azadirachta indica*) seedlings. Seedlings were raised in the polybags of size 6" x 10" under green shed net (50 % light intensity) nursery conditions. Maximum growth of Neem seedlings was observed in T_{15} [Soil: Sand: Vermicompost (2:1:2)] treatment as the best height (33.50 cm), collar diameter (5.21 mm), number of leaves (16.42), length of longest tap root (17.55 cm), diameter of longest tap root (2.91 mm), fresh weight of seedlings (59.90 g), dry weight (26.34 g), and root-shoot ratio (1.09). Thus, mixture of Soil: Sand: Vermicompost (2:1:2) can be used to produce quality planting material of Neem in shortest possible time.

Keywords: Growing media, *Azadirachta indica* (Neem), Seedling, Vermicompost and Farmyard manure.

Introduction

The Neem tree *(Azadirachta indica)*, belongs to family Meliaceae, is a tropical evergreen tree related to mahogany and native to east India and Burma. Neem (*Azadirachta indica*) is a versatile, hardy Indian tree of great religious, medicinal and ornamental importance. The species has been used to afforest drier tracts, ravines and refractory soils in the states of Gujarat, Rajasthan, Punjab, Haryana, Utter Pradesh, Bihar, Orissa, Tamil Nadu. It grows in much of Southeast Asia and West Africa; a few trees have recently been planted in the Caribbean and several Central American countries including Mexico. The people of India have long revered the neem tree for centuries, millions have cleaned their teeth with neem twigs, smeared skin disorders with neem-leaf juice, taken neem tea as a tonic and placed neem leaves in their beds, books, grain bins, cupboards, and closets to keep away troublesome bugs.

Trees can reach up to 30 m tall with limbs reaching half as wide. The shiny dark green pinnately compound leaves are up to 30 cm long. Each leaf has 10–12 serrated leaflets that are 7 cm long by 2.5 cm wide. It will grow where rainfall is as little and thrives in areas that experience extreme heat of up to 48°C. Even some of the most cautious researchers are saying that neem deserves to be called a "wonder plant". Neem is used as fertilizer, manure, and urea coating agent, fumigant, pesticide and soil conditioner. Neem pest control is very beneficial for proper crop and pest management (Roshan *et al*., 2015).

Sowing of seeds is done in June-July in drills 15 cm apart in raised nursery beds; the seed being 2.5 cm apart in the lines (Luna, 1996). The seeds are sown in raised seedbeds of size 12 m x 1.2 m. Seedbeds should contain sand, soil and FYM in the ratio 1:1:1. The seeds are broadcasted and watered daily. Seeds are covered lightly by soil to prevent insects attacking the radical. Germination takes place after 15 – 20 days.

The seedlings can be transplanted into polybags after 3 – 4 months when they are 6 – 8 cm in length. In polythene bags, the seedlings can also be raised containing sand, soil and FYM in the ratio of 1:1:1. Germination commences after 7 to 20 days.

Soil is one of the most essential environmental factors which play an important role in seedling establishment. However, root system of the plant is equally important. In fact, environmental factors influence the formation of roots. Early growth and survival of seedlings are important aspects of forest management to ensure a quick economic return of the species. Hence, the present experiment is proposed to standardize optimum ratio of sand, soil, FYM, vermicompost for proper germination and growth of seedlings in semi-arid region of Rajasthan like Jhalawar.

Material and Methods

A field experiment was conducted at Instructional farm, Fruit Science in College of Horticulture and Forestry, Jhalawar during 2019-2020. Jhalawar district is located at 23°4' to 24°52' N-Latitude and 75°29' to 76°56' E Longitude in South-Eastern Rajasthan. It has a spatial extent of 6928 Sq. Kms. The experimental site of Instructional farm of the Department of Fruit Science falls in Zone V and is known as Humid South Eastern Plain. Jhalawar is rich in water resources. District topography is made up of plain though some parts consist of hilly terrain. The Aravallis which are the most ancient mountain system of India roughly divide the plains of Hadoti from the Malwa Plateau. Climate of Jhalawar is different from the rest of the state because of abundant rainfall received by the region which is against the common perception we have of Rajasthan. Climate is typically sub-humid with extremes of temperature both in summer and winter. The climate here is classified as Cfa by the Köppen-Geiger system. During summer season (March - June) temperature ranges from 27 - 42 ^{0}C. May is the hottest part of the year. Temperatures remains high during this season and the heat can be very oppressive sometimes. The summers are hot and extremely uncomfortable. The monsoon season is from June to September. Temperature ranges around the 30 ^{0}C during this period. South western monsoon brings abundant rainfall to the region. Jhalawar district receives an average rainfall of around 943 mm, the highest rainfall in Rajasthan. The region is governed by the monsoonal rhythm like the rest of India. The driest month is February which receives little or nil rainfall. Most of the precipitation here falls in August amounting to 336 mm on an average. Temperature stays between 10 to 25 ^{0}C during winter season (October - February) though sometimes temperature may go down as low as 1^{0}C.

Growing medium were prepared by mixing soil, sand, farm yard manure (FYM) and vermicompost in different but fixed ratios. Before preparing growing medium, sand and FYM was also sieved using 2 mm diameter sieve. The required material was obtained from the sources which have been stated below:

1. Fine soil was collected from the outskirts of Patan town. Soil was then sieved with 2 mm diameter sieve to remove pebbles and boulders from it. Soil was of the order vertisols and exhibiting average value of soil pH (7.90), EC (0.577 dSm^{-1}), organic carbon (0.190 %), available nitrogen (110 kg ha^{-1}), available phosphorus (761.80 kg ha^{-1}) and available potassium (91.60 kg ha^{-1}) was used.
2. Sand was obtained from dry river bed of Kali Sindh River.
3. FYM was obtained from a dairy farm located in close proximity to campus.
4. Vermicompost was obtained from Agriculture Research Sub-Station, Aklera, Khanpur (Jhalawar).

Seedlings were raised in the polybags of size 6" x 10" filled with different combination of growing medium under green shed net (50 % light intensity) nursery conditions. Treatments details are T_0 [(Soil) (1)], T_1[(Soil : Sand) (1:1)], T_2[(Soil :FYM) (1:1)], T_3[(Soil: Vermicompost) (1:1)], T_4[(Soil :Sand :FYM) (1:1:1)], T_5[(Soil :Sand :FYM) (1:1:2)], T_6[(Soil :Sand :FYM) (2:1:1)], T_7[(Soil :Sand :FYM) (1:2:1)], T_8[(Soil :Sand :FYM) (2:1:2)], T_9[(Soil :Sand :FYM) (1:2:2)], T_{10} [(Soil :Sand :FYM) (2:2:1)], T_{11}[(Soil :Sand: Vermicompost) (1:1:1)], T_{12}[(Soil : Sand: Vermicompost) (1:1:2)], T_{13}[(Soil :Sand: Vermicompost) (2:1:1)], T_{14}[(Soil :Sand: Vermicompost) (1:2:1)], T_{15}[(Soil :Sand: Vermicompost) (2:1:2)], T_{16}[(Soil :Sand: Vermicompost) (1:2:2)], T_{17} [(Soil :Sand: Vermicompost) (2:2:1)].

Result and Discussion

Shoot parameters

Plants with significant highest mean height of 33.50 cm was in treatment T_{15} [Soil: Sand: Vermicompost (2:1:2)] (Fig. 1). Treatment T_0 (Soil, control) had significant lowest mean height of 13.80 cm. Heights of seedlings in treatments viz; T_{12} (32.10 mm),T_8 (31.70 mm), T_5 (31.23 mm),T_{16} (30.23 mm) andT_{13} (26.70 mm) were found to be statistically at par with maximum height and each of this treatment had high quantity of growing media. Sofi *et al*. (2016) found that the growing medium having soil, sand and

Vermicompost in the ratio of 2:1:2 performed best with respect to germination percentage, growth attributes, physiological attributes and survival percentage in Himalayan maple (*Acer caesium* Wall.) propagated through seed and softwood cuttings. Results are in agreement with the findings of Bhardwaj *et al*. (1996) in *Pinus roxburghii*, Pyarelal and Karnataka (1993) in *Quercus leucotrichophora*, and Bahuguna *et al*. (1987) in *Acacia albida.*

Treatment T_{15} [Soil: Sand: Vermicompost (2:1:2)] had collar diameter of 5.21 mm, which was significantly highest among all the treatments (Fig. 2). It was more than double the minimum collar diameter of 2.27 mm observed in treatment T_0 (Soil, control). Results are in agreement with the findings of Sofi *et al*., (2016) in Himalayan maple (*Acer caesium* Wall.) propagated through seed and softwood cuttings.

Treatment T_{15} [Soil: Sand: Vermicompost (2:1:2)] had significantly highest number of leaves and had a value of 16.42 (Fig. 3). Significant minimum number of leaves were observed in treatment T_0 (Soil, control) having a value of 9.67. It can be due to beneficial effect of vermicompost. Vermicompost not only enhance microbial and enzymatic activities that have long lasting residual effects but also modulates soil structure, increases the availability of nutrients and water retention capacity of the media (Edwards *et al*., 2004 and Knapp *et al*., 2010).

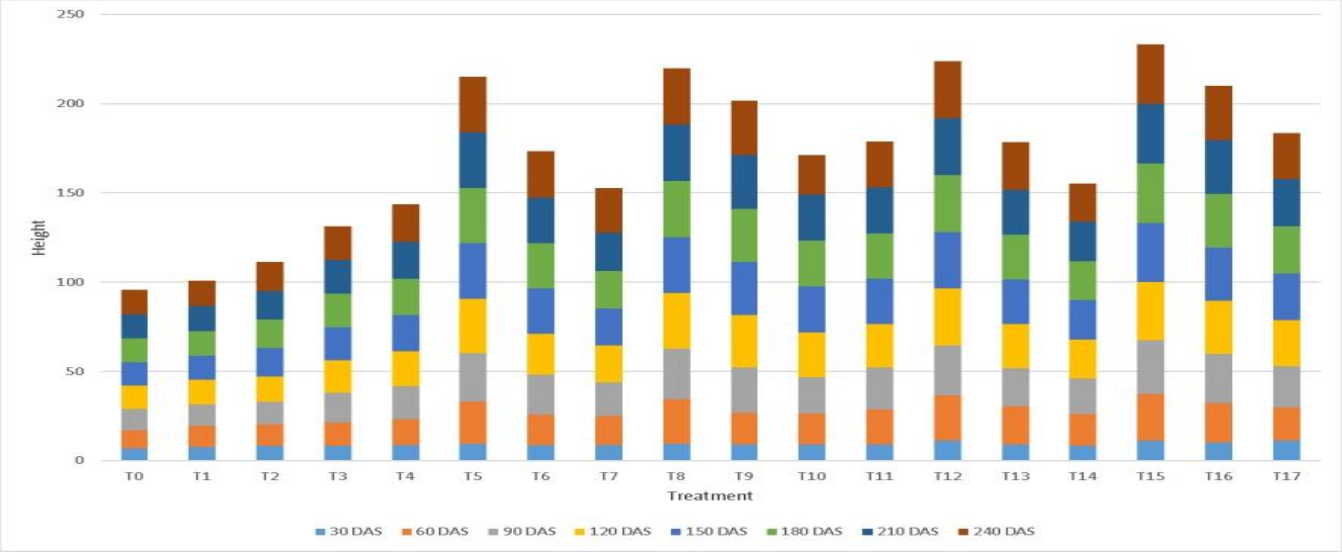

Fig. 1: Influence of various growing media on plant height (cm) in Neem *(Azadirachta indica)* at various growth periods

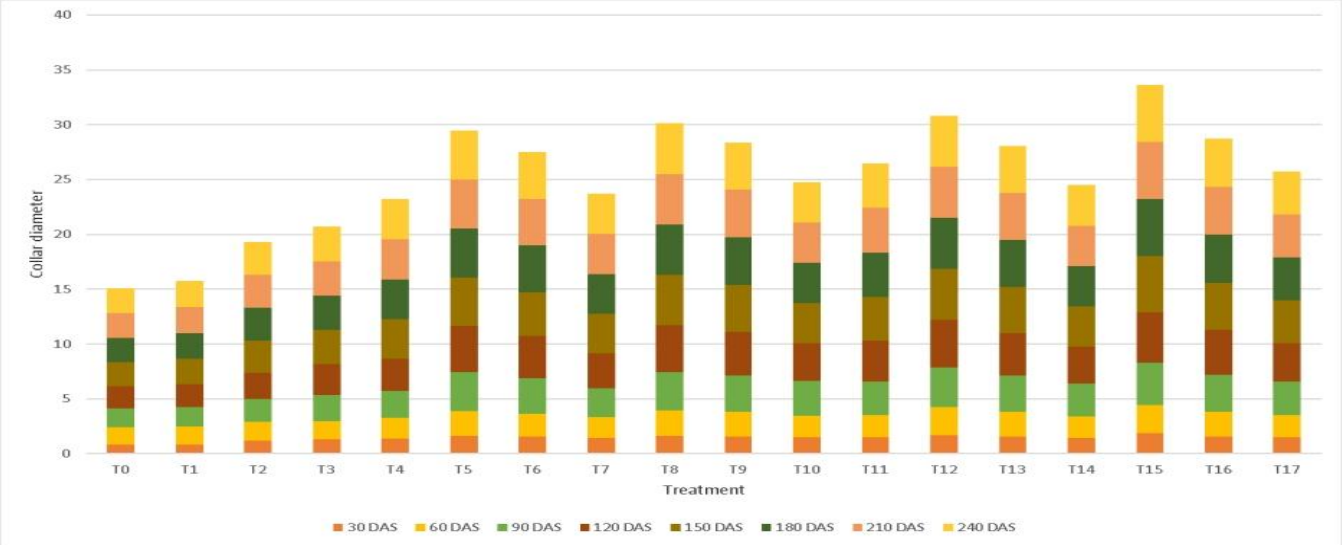

Fig. 2: Influence of various growing media on collar diameter (mm) in Neem *(Azadirachta indica)* at various growth periods

Fig. 3: Influence of various growing media on number of leaves in Neem *(Azadirachta indica)* at various growth period

Root parameters

It is apparent from the Fig. 4. that treatment T_{15} [Soil: Sand: Vermicompost (2:1:2)] had significant maximum root length of 17.55 cm whereas shortest tap root was in treatment T_0 (Soil, control) having a length of 7.17 cm. Significantly maximum and minimum tap root diameter of 2.21 mm and 1.19 mm was recorded in treatments T15 [Soil: Sand: Vermicompost (2:1:2)] and T0 (Soil, control), respectively (Fig. 5). Nutrient rich growing medium led to development of fibrous network of roots resulting in more nutrient uptake by plants. Vermicompost represented hormone-like activity and increased the number of roots, thereby, enhancing nutrient uptake as well as plant growth and development (Alvarez and Grigera, 2005). Sofi *et al.* (2016) conducted a study on the propagation of Himalayan maple (*Acer caesium* Wall.) through seed and softwood cuttings. He found that the growing medium having soil, sand and Vermicompost in the ratio of 2:1:2 performed best with respect to germination percentage, growth attributes, physiological attributes and survival percentage. Rana *et al.*, (2017) found that among different ratio of soil, sand and FYM, potting mixture consisting of soil, sand and FYM in ratio 1:2:4 produced significant highest root length.

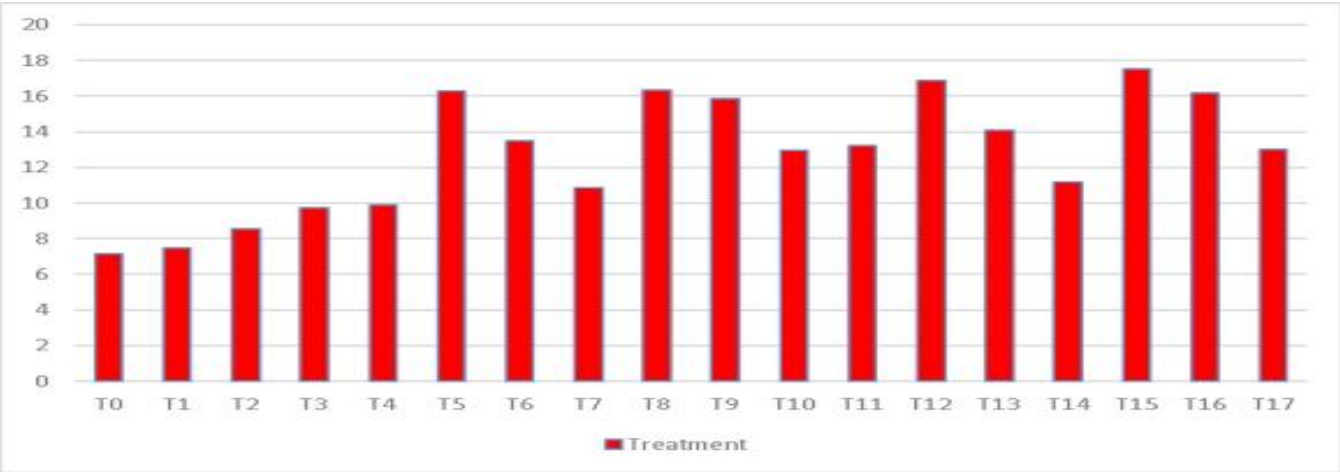

Fig. 4 : Influence of various growing media on longest tap root (cm) in Neem *(Azadirachta indica)*

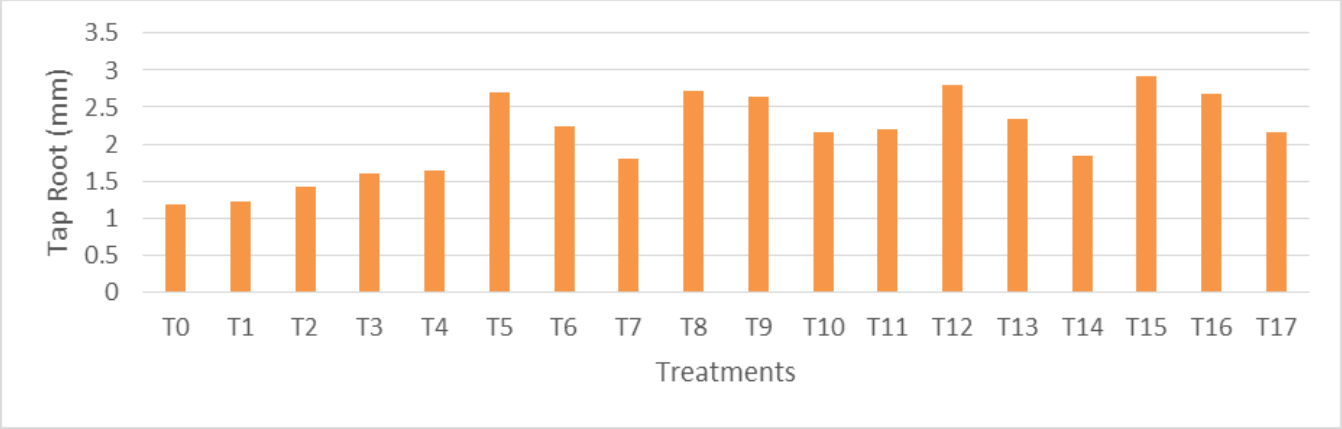

Fig. 5: Influence of various growing media on diameter of tap root (mm) in Neem *(Azadirachta indica)*

Biomass attributes

Highest value of fresh weight of seedlings (59.90 g) was reported in treatment T_{15} [Soil: Sand: Vermicompost (2:1:2)]. Treatment T_0 (soil, Control) reported significant minimum fresh weight of seedlings (16.48 g). The better results obtained in Soil: Sand: Vermicompost in present study can be due to presence of sand and nutrient rich vermicompost in the media wherein sand provides better aeration and good drainage of water and Vermicompost contains plant growth regulating material such as humic acid (Muscsolo *et al*., 1999). Srivastava *et al*. (1998) showed potting mixture of compost, sand and soil in the ratio of 2:1:2 as best for raising quality seedling of *Eucalyptus hybrid*. Significant maximum (26.34 g) and minimum dry weight (7.63 g) of seedlings was recorded in treatment T_{15} [Soil: Sand: Vermicompost (2:1:2)] and treatment T_0 (soil, Control), respectively. Statistically significant maximum Root/shoot ratio (1.09) was recorded in treatment T_{15} [Soil: Sand: Vermicompost (2:1:2)] and minimum Root/shoot ratio (0.76) was reported in treatment T_0 (soil, Control) (Fig. 6). Sagar and Kasera (2016) reported significant maximum dry biomass per plant in 1:3:2 soil mixture ratio of sand, clay and FYM respectively. Benjamin *et al*., (2019) found root shoot ratio of 1.02 – 1.06 in *Terminalia chebula* Retz under nursery conditions with different seed size, pre-sowing treatments and potting mixture. Results are consistent with Kumar *et al*. (2016) in *Pinus gerardiana* and with Sofi *et al*. (2016) in *Acer caesium.*

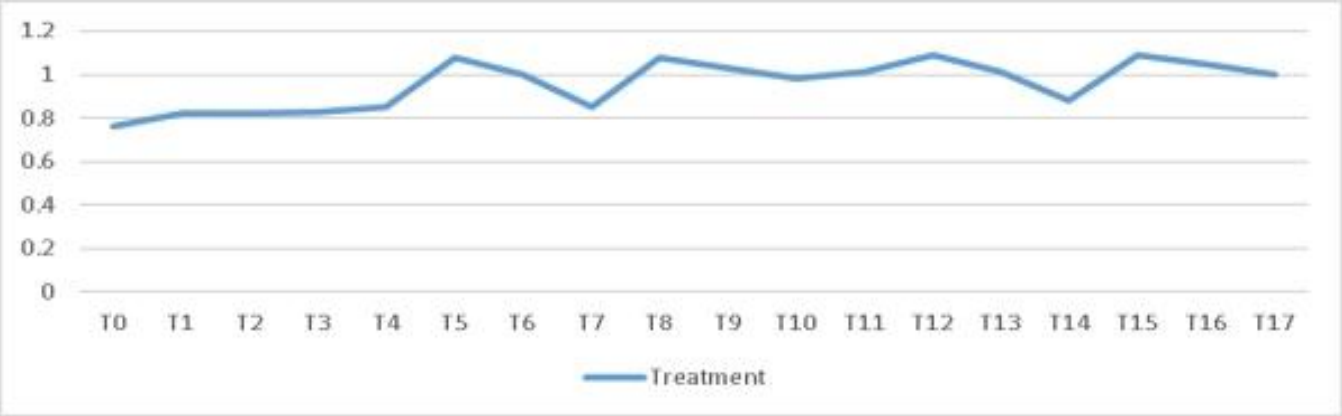

Fig. 6: Influence of various growing media on root/shoot ratio in Neem *(Azadirachta indica)*

Conclusion

From the conducted experiment, an inference can be drawn that growing media have a profound impact on, growth of seedlings. This can be observed by comparing the different treatments with control. Seedlings of Neem responded differently to different growing media and also to the various ratios of soil, sand and growing media. T_{15} [Soil: Sand: Vermicompost (2:1:2)] emerged as best treatment for Neem *(Azadirachta indica)*. Height, collar diameter and number of leaves showed a temporal increase but the increase was irregular signifying that climate and

precipitation have an effect on the growth rate of seedling. An effective combination of soil, sand and growing media can help us to get healthy planting stock quickly and timely. Agroforestry plantation is an idea which integrates livestock, agriculture and forestry sector together. To increase the income of farmers, concept of raising seedlings of agroforestry species can be used.

References

Alvarez, R. and Grigera, S. (2005). Analysis of soil fertility and management effects on yields of wheat and corn in the rolling Pampa of Argentina. *Journal of Agronomy and Crop Sciences*, 191, 321-329.

Bahuguna, V.K., Maithani, G.P., Dhaundiyal, U.D. and Unnikrishna, K.P. (1987). Standardization of nursery techniques of *Acacia albida*Del. under north Indian moist climatic conditions. *Indian Forester*, 13, 95-100.

Benjamin, A., Dilip, S., Ranibala, G. and Chanu, N. B. (2019). Effect of seed size, pre-sowing treatments and potting mixture on seedlings growth character and biomass production under nursery conditions of *Terminalia chebula Retz*. *IJCS*, 7(4), 1502-1507.

Bhardwaj, S.D, Shamet, G.S., Chauhan, P.S. and Mishra, V.K. (1996). Nursery and plantation technology of Chirpine (*Pinus roxburghii*) under Solan conditions of Himachal Pradesh. *Himachal Journal of Agricultural Research*, 12(1), 15-21.

Edwards, C. A., Dominguez, J., and Arancon, N. Q. (2004). The influence of vermicompost on plant growth and pest incidence. Soil zoology for sustainable development in the 21st century. Cairo, Egypt, 397-420.

Knapp, Brigitte A., Ros, M. and Insam, H. (2010). Do Composts Affect the Soil Microbial Community?. In: H. Insam, I. Franke-Whittle and M. Goberna, (Eds.), Microbes at Work: From Wastes to Resources. (pp 93-114). Springer, Berlin Heidelberg.

Kumar, R., Shamet, G.S., Alam, N.M. and Jana, C. (2016). Influence of Growing Medium and Seed Size on Germination and Seedling Growth of *Pinus gerardiana Wall*. *Compost Science and Utilization*, 24(2), 98-104.

Luna, R. K. (1996). Plantation trees. International Book Distribution, Dehra Dun. 975p.

Muscsolo, A., Bovalo, F., Gionfirddo, F. and Nardi, F. (1999). Earthworm humic matter produce auxin like effect on carrot (*Daucus carota*) cell growth and nitrate metabolism. *Soil Biol. Biochem*., 31, 1303-1311.

Pyarelal and Karnataka, D.C. (1993). Effect of orientation, sowing and soil mixture on germination behavior of *Quercus leucotrichophora*. *Indian Forester*, 119, 112-125.

Rana, A., Leishangthem, C.L., Kadiri, H. and Ziipoa, B.N.N. (2017). Effect of Seed Size, Pre-Sowing Treatment and Potting Mixture on the Seedling Growth of *Parkia roxburghii* G. Don Seeds. *Int. J. Curr. Microbiol. App. Sci*, 6(8), 629-638.

Roshan, A., and Verma, N.K. (2015). A brief study on Neem (*Azadirachta indica* A.) and its application–A review. *Research Journal of Phytomedicine*, 1, 01-03.

Sagar, A. and Kasera, P.K. (2016). Effect of soil mixture ratios and sowing depths on seed germination dynamics in *Dipcadi erythraeum* under in- vivo conditions. *World J. Pharm. Life Sci.*, 2, 417-422.

Srivastava, R., Nanhorya, R. and Upadhyaya, J.K. (1998). Selection of proper potting mixture for root trainer of *Eucalyptus hybrid*. *Indian Forester*, 124, 502-510.

Sofi, P.A., Bhat, S.A., Masoodi, T.H., Islam, M.A., Bhat, G.M. and Malik, A.R. (2016). Propagation of Himalayan maple (*Acer caesium* Wall.) through seed and softwood cuttings. *Journal of Applied and Natural Science*, 8(3), 1235-1240.