International Journal of Plant & Soil Science

16(4): 1-4, 2017; Article no.IJPSS.33913
ISSN: 2320-7035

Comparision of Growth Performance in Timber Tree Species Cultivated under Drip Irrigation on Farm Lands

A. Balasubramanian[1], C. N. Hari Prasath[1*], S. Radhakrishnan[1] and S. Manivasakan[1]

[1]Department of Silviculture, Forest College and Research Institute, Tamil Nadu Agricultural University (TNAU), India.

Authors' contributions

This work was carried out in collaboration between all authors. Author AB designed the study, performed the statistical analysis and wrote the protocol. Author CNHP wrote the first draft of the manuscript and managed the analyses of the study. Authors SR and SM managed the literature searches. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/IJPSS/2017/33913
Editor(s):
(1) Ying Ouyang, United States Department of Agricultural Forest Service, USA.
Reviewers:
(1) Cengiz YÜcedağ, Mehmet Akif Ersoy University, Turkey.
(2) B. P. Bhaskar, ICAR_NBSS&LUP, Regional centre, Bangalore, India.
(3) Ibrahim, Yusuf El-Ladan, Umaru Musa 'Yar-adua University, Katsina, Nigeria.
Complete Peer review History: http://www.sciencedomain.org/review-history/19400

Original Research Article

Received 3rd May 2017
Accepted 29th May 2017
Published 7th June 2017

ABSTRACT

A field experiment was conducted at Forest College and Research Institute, Mettupalayam, Tamil Nadu, India to study the growth performance of *Neolamarckia cadamba*, *Acrocarpus fraxinifolius* and *Dalbergia sissoo* under drip irrigation. The biometric attributes *viz*., height, basal diameter and diameter at breast height (DBH) were studied during 3 month after planting (MAP), 6 MAP, 9 MAP and 12 MAP. Among the three fast growing tree species, *Neolamarckia cadamba* exhibited a maximum height of 4.40 m, basal diameter of 5.31 cm and DBH of 5.03 cm followed by *Acrocarpus fraxinifolius* (Height of 3.99 m, basal diameter of 4.52 cm and DBH of 4.26 cm) and minimum in *Dalbergia sissoo* (Height of 3.37 m, basal diameter of 3.45 cm and DBH of 3.96 cm). The drip technology in tree species responded well to the drip irrigation system.

**Corresponding author: E-mail: prasathforestry@gmail.com;*

Keywords: Basal diameter; Cadamba; drip irrigation; height; farm lands.

1. INTRODUCTION

Wood from forest is the world's major renewable commodity and the demand for wood and other forest products are increasing in a trend, which resulted in serious depletion of forest cover due to demand for fuel wood, fodder and timber. The gap between demand and supply of forest produce is so wide that most intensive management practices in the existing forests cannot bridge it. The ever increasing human population would likely to keep the demand for forest produce at a higher order. In order to bridge the widening gap, forest productivity has to be maximized to meet the increasing demand by adopting new ways and technologies. The demand for Indian industrial rose from 58 million m^3 in 2000 to 123 million m^3 in 2013 and expected to cross 150 million m^3 by 2018 [1].

Water management experts have assessed that water is going to be the major constraint for economic development in most parts of the world, since the demand of water has been increasing at an alarming rate. Therefore, water is a precious commodity and its judicious utilization is very much essential for maximizing crop yield. In recent times, the mean annual rainfall is decreasing, the length and severity of dry season has become a limiting factor for the crop growth and productivity. The moisture requirements of crops are met with drip irrigation system in many parts of the world. Since in forest, natural vegetation and rainfed plantations have low annual increments that cannot meet the increasing needs of the local communities and industries for wood, building materials, industrial inputs and other products.

Drip method of irrigation helps to reduce the over-exploitation of groundwater that partly occurs because of inefficient use of water under surface method of irrigation. Environmental problems associated with the surface method of irrigation like water logging and salinity are also completely absent under drip method of irrigation [2]. Drip method helps in achieving saving in irrigation water, increased water-use efficiency, decreased tillage requirement, higher quality products, increased crop yields and higher fertilizer-use efficiency [3,4,5]. Similarly, in drip irrigated plantation the weed problem was very minimum and it also helpful in reducing the labour usage [4]. The plant height and basal diameter of citrus was increased under drip irrigation than canal irrigation [6].

The country is likely to be water stressed in the coming years. Therefore hand in hand with technologies for water harvesting and storage, technologies for precision water application methods need to be adopted. To adopt the latest technologies for precision irrigation, the study was carried out at Forest College and Research Institute, Mettupalayam to study the growth performance of timber tree species under drip irrigation.

2. MATERIALS AND METHODS

The experiment was conducted in Forest College and Research Institute, Mettupalayam at 11°19' N longitude and 77°56' E latitude with an altitude of 300 m above mean sea level and mean annual rainfall of 920.5 mm. The normal weather conditions of the experimental site prevailed during the study period was maximum and minimum temperature with 38.8°C and 17.7°C respectively. The soil of the experimental field was Illupanatham soil series and slightly alkaline (pH-7.87) in nature. The soil was loamy sand, well drained and non saline (EC-0.20 dSm^{-1}).

The drip irrigation system is a method of irrigation used in arid region that helps in the water wastage and reducing the cost of cultivation. In drip irrigation, water drains slowly towards the roots of the trees either while running on the surface of the ground or by directly irrigating the rhizosphere. Kumar [7] identified that transition from flood irrigation method to drip irrigation increases the biometric growth in trees, which is an important marketing criterion for tree growers.

Drip irrigation system was installed and the irrigation was given once in every three days during summer/non rainy days for first six months and in later stages it was irrigated for twice/week. The discharge rate of drippers was 4.0 liters/hour for one hour/day. The timber tree species planted under drip irrigation was *Neolamarckia cadamba, Acrocarpus fraxinifolius and Dalbergia sissoo* with the area of 1 acre and 10 trees per replication.

The biometric characteristics *viz*., height, basal diameter and DBH were measured at initial, 3

MAP, 6 MAP, 9 MAP and 12 MAP in tree seedlings. The height of the trees was measured from the ground level to the leading terminal tip using the standard scale and is expressed in metre. Basal diameter is measured with the help of digital vernier caliper at the ground level and expressed in cm. Diameter is measured at 1.37 m from ground level using the tree calliper and expressed in cm. The data obtained were subjected for statistical analysis to evaluate the possible relationship between the different parameters and to employ analysis of variance [8].

3. RESULTS AND DISCUSSION

Among the three timber species studied, *Neolamarckia cadamba* was exhibited with the maximum mean height of 4.40 m followed by *Acrocarpus fraxinifolius* (3.99 m) and the minimum height of 3.37 m in *Dalbergia sissoo* (Table 1). Wood et al. [9] and Bheemaiah et al. [10] reported that maximum height increment in Casuarina may be attributed by micro irrigation with regular interval. On supporting the present result, Kandell et al. [11] and Igbal [12] reported that the tree growth was the highest in drip irrigated plants as compare to furrow irrigation.

In the present study, the basal diameter of plants in different treatments showed a significant variation and was significantly higher in drip irrigation (Table 2). The mean basal diameter was ranked in the order of 5.31 cm (*Neolamarckia cadamba*) > 4.52 cm (*Acrocarpus fraxinifolius*) > 3.45 cm (*Dalbergia sissoo*) in Table 2. Similarly in the mean diameter the maximum was observed in *Neolamarckia cadamba* with the diameter of 5.03 cm followed by *Acrocarpus fraxinifolius* (4.26 cm) and minimum was exhibited in *Dalbergia sissoo* (3.96 cm) in Table 3. This result was in line with the findings of Narayanamoorthy [2] concluded that the increase in rate of micro irrigation will have a significant increase in tree collar diameter and vigour.

Table 1. Effect of drip irrigation on height (m) in timber tree species under drip irrigation

Tree species	Initial	3 MAP	6 MAP	9 MAP	12 MAP	Mean
Neolamarckia cadamba	1.31	3.23	4.46	5.87	7.12	4.40
Acrocarpus fraxinifolius	1.21	3.05	4.11	5.21	6.36	3.99
Dalbergia sissoo	1.28	2.69	3.22	4.35	5.29	3.37
SEd	0.07	0.10	0.15	0.20	0.14	
CD (0.05)	0.17	0.24	0.39	0.51	0.32	

Table 2. Effect of drip irrigation on basal diameter (cm) in timber tree species under drip irrigation

Tree species	Initial	3 MAP	6 MAP	9 MAP	12 MAP	Mean
Neolamarckia cadamba	1.25	3.13	5.28	7.75	9.12	5.31
Acrocarpus fraxinifolius	1.18	2.89	4.77	6.07	7.71	4.52
Dalbergia sissoo	1.21	2.18	2.89	4.51	6.45	3.45
SEd	0.04	0.21	0.56	0.47	0.59	
CD (0.05)	0.13	0.58	1.28	1.10	1.53	

Table 3. Effect of drip irrigation on diameter (cm) in timber tree species under drip irrigation

Tree species	3 MAP	6 MAP	9 MAP	12 MAP	Mean
Neolamarckia cadamba	2.56	4.22	5.94	7.41	5.03
Acrocarpus fraxinifolius	2.07	3.68	5.08	6.21	4.26
Dalbergia sissoo	1.95	3.34	4.54	6.02	3.96
SEd	0.12	0.23	0.38	0.52	
CD (0.05)	0.27	0.65	0.99	1.17	

4. CONCLUSION

The tree species (*Neolamarckia cadamba* and *Acrocarpus fraxinifolius*) planted under drip irrigation was responded well in growth parameters. As growth parameters are primary root for volume and biomass production.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Wood news. The statistical details of wood production in and around world (Since 1991); 2014. Available:http://www.woodnews.in/index.php.
2. Narayanamoorthy A. Averting water crisis by drip method of irrigation: A study of two water intensive crops. Indian Journal of Agricultural Economics. 2003;58(3):427-437.
3. Qureshi ME, Wegener MK, Harrison SR, Bristow KL. Economic evaluation of alternate irrigation systems for sugarcane in the Burdekin delta in North Queensland, Australia, In: Water resource management, Eds: CA. Brebbia K, Anagnostopoulos K, Katsifarakis and AHD. Cheng, WIT Press, Boston. 2001;47-57.
4. Sivanappan RK. Strengths and weaknesses of growth of drip irrigation in India, In: Proc. of micro irrigation for sustainable agriculture. GOI Short–term training 19-21 June, WTC, Tamil Nadu Agricultural University, Coimbatore. 2002; 1037.
5. Namara, Regassa E, Upadhyay, Bhawana, Nagar RK. Adoption and Impacts of microirrigation technologies: Empirical results from selected localities of Maharashtra and Gujarat States of India, Research report 93, international water management institute, Colombo, Sri Lanka. 2005;176-195.
6. Panagrahi P, Srivastava AR, Huchche AD. Water use efficiency of micro irrigated Citrus (*Citrus reticulata* var. Blanco) tree. Management, performance and application of micro irrigation systems (Edited by Megh R. Goyal. Apple Academic Press. 2015;219-228.
7. Kumar, Suresh. Promoting drip irrigation: Where and Why? Managing water in the face of growing scarcity, inequity and declining returns: Exploring fresh approaches, IWMI TATA 7th Annual Partner Meet. 2008;1:108-120.
8. Panse VG, Sukhatme PV. Statistical methods for agricultural workers (Ref. Edn.). ICAR, New Delhi. 1985;9-15.
9. Wood PJ, Willens AF, Willens GF. An irrigated plantation project in Abu Dhabi. Commonwealth Forestry Reviews. 1975; 54(2):139-146.
10. Bheemaiah G, Subrahmanyan MVR, Syed Ismail. Performance of teak under different irrigated and fertilizer management practices. Indian Forester. 1997;123(12): 1171-1175.
11. Kandell SAE, Isebrands J, Ali MH. Evaluation of short rotation *P. deltoides* and *Eucalyptus* for pulp production under drip irrigation. Forest Products Research Society Abstracts. 1980;34:24.
12. Igbal B. Evaluation of water requirement and growth characteristics of casuarina (*Casuarina equisetifolia* Forst.) under drip irrigation. M.Sc. Thesis, TNAU, Coimbatore, India; 2005.

© 2017 Balasubramanian et al.; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (http://creativecommons.org/licenses/by/4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Peer-review history:
The peer review history for this paper can be accessed here:
http://sciencedomain.org/review-history/19400