

Comparative Growth Performance of Gum Yielding Tree Species Cultivated Under Drip Irrigation in Farmlands

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Abstract

A field experiment was conducted at Forest College and Research Institute, Mettupalayam, Tamil Nadu, India to study the growth performance of gum yielding tree species with regional importance namely *Butea monosperma* (Bengal Kino), *Acacia nilotica* (Gum arabic), *Acrocarpus fraxinifolius* (Cedar gum), *Pterocarpus marsupium* (Kino gum), *Azadirachta indica* (Neem gum), *Acacia senegal* (Senegal gum), *Anogeissus pendula* (Indian gum) and *Lannea coromandelica* (Jhingan gum). The biometric attributes *viz.*, height, basal diameter and diameter at breast height (DBH) were studied during initial, 3 MAP, 6 MAP and 9 MAP. Among the eight gum yielding trees, *Acacia nilotica* (Gum arabic) exhibited a maximum height of 7.01 m, basal diameter of 14.68 cm and DBH of 9.78 cm during 9 months after planting followed by *Lannea coromandelica* (Height of 6.16 m, basal diameter of 14.14 cm and DBH of 8.81 cm) and minimum in *Anogeissus pendula* (Height of 2.96 m, basal diameter of 3.75 cm and DBH of 2.37 cm). The drip technology boosted the gum productivity and overall production of tree crops in addition to betterment of soil and tree health especially in problem soils. *Acacia nilotica* and *Lannea coromandelica* were responded well to the drip irrigation system and it also plays a major in water as well as labour management.

Keywords

Acacia nilotica, Biometric attributes, Drip irrigation, Farm plantation, Gum yielding trees.

Introduction

Gums are probably the most extensively used and traded non-wood forest products other than those consumed directly as food, fodder and medicine. Mankind has been using gums in their various forms for ages. The history of gum arabic, long recognized as an ideal adhesive, goes back to 2000 years. In modern times, gums and resins are being used all the world over as embalming agents, incense, and in industries like pharmaceuticals, cosmetics, textiles, leather, oil exploration, paints and varnishes as also for waterproofing and caulking ships. Though there are more than 30 commercially important species of gums and resins in the country, the important ones with substantial production are rather small in number. Amongst the various species of gums, the most important are Arabic (*Acacia senegal*), Karaya (*Sterculia urens*), Dhawra/ghatti (*Anogeissus latifolia*), Khair (*Acacia catechu*), Palas (*Butea monosperma*), Babool (*Acacia nilotica*), Moringa (*Moringa olifera*), Jhingan (*Lannea*

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coromandelica), Guar (*Cyamopsis tetragonoloba*), etc. The gums have a niche market globally.

The gap between demand and supply of forest produce and non-forest produces 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. 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. 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 (Narayanamoorthy, 2003). 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 (Sivanappan, 20014).

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 gum yielding tree species under drip irrigation.

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.

The soil was loamy sand in texture, well drained, slightly alkaline in reaction (pH-7.87) and non saline (EC-0.20 dSm⁻¹).



Fig. 1: Gum yielding trees with regional importance

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 gum yielding tree species planted under drip irrigation are *Butea monosperma* (Bengal Kino), *Acacia nilotica* (Gum arabic), *Acrocarpus fraxinifolius* (Cedar gum), *Pterocarpus marsupium* (Kino gum), *Azadirachta indica* (Neem gum), *Acacia senegal* (Senegal gum), *Anogeissus pendula* (Indian gum) and *Lannea coromandelica* (Jhingan gum). The following biometric observations were recorded at Initial, 3 MAP, 6 MAP and 9 MAP in trees was calculated by using the parameters below.

- *Height*: 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*: Basal diameter is measured with the help of digital vernier caliper at the ground level and expressed in cm.
- *Diameter at Breast Height (DBH)*: Diameter is measured at 1.37 m from ground level using the tree calliper and expressed in cm.



Fig. 2: Gum arabic (*Acacia nilotica*) and Jhingan (*Lannea coromandelica*) plantation

Results and Discussion

The drip irrigation system is a method of irrigation used in arid region that helps in the water wastage and reducing the cultivation cost to farmers. 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 soil. Kumar (2008) 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. The biometric parameters viz., Height and basal diameter was recorded during initial, 3 MAP, 6 MAP, 9 MAP and 12 MAP respectively. Among the gum yielding trees studied, *Acacia nilotica* was exhibited with the maximum mean height of 3.93 m followed by *Lannea coromandelica* (3.66 m) and the minimum height of 1.58 m was registered in *Butea monosperma*. Bheemaiah *et al.* (1997) reported that maximum height increment in Casuarina may be attributed by micro irrigation with regular interval. On supporting the present result, Igbal (2005) reported that the height growth was highest in drip irrigated plants when compare to furrow irrigation.

Table 1: Effect of drip irrigation on height (m) in gum yielding tree species

Tree Species	Initial	3 MAP	6 MAP	9 MAP	Mean
<i>Butea monosperma</i>	0.85	1.34	1.86	2.25	1.58
<i>Acacia nilotica</i>	0.96	2.98	4.76	7.01	3.93
<i>Acrocarpus fraxinifolius</i>	0.77	2.31	4.46	6.13	3.42
<i>Pterocarpus marsupium</i>	0.66	2.16	3.81	5.21	2.96
<i>Azadirachta indica</i>	0.75	1.88	3.55	4.78	2.74
<i>Lannea coromandelica</i>	0.88	2.35	4.09	6.16	3.66
<i>Acacia senegal</i>	0.80	1.66	2.76	3.88	2.28
<i>Anogeissus pendula</i>	0.55	1.44	2.63	2.96	1.90

The basal diameter of plants in different treatments showed a significant variation and was significantly higher in drip irrigation. In the study, the mean basal diameter was ranked in the order of 9.07 cm (*Acacia nilotica*) > 8.91 cm (*Lannea coromandelica*) > 8.53 cm (*Acrocarpus fraxinifolius*) > 5.35 cm (*Azadirachta indica*) > 5.30 cm (*Pterocarpus marsupium*) > 4.06 cm (*Butea monosperma*) > 4.04 cm (*Acacia senegal*) > 2.49 cm (*Anogeissus pendula*). Similarly, in the mean diameter at breast height

(DBH) the maximum was observed in *Neolamarckia cadamba* with the diameter of 5.03 cm followed by *Acacia nilotica* (8.83 cm) followed by *Lannea coromandelica* (8.17 cm), *Acrocarpus fraxinifolius* (7.79 cm) and minimum was exhibited in *Anogeissus pendula* (1.95 cm). This result was in line with the findings of Narayanamoorthy (2003) concluded that the increase in rate of micro irrigation will have a significant increase in tree collar diameter and vigour.

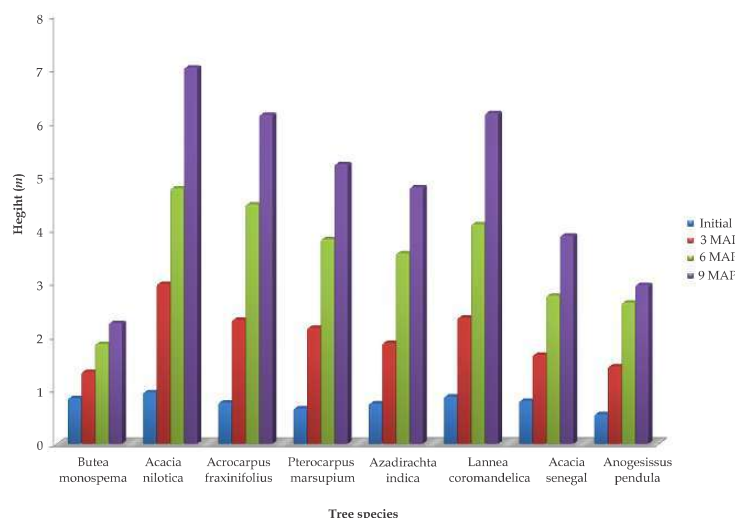


Fig. 3: Effect of drip irrigation on height (m) in gum yielding tree species

Table 2: Effect of drip irrigation on basal diameter (cm) in gum yielding tree species

Tree Species	Initial	3 MAP	6 MAP	9 MAP	Mean
Butea monosperma	1.51	3.74	4.73	6.27	4.06
Acacia nilotica	1.98	8.53	11.08	14.68	9.07
Acrocarpus fraxinifolius	2.11	7.95	10.76	13.31	8.53
Pterocarpus marsupium	2.05	4.77	6.19	8.18	5.30
Azadirachta indica	2.22	4.31	6.26	8.63	5.35
Lannea coromandelica	1.73	8.79	10.97	14.14	8.91
Acacia senegal	1.44	3.33	5.08	6.30	4.04
Anogeissus pendula	1.20	2.15	2.86	3.75	2.49

Table 3: Effect of drip irrigation on diameter (cm) in gum yielding tree species

Tree Species	6 MAP	9 MAP	Mean
Butea monosperma	3.07	4.16	3.62
Acacia nilotica	7.89	9.78	8.83
Acrocarpus fraxinifolius	7.35	8.42	7.89
Pterocarpus marsupium	4.61	6.26	5.43
Azadirachta indica	4.35	5.84	5.09
Lannea coromandelica	7.53	8.81	8.17
Acacia senegal	3.32	4.45	3.88
Anogeissus pendula	1.52	2.37	1.95

Conclusion

Acacia nilotica, *Lannea coromandelica* and *Acrocarpus fraxinifolius* were responded well to the drip irrigation system among the gum yielding tree species and it also plays a major role in water as well as weed management. The increase in the stem thickness will helps in inducing the treatments for exudes the gum from the trees.

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