Journal of Plant Development Sciences
Meerut, India

RESEARCH

EFFECT OF SPACING REGIMES ON GROWTH AND YIELD OF *ENTEROLOBIUM CYCLOCARPUM*

B. Sivakumar[a], M. Sivaprakash[a]*, P.S. Devanand[a]*, N. Raja[b], S. Utharasu[c], P. Kumar[d], M. Kiruba[e], P. Radha[a] and K. Hemaprabha[a]

[a]*Forest College and Research Institute, Tamil Nadu Agricultural University, Mettupalayam*
[b]*Agricultural Engineering College and Research Institute, Kumulur, Trichy*
[c]*Agricultural Research Station, Tamil Nadu Agricultural University,Bhavanisagar*
[d] *Agricultural Research Station, Tamil Nadu Agricultural University,Paiyur*
[e] *Krishi Vigyan Kendra, ICAR, Sandhiyur, Salem*

Received-27.05.2024, Revised-12.06.2024, Accepted-27.06.2024

Abstract: Studies were the effect of spacing regimes on growth and yield of *Enterolobium cyclocarpum for* its suitability in various fields of utility as a Multipurpose Tree Species adoptability in northern zone of Tamil Nadu.In evaluation of spatial trial plantation for its biometric measurements with four different spacing, the trees exhibited better increments of height and diameter over periodic measurements taken at a month interval. Hence, height and diameter could be considered as selection criteria in evaluating trees.The results are revealed that, the planted at 1.5 m x 1.5 m spacing exhibits maximum height growth (4.92 m) at 24 months after planting followed by the planted at 2 m x 2 m spacing (4.80m). The maximum diameter at breast height (DBH) was recorded for the planted at 1.5m x 1.5m spacing (0.098m) followed by 3m x 3m spacing (0.078m). In the spacing of 1.5 m x 1.5 m, spacing exhibits maximum height growth and volume.*Enterolobium cyclocarpum* is suitable for northern zone of Tamil Nadu. Hence, tree adopted in northern zone of Tamilnadu.

Keywords*: Enterolobium cyclocarpum*, Spacing, Multi-Utility, Growth, Yield, Wood

INTRODUCTION

Enterolobium cyclocarpum is a tropical tree that has played a fundamental part in the development of rural man living from southern Mexico to the middle part of the South American subcontinent. (Pacheco *et al*., 2012). *Enterolobium cyclocarpum* (Jacq.) Griseb. is a spectacular looking tree with its huge spreading and spherical crown. It is a deciduous tree with high nutritive value and moderate palatable pods. This tree was first described in 1809 and 1887 in New Spain; it became known with the name of *Mimosa cyclocarpa*. Then, the British Jacq and Griseb classified it as *Enterolobium cyclocarpum* (Jacq.) Griseb. (Standley, 1924). *E. cyclocarpum* belongs to Phylum - Magnoliophyta; Class - Magnoliopsida (Dic.), Order - Fabales. Family - Leguminosae (Mimosaceae), Genus – *Enterolobium*, Species – *cyclocarpum*, commonly known Guanacaste is a fast growing all time light demanding forage tree legume from tropical America; A multipurpose species that can be used to feed browsing livestock in its native range (Francis, 1988); it proves to be a promising species for agroforestry systems in humid areas being the national tree of Costa Rica.

The nitrogen fixing tree, (Van Kessel *et al*., 1983; Goi *et al*., 1984) *Enterolobium cyclocarpum* belongs to the subfamily Mimosoideae of the Leguminosae and is placed in the tribe Ingeae. Closely related species, such as *E. schoinburgkii* Benth., remain untested to date. Ear pod tree is a light demanding species in all stages of its development. It is susceptible to weed competition during early growth. *Enterolobium* resprouts vigorously after coppicing or lopping; indeed it is difficult to kill *Enterolobium* by girldling; because of its tendency to resprout below the girdle line.

Soil type- *E. cyclocarpum* tolerates alkaline, calcareous and even acidic soils; Medium-textured soils are probably best, but eroded Ultisols, deep moist clays, shallow sandy clays and porous limestone all allow good development (Agroforestry Database 4.0) (Orwa *et al*., 2009). The soil pH 6.05, EC (dsm^{-1}) 0.9, Organic carbon 0.16, Available nitrogen (Kg $ha.^{-1}$) 0.3 (376.3 kg.), Available phosphorus (Kg $ha.^{-1}$) 0.4 (44.8 kg.), Available potassiumnitrogen (Kg $ha.^{-1}$) 99.34 (993.8 kg.).

Silviculture - Trees produce seed crops in most years in Central America. It is likely that the original consumers of Enterolobium pods are now extinct and their role as seed dispersal agents has been assumed by horses and cattle. Collected seed requires pre-treatment before sowing to allow water to penetrate the seed coat. Manual scarification is effective, as is treatment with hot water or concentrated sulphuric

*Corresponding Author

acid. A suitable hot water treatment is a brief (30second) soak in water close to boiling point, followed by 24 hours in water at room temperature. Seed supplies are currently dependent on collections from natural populations in Latin America and scattered cultivated trees in areas where Enterolobium has been introduced. Most early introductions of *E. cyclocarpum* were undocumented, casual and collected from a narrow genetic base. (NFTA, 1990) A broader range of representative germplasm should be tested to evaluate the potential of the species. Seed is available from OFI and NFTA for the establishment of field trials. (Oxford Forestry Institute & Niagara Frontier Transportation Authority)

MATERIALS AND METHODS

Study Area

The identified clone MTP EC2 was planted with a spacing of 3m x 3m, 2m x 2m, 1.5m x 1.5m and 1m x 1m. The field located at Agricultural College and Research Institute, Vazhavachanur, Tiruvannalai district is coming under North Zone region and the total area under cultivation is 192174.70 ha. Tiruvannamalai is located at 12^0N 79.05^0E. It has an average elevation of 200 meters (660 ft). The topography of Tiruvannamalai is almost plain sloping from west to east. The temperature ranges from a maximum of 40^0C ($104\ ^0$F) to a minimum of $20\ ^0$C ($68\ ^0$F). Like the rest of the state, April to June are the hottest months and December to January are the coldest. Tiruvannamalai received scantly rainfall with an average of 815 mm (32.1 in) annually, which is lesser than the state average of 1,008 mm (39.7 in). The southwest monsoon with an onset in June and lasting up August brings scanty rainfall.

Treatment Details

The above experiment four treatments, five replication and Randomised Block Design (RBD) were adopted.

Growth Attributes

1. **Plant height:** Plant Height was measured from ground level to the tip of the stem and expressed in meter.
2. **Diameter at breast height (DBH):** Diameter was measured at breast height 1.37 m from ground level and expressed in cm; For small poles diameter was measured at the base of the stem (near to the ground level).
3. **Volume**
   The volume was determined using the following formula.

$$\mathbf{V = \Pi r^2\ h \times Form\ Factor}$$

Where,
V = Volume (m^3);
r = radius (m)
h = Height (m);
Form factor – ocular estimate (0.48) approx.

RESULTS AND DISCUSSION

The results are revealed that, the planted at 1.5 m x 1.5 m spacing exhibits maximum height growth (4.92 m) at 24 months after planting followed by the planted at 2 m x 2 m spacing (4.80m). The maximum diameter at breast height (DBH) was recorded for the planted at 1.5m x 1.5m spacing (0.098m) followed by 3m x 3m spacing (0.078m).

In the spacing of 1.5 m x 1.5 m, spacing exhibits maximum height growth and volume.In the spacing of 2m x 2m, the application of humic acid enhances the height (1.28%). Whereas the application of NPK (150: 100: 100) enhanced the height growth for the trees planted at spacing of 1.5m x 1.5m (1.5%) and 1m x 1m (1.5%).

Yadav, R (2009) reported that treatment combination of 100 kg of P2O5 ha-1 mixed in auger pits of 15 cm diameter and 20 cm depth and same dose placed at 5 cm depth in rows 20 cm apart from the cutting line produced plants of more height (3.42m) and diameter (2.67cm) in *Populus deltoides*.

Table 1. Growth attributes of *Enterolobium cyclocarpum clones* at different spacing.

S. No.	Spacing	Height (m)			DBH (m)			V (m^3)
		12 MAP	24 MAP	36 MAP	12 MAP	24 MAP	36 MAP	36 MAP
1	3.0 m x 3.0 m	4.22	5.28	6.97	0.069	0.085	0.257	0.658
2	2.0 m x 2.0 m	4.80	5.35	**7.14**	0.050	0.092	**0.267**	**0.763**
3	1.5 m x 1.5 m	4.97	5.49	**7.26**	0.064	0.099	**0.279**	**0.851**
4	1.0 m x 1.0 m	3.83	4.23	4.98	0.048	0.067	0.205	0.289
	SE(d)	**0.67**	**0.73**	**0.87**	**0.01**	**0.01**	**0.03**	**0.05**
	CD (= 0.05)	**1.42**	**1.56**	**1.89**	**0.01**	**0.02**	**0.07**	**0.11**

The wood production (tons ha-1) at 12 and 18 months after planting across different spacing treatments and a control (Tree). At 12 months, the highest production was seen in the 1.5 m x 1.5 m spacing (9.71 tons ha-1), followed by 3.0 m x 3.0 m (9.37 tons ha-1). At 18 months, 1.5 m x 1.5 m again led (29.10 tons ha-1), with 3.0 m x 3.0 m close behind (28.69 tons ha-1). The control consistently

had lower production. Critical differences (CD) indicate significant variations among treatments and ages, underlining spacing's impact on wood yield in intercropped conditions. The physical properties of wood material particularly basic density, bulk density, wood moisture are highly essential. It is not usually desirable to us the material that experiences rapid moisture changes because moisture effects the physical and mechanical properties of wood materials (Ahamad and Kamke, 2005).

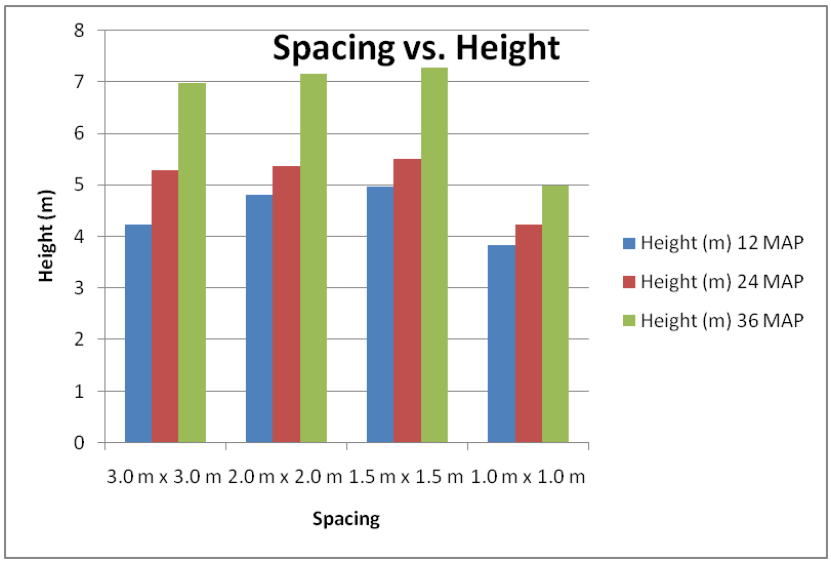

FIG 1 - Graph plotted for Spacing against Height Growth

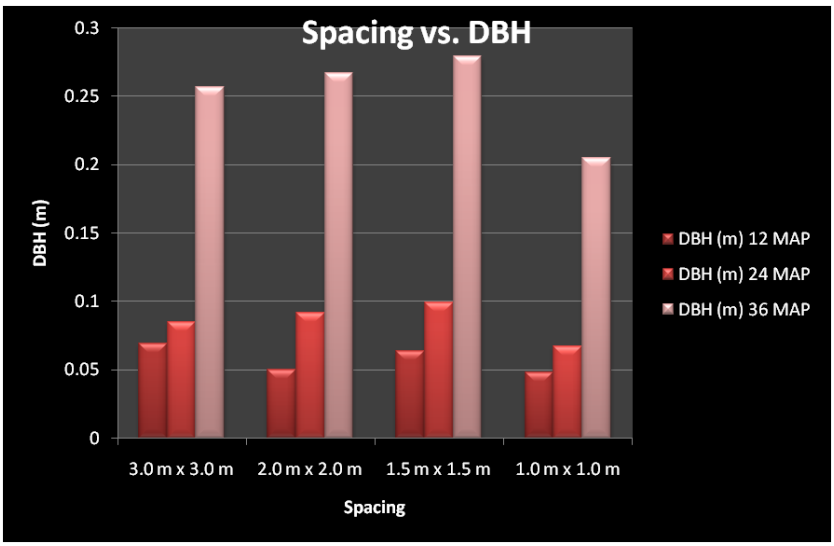

FIG 2 - Graph plotted for Spacing against DBH

Table 2. Wood production (tons ha^{-1}) of *Enterolobium cyclocarpum* influenced different spacing.

Treatments	Wood production (tons ha^{-1})	
	Age (Months after planting)	
	12(After 2nd intercrop)	18(After 3rd intercrop)
Different spacing		
3.0 m x 3.0 m	9.37	28.69
2.0 m x 2.0 m	7.80	25.96
1.5 m x 1.5 m	9.71	29.10
1.0 m x 1.0 m	8.49	25.15
Tree (Control)	6.25	19.93
SEd	1.063	2.359
CD	2.119	4.67

Values with the same superscripts do not differ significantly. ns - non significant at p<0.05.
* Significant at 1% level.

REFERENCES

Ahmad, M. and Kamke, F.A. (2005). Analysis of Calcutta bamboo for structural composite materials: Physical and mechanical properties. *Wood science and Technology*, **39**(4): 448-459.

Google Scholar

Francis, J.K. (1988). *Enterolobium cyclocarpum* (Jacq.) Griseb. Guanacaste, Earpod-tree. Leguminosae. Legume Family. USDA Forest Service. Southern Forest Experiment Station. SO-ITF-SM-15.

Google Scholar

Goi, S. R., Defaria, S. M. and Neves, M. C. P. (1984). Nitrogen-Fixation, Nodule Type and Occurrence of Ureides in Legume Trees. *Pesquisa Agropecuaria Brasileira*, **19**: 185-190.

Google Scholar

Orwa, C., Mutua, A., Kindt, R., Jamnadass, R. and Simons, A. (2009). Agroforestree database: a tree reference and selection guide version 4.0.

Google Scholar

Pacheco, M. M. M., Garcia, A. F., Muñoz, R. E. M., Echeverria, O. A. R. and Gonzalez, D. R. (2012). Enterolobium cyclocarpum (Jacq.) Griseb.: The biotechnological profile of a tropical tree. *Boletín Latinoamericano y del Caribe de Plantas Medicinales y Aromáticas*, **11**(5), 385-399.

Google Scholar

Standley, P.C. (1924). Trees and shrubs of Mexico. United States Herbarium. **23** (4), Smithsonian Press, Washington DC, US.

Google Scholar

Van Kessel, C., Roskoski, J.P., Wood, T. and Montano, J. (1983). 15N2 Fixation and H2 evolution by six species of tropical leguminous trees. *Plant Physiol*., **72**: 909 - 910.

Google Scholar

Yadav, R., Arora, P., Kumar, D., Katyal, D., Dilbaghi, N. and Chaudhury, A. (2009). High frequency direct plant regeneration from leaf, internode, and root segments of Eastern Cottonwood (Populus deltoides). *Plant Biotechnology Reports*, **3**: 175-182.

Google Scholar