

Performance of Eucalyptus clones in Gangetic plains of Eastern Uttar Pradesh ,India

Abstract

Eucalypts provide major raw material for the pulp and paper industries in India, so it is imperative that planting stock of high genetic quality be used to increase the yield from plantations (Varghese *et al.* 2008). In eastern part of Uttar Pradesh, Eucalypts are in improving stage for adoption at larger level and choice of suitable clones is still a big challenge .To assess the suitable clones of Eucalyptus for this region, an experimental trial was established under statistical design of RBD for 13 clones (IFGTB 1-10, FRI-100,104,124) of 02 eucalyptus species (*E. tereticornis* and *E. camaldulensis*). The soil analysis indicated pH 9.3, EC 0.89 mm /cm, organic carbon 0.21 %, Nitrogen 47.3 kg/ha , Phosphorus 11.3 kg/ha and Potassium 184.8 kg/ha. The highest value of increment in gbh belonged to clones IFGTB 6 (5.18 cm) followed by IFGTB 8 (5.12 cm) ,IFGTB 2 (4.74 cm), IFGTB 5 (4.36 cm) and IFGTB 10 (4.02 cm) amongst IFGTB series whereas in FRI clones, clone FRI 100 performed superior with 3.03 cm increment in girth after one year of planting. The lowest values belonged to clone IFGTB 9 and DDN 124 with 2.44 cm and 2.49 cm respectively. The clones with good annual increment in height were IFGTB 2 (3.85 m) followed by IFGTB 6 (3.80 m), IFGTB 10 (3.77 m) ,IFGTB 8 (3.55 m) and IFGTB 5 (3.30 m) in IFGTB series whereas in FRI series, FRI 100 (2.70 m) performed superior over other two clones. The survival of plants was in range of 66-100%. The clones of species *E. camaldulensis* in IFGTB series performed better over other clones/species.

Keywords: Eucalyptus clones, growth performance, Eastern Gangetic plains, promising clones

Introduction

Eucalyptus, one of few trees which due to its astonishing growth characteristics are capable of reducing wide gap between demand and production of wood in shortest possible time. Eucalypts provide major raw material for the pulp and paper industries in India, so it is imperative that planting stock of high genetic quality be used to increase the yield from plantations [1] The species provide ample scope for genetic improvement due to wide geographic distribution and natural occurrence of variation. The demand of wood from forest or commercial plantation for timber, fuel wood, pulp and paper production is increasing each year at an alarming rate. Therefore, there is an urgent need for improvement in production of forest resources to meet the needs of fuel-wood, timber and wood production on a sustainable basis and increase biomass yield from farm forestry plantations. [2] India has ~10% of the world's Eucalyptus plantation. As per the Food & Agriculture Organisation (FAO) Report (FP/48/E) 2014, around 93% of industrial wood requirement in the country is met out of agro / farm forestry plantations (~70% is Eucalyptus). In India, Eucalyptus is one of the most prime species in Agro forestry and farmers are mostly diverting towards clonal planting material of this species for more returns in shorter rotation period. In eastern part of Uttar Pradesh state of India, Eucalypts are in improving stage for adoption at larger level and choice of suitable clones in plantations is still a big challenge for them.

Material and Methods

The district Pratapgarh in Gangetic plains of Eastern Uttar Pradesh, India forms a part of Allahabad Division and lies between the parallels of 25°34' and 26°11' north latitude and between the meridians of 81°19' and 82°27' east longitude extending for some 110 kilometres from west to east. It is bounded on the north by the district of Sultanpur, on the south by Allahabad, on the east by Jaunpur, on the west by Fatehpur and north-west by Raebareli. In the south-west, the Ganges forms the boundary of the district for about 50 kilometres. Separating it from Fatehpur and Allahabad and in the extreme north-east, the Gomti forms the boundary for about 6 kilometres. According to the Central Statistical Organization (Central Statistics Office), India, the district has an area of 3,730 square km. The majority of the land is salt affected in the district. To assess the suitable clones of Eucalyptus for this region, an experimental trial was established under statistical design of randomized complete blocks with three replicates and 3x2 m spacing for 13 clones (IFGTB 1-10, FRI-100,104,124) of 02 eucalyptus species (*E. tereticornis* and *E. camaldulensis*) along with control (locally available seedlings) for 14 treatments in Pratapgarh district of Eastern Uttar Pradesh in 2017. The soil analysis was done for pH, EC, organic carbon and NPK contents using standard procedures (Jackson, 1985). The mean annual increment (MAI) of each clone was calculated using all the growth parameters (gbh and height) after one year of planting to assess early growth performance of clones. The data were statistically analysed by standard ANOVA techniques.

Results

The results of early growth performance evaluation of these clones after one year of planting were carried out for mean annual measurements of total height, gbh and survival (Table 1, Fig. 1 & 2). The site is salt affected and soil analysis indicated pH 9.3, EC 0.89 mm/cm, organic carbon 0.21 %, Nitrogen 47.3 kg/ha, Phosphorus 11.3 kg/ha and Potassium 184.8 kg/ha. The highest value of increment in gbh belonged to clones IFGTB 6 (5.18 cm) followed by IFGTB 8 (5.12 cm), IFGTB 2 (4.74 cm), IFGTB 5 (4.36 cm) and IFGTB 10 (4.02 cm) amongst IFGTB series whereas in FRI clones, clone FRI 100 performed superior with 3.03 cm increment in girth after one year of planting. The lowest values belonged to clone IFGTB 9 and DDN 124 with 2.44 cm and 2.49 respectively. The clones with good annual increment in height were IFGTB 2 (3.85 m) followed by IFGTB 6 (3.80 m), IFGTB 10 (3.77 m), IFGTB 8 (3.55 m) and IFGTB 5 (3.30 m) in IFGTB series whereas in FRI series, FRI 100 (2.70 m) performed superior over other two clones. The survival of plants was in range of 66-100%. The clones of species *E. camaldulensis* in IFGTB series performed better over other clones/species. The performance of control (local seed grown seedlings) was inferior for girth increments as compared to both clone series. The remaining clones had different ranks of gbh and height increments as compared to the control. The results of the analysis of variance (ANOVA) for annual mean increment in height and girth showed levels of significance (Table 2 & 3). The results of early growth performance indicated that out of thirteen clones, all clones gave superior results for growth indicators as compared to control.

The clones of species *E. camaldulensis* performed superior over other clones/species. Similarly, significant differences in different *Eucalyptus* species have been reported by various workers. Lal [3] conducted a study to assess the comparative growth performance of various *Eucalyptus* species. Red Gum (*Eucalyptus camaldulensis* L.) is renowned globally for its fast growth, high levels of drought tolerance and adaptability to diverse climatic conditions and soils, which makes it popular among eucalypt tree growers [4]. The significant differences for growth attributes among seven species of *Eucalyptus* species was also studied. It is also established *E. camaldulensis* as a pure species is adapted to low-to intermediate rainfall environments with a dry season of up to 8 months [5]. Several studies have reported the significant growth performance of *Eucalyptus* clones in the world.

The results from these studies show that Eucalypts hybrid has similar or better growth than their parent and significant differences in growth between hybrid clones may be attributed to genetic constitution as well as environmental factors. The results of study confirm that *E. camaldulensis* clones are better suited to growth at early stage in Gangetic plain region of Pratapgarh district of Uttar Pradesh state of India. However, these are early growth results, with expected low juvenile–mature correlations, and growth monitoring will continue in this trial series for confirm assessment of promising clones for the region.

Table 1. Growth performance of clones (Mean annual increment in height & girth and survival) after one year of planting

S. No.	Clone name	Mean annual increment in height (M)	Mean annual increment in girth (cm)	Survival (%)
1.	IFGTB1	2.94	3.31	88
2.	IFGTB2	3.85	4.74	88
3.	IFGTB3	2.76	3.34	77
4.	IFGTB4	2.71	3.21	88
5.	IFGTB5	3.30	4.36	66
6.	IFGTB6	3.80	5.18	88
7.	IFGTB7	3.17	3.83	77
8.	IFGTB8	3.55	5.12	77
9.	IFGTB9	2.46	2.44	66
10.	IFGTB10	3.77	4.02	100
11.	100	2.70	3.03	100
12.	104	2.26	2.49	83
13.	124	2.17	2.83	66
14.	Control	1.90	2.41	78

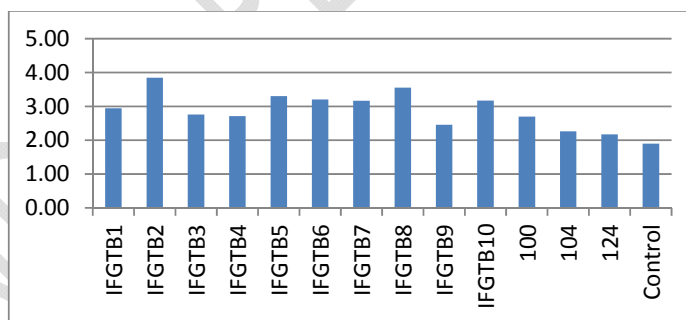


Fig. 1 Mean annual increment (MAI) in height (M) after one year of planting

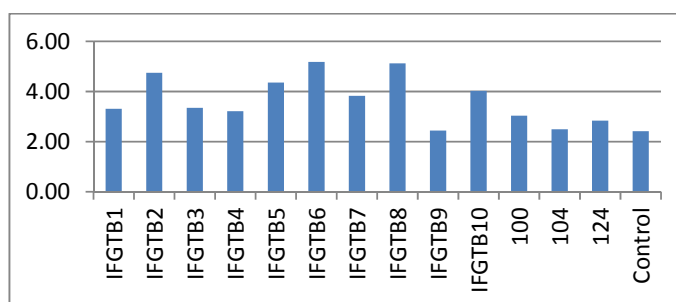


Fig.2 MAI Mean annual increment (MAI) in girth (cm) after one year of planting

Table 2. Analysis of variance for MAI in height(M)

Source	D.F.	SS	MSS	Cal. F	TAB F(5%)	TAB F(1%)
Treatment	13	11.83	0.91	4.69	S	S
Replication	2	1.00	0.50	2.57	NS	NS
Error	26		0.19			
TOTAL	41	17.87				
#VALUE!	0.25	CD(5%)=	0.74	TAB. F(5%)=	2.12	
SE.d=	0.36	CD(1%)=	1.00	TAB. F(1%)=	2.90	
CV=	15.37					

Table 3. Analysis of variance for MAI in girth (cm)

Source	D.F.	SS	MSS	Cal. F	TAB F(5%)	TAB F(1%)
Treatment	13	36.30	2.79	2.21	S	NS
Replication	2	0.13	0.06	0.05	NS	NS
Error	26	32.89	1.26			
TOTAL	41	69.31				
#VALUE!	0.65	CD(5%)=	1.89	TAB. F(5%)=	2.12	
SE.d=	0.92	CD(1%)=	2.55	TAB. F(1%)=	2.90	
CV=	31.28					

References

- [1] Varghese, M.; Harwood, C.E.; Hegde, R. and Ravi, N. 2008. Evaluation of provenances of *Eucalyptus camaldulensis* and clones of *E. camaldulensis* and *E. tereticornis* at contrasting sites in southern India. *Silvae Genetica*, 57(3): 170-179.
- [2] Patil, H. Y., Patil, S. J., Mutanal, S. M. and Shahapurmath, G., 2012. Growth and productivity of different *Eucalyptus* species on degraded land, *Karnataka J. Agric. Sci.*, 25 (1) : 92-93.
- [3] Lal, P., 2005, Performance of Eucalyptus clones in Punjab. Proc.; *National Symposium on Exotics in Indian Forestry, held at Department of Forestry and Natural Resources, PAU, Ludhiana, March, 15 – 18, 2005, p. 45.*
- [4] Bindumadhava, H., Tamak, J., Mahavishnan L. K., Upadhyay, A. P., Varghese, M. and Sharma, N., 2011. Clonal propagation in *Eucalyptus camaldulensis* using minicutting technique, *Current Science*, Vol. 101, No. 12, 25.
- [5] Kumar, R. and Bangarwa, K. S., 2006, Clonal evaluation in *Eucalyptus tereticornis* Sm. *Environ Ecol*, 24 (4): 1188 – 1191.