

## COMPARATIVE PERFORMANCE OF TREE SPECIES SUITABLE FOR AGROFORESTRY SYSTEM\*

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### ABSTRACT

A field experiment was conducted at Agricultural College, Dharwad, Karnataka, during kharif, 1979 through 1984 to evaluate the performance of six tree species (viz., *Leucaena leucocephala*, eucalyptus, sissoo, casuarina, teak and bamboo) in agroforestry system, Eucalyptus produced significantly higher total harvestable biomass per plant (168.11 kg) than other species at the end of the fifth year after planting. This was followed by sissoo, bamboo, casuarina and teak. *Leucaena* produced the minimum total harvestable biomass per plant (30.05 kg) compared to other species.

### INTRODUCTION

By 2000 A.D. the fuel wood requirement in India is expected to reach 225 million m<sup>2</sup> (Anonymous, 1976). Already there is acute shortage of fuel wood, timber, fodder and pulp in the country. Efforts to increase forest produce by bringing uncultivated and wastelands under tree planting have made agroforestry immensely important. In Rajasthan, 60 to 80 trees per hectare of *Prosopis cineraria* grown in cultivated fields were reported to have no deleterious effect on the field crops (Kaul and Gyanchand. 1977). Chaturvedi (1983) opined that growing poplar on field bunds did not affect yields of various crops. However, detailed and systematic information regarding comparative performance of various tree species in agroforestry is lacking. Hence, a field experiment was conducted to evaluate the performance of various tree species in transitional tract of Karnataka at Dharwad.

### MATERIAL AND METHODS

Performance of six tree species in agroforestry system was studied at the Agricultural College Farm, Dharwad from 1979 to 1984. The trial was laid out in a Randomised Block Design with four replications. The tree species were *Leucaena leucocephala* (Lam.) de Wit., *Dalbergia sissoo* Roxb., *Eucalyptus tereticornis* Sm., *Casuarina equisetifolia* J.R. & Forst. *Tectona grandis* Linn. f., and *Dendrocalamus strictus* (Roxb.) Nees. The soil was well drained vertisol. having pH. 7.5, depth 120 to 150 cm, total N 0.063%, available P 28 kg/ha and available K 468 kg/ha. The total rains

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during 1979-80, 1980-81, 1981-82, 1982-83 and 1983-84 were 888, 752, 749, 695 and 792 mm, respectively. The required number and species of saplings were raised in nursery, in polypots, and finally planted at the age of about one year in pits (30 cm) x 30 cm x 30 cm) 1 m apart in a row (graded contour), in four replications during July, 1979. Before planting, pits dug were left open for a month, filled up in first fortnight of June by thoroughly mixing the farmyard manure (5 kg/pit) with the required amount of excavated soil. In the first year of planting, urea (34 g), single superphosphate (63 g) and muriate of potash (17 g) per plant were applied one month after planting in a ring around each plant and another dose of urea (34 g) was similarly placed at 2 months of planting. Five plants were selected at random in each treatment, tagged and observations were recorded for plant height (from ground level to the growing tip of the main stem), diameter at breast height (d.b.h.) at 1,2,3, 4 and 5 years of age after planting. Total dry matter production per plant and its distribution were recorded by destructive sampling at tree age of 4 and 5 years after planting for one tree selected at random in each replication of the treatments.

### RESULTS AND DISCUSSION

Eucalyptus produced maximum plant height (Table 1) of 3.68 m and 13.60 m as against 2.08 m and 5.51 m with *Leucaena* at the end of first and fifth year of planting, respectively. This was followed by sissou. Thus, the differences in plant height of eucalyptus and sissou might have favoured to produce more dry matter in the branches and their leaves consequently suitable canopy to trap more solar energy and in turn resulted in higher accumulation of dry matter in stem, branches and leaves and eventually higher total biomass/plant than that of remaining species.

Significantly higher d.b.h. (initial 4.0 cm, final 16.8 cm) was recorded by eucalyptus compared to rest of tree species (Table 1). *Leucaena* showed minimum d.b.h. (7.3 cm) at the end of fifth year of planting except bamboo (in which d.b.h. is uncomparable with other species). The higher d.b.h. both in eucalyptus and sissou enabled them to accumulate more dry matter in stem and branches to give higher total biomass yield per plant compared to remaining species.

At the end of the 5th year of planting highest total harvestable biomass per plant (Table 2) was produced by eucalyptus (168.11 kg), followed by sissou (144.34 kg), bamboo (76.11 kg), casuarina (70.67), teak (48.14 kg) and *Leucaena* (30.05). Variations in total biomass production/plant were due to differences in the growth components like plant height, d.b.h., dry weight in stem, branches and leaves. Growth events of tree species, of course, explain to certain extent the deviation and anomalies in total harvestable biomass production/plant, but more concrete clues for these emerge by estimating the above components.

Table 1. Mean plant height and diameter at breast height of various tree species at different years after planting

Tree species	Plant height (m)					Diameter at breast height (cm)				
	1	2	3	4	5	1	2	3	4	5
Sissoo	3.06	5.58	7.22	8.70	10.55	3.4	5.8	9.3	11.8	14.6
<i>Leucaetha</i>	2.08	3.68	4.76	5.08	5.51	1.9	3.4	5.3	6.5	7.3
Eucalyptus	3.68	6.24	8.68	11.38	13.60	4.0	7.7	10.5	13.9	16.8
Casuarina	2.56	4.28	6.20	8.15	10.31	2.6	4.7	6.7	7.8	9.3
Teak	2.06	3.32	4.36	5.42	6.70	-	3.7	5.5	6.6	9.5
Bamboo	1.89	2.84	3.86	5.04	6.30	-	1.8	2.3	2.9	3.3
SEm	0.05	0.13	0.14	0.13	0.37	-	0.1	0.1	0.1	0.3
CD 5%	0.15	0.40	0.43	0.38	1.10	-	0.3	0.3	0.2	0.8

Table 2. Total biomass production (kg/plant) and its distribution in stem, branches and leaves (including pruned material upto third year) of various tree species

Tree species	Year after planting							
	Four years after planting			Five year after planting				
	Stem	Branches	Leaves	Total	Stem	Branches	Leaves	Total
Sissoo	13.10	20.85	25.19	59.14	40.57	56.65	45.12	144.34
<i>Leucaena</i>	3.86	4.72	6.82	15.40	8.55	8.41	13.09	30.05
Eucalyptus	38.57	22.57	28.57	89.71	68.65	36.07	63.40	168.11
Casuarina	7.20	12.39	16.33	35.93	16.25	18.04	36.39	70.67
Teak	5.72	7.51	8.39	21.62	11.64	17.61	15.90	45.14
Bamboo	18.90	9.29	11.52	39.71	38.30	20.60	17.72	76.61
SEM $\pm$	0.69	0.57	0.75	0.54	1.64	0.69	0.77	2.01
CD 5%	2.07	1.71	2.25	4.54	4.94	2.06	1.32	6.05

The higher total harvestable biomass/plant in eucalyptus and sissoo was largely due to increased plant height, higher d.b.h., and higher accumulation of dry matter in stem, branches and leaves compared to other species. Chaturvedi (1983) reported close association between the debarked wood volume produced by *E. tereticornis* and plant height and d.b.h. in Uttar Pradesh. Similarly, Rao (1984) reported that because of fast growing nature, eucalyptus enjoyed a competition free environment throughout its growth period and also efficient utilization of natural resources like solar energy, soil moisture and nutrients.

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