GROWTH AND FUELWOOD YIELD OF PETFORD PROVENANCE OF *EUCALYPTUS CAMALDULENSIS* DEHN. GROWN IN RURAL MARGINAL LAND

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Abstract

A small plantation (0,018 hectare) of Petford provenance of *Eucalyptus camaldulensis* Dehn. was raised on the banks of rural ponds with a spacing of 1,6 X 1,6m to assess the growth and fuelwood yield under rural site condition. The survival of plants was 96%. At the age of 5 years, the plants attained an average height of 11,54m with an average diameter (dbh) of 11,64cm. The yield of fuelwood including bark and branches was 139,1t/ha 12% moisture content. The results show a good prospect in raising fuelwood plantation of the provence in rural waste and marginal land on a rotation of 5 years.

Introduction

On the total wood cut through out the world, nearly 45% is used for fuel (Dasmann, 1976). In less developed countries, this percentage increases to 86%, and of this, at least half is used for cooking food (Ayensu, 1980). In Bangladesh, the annual requirement of fuelwood is 17 million cubic meters. The supply from all sources including village groves is less by about 50% (Chowdhury, 1977). With the increase of rural population, the source of woodfuel extends progressively from collecting deadwood to the total destruction of tree cover. Following the destruction of tree cover, the process of environmental degradation is accelerated particularly in the neighbourhood of thickly populated villages. This has led to create treeless waste in the forests around many villages. In addition there is the diversion of agricultural crop residues and cattle dung to fuel use. In Bangladesh, 37% of 61 million tons of fresh cowdung, 11 million tons of agricultural crop residues and burnt annually for cooking food (Alim, 1980), depriving the agricultural land from valuable measures. So, if the present trend of deforestation and depletion of rural wood-lots for fuelwood continue, by the turn of the century, a considerable number of families would be without fuelwood for their minimum cooking and heating needs, and would be forced to burn more dried animaldung and agricultural waste, thereby further decreasing food crop yields.

As most of the fuelwood users are concentrated in the rural areas, the waste and marginal lands of the rural areas may be utilized for the production of fuelwood at their doorsteps. Marginal land and slopes available by the side of highways, roads, railwaylines, canals and rivers, ponds, farm-land ridges and homestead can be used for the purpose.

The selection of tree species for planting is also important. Species with characteristics of fast rate of growth, ability to coppice, to fix nitrogen from the atmosphere, to produce

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wood of high calorific value, and to 'grow successfully in a wide range of environmental conditions are considered suitable for fuelwood plantation. *Eucalyptus camaldulensis* Dehn. a native of Australia, has all the characteristics except the ability to fix nitrogen from the atmosphere, and produce moderately dense wood with a fuel value of 4800kcal/kg. There are considerable differences in growth and adaptability between different provenances of the species. Two provenances Petford and Irvinbank, among nine provenances tried in the forest area of Bangladesh are reported to have shown good performance (White, 1979). A plantation of Petford provenance was raised on the banks of a pond of rural area to study the growth performance under rural site condition and to determine the fuelwood production in the rural marginal land. This paper is therefore, a report on growth and fuelwood yield of the Petford provenance grown on rural marginal land.

Materials and Methods

Experiment sites are the banks of ponds situated in the village Jobra, Upajila Hathazari, District Chittagong (Latitude 22^{O}30'N, longitude 91^{O}40E, and altitude 12 m) of Bangladesh. The land was fellow covered with a thick layer of grass. There were some trees of *Zizyphus jujuba* Lamk. and *Phoenix sylvestris* Robx. on the site before setting the experiment. The soil is deep, sandy loam and fertile with the pH of 6,2. The climate is tropical monsoon with mean monthly maximum temperature of 29,7C^{O} and mean monthly minimum of 21,4C^{O}. The extreme maximum temperature occurs in May as 39C^{O} and the extreme minimum in January as 9C^{O}. Mean annual rainfall is 2900mm. The region receives more than 200mm of rainfall per month only from May to September and has five months with less than 100mm rainfall per month.

Seedlings of 10 weeks were obtained from Forest Research Institute, Chittagong. Outplanting was done in middle of June in four small plots of 9 X 5m dimensions with the spacing of 1'6 X 1'm. The early deaths of seedlings were replaced within 2 weeks after outplanting. No thinning was done till the end of the experiment.

At the end of 5 years, 28 trees 7 from each plot were felled selecting at random. Felling was done with hand-saws cutting as near to the ground level as possible. The sample trees were then measured for diameter for diameter breast height (dbh), length to the tip and length to 5cm top diameter (Pole height).

For solid volume estimate, each sample tree was divided into 1m sections upto 5cm top diameter. Mid-length diameter over bark and mid-length bark-thickness of each section were recorded. Diameter was measured by diameter tape and barkthickness by bark-guage. Hubers formula was followed to estimate solid volume under bark.

For weight assessments, fresh weights of stem upto pole height, branch along with stem under 5cm diameter and leaves of each sample tree were taken in Spring balance soon after felling.

10cm wood-discs from the middle of pole length, branch samples with 50 species in each

(15cm long) and leaf samples with 100 leaves in each were taken from two random trees of each plot. The samples were weighed immediately after cutting before lying them out of the laboratory for air drying. After four weeks, the samples were weighed at weekly intervals until moisture content reached a constant. For the determination of moisture content of air-dried materials, the samples were put into the Oven at $110C^{o}$ for 12 hours.

Wood density was calculated from air-dried weight of wood discs and volume by displacement of water. Before taking the weight and volume, the wood discs were debarked.

Results and Discussion

The Petford provenance grew with the mean annual increments of 2'3m and 2'3cm in height and diameter respectively (table 1). The mean annual growth increments of 2m in height and 2cm in diameter can be maintained for 10 years on good sites (NAS, 1980). The provenance produced solid wood(ub) of $165m^3$/ha at the end of 5 years, the mean annual volume increment being $33m^3$/ha (table 1). Growing the species with the spacing of 1'5 X 1'5m in Pakistan, Hussain and Abbas (1983) recorded a yield of $159'396m^3$/ha at the age of 5 years, the mean annual volume increment being $31'879m^3$/ha. The annual wood yields of $20-25m^3$/ha have been reported from Argentina and $30m^3$/ha from Israel (NAS, 1980).

Table 1

Survival and growth assessments of Petford provenance of *E. camaldulensis* Dehn.

Variable	Unit	Value	Standard error
Survival per hectare	No.	3750	
Mortality	%	4	
Mean height to tip	m	11'54	1'17
Mean pole height	m	7'43	1'15
Mean dbh (ob)	cm	11'64	1'12
Mean annual increment in height	m	2'3	
Mean annual increment in diameter	cm	2'3	
Basal area per hectare	m^2	39'9	
Solid volume (ub) per hectare (upto pole height)	m^3	165	
Mean annual volume increment (ub)	m^3	33	

Table 2

Weight assessments and wood density of 5 years old Petford provenance of *E. camaldulensis* Dehn. at 12% moisture content

Variable	Unit	Value
Wood (ub) upto pole height	t/ha	98'6
Bark of stems upto pole height	t/ha	12'0
Branch alongwith stem under 5cm diameter(ob)	t/ha	28'5
Leaves	t/ha	9'9
Wood density	g/cc	0'62

The total combustible aerial biomass (at 12% moisture content) produced at the end of 5 years was 149 t/ha (table 2), of which underbark wood upto pole height was 66%, bark of stems upto pole height 8%, branch including stems under 5cm diameter overbark 19% and leaves 7% by weight. The provenance produced 139'1 of woodfuel including bark and branches per hectare on 5 year rotation (table 2). *Casuarina equisetifolia* L. which produces the best fuelwood (4950kcal/kg) of the world, yields 75–200 t/ha on a rotation of 7–10 years planted with the spacing of 2 x 2m in Malaysia and Philippines (NAS, 1980).

Conclusion

The results in respect of survival, growth and yields of fuelwood of the provenance may be considered promising and show a good prospect in raising fuelwood plantations in rural waste and marginal land. In Bangladesh, the marginal land area of ponds available for planting is estimated to be 0 2[illegible] million hectares (Alim, 1980). If the entire area is planted with the provenance on a rotation of 5 years with the spacing of 1'6 X 1'6m, an annual yield of 5'6 million metric tons of fuelwood may be expected. This may not only meet the demand of fuelwood in rural areas but may also increase the food crop yields saving the cattle-dung and agricultural crop residues from burning. Such large scale fuelwood plantation programme requires education, training, political commitment of government as well as co-operation internationally.

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