Growth Response of *Eucalyptus camaldulensis* to Different Fertilizers in One Year Old Plantation

S. P. Paul, A. T. M. Emdad Hossain and H. B. Dey
Bangladesh Forest Research Institute, P. O. Box 273, Chittagong 4000, Bangladesh

Abstract

Evaluation was made on growth response of one year old *Eucalyptus camaldulensis* seedlings to various dose-combination of NP fertilizers under a comparatively poor site condition of Silvicultural Research Station at Keochia. Results indicate that the maximum average height (262.17 cm) and diameter (2.08 cm) of the seedlings in one year were attained through application of urea and triple super phosphate (TSP) combinedly at the rate of 30 and 20 g/pit respectively with a basal dose of muriate of potash (MP) at 20 kg/ha. Application of the above mentioned fertilizer dose promoted above-ground green biomass production almost 8 times higher than the control. Subsequently, the biomass distribution to shoot, leaf and twig was modified. The intake of nutritional elements by the seedlings was found to increase due to application of fertilizer.

সারসংক্ষেপ

কেওচিয়া সিলভিকালচারাল রিসার্চ স্টেশন -এর অপেক্ষাকৃত অনুর্বর মাটিতে এক বৎসর বয়স্ক *Eucalyptus camaldulensis* চারার বর্ধনে বিভিন্ন মাত্রার নাইট্রোজেন ও ফসফেট সারের কার্যকারিতা মূল্যায়ন করা হয়। ফলাফল থেকে দেখা যায় যে, হেক্টর প্রতি ২০ কেজি এমপি সারের মূল-প্রয়োগের সাথে গর্ত প্রতি যথাক্রমে ৩০ ও ২০ গ্রাম ইউরিয়া ও টিএসপি সার প্রয়োগে এক বৎসর বয়স্ক চারাগাছ সর্বাধিক গড় উচ্চতা (২৬২.১৭ সেঃমিঃ) ও ব্যাসার্ধ (২.০৮ সেঃমিঃ) প্রাপ্ত হয়। উক্ত মাত্রায় সার প্রয়োগে কন্ট্রোল প্লটের তুলনায় প্রায় ৮ গুণ অধিক সজীব বায়োমাস উৎপন্ন হয়। একই সাথে চারাগাছের কাণ্ড, পাতা ও ডালপালায় বায়োমাস-এর বণ্টনে পরিবর্তন লক্ষ্য করা যায়। সার প্রয়োগের ফলে চারাগাছ কর্তৃক বিভিন্ন পুষ্টিমৌল গ্রহণ বৃদ্ধিপ্রাপ্ত হয়।

Key words : Biomass, *Eucalyptus camaldulensis*, fertilizers, nutritional intake, seedling growth

Introduction

Out of the little more than one million ha of land under existing forest in Bangladesh (FAO 1995), eucalyptus occupies a substantial land area. Besides, eucalyptus enjoys a good popularity in social forestry, home garden and even in the cropland agro-forestry practice in our country. However, the growth performance of this species is found to vary under different edaphic conditions. This is particularly true of hilly terrains, where the growth of eucalyptus is not uniform.

Therefore, the option of fertilizing eucalyptus as one of the remedial measures for sub-standard growth is often felt. On the other hand, through

several field studies it was shown that the growth of eucalyptus is impeded by inadequate supply of nitrogen and phosphorus (Crommer 1971, Miayasaka 1984). In view of this, the present study was undertaken to investigate the effect of fertilizers on the growth of *E. camaldulensis* seedlings in the early plantation stage.

Materials and method

The study was conducted at the Silvicultural Research Station at Keochia under Bangladesh Forest Research Institute (BFRI). The experimental site is represented by the undulating terrains of closely dissected low hills with shallow to moderate soil depth. Some properties of soil of the experimental site is given in Table 1.

The experiment was laid out in a Randomized Complete Block (RCB) design and replicated three times. The nitrogenous and phosphatic fertilizers were combined to form 16 treatment combinations including no-fertilizer control. A common dose of muriate of potash (MP) was applied as basal fertilizer at the rate of 20 kg/ha. The variable doses of nitrogen as urea and phosphorus as triple super phosphate (TSP) in g/pit were as follows :

$T_1 = N_0P_0$	$T_2 = N_{15}P_0$	$T_3 = N_{30}P_0$	$T_4 = N_{60}P_0$
$T_5 = N_0P_{10}$	$T_6 = N_{15}P_{10}$	$T_7 = N_{30}P_{10}$	$T_8 = N_{60}P_{10}$
$T_9 = N_0P_{20}$	$T_{10} = N_{15}P_{20}$	$T_{11} = N_{30}P_{20}$	$T_{12} = N_{60}P_{20}$
$T_{13} = N_0P_{40}$	$T_{14} = N_{15}P_{40}$	$T_{15} = N_{30}P_{40}$	$T_{16} = N_{60}P_{40}$

Half of the urea and the full dose of TSP were applied in the pit of 30 cm x 30 cm x 30 cm size. The fertilizers in the pit were mixed with soil dug out and left for two weeks. Broadcasting of MP was made just before application of urea and TSP. At the 16th day after fertilizer application, the planting activities of the seedlings were carried out. The rest of the urea was applied at 5-8 cm depth by drilling around the base of the seedlings at 1.5 month after planting.

The three and a half months old *E. camaldulensis* seedlings grown in 15 cm x 10 cm polybags were used in the experiment. The average height and diameter of the seedlings were 30-40 cm and 3.0-5.0 mm respectively. Planting of the seedlings was done in June following 1.5 m x 1.5 m spacing. In each plot, 15 seedlings were accommodated. Weeding of the experimental area was done thrice a year.

Growth response to fertilizers was assessed in terms of height and diameter increment and above-ground green biomass weight at one year after planting. Two of the seedlings from each plot were selected for assessment of the biomass.

Total nitrogen content of soil and plant was analyzed through micro Kjeldahl method and organic carbon by Walkly and Black method (Jackson 1958). Phosphate and potassium was determined by atomic absorption spectrophotometer., model-2000. Australia.

Result and discussion

Average height and diameter of *E. camaldulensis* seedlings at one year old plantation are presented in Table 2. The results indicate that both urea and TSP are effective in height and diameter increment of the seedlings. Thus, the

Table 1. Some properties of soil of the experimental site.

Soil depth (cm)	pH (H_2O)	Organic carbon (%)	Total N %	Available P (ppm)	Available K (m.e.%)
0-20	5.90	0.66	0.07	13.50	0.16
20-40	5.45	0.43	0.04	9.76	0.22

maximum average height of 262.17 cm and diameter of 2.08 cm were obtained when $N_{30}P_{20}$ g/pit was applied. Apparently, the use of lower doses of urea (N_{15}) in combination with various levels of phosphate give better results than those of higher doses of urea (N_{60}) in terms of seedlings height and diameter increment. Growth response of various eucalyptus to the addition of nitrogenous and phosphorus fertilizers have also been confirmed by field trials over a large part of Australia (Crommer 1975).

Subsequently, it appears from the graphical presentation (Fig. 1) that application of urea and phosphate at the rate of $N_{30}P_{20}$ g/pit enhanced above-ground green biomass to 4.7 ton/ha which is eight times greater than that in the control. An insignificantly higher biomass was recorded under the treatments of $N_{30}P_{40}$ g/pit than that of $N_{30}P_{20}$ g/pit. Therefore, in terms of biomass production the application of $N_{30}P_{20}$ g/tree fertilizer level seems to be the best.

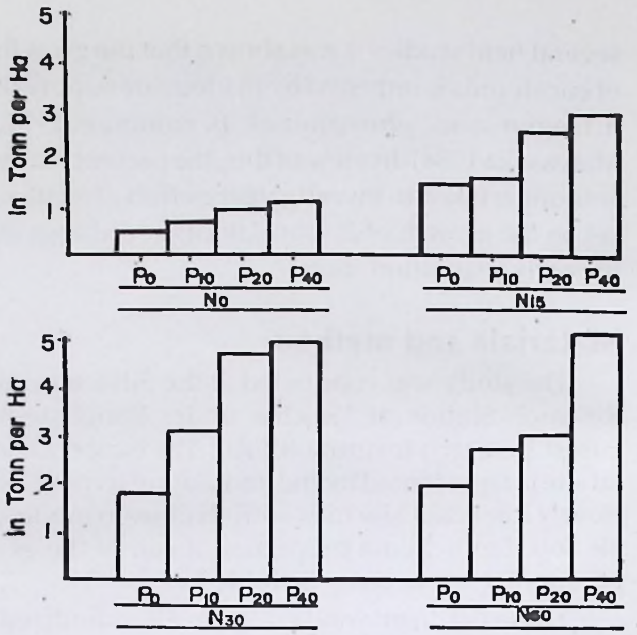

Figure 1. Graphical presentation of above-ground green biomass of *E. camaldulensis* seedling at one year period.

Table 2. Effect of NPK on height and diameter increment of *E. camaldulensis* seedlings at one year period after planting.

Urea as N (g/pit)	Average height and diameter (cm)			
	Phosphate as TSP (g/pit)			
	P_0	P_{10}	P_{20}	P_{40}
N_0	161.75 J*	166.68 IJ	185.78 H	173.23 I
	(0.87)**i	(0.82) i	(1.34) g	(1.14)h
N_{15}	240.00 CD	237.30 D	248.07 BC	255.38 AB
	(1.38)gf	(1.38)gf	(1.80)b	(2.10)a
N_{30}	234.85 D	209.19 FG	262.17 A	263.48 A
	(1.55) de	(1.51) e	(2.08) a	(2.07) a
N_{60}	215.00 EF	219.36 E	201.85 G	213.03 EF
	(1.48) ef	(2.65) cd	(1.49) ef	(1.75) bc

* Means denoted by same letter do not differ significantly (F=0.05)

** Parentheses indicate the diameter of the seedlings

The results mentioned above are in agreement with the research findings on biomass production of various eucalyptus seedlings (Sharma *et al.* 1986, Krishnamurthy and Vijayan 1984).

The biomass distribution to different plant parts is favoured by fertilizer application. From the results, it is evident that the increased rate of nitrogen application (N_{30}, N_{60}) in combination with various phosphorus doses (P_0, P_{10}, P_{20} and P_{40}) makes the biomass distribution trend to shoots, leaves and twigs more uniform (Fig. 2).

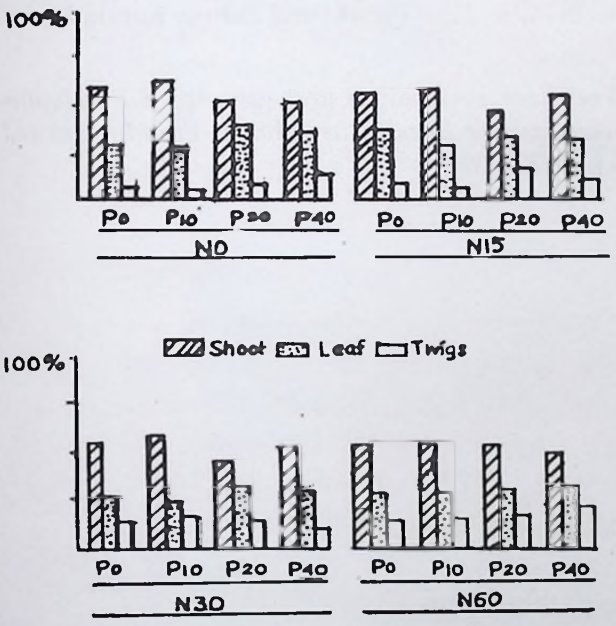

Figure 2. Graphical presentation of biomass distribution (%) of *E. camaldulensis* to shoot, leaf and twig at one year period.

Nutrient mining by the above-ground biomass is given in Fig. 3. It appears that the removal of additional N and P are caused by increased application of these elements. As much as 11.0 kg N and 2.1 kg P/ha were uptaken by the trees when $N_{30}P_{20}$ g/pit was applied.

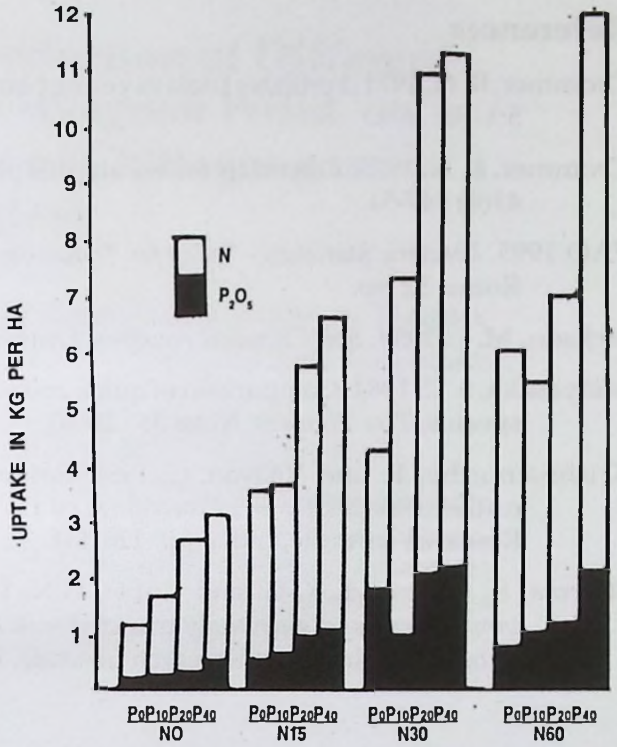

Figure 3. Graphical presentation of nutrient mining by one year old *E. camaldulensis* seedlings.

Conclusion

Application of NPK is essential for incremental growth of *E. camaldulensis* seedlings specially in the planting time under poor site condition. Fertilizing eucalyptus seedlings with urea and TSP at the rate of $N_{30}P_{20}$ g /pit and a basal dose of 20 kg MP/ha enhances height and diameter increment by about two times and above-ground green biomass by eight times in the one year old plantation. Use of increased level of NPK particularly $N_{30}P_{20}$ g/pit with a basal dose of 20 kg MP/ha makes the biomass distribution pattern to shoots, leaves and twigs more uniform. Application of mineral fertilizers (NPK) stimulates removal of nutrients by *E. camaldulensis* seedlings in one year old plantation.

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