

REGENERATING *EUCALYPTUS CAMALDULENSIS* THROUGH COPPICE - AN ECONOMICAL METHOD

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ABSTRACT

The common method for regenerating *Eucalyptus camaldulensis* through seeds is quite expensive, laborious and lengthy. Keeping this in view, the present study was conducted on 12 years old plantation using R.C.B. design with five replications. The results are quite encouraging and suggest that *Eucalyptus camaldulensis* can be raised successfully through coppice. Growth of coppice shoots was about 2-3 times faster than that crop of seed origin. Volume production was not affected by the number of shoots retained or removed. Reduction in number of shoots would be, however, required to obtain bigger sized wood in relatively short rotation.

INTRODUCTION

Eucalyptus camaldulensis, a native of Australia, has been planted on large scale under varying edaphic and climatic conditions in Pakistan. As such it has been planted in irrigated plantations of the Punjab and other provinces. It is now being grown by farmers under various social forestry programmes. This species has also proved fairly successful in waterlogged and saline areas.

Because of its rapid growth, *Eucalyptus camaldulensis* is generally worked on short rotations and its regeneration is, therefore, repeated at short intervals. The common method for regenerating this species through seeds is expensive, laborious and time consuming, hence it is very important to find out some economical method for its regeneration. Keeping this in view, the present study was carried out to see the possibility of raising *Eucalyptus camaldulensis* through coppice.

REVIEW OF LITERATURE

Sheikh (1982) indicated that more the stems per hectare the greater is the volume yield in the early stages of *Eucalyptus camaldulensis*. Maximum yield of 95 m³/ha was obtained by planting *Eucalyptus camaldulensis* at 1.5 x 1.5 m spacing. Rathinam and Surendran (1982) observed that coppice potential of *Eucalyptus treticornis* depends largely upon its vigor, reproductivity and stool longevity. They concluded that larger the diameter of the stool larger the number of clusters developing from it.

Siddiqui *et al.* (1984) reported that *Eucalyptus camaldulensis* is a principal species of all afforestation programmes in the country especially of arid and semi-arid areas. Hills and Brown (1984) revealed that *Eucalyptus camaldulensis* is widely afforested in arid and semi-arid areas because of its rapid growth on poor sites, ability to coppice readily tolerate periodic waterlogging, salinity and its multifarious uses. They further observed that most *Eucalyptus* plantations outside Australia are regenerated several times by coppicing. The low *Eucalyptus* forest are best managed by the coppice system.

MATERIALS AND METHODS

In order to see the coppicing capacity of *Eucalyptus camaldulensis*, an experiment was conducted on 12 years old plantation of *Eucalyptus camaldulensis* in Cpt. No.23 of Bahawalpur plantation over an area of 4 acres. Trees were felled with axe in April, 1990. The height of stumps was 6" above ground level. Diameter of stumps were recorded after felling which ranged from 10 to 25cm.

A randomized complete block (RCB) design with five replications was used. The new crop (tubed plants) was planted after extraction of useless mundies at 1.5x1.5m spacing. The first coppice shoot appeared in the last week of April, 1990 and all the stumps gave coppice shoots by mid of May, 1990. In November 1990, after seven months of coppicing of the stumps, the coppice shoots were reduced artificially to the required treatments. Following is the detail of treatments in each replication:

- T₀ = New planting (tubed plants)
- T₁ = One coppice shoot retained
- T₂ = Two coppice shoots retained
- T₃ = Three coppice shoots retained
- T₄ = Four coppice shoots retained

Equal number of plants (187) were retained in each experimental unit (plot) having size of 15x28m. Since there were five replications and five treatments in each replication the total number of plants were, therefore, 4675. The five treatments in each replication were allotted randomly according to procedure described by Steel and Torrie (1980).

Various silvicultural operations like weeding, irrigation etc. were carried out according to the requirement of crop. Every experimental tree was numbered and marked to retain its identity for repeated measurement of diameter and height.

Data regarding height and diameter were recorded during December every year. Volume calculation was made with the help of local volume table.

Analysis of variance (ANOVA) was performed on diameter growth, height growth and total volume production for each parameter, separately. The F-ratio was used to indicate significant differences among treatments. To determine whether significant differences among treatments means lay, the LSD (least significant difference) test was applied at the five percent confidence level.

RESULTS AND DISCUSSION

Diameter growth

Analysis of variance for data of 3 years old plantation (Table 1) indicated that diameter growth among treatments was significantly different at the five percent and one percent levels of confidence. The means for average diameter growth for all the treatments are presented in Table 2. Maximum diameter growth was attained by T₁ (one shoot) and it was significantly different from all other treatments including control i.e. planting tubed plants. Similarly, diameter growth was significantly higher in T₂ (two shoots) than T₃ (three shoots), T₄ (four shoots) and T₀ (tubed plants). T₃ (three shoots) and T₄ (four shoots), however, remained at par regarding diameter growth but significantly different from other treatments. It is worth to mention that direct planting of tubed plants (T₀) showed less diameter development than all the coppice treatments.

Results indicated that more the number of coppice shoots, lower is the diameter growth as weaker shoots are suppressed due to limited supply of light, nutrients and other environmental factors and these will take more time to attain same size. Lower average diameter in tubed plants as compared to shoots of coppice origin can be attributed to more developed and well established root system that take nutrients and water in a better way in the latter.

Height growth

The results of variance for height growth given in Table 3 revealed that height was significantly different among treatments. Means for height growth when separated by the LS.D. test at the five percent level of significance (Table 4) showed that significantly more height was attained by T₁ (one shoot) as compared to other coppice origin shoots. There was, however, no significant difference among other coppice treatments regarding height growth. Significantly low height was attained by directly planted tubed plants (T₀).

As a general rule height growth decreased with number of coppice shoots retained but it was significantly low if the coppice shoots retained are more than one. Average height, however, statistically remained same irrespective of number of shoots retained beyond one coppice shoot. There was less

reduction in height as compared to diameter growth mainly due to the reason that diameter growth is more influenced, by local environmental conditions (Champion, *et al.*, 1965) More height attained by the coppice shoots may be due to their established root system as already explained under diameter growth.

Table 1. Analysis of variance for diameter growth of *Eucalyptus camaldulensis* in coppice and non-coppice treatments

Sov.	Df.	S.S.	M.S.	F.
Treatments	4	17.3	4.3	21.5**
Replications	4	2.7	0.7	3.5 NS
Error	16	3.9	0.2	-
Total	24	23.9	-	-

NS = Non-significant

** = Significant at one percent and 5% significant levels

Table 2. Average diameter growth (inches) in each treatment

Treatment			Means	
T0	T1	T2	T3	T4
2.9	5.3	4.2	3.5	3.3*
(d)	(a)	(b)	(c)	(c)

* Means followed by different letters differ significantly at 5% level of significance to the LSD test.

Table 3. Analysis of variance for height growth of *Eucalyptus camaldulensis* under coppice and non-coppice treatments

Sov.	Df.	S.S.	M.S.	F.
Treatments	4	1079.8	269.9	29.3**
Replication	4	118.8	29.7	3.2 NS
Error	16	146.8	9.2	-
Total	24	1345.4	-	-

NS = Non-significant

** = Significant at one percent and 5% significant levels

Table 4. Average height growth (feet) of *Eucalyptus camaldulensis* in each treatment

Treatment			Means	
T0	T1	T2	T3	T4
16.0	36.2	30.2	26.8	26.6*
(c)	(a)	(b)	(b)	(b)

* Means followed by different letters differ significantly at 5% significance level according to LSD test.

Table 5. Analysis of variance for volume production of *Eucalyptus camaldulensis* under coppice and non-coppice treatments.

Sov.	Df.	S.S.	M.S.	F.
Treatments	4	28.74	7.185	6.86 **
Replication	4	12.61	3.153	0.33 NS
Error	16	16.77	1.048	-
Total	24	58.12	-	-

NS = Non-significant

** Significant at the five and one percent level

Table 6. Average volume production (Cft.) in each treatment

Treatment			Means	
T0	T1	T2	T3	T4
0.7052	3.172	3.692	3.115	3.371*
(b)	(a)	(a)	(a)	(a)

* Means followed by different letters differ significantly at 5% significance level according to LSD test.

Volume production

Result of analysis of variance (Table 5) of the volume production exhibited highly significant difference among treatments. Means for volume production tested by the L.S.D. at the five percent (Table 6) showed that there was no significant

difference among coppice origin shoots inspite of variation in diameter and height growth. This suggests that if more coppice shoots are retained they will grow less due to more competition for food and energy and thus their numerical advantage for more wood production would be finally averaged by more growth of fewer number shoots. Tubed plants (T0) produced significantly less volume as compared to all

coppice treatments. Less volume production in case of tubed can be rightly attributed to lesser diameter and height growth and resultantly less volume production. It can be, therefore, inferred that if the objective of raising *Eucalyptus camaldulensis* is to obtain higher size wood at a short rotation it can be raised through coppice by retaining only one shoot. However, if one is interested in total volume production (firewood), irrespective of size of end product *Eucalyptus camaldulensis* can be raised through coppice by retaining all available shoots as it will cut-down the cost of establishment without affecting the total volume production.

CONCLUSIONS

- a. *Eucalyptus camaldulensis* can be raised successfully through coppice. It is more economical as compared to planting of tubed plants.
- b. Growth of coppice shoots is better than new planting. It is almost 2-3 times more than crop of seed origin (new planting).
- c. Volume production is not affected by the number of shoots retained or removed despite variation in diameter and height growth. Reduction in number of shoots will be, however, required to obtain plants of bigger size in a relatively short time.

ACKNOWLEDGEMENTS

The author is grateful to Shahbzada Muhammad Hafeez, Director, Punjab Forestry Research Institute, Faisalabad for guidance, criticism, suggestions and assistance in the preparation of this article. Acknowledgements are also extended to Mr. Akhtar Mehmood Bhatti, SDFO and Mr. Fida Hussain, SDFO for maintaining the experiment and collection of data.

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