

**Short communication**

**EFFECT OF DIFFERENT SITE PREPARATION METHODS  
ON GROWTH AND SURVIVAL OF *EUCALYPTUS GLOBULUS*  
LABILL. AT GEFERSA, ETHIOPIA**

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**ABSTRACT**

A study was conducted with the aim of investigating the effects of different site preparation methods on the establishment of *Eucalyptus globulus*. The experiment involving complete cultivation, furrow cultivation, spot hoeing and pitting treatments was conducted at Gefersa, 18 km west of Addis Ababa, Ethiopia. Each treatment was replicated four times and laid out in RCBD. Data were collected 27 months after establishment of the experimental plots. Two growth characteristics, survival and height growth, were evaluated. Two-ways ANOVA followed by comparison of treatment means using the Least Significant Difference (LSD) Range Test revealed significant differences in survival and height growth among treatments. Complete cultivation of site was found to be the best treatment for the establishment of *E. globulus*.

**Key words:** Acceptable growth, compact soil, establishment techniques, rapid early growth, site preparation intensities

**INTRODUCTION**

*E. globulus* was introduced to Ethiopia in 1895 (von Breitenbach, 1961). At that time the main purpose of introducing this species was to overcome the shortage of fuelwood and construction materials in and around Addis Ababa.

Since then, shortage of forest products has worsened throughout the country, while the population shortage of forest products has worsened throughout the country, while the population increased dramatically from time to

time (CSA, 1984, 1988). As a result, the newly introduced species was quickly adapted by farmers who planted it on their woodlots and around homesteads. Today, it is the most widely planted tree species in the country. Pohjonen and Pukkala (1990) reported that over 100,000 ha of *E. globulus* plantations have been established around cities and villages (mainly woodlots), on marginal lands and state forests in the central highlands of the country. According to the same authors and Davidson (1995) *E. globulus* dominates the Ethiopian reforestation and afforestation programme, since it ideally suits requirements of wood users and the prevailing economic and social conditions of the country.

However, planting of large areas alone can not fulfil the wood deficit which is estimated to be 32.5 m<sup>3</sup> annually (EFAP, 1994). To increase the productivity of this species per unit area, emphasis should be given to the use of intensive silviculture that involves, among others, optimum site preparation, which gives excellent survival and rapid early growth. This can be achieved on the basis of an understanding of growth requirements of *E. globulus*. Evans (1986) emphasised that site preparation is an integral part of plantation establishment for securing both survival and rapid early growth. It is also vital for increased soil aeration and thereby root respiration, removal of physical obstruction to tree growth, control of competing vegetation, and aids rooting by modification of natural drainage.

So far, planting of this species has been carried out on sites with low soil fertility, overgrazed lands, and very compacted soils. On the other hand, it is necessary to ensure that planting is practiced on well-suited sites, which would give acceptable growth and survival rate throughout the rotation. Based on these facts, a trial was established at Gefersa with the aim of comparing the performance of *E. globulus* under different methods of site preparation.

## MATERIALS AND METHODS

The experiment was established at Gefersa, located 18 km west of Addis Ababa, at latitude 9°02'N, longitude 38°43'E and altitude of 2400 m (EMA, 1988). The annual rainfall varies, but the five-decade mean (1931 to 1979) was 1225 mm, 95% of which was received from June to September (FAO, 1982). The site has reddish brown clay-loam soil (Murphy, 1968). The original vegetation was dominated by grasses such as *Pennisetum spachelatum* and *Cynodom* spp. and the

site was previously used as grazing land.

### *Experimental design and layout*

Four site preparation treatments were studied (Table 1). The ground preparation was done by using ordinary plow and digging hoe. The treatments in Table 1 were laid out in a randomised complete block design and replicated four times. Plot sizes of 100 m<sup>2</sup> were used with a spacing of 1 m by 1 m. Plots within blocks were separated from each other by 2 m wide paths whereas 4 m wide paths were used between blocks. The blocks were aligned perpendicular to the direction of the gradient in order to minimize soil variability.

Table 1. Summary of site preparation treatments applied at Gefersa

Treatments	Soil depth (cm)	Cultivated soil width (cm)
Complete cultivation	20-30	-
Furrow cultivation	13-15	60
Spot hoeing	30	60
Pitting	30	30

### *Germination and seedling establishment*

*E. globulus* seeds were sown on seedbeds at the Forestry Research Centre in Addis Ababa in a mixture that consisted of sand and forest soils. After germination, they were transplanted into polythene tubes (8 cm x 12 cm). The potting mixture in the polythene tubes consisted of two parts sand and three parts forest soil. The seedlings were protected from strong sunlight with grass shade until they were well established. Routine weeding and cultivation practices were undertaken accordingly. Root pruning was also undertaken in order to prevent elongation of tap roots. Watering was done twice per day, early in the morning and late in the afternoon. The seedlings were then transported to the planting site and planting was carried out. During transplanting the polythene tubes were

carefully removed leaving the soil around the root system intact.

### *Growth assessment*

Assessment of height and survival were carried out 27 months after field planting. Graduated poles were used for measuring heights that were greater than two meters. A record of all surviving trees was undertaken during height assessment.

### *Data analysis*

Since seven and two observations were derived from less than 30% and above 70%, respectively, arcsine transformation was made prior to analysis of survival percentage of variance. Then all data were subjected to analysis of variance to determine whether the different site preparation methods had any influence on height growth and survival of *E. globulus*. The best site preparation methods were sorted out by using the Least Significant difference test at  $P = 0.05$  and  $0.01$ .

## RESULTS AND DISCUSSION

### *Survival*

There was significant difference ( $P = 0.01$ ) in survival among the different types of site preparation (Table 2). There was an increase in survival rate with increase in site preparation intensities. The complete cultivation treatment gave reasonably higher survival compared to the rest of the treatments. On the other hand, the other three treatments (furrow cultivation, spot hoeing and pitting) were not significantly different from each other (Table 2).

Complete cultivation is one of the most intensive methods of site preparation and it typically provides suitable condition for rapid early tree growth and development. Good aeration and low soil strength promote mineralisation and allow easy root penetration. The only treatment, which depressed and gave the lowest survival percentage, was planting by pitting. This could be attributed to competition for moisture, nutrients and soil aeration, since the experimental field was highly overgrazed and compacted previously. This result supports previous

The increase in height in the complete cultivation treatment could be attributed to improved growth conditions due to increased soil aeration and improved soil structure. Complete cultivation also creates weed-free environment. It may also be argued that the practice resulted in increased rainwater percolation and a reduction in surface runoff. This consequently enables building of deep reserves of moisture in the soil. Complete cultivation results in better rooting conditions where young trees could develop a vigorous root system, which in turn enables the trees to obtain optimum moisture and nutrients from the soil. Moreover, the response could also be attributed to increase in nitrogen resulting from mineralisation of the original vegetation after cultivation (Schonau et al., 1981). Poynton (1984) also reported that complete cultivation leads to high survival and growth in compacted or laterised soils.

Complete cultivation can not be implemented on gentle slopes where the limitations are imposed by terrain conditions. Under this condition, spot hoeing can be used as an alternative to complete cultivation in order to minimise soil loss. Complete cultivation may be impractical on stony sites; in such case it is necessary to prepare planting spots on pocket lands. The planting spots should be well cultivated paths of at least 60 cm diameter, and preferably, large enough to provide good initial root development. Also the spot should be dug to a depth of at least 30 cm.

## CONCLUSION AND RECOMMENDATIONS

Preparing sites for planting is one of the important forest cultural practices. Results of the study reported here revealed that complete cultivation as a method of site preparation had significant effect in terms of survival rate and rapid early growth of *E. globulus*. When gentle slopes are not available or where complete cultivation cannot be used, as on steep terrain, spot hoeing in the immediate vicinity of the seedlings should be undertaken. When complete cultivation may be impractical on stony sites, it is necessary to prepare planting spots. It is also preferable to prepare the planting spots before the actual planting season.

Further studies should be undertaken to evaluate the long-term effects of the different methods of site preparation treatments, depending upon agro-ecological conditions and past history and land-use systems of the area. Since the demand for

fuelwood and construction materials is far higher than the supply available in this country, afforestation and reforestation of fuelwood and industrial plantations need to expand considerably. In these efforts, special attention should be paid to establishment techniques while also planting numerous seedlings on tenacious sites.

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