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SILVICULTURAL PERFORMANCE OF THREE EUCALYPTUS GENOTYPES IN A SILVOPASTORAL SYSTEM

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ABSCTRACT

Defining the best genotype for silvopastoral purposes in mountainous areas is an issue that deserves special attention, considering the morphological differences in root system between the material propagated by seeds and cuttings, which can set its vulnerability to drought conditions. In this sense, this work aimed to evaluate the performance of three eucalyptus genotypes established in silvopastoral systems in mountainous areas in the Zona da Mata de Minas Gerais. This study was conducted in a 50 hectares area from a private property. It was used a completely randomized design with three treatments and four replications. The treatments corresponded to two materials propagated by cuttings and one material propagated by seeds from a hybrid of *Eucalyptus grandis* x *Eucalyptus urophylla*. Each experimental plot was represented by 20 trees. The first step was to characterize the diameter distribution and scale the trees by using the tree-model method for volume yield estimation in each plot. In addition, the percentage of dominant, co-dominant, dominated trees and the failure rate were recorded. Statistical differences were observed only for diameter at breast high and failure rate characteristics, and the material propagated by seeds showed the highest values. The same was observed for the others characteristics, although there were no statistical differences.

Key words: Eucalyptus, systeme agrosylvopastoral, clones, genotypes

Introduction

Zona da Mata Mineira is a mountainous region located in the southeastern Minas Gerais. It is characterized by steep landscapes occupied, mainly, by livestock activities. Originally, this region was covered by Atlantic forest formations, therefore it indicates its natural vocation. The land use change has replaced the forest cover by grasslands, eliminating the natural protection of the slopes. In addition, the overgrazing and low technology level of tillage practices have led to a degradation process.

In this sense, silvopastoral systems are seen as a sustainable way of land use, as it ensure protection against erosive agents, water conservation and re-supply of underground waters, maintenance of the hydrological cycle and improvement of soil physical and chemical properties (Macedo 2000; Xavier et al., 2003; Castro et al., 2009).

The most used species in silvopastoral systems are those from Eucalyptus genus, because of their vigorous growth rates and technological characteristics. Since 1970, the eucalyptus silviculture has been developed and, besides the tillage techniques and silvicultural

treatments, the genetic improvement and methods of propagation have received great attention, in order to provide better stands. With this development, cuttings have gained space and, today, are the most used material in forest plantations.

According to Sasse & Sands (1997) the root systems of cuttings are fundamentally different from those of seedlings, mostly because of their structure. They compared the root system development of *Eucalyptus globulus* plants propagated, either, by cuttings and seedlings. The authors observed that seedlings had strongly gravitropic tap-roots, with two types of primary roots from which secondary roots emerged. Cuttings had no tap roots, and the main structural components of their root systems were adventitious roots formed during propagation. Cuttings did not develop further structural roots during the experiment, whereas seedlings continued to develop primary roots. The same authors, in a previous study (Sasse & Sands, 1996) suggested that the differences in resistance to water stress were due to differences in the functional capacities of the root systems Mokotedi et al. (2010) observed that micropropagated plants of *Eucalyptus grandis* and *E. nitens* were most vulnerable to the combination of prolonged dry conditions and air frost than seed-propagated plants of the same genetic material.

On the other hand, others studies have shown no differences in growth performance between cuttings and seedlings (Bell et al., 1993; Gaspar et al., 2005). Even reverse results were found in *Eucalyptus* spp. and rooted cuttings outgrew seedlings

Considering these differences, and taking into account that in mountainous areas, like Zona da Mata, the slopes are more susceptible to water losses, it is imperative the evaluation of different materials from different propagations methods. Thus, this work aimed to evaluate de silvicultural performance of two vegetative-propagated clones and a seed-propagated material from a hybrid of *Eucalyptus grandis* x *Eucalyptus urophylla*.

Material and Methods

The study was carried out in a 50 hectare area located at a private property in Coronel Pacheco, state of Minas Gerais, Brazil (21°33' S; 43°06' W, altitude of 410 m). The climate in the region can be classified as Cwa (Köppen), mesothermal, with hot and rainy summers and cold and dry winters. The average annual rainfall is over 1,500 mm, unevenly distributed, with only 13% occurring from May to September, which is considered the dry season. The average temperature is 18°C in colder months of the year and 22°C in the summer. The average slope ranges from 30 to 45%.

It was used a completely randomized design with three treatments and five replications. The treatments corresponded to two plant types: two materials propagated by cuttings (clone 1 and clone 2) and one material propagated by seeds (seed-propagated) from a hybrid of *Eucalyptus grandis* x *Eucalyptus urophylla*. Each experimental plot was represented by 20 trees. The trees were established in rows composed by two lines of tress spaced by 3 meters between lines and 2 meters between plants. Each row was spaced by 15 meters, totaling 555 trees per hectare.

The first step was to characterize the diameter distribution by measuring the total height (H) and the diameter at breast height (DBH) of all the 20 tress in each plot. The trees were distributed in diameter classes of 5 cm. After that, by using the tree-model method, three trees were selected, by diameter class, to be scaled. To scale the tress the Smalian's model was used, considering a 1.5 m section length. The failure rate was also recorded.

These data were submitted to analysis of variance and the means were compared using the Tukey test at 5% significance.

Results and discussion

Table 1 shows the comparison results for each parameter evaluated, among the three materials. As it can be seen, the lowest survival rate of seed-propagated plants was compensated by highest values of individual volume, volume per hectare and DBH, which differed significantly from the vegetative propagated materials. Between the two vegetative propagated materials there was no significant difference. For the Height variable, there were no significant differences among the three plant types at 30 months of age (Table 1).

Table 1 – Comparison of means for diameter at breast height - DBH, total Height (H), individual volume, total volume per hectare, and survival rate (S), between seedlings and cuttings of a hybrid of *Eucaliptus urophylla*, at 30 months of age

Treatments	DBH (cm)	H (m)	Ind vol ($m^3.tree^{-1}$)	Vol ($m^3.ha^{-1}$)	S (%)
Seed-propagated material	14.62 a	12.71 a	0.094 a	52.52 a	0.840 b
Clone 1	12.42 ab	12.83 a	0.076 ab	43.85 ab	0.994 a
Clone 2	10.90 b	10.36 a	0.052 b	29.07 b	0.992 a

These results are corroborated by those obtained by Gaspar et al. (2005). They found that, at the age of 2.7 years (32 months), seedlings of *E. globulus*, showed higher diameter means than cuttings, but there was no difference for Height variable.

Sasse and Sands (1996) found that seedlings performed higher diameter growth rates than cuttings when submitted to water stress in a 9-week experiment. However, there was no significant difference between plant types related to height growth rates. They also observed that the water use of seedlings was significantly higher than cuttings. Thus, the authors concluded that cuttings would be less likely to survive extreme water stress.

On the other hand, it is important to observe that, like Gaspar et al. (2005) suggest, some studies revealed that such differences tend to decrease over time as the trees mature (Sweet, 1973; Swet, 1974; Gemmel et al., 1991). Gaspar et al. (2005) also observed that, in earlier ages, the differences among seedlings and cuttings of *Eucalyptus globulus* were greater than in later ages.

Conclusions

- The vegetative-propagated material showed the best silvicultural performance for diameter, individual volume and volume per hectare evaluated at 30 months of age;
- There was no differences for total Height among the three plant types;
- The survival rate was higher for both vegetative-propagated plants than for the seed-propagated one.

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