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Growth of tree eucalyptus clones in intercroped crop-livestock-forestry systems under diferent pruning intensities

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Introdução

The artificial pruning is a common silvicultural practice used in forest stands to produce high quality wood. It can be described as the removal of all branches to a predetermined height, resulting in a branch free stem up to this point (Springmann *et al.*, 2011). The wounds from pruned branches are confined to the central part of the stem, and then, the wood produced after the pruning is free from wounds (Finger *et al.*, 2001; Vale *et al.*, 2002; Polli *et al.*, 2006). On the other hand, pruning may benefit plant growth and its dendrometric characteristics (Finger *et al.*, 2001). It also has benefits to the understory growing pastures by reducing canopy closure (Fontan *et al.*, 2011).

According to Vale *et al.* (2002), the decrease of wood stocks in pine forest stands, has driven the sawmill industry attention to the use of eucalyptus wood. However, the same authors say that the eucalyptus wood has some problems as knots, which affect either its appearance or its mechanic properties.

Thus, pruning practices should adequate frequency, intensity and plant age, to promote, as fast as possible the healing of wounds without undermining both plant growth and stem form (Polli *et al.*, 2006). Pulrolnik *et al* (2005), have observed that intensity, frequency and pruning age can vary according to the genotype, site quality, plant age and plant vigor. Tree spacing may influence branch formation and senescence (Finger *et al.*, 2001).

In wide-spacing stands, such as found in intercropped crop-livestock-forestry systems, the increased availability of solar radiation favors the development of thicker branches (Vale *et al.*, 2002; Fontan *et al.*, 2011).

Few pruning studies have been undertaken for intercropped crop-livestock-forestry systems related to intensity, frequency and age of pruning (Vale *et al.*, 2002; Fontan *et al.*, 2011).

This study aimed to evaluate the effect of pruning intensity on the growth of tree eucalyptus clones established in an intercropped crop-livestock-forestry system.

Material and methods

The study was carried out in a 4 hectare area located in Coronel Xavier Chaves, state of Minas Gerais, Brazil, planted in 2009. The trees were established in rows composed by two lines of trees spaced by 3 meters between lines and 2 meters between plants. Each row was spaced by 24 meters, totaling 370 trees per hectare.

It was used a completely randomized design with three replications in a factorial arrangement, with two factors: tree clones (clones 1, 2 and 3) and tree pruning intensities (0, 20 e 30% of tree high). Each plot consisted of two rows of plants with a double border and 7 trees per row.

The first pruning was carried at 18 months and the second at 24 months, keeping the same intensities. The diameter at breast high (DBH) and total plant high (Ht) were measured from 12 to 30 months, each six months. After, the basal area per plant (BA) and the individual volume (IndVol) as well as its increases in the period (per month) were calculated.

These data were submitted to analysis of variance and the means were compared using the Scott- Knott test ($P<0,05$).

Results

There were no effects of pruning intensities on the dendrometric characteristics inside clones,

at 30 months of age. However, some differences were observed between clones at 0% of pruning. The clone 3 and clone 2 basal area values were 31.1 e 22.2% higher than for clone 1. For the total height variable, the effects were observed at 0% and 20% of the total height of pruning. Total height values of clones 3 and 2 were 16.1 and 8.2% higher than clone 1 at 0% of pruning. At 20% of pruning, clone 3 was superior to the 2 and 1 in 13.1 and 14,5%.
The same trend was observed for volume values. At 0% of pruning clones 3 and 2 individual volume were 50.3 and 31,5% higher than clone 1. At 20% of pruning, clone 3 was superior to clones 2 and 1 in 25.4 and 39.8% (Table 1).

Table 1 – Basal Area (BA), Total Height (H) and Individual Volume (IndVol) of tree eucalypts clones at 30 months of age under different pruning intensities.

Clone	Pruning intensity (% of the total height)	BA (m^2.plant)	H (m)	IndVol (m^3.plant)
1	0.0	0.010379 b	11.25617 b	0.053264 b
2	0.0	0.012682 a	12.13331 a	0.070460 a
3	0.0	0.013603 a	13.02153 a	0.080519 a
1	20	0.010192 a	11.25617 b	0.053264 b
2	20	0.011277 a	11.39552 b	0.059371 b
3	20	0.012663 a	12.89425 a	0.074450 a
1	30	0.010679 a	11.49026 a	0.056384 a
2	30	0.011552 a	12.38180 a	0.065344 a
3	30	0.011956 a	12.21716 a	0.074724 a

The basal area increase between clones was higher for clones 3 and 2 in 26.8 and 18.2% compared to clone 1, at 0% of pruning. There were no differences ($P<0,05$) between clones at 20 and 30% of pruning. It was observed the effect of pruning intensity on basal area increase only for the clone 3. The treatments 0% and 20% of pruning increased 20.3 and 13.9% the basal area increase compared to 30% of pruning.
Increases in total height were not affected either by clones or pruning intensities.
For the increases in individual volume, it was observed differences ($P<0,05$) between clones at 0 and 20% of pruning. Clones 3 and 2 showed volumetric increases 46.0 and 27.2% higher than clone 1, at 0%. At 20% of pruning clone 3 was 36.8 and 25.3% superior to clone 1 and 2 (Table 2).

Table 2 – Increases in Basal Area (BA), Total Height (H) and Individual Volume (IndVol) of tree eucalypts clones under different pruning intensities.

Clone	Pruning intensity (% of the total height)	BA ($m^2.pl^{-1}.mth$)	H ($m\ pl^{-1}.mth$)	IndVol ($m^3\ pl^{-1}.mth$)
1	0,0	0,000406 b	0,285127 a	0,002472 b
2	0,0	0,000482 a	0,284561 a	0,003166 a
3	0,0	0,000515 a	0,299542 a	0,003634 a
1	20	0,000403 a	0,287585 a	0,002472 b
2	20	0,000443 a	0,256911 a	0,002700 b
3	20	0,000488 a	0,291619 a	0,003382 a
1	30	0,000424 a	0,286868 a	0,002626 a
2	30	0,000443 a	0,293949 a	0,002976 a
3	30	0,000427 a	0,260474 a	0,003293 a

Conclusions
At 18 months the pruning intensity did not affect the development of clones 1 and 2 but clone 3. Then, these data show that the strategy suggests that, for clones 1 and 2, the highest pruning intensity (30%) should be recommended, in the sense to favor the increase in solar

radiation to the understory growing pasture;

There were differences between genetic material and clone 3 showed the higher development values.

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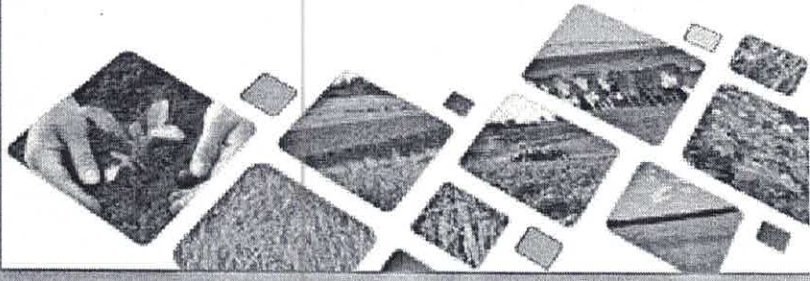

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