Increasing nutrient use efficiency in Eucalyptus plantations

By using controlled release fertilizers at planting

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Introduction

Investment in fertilization can increase volume growth and wood density simultaneously (du Toit et al. 2001, du Toit and Drew, 2003). However, fertilization practices with conventional fertilizers are under review because of negative environmental impact (Nitrogen losses by leaching and volatilization) as well as increasing costs due to manual applications and transport into the plantations.

Controlled Release (coated) Fertilizers (CRF) have been tested intensively the last years in various regions in the world as a new way of fertilization at planting. The advantage of CRF is that the NPK fertilizer is protected by the coating from leaching, volatilization and possible fixation in tropical low pH soils. Since the amount of nutrients released daily is small and goes in line with plant uptake requirements, this type of high-tech fertilizers are an ideal tool to reduce nutrient losses and optimize the NUE (Diara et al., 2014; Terlingen et al., 2016).

Due to the fact that the coating protects the fertilizer from immediate availability, it is possible to apply CRF's locally, in the planting hole or directly next to the young seedling.

Materials and Methods

Trials have been executed in new planting of Eucalyptus in various regions of the world between 2015 and 2018 in cooperation with several forestry research institutes.

Trials were executed in Spain, China, South Africa and Brazil comparing conventional fertilization practices at planting to the use of Agroblen Controlled Release Fertilizer. Agroblen was always applied into the planting hole, directly under the roots of the Eucalyptus seedling and only applied once. This was compared to standard fertilization practices in the various countries which generally were applied superficially, in multiple applications in the year of planting and at higher doses. Rates of application varied per location, depending on local practices and climatological differences.

Aim of these trials was to compare the fertilization systems on their effect on plant establishment in the first years after planting by measuring:

- **Tree height**
- **Trunk diameter (at 1.30 m)**
- **Survivalrate (% of blanking in first 2 months after planting) (results not shown)**

Trials generally were executed in RCBD (randomized complete block design) with the blocks arranged to minimize the statistical effect of soil-type variation or variations in topography. Each plot contained at least 25-50 trees, creating 4-5 replicates per treatment.

Application methods tested

Trial locations

- South Africa, University of Stellenbosch
- Spain, Galicia by Agricultura y Ensayo S.L.
- China, Guangxi Province by China Eucalypt Research Centre, Zhanjiang
- Brazil, Matto Grosso do Sul, C. Medeiros

Eucalyptus species tested

Globulus, Clone DH 32.29, Clone I144, Mondi clone GxN010

Results and Discussion

Besides this, fertilizer rates could be reduced strongly as well, most probably because of the very efficient application in the planting holes. Despite the reduction in number of applications and doses compared to the conventional practices, the tree establishment even mostly improved. In Figure 1 and 2 the effect on the trunk diameter and tree height is shown – based on measurements done in the first year after planting. There was a significant improvement in growth by the coated fertilizer in China, South Africa and Brazil – only in Spain the result was similar.

Table 1. Comparison on number of applications of conventional and coated fertilizer (Agroblen)

Trial region	No. of fertilizer applications in the first year after planting		Total amount of fertilizers applied at planting (grams/tree)	
	Grower Practice	Agroblen	Grower Practice	Agroblen
South Africa	1	1	75	75
Spain	1	1	150	50
China	2	1	365	90
Brazil	3	1	1000	150

Figure 1. Trunk diameter (in cm) and tree height (in m) measured from 6 to 14 months after planting (MAP)

Different letters identify significant differences (P<0.95); statistics based on individual trials

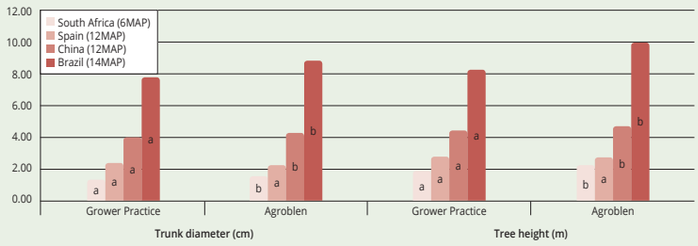
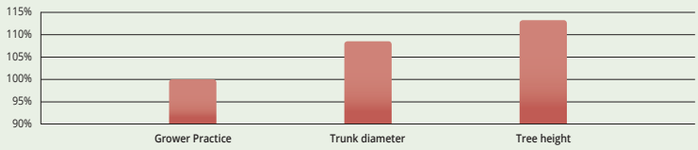
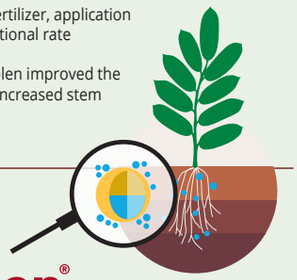


Figure 2. Relative growth improvement by Agroblen on trunk diameter and tree height averaged over 4 regions



Conclusions

1. **Less applications** in the first year of planting: by using a coated NPK fertilizer (Agroblen), the number of applications could be reduced to 1 only, without any reduction of the growth of the trees in the 1st year after planting
2. **Lower application rates**: by the use of the coated fertilizer, application quantities could be reduced to 15-30% of the conventional rate
3. **Nutrient Use Efficiency** – the coated fertilizer Agroblen improved the NUE by lower application rates and on average +8% increased stem diameter and +13% in tree height



References

Terlingen, J.G.A., Radersma, S., Out, G.J.J., Hernandez-Martinez, J., Raemakers-Franken, P.C. (2016) Current Developments in Controlled Release Fertilizers. *Proceedings / International Fertiliser Society*: 781 (ISSN 1466-1314).

du Toit B, Drew D, 2003. Effects of fertilizing four eucalypt hybrid stands at planting on wood density, screened pulp yield and fibre production. *ICFR Bulletin 22/2003. Institute for Commercial Forestry Research, Pietermaritzburg, South Africa.*

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