Mechanisms Of Eucalyptus Plantations Productivity In Congo: Effects Of Fertilization And Thinning

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Context

- 43 000 ha of eucalypt plantations, on an undulating plateau
- An apparent soil homogeneity: sandy soils, low water retention capacity, low CEC and nutrient contents except for P
- BUT, a high production variability: (6 < MAI < 40 m3 ha-1 y -1), and about 150 different clones

Objectives

Identifying mechanisms of eucalyptus plantation productivity in Congo via in situ experiments: current fertilization vs non limiting one coupled with a high stand density (10000 trees/ha)

To understand, measure and model the impact of fertilization, the density of plantation and the patterns of thinning on wood production and stand structure. Identification of the mechanisms involved (light use efficiency, carbon and nutrient allocation etc.)

Hypothesis

My research hypothesis is that an optimum combination of plantation density and fertilization regime can be found for each eucalypt clone and each ecological situation allowing a sustainable management for wood production, carbon sequestration and soil fertility.

Calcic amendment before plantation

Plot 178 at 11 months

Experimental Design and Methods

A large experimental design which required innovative methods to assess soil fertility before treatment installation

Approach used

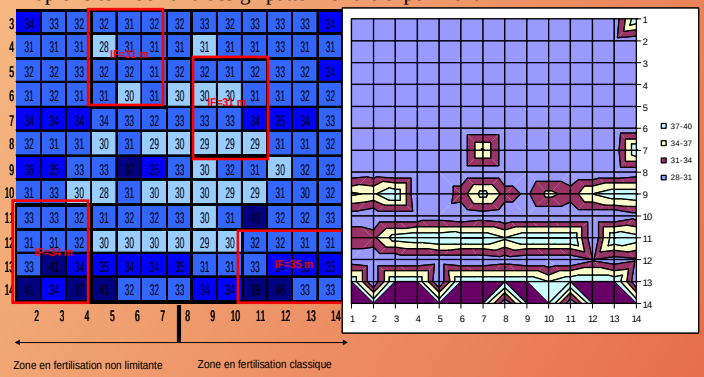
Biometry (tree growth, C partitioning, via E-Dendro model)
Ecophysiology (light use efficiency via MAESTRA model)
Biogeochemistry (nutrient allocation and nutrient use efficiency)

To disentangle effects of

Genetics	☛ **three clones tested**
Environment	☛ **non limiting fertilization**
Competition between trees	☛ **patterns of thinning**

On eucalyptus plantation productivity

Map of site index and design pattern of the experiment



☛ **Measurement of tree growth** :
Diameter and height : every 3 months

☛ **Mortality** : every 3 months during the first year, every 6 months later on

☛ **Biomass and nutrient content** with each thinning + some intermediate dates

☛ **Leaf Area Index**
- complete inventory of LAI plots every 6 months
+ destructive method every 2 months

☛ **Litter Falls** : every 15 days

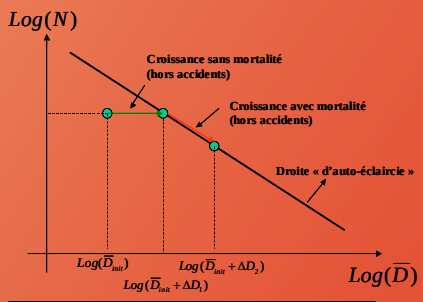
Perspectives

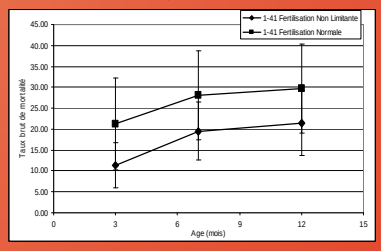
This study will strongly contribute to the following points :

(I) Self-thinning relationships and RDI density index (Reineke Density Index) (Reneike, 1933) stability among species and their applicability to rapid growth plantations,

(II) Light use efficiency (LUE) variations among clones and different level of between-tree competition,

(III) to disentangle effects of “genetics, competition and nutrition” factors on the allometric relations, tree growth, stand structures (mortality and size distributions).





Mortality time course : mortality is lower in the non limiting fertilisation regime

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