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## INTRODUCTION

The yield of *Eucalyptus* plantations in Brazil has increased from 15 to 50 m<sup>3</sup>ha<sup>-1</sup>yr<sup>-1</sup> since the 1960's, mainly as a combined result of breeding programs and enhanced silvicultural practices. However, wood production represents a small fraction of gross primary production.

The increase in wood production can result from higher photosynthesis rates, increase in efficiency, change in partitioning of the photosynthesis to wood, or a combination of these factors.

Assessing patterns of carbon partitioning between above and belowground components, in response to site characteristics and resource use and efficiency, is essential to understand processes driving production ecology of these plantations.

## MATERIAL AND METHODS

We quantified aboveground net primary production (ANPP, eq. 1), total belowground carbon flux (TBCF, eq. 2), and gross primary production (GPP, eq. 3) in 12 plots (504m<sup>2</sup> each) representing the gradient of productivity within a 90ha stand of *Eucalyptus grandis* in Southeastern Brazil (Fig. 1). Carbon fluxes were measured during the last year of the rotation before harvesting (from 6 to 7 yrs after planting) and the C partitioning was studied on a gradient of productivity.

We also evaluated the patterns in light interception and of light use efficiency (LUE, eq. 4) to provide additional insights into wood production and to understand relations among light use efficiency, partitioning and carbon fluxes.

Our methodology was based on Giardina and Ryan (2002) and Ryan et al. (2010)

$$\text{ANPP} = F_A + \Delta(C_W + C_F) \text{ eq. 1}$$

$F_A$ : litterfall,  $\Delta C_W$ : change in carbon content on aboveground wood biomass (stem, bark and branches),  $\Delta C_F$ : change in carbon content on foliage in the canopy.

$$\text{TBCF} = F_S + F_A + \Delta(C_R + C_L + C_T) \text{ eq. 2}$$

$F_S$ : soil respiration,  $F_A$ : litterfall,  $\Delta(C_R, C_L, C_T)$ : change of carbon content in coarse roots, litter layer and stumps.

$$\text{GPP} = \text{ANPP} + \text{TBCF} + R_p \text{ eq. 3}$$

$R_p$ : aboveground autotrophic respiration (wood + foliage) calculated based on Ryan et al. (2009)

$$\text{LUE} = \text{WNPP} / \text{APAR} \text{ eq. 4}$$

WNPP: wood net primary production, APAR: absorbed photosynthetically active radiation

## RESULTS

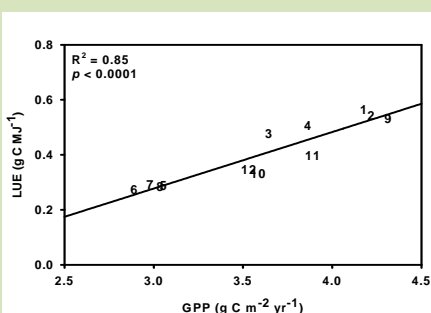
The variability of clay content of the Oxisol at the experimental site (from 20% to 40%) and contrasted nutrients and water availabilities led to a current annual increment ranging from 32 to 72 m<sup>3</sup>ha<sup>-1</sup>yr<sup>-1</sup>.

From the lowest to the highest productivity area, ANPP ranged from 1.2 to 2.1 kg C m<sup>-2</sup> yr<sup>-1</sup>, with increased bole production of 98%.

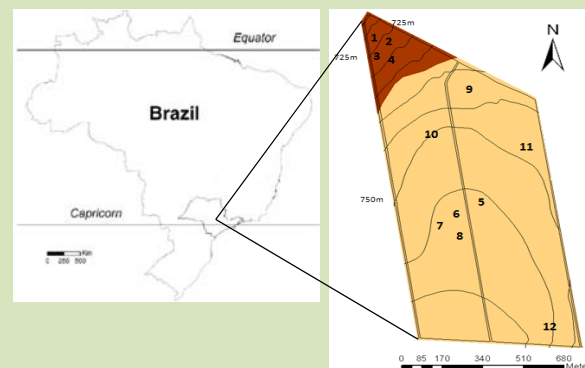
Spatial variability of TBCF ranged from 0.6 to 1.3 kg C m<sup>-2</sup> yr<sup>-1</sup>, with soil respiration tending to decrease with higher ANPP ( $R^2=0.36$ ,  $p=0.04$ ).

The APAR was fairly constant over the area ( $\approx 78\%$  of the incoming PAR), therefore, the increased of bole production can be credited to elevation of photosynthesis (GPP) by 49%, increase in partitioning of the GPP to wood from 26% to 34% (Fig. 2A e 2B) and increase in light use efficiency by 89%. The belowground carbon flux did not shown significant pattern with the increase of annual GPP (Fig. 2C,  $R^2 = 0.002$ ,  $p = 0.87$ ).

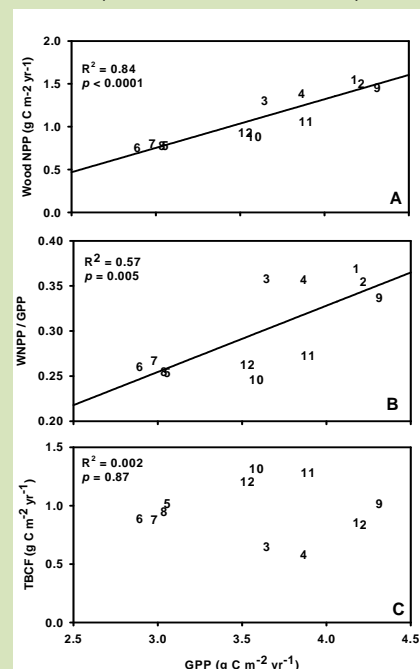
The light use efficiency increased with elevation of annual photosynthesis mainly due to increase of partitioning and flux to wood production over the gradient of the site (Fig. 3)



**Fig. 3.** Light use efficiency (annual wood production per unit of photosynthetically active radiation absorbed) is positively correlated with mean gross primary productivity (GPP) across the gradient of productivity.



**Fig. 1.** Experimental site with the location of the 12 plots. Dark brown represents Oxisol with 40% of clay, light brown represents Oxisol with 20% of clay.



**Fig. 2.** WNPP increases with GPP (A) due to two higher carbohydrate supply (GPP) and increased partitioning to WNPP (B). TBCF does not vary with GPP across the gradient of productivity (C).

## CONCLUSIONS

- Partitioning of the GPP to wood production increase with productivity
- No patterns was found between TBCF and productivity
- Stands with higher productivity show higher LUE
- The increase in wood production is a result of more photosynthesis, higher partitioning to wood production and higher efficiency of the absorbed radiation

## REFERENCES

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