



Minimizing the long-term effect of *Eucalyptus grandis* on soil C and N stocks in a Brazilian sandy soil with a N₂ fixing tree

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Volume 1, 2025 - 323739

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Abstract

Mixed plantations of *Eucalyptus* spp. with nitrogen fixing trees may accumulate more carbon in the soil than their monoculture, but this is affected by some factors including the percentage and spacing of leguminous trees, aboveground growth potential, forest management, rotation and the land-use history. This study aims to explore the long-term effects (third rotation) of intercropping *Acacia Mangium* - a leguminous tree species that fixes N₂ - with *E. grandis* on soil C and N stocks in a sandy soil (Itatinga Municipality, SP). Plantations (1,100 plants ha⁻¹) of Eucalyptus, with N (120 kg ha⁻¹) (E100+N) and without N fertilization (E100), Acacia (A100), a mixed of both species (E50:A50), and a nearby native *Cerrado* area were compared. Soil samples at 0-10, 10-20 and 20-30 cm were analyzed for bulk density, total C, total N, and two organic matter fractions: particulate (POM) and associated to minerals (MAOM). Among the planted forests, the A100 treatment outperformed the C stocks in relation of E100, E100+N, and E50:A50 treatments by 0.78, 0.51, and 0.61 Mg ha⁻¹, respectively. On the other hand, regarding the E100 plantation, treatments with N input by fertilization (E100+N) or through biological N fixation (E50:A50 and A100) showed higher N stocks by 0.27, 0.17, and 0.78 Mg ha⁻¹. Compared to the reference C stock (0-30cm) of the *Cerrado* soil (4.92 Mg ha⁻¹), all treatments reduced the C stocks, with E100 causing the greatest loss (preserving 64% of the stock) and A100 the least one (preserving 80%). Regarding the soil N stock, A100 preserved 88%, while E100 preserved 71% of the original N stock found in the *Cerrado* soil (0.27 Mg ha⁻¹). Rotating with acacia and the mixed planting may provide benefits for managing Eucalyptus monocultures. Despite the low clay content of the soil, total organic C predominated in the fraction associated with minerals (~94%). Soils from E100 and *Cerrado* exhibited the highest average C contents in POM, while the A100 and E100+N treatments had the highest C contents in the MAOM fraction. The mixed plantation showed the lowest average C content in POM across all depths, and intermediate values for MAOM. Rotating Eucalyptus with Acacia is expected to increase soil C and N stocks in sandy textured soils, due N₂ fixing capacity of Acacia. Despite intercropping these species do not implies in boosts of N stocks after four rotations, higher C content in MOAM fraction indirectly demonstrates the contribution of N to more efficient C stabilization.



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Topic

- Sustainable agricultural and forestry production for carbon sequestration, soil health, and food security

Keywords

Soil carbon sequestration

Climate adaptation

Mixed plantation

Acacia mangium

Cerrado biome

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