

Plantations of native tree species in Africa: a synthesis of tree survival and growth across plantation methods in the Guineo-Congolian region

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Abstract: In the Guineo-Congolian region, forest plantations of native tree species were established and tested with different silvicultural itineraries and objectives in several countries. The results of these tests remained scattered, hampering our ability to identify the key drivers of plantation performance.

We then conducted a systematic literature review to gather, in a single dataset, records of planted tree survival and growth for the different planted tree species. From 37 studies, we compiled records of tree age, survival, mean height and diameter of 70 native tree species in 394 plantations across 8 countries of the Guineo-Congolian region. We modelled tree survival, height and diameter increments using linear mixed-effects models.

We found that the mean annual survival rate was $89.0 \pm 15.2\%$ in plantations whose mean age was 11.8 ± 14.7 years. The survival rate significantly varied with plantation methods, forest type, composition and differences in annual rainfall at plantation sites. Mean height growth was 90.9 ± 57.1 cm year⁻¹ and was higher for pioneer species (102.1 ± 63.2 cm year⁻¹) and in evergreen forests (126.1 ± 63.5 cm year⁻¹). Variation in height increment was significantly related to plantation age, forest type, species guild and leaf phenology. Plantation methods did not explain the differences in height increments. Stem diameter increment was 12.4 ± 7.5 mm year⁻¹ and slightly higher for pioneer species (13.2 ± 8.4 mm year⁻¹). This increment depended on plantation method and was the highest after clear-cutting (15.5 ± 6.8 mm year⁻¹). On average, the evergreen species showed a higher diameter increment (14.8 ± 7.6 mm year⁻¹) than the semi-deciduous species. We found high between-site variability for height increment and survival rate, but to a lesser extent for diameter increment.

These results helped identify the factors driving plantation performance and could guide foresters in choosing the best silvicultural itineraries for tree species.