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“Filling gaps and removing traps
for sustainable resource management”

Integral Assessment of Productive and Environmental Parameters of a Forage-Based Silvopastoral System

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Abstract

To quantify the productivity and environmental benefits of improved forage-based silvopastoral systems, a six hectares field trial was established in 2013 at the headquarters of the International Center for Tropical Agriculture (CIAT) using improved forages developed at CIAT and the International Livestock Research Institution (ILRI). A randomised complete block design with three replications was used with three treatments: T1 grass alone, *Brachiaria* hybrid cv. Cayman; T2: Grass + herbaceous legume, *Canavalia brasiliensis* and T3: Grass + herbaceous legume + tree legume *Leucaena diversifolia*. In order to measure animal productivity, a group of steers was fattened (from 200 to 450 kg) and subgroups of animals were assigned to the three treatments (T1, T2 and T3) in a rotational grazing system (stocking rate: 4 animal per hectare). Animal subgroups were kept in each treatment for comparison purposes. Live weight gain per animal was recorded monthly and large differences were found between treatments with an average of 240, 744 and 819 kg ha⁻¹ yr⁻¹ for T1, T2 and T3, respectively. Environmental parameters evaluated in the three treatments included soil chemical and physical parameters as well as soil macrofauna, as an indicator of soil health. A positive impact of forage diversification on key soil properties and the abundance and diversity of soil macroinvertebrates was found with best results in T3 compared to the other two treatments. The taxonomic abundance and functional diversity of soil macrofauna were found to correlate positively with forage diversification and the level of inclusion of legumes in a grass-alone system. Finally, the enteric methane emissions of animals grazing T1 and T3 were measured. Average amounts per treatment (n=4), were 30.1 and 19.9 g CH₄ kg⁻¹ of dry matter intake for T1 and T3, respectively. Our results evidence the benefits of silvopastoral systems in supporting sustainable intensification of livestock systems and improving livestock productivity per unit area, while delivering ecosystem services and simultaneously reducing the environmental footprint of the animals.

Keywords: Climate change, greenhouse gases, soil quality, tropical forages