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"Competing pathways for equitable food systems transformation: Trade-offs and synergies"

Profitability analysis of a silvo-pastoral system in Colombia: Economic and environmental benefits

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Abstract

Cattle production systems generate considerable environmental impacts, among which deforestation and the emission of methane by ruminants stand out. Consequently, technological innovations within this sector must be focused on achieving sustainable production in both economic and environmental terms. Silvo-pastoral systems (SPS) as a productive alternative allow an increase in economic yields while generating environmental benefits and ecosystem services. This study is aimed at evaluating the environmental-economic benefits of implementing two SPS in Colombia, namely (i) *Urochloa brizantha* cv. Toledo + *Leucaena leucocephala* and (ii) *Urochloa* hybrid cv. Cayman + *Leucaena leucocephala*. They are compared with two monoculture systems (M), namely (i) *Urochloa brizantha* cv. Toledo and (ii) *Urochloa* hybrid cv. Cayman. The evaluation comprises two components, an economic evaluation, which estimates the potential improvements in profitability of meat production in the SPS through with the cost-benefit analysis methodology, and an environmental evaluation, which estimates the economic value of the environmental benefits and ecosystem services generated in the SPS. This resulting economic-environmental value is integrated into the economic evaluation, achieving a sustainability analysis of the studied SPS. The results show better profitability indicators for the SPS, such as the net present value, internal rate of return, and benefit-cost ratio, which further improve when the results of the environmental evaluation are incorporated. Likewise, SPS are less sensitive to external shocks. Regarding the environmental values, economic values for the reduction of methane emissions of US$6.12 per cattle and for the microclimatic regulation of US$ 2,026 per ha are estimated for the SPS. The results thus suggest an improvement in economic profitability added to the value of ecosystem services and environmental benefits that they incorporate. This type of evidence can be used to promote the adoption of SPS in regions with low productivity and high deforestation rates, such as in large parts of Colombia.

Keywords: Ecosystem services, heat stress, methane emissions reduction

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