Economic Analysis of Tropical Forages in Livestock Systems in the Eastern Plains of Colombia

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Introduction

- 70% of the Colombian livestock production are characterized by extensive production systems, which usually show low productivity levels, low land use efficiency and often lack environmental sustainability
- This is related to native grasses and degraded pastures that generate limited forage supply, both in volume and quality, especially in the dry season
- With their high potential for mitigation of and adaptation to climate change and their ability to increase productivity levels, technologies such as improved forages and silvo-pastoral systems can be viable alternatives for sustainable cattle production
- The establishment of such technologies implies higher investment and management costs for the producer, which limits in many cases their adoption

Photo *Brachiaria humidicola* in the Eastern Plains of Colombia — Source: Tropical Forages Program, CIAT

Objectives

To evaluate the financial viability of the implementation of improved forage technologies in livestock systems, in this case of improved pastures and scattered trees associated with improved pastures, and to compare them to the traditional production system with native or naturalized pastures

Materials & Methods

- Research took place in 2015 in the Casanare Department in the Eastern Plains of Colombia as a part of the research project "*Clima y Sector Agropecuario Colombia no-Adaptación para la sostenibilidad productiva*" between CIAT and the Colombian Ministry of Agriculture (MADR)
- Data sources: Field measurements; expert consultations; secondary data and literature review
- Economic Analysis:

1. Construction of a discounted cash-flow model (10 year period) taking into account the factors associated to the benefits (animal productivity in kg/ha/yr) and the costs related to the initial investment and management
2. Development of a simulation model (soft-ware @Risk-Decision Tools Suite of Paladise) for analyzing the different associated risk factors
3. Estimation of profitability indicators for dif-ferent scenarios: Net Present Value (NPV), Internal Rate of Return (IRR), Probability of NPV<0

Table 1 Productive parameters, investment and management costs per production system

	Improved Pasture[1]	Scattered Trees + Improved Pastures[2]	Native Pasture[3]
Productive parameters ha^{-1} year^{-1}			
Animal stocking rate (AU/ha)	2	2	0.27
Live-weight gain (g/animal/day)	130-445	310-486	77-258
Animal productivity (Kg/ha/year)	294-402	352-480	18-37
Investment and management costs[4]			
Initial investment (US$/ha^{-1}) [5]	1,090	1,187	0
Management costs (US$/ha^{-1} year^{-1}) [6]	179	231	12.7

[1]Species *Brachiaria humidicola, Brachiaria decumbens;* [2]Improved pastures such as *Brachiaria humidicola, Brachiaria decumbens* associated with shadow trees; [3]Native Savanna species such as *Axonopus Purpussi;* [4]Representative Market Exchange Rate for 2016; [5]Pasture establishment and fencing costs (inputs, machinery, labor); [6] Costs for fertilization, weed control, pruning and trimming, fence maintenance and controlled burning (only for native pasture)

In comparison with native pastures, improved pastures on average allow:

- Increases in animal stocking rate of **86%** and in animal productivity of **42%**

In comparison with a pasture monoculture, the use of scattered trees on average allows:

- Increases in animal productivity between **15 and 20%**

- Compared to native pastures, improved pastures on average increase the NPV by 86% and show an IRR higher than the opportunity costs (16%)

Table 2 Profitability indicators per production system

	Scenarios	NPV[4]	IRR	Probabiltiy(NPV<0)
Improved Pastures	N[1]	$ 49.78	18%	48,60%
	O[2]	$ 290.3	32%	10,14%
	P[3]	$ 40.1	18%	50,77%
Scattered Trees + Improved Pastures	N[1]	$ -120.6	13%	97,60%
	O[2]	$ 25.17	17%	65,63%
	P[3]	$ -258.86	9%	100,00%
Native Pastures		$ 18.19	--	11,23%

[1]Normal Scenario: A reduction of pasture cover of 45% in the fifth year was assumed; [2]Optimistic Scenario: A reduction of pasture cover of 30% in the fifth year was assumed; [3]Pessimistic Scenario: A reduction of pasture cover of 70% in the fifth year was assumed; [4]Real Discount Rate = 16%

- The system with scattered trees is not profitable resulting from the high initial investment necessary (e.g., tree protection during the first year, slow tree growth delaying improvement of productive parameters). However, this study focused only on the benefits with regard to animal productivity and did not consider additional income that might result from planting trees (e.g.,firewood, timber, fruits, eco-system services)
- The profitability indicators are highly sensitive to variations in meat sales prices

Conclusions

- The technologies evaluated in this study showed to be an alternative to improve production efficiency and profitability of livestock farms
- However, strategies and / or incentives need to be developed that aim at reducing the high initial costs of systems in association with scattered trees

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