

Economic risk analysis of an agroforestry system in Mato Grosso do Sul, Brazil

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Introduction

Population growth and increased demand for food forecasted for the next decades have caused a growing need for producing more food and energy within the same land area. Scientists have become increasingly interested in agroforestry systems because of their economic, social and mainly ecological benefits as they foster the diversification of production activities and favor the minimization of risks related to climate events or market conditions.

The interaction between cattle raising and agriculture provided by this kind of system has shown a higher complexity level. Thus, the economic and risk analysis has become a prerequisite for strategic planning and management of systems that integrate crop, cattle raising and forestry.

The aim of this study was to evaluate the economic viability and quantify the risk of implantation of an agroforestry system in the region of Bolsão in Mato Grosso do Sul.

Material and Methods

This study used data from literature about systems that involve the integration of crops, cattle raising and forestry in the region of Bolsão in Mato Grosso do Sul. The definition of production system was grounded on studies. The probabilistic simulation model was structured from a seven-year cash flow comprehending soy, beef cattle and eucalyptus, considering 6% per year as Minimum Attractive Rate (MAR) of the project.

The analyses were performed with the use of @RISK 5.7 software, utilizing 1,000 interactions through the Monte Carlo method. From technical information provided by experts and data provided by Instituto de Economia Agrícola, we used the probability distribution of the following variables: soy productivity and price; stocking rate; average daily gain; price and weight at acquisition and slaughtering of the animals; price and productivity of eucalyptus; and cost of fertilizers.

For economic viability, the following indicators were used: Net Present Value (NPV), Internal Rate of Return (IRR) and Uniform Annual Revenue per Hectare (UARH). UARH (1) was adapted from the formula of the Equivalent Uniform Annual Value (EUAV) in order to represent the annual revenue obtained from the project considering the money value over time. US Dollar to Brazilian Real Exchange Rate was of 2.05 in the period of data collection.

$$(1) \quad UARH = \frac{NPV * i}{[(1+i)^n] - 1} / UA$$

Where i = internal rate of return; n = project length in number of periods; NPV = net present value, and UA = used area.

Results and Discussion

The most probable values found for NPV, IRR and UARH were R\$ 1,294,991.82, 19.9% and R\$ 463.96 per hectare, respectively. Depending on the combination of values, the indexes had

either positive or negative values (Table 1). The Uniform Annual Revenue per Hectare (UARH) ranged from R\$ -528.22 to R\$ 1,062.81 per hectare.

TABLE 1. Economic indexes found through risk analysis, with their maximum, minimum and most probable values, and variation coefficient (VC)

Indexes	Minimum	Most Probable	Maximum	VC
NPV (R\$)	-1,474,365.00	1,294,991.82	2,966,515.00	0.74
IRR (%)	-13.7%	19.9%	34.6%	0.45
UARH (R\$/ha ⁻¹)	-528.22	463.96	1,062.81	0.74

There is some probability of loss. However, the results obtained in this model have evidenced that, with the implantation of the agroforestry-cattle farming system, there is an 8.8-percent risk that NPV is below zero. IRR has 62.0 percent of probability of being above the savings account rate and below IRR expected for the project (Figure 1).

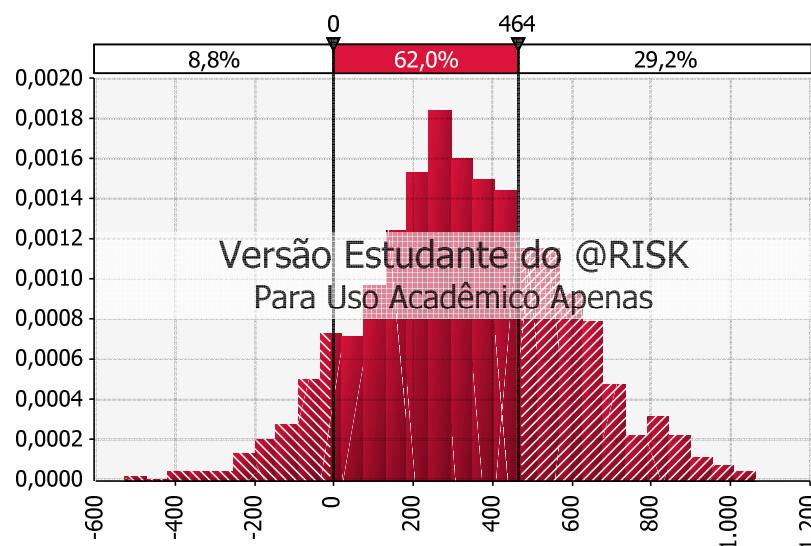


FIGURE 1. Probability (%) and Values (R\$.hectare⁻¹) for Annual Uniform Revenue per Hectare (AURH), with 1,000 interactions performed.

Eucalyptus productivity, cattle price and stocking rate in the rainy season are the variables that have showed a greater correlation with NPV among the 13 inputs: 0.59, 0.54 and 0.39, respectively. These are the variables that have the greatest impact on the economic result and require more attention to minimize loss risks with the implantation of the agroforestry-cattle farming system.

Conclusions

The investigated system is economically viable, shows moderate risk and may be an alternative to leverage the process of restructuring the pastures that are in varying degrees of degradation in the region of Bolsão in Mato Grosso do Sul.

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