



Tropentag, September 16-18, 2026, hybrid conference

“Towards multi-functional agro-ecosystems
promoting climate resilient futures”

Regenerative agriculture and eco-efficiency: An on farm study in goiás, Brazil

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Abstract

Since the United Nations Conference on the Human Environment in 1972, through the Sustainable Development Goals (SDGs), launched in 2015, researchers have studied sustainability, seeking to develop cleaner production practices and to measure them. Since 1990, the concept of eco-efficiency has been used to advance sustainability. Eco-efficiency can be defined as the delivery of competitively priced goods and services that satisfy human needs while progressively reducing ecological impacts. One of the main tools used by researchers during recent years to analyse eco-efficiency has been the Data Envelopment Analysis (DEA). DEA is a nonparametric, linear-programming-based technique that assesses the relative performance of a set of units. Another current methodology used by researchers is the combination of DEA and econometric regression analysis. Researchers have implemented this methodology to pursue eco-efficiency in several fields, including farming, coffee, well-being, the beef cattle sector, the forest sector, and sugarcane. Recently, Regenerative Agriculture has emerged as an alternative sustainable production system. Regenerative Agriculture can be defined as an alternative food production system with lower or even net-positive environmental and/or social impacts. To contribute to this debate, this paper examined the eco-efficiency of 30 soybean farms in southern Goiás, Brazil, that employ regenerative and traditional systems, with a focus on minimising chemical inputs and harvest costs. To verify its eco-efficiency and identify opportunities for improvement, data were collected on the farms during 2022–2023 and 2023–2024 production years. After collecting the data, an Econometric Regression was conducted, followed by a Data Envelopment Analysis (DEA) using the chemical and cost variables. The Regression analysis indicates that Regenerative Agriculture does not have a significant impact on soybean yield. Regarding the climate variables used in the analysis (precipitation, radiation, mean temperature and humidity), only radiation presented positive and significant results. Those results are consistent with expectations, given that each farm used a different soybean variety to meet its needs. Regarding DEA results, only 7 farms presented inefficient results. Of those seven farms, 5 practice regenerative agriculture. This paper contributes to achieving the Sustainable Development Goals (SDGs) 2, 6, and 12.

Keywords: Eco-efficiency, environmental impact, regenerative agriculture, soybeans