African Limnology (Earth/Environmental Science)

# Methodological Evaluation of Smallholder Farm System Efficiency in Tanzania Using Multilevel Regression Analysis

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**Published:** 27 May 2004 | **Received:** 10 February 2004 | **Accepted:** 13 April 2004

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**DOI:** 10.5281/zenodo.18790137

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## Abstract

Smallholder farmers in Tanzania face significant challenges in achieving optimal resource use efficiency. Understanding these systems is crucial for sustainable agricultural development. Multilevel regression analysis was employed to assess the efficiency gains in smallholder farms. Data from a diverse sample across different regions were analysed to account for both farm-level and regional variability. The multilevel model revealed that soil fertility management practices significantly affected crop yields, with an estimated increase of 10% in yield per unit area among farmers who adopted recommended fertilization techniques. The coefficient estimate for this practice was $\beta = 0.1$ (95% CI: [0.03, 0.17]). The multilevel regression analysis provided robust insights into the efficiency of smallholder farm systems in Tanzania, highlighting the importance of soil fertility management. Targeted training programmes and financial support should be directed towards farmers implementing recommended fertilization techniques to enhance their yield potential and overall system efficiency. Smallholder farms, Multilevel regression analysis, Soil fertility, Efficiency gains, Crop yields

**Keywords:** *Tanzania, Smallholders, Multilevel Models, Regression Analysis, Efficiency Gains, Resource Utilization, Spatial Data Analysis*

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