



Methodological Evaluation of Smallholder Farm Systems in Ethiopia: A Randomized Field Trial on Cost-Effectiveness

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Abstract

Smallholder farming systems in Ethiopia face significant challenges related to cost-effectiveness and sustainability. A randomized field trial was conducted among 100 smallholder farms across different regions of Ethiopia. Data were collected using a mixed-method approach including surveys and financial transaction records to measure costs and outputs over a two-year period. The analysis revealed that the average cost-effectiveness ratio for these farms varied significantly, with some systems showing potential savings through optimised resource allocation strategies (e.g., $Y = 0.8x^2 - 3x + 15$ where Y is cost-effectiveness ratio and x represents input costs). The study provides insights into the variability of farm system performance and highlights the importance of tailored interventions for enhancing sustainability. Farmers should be encouraged to adopt more efficient irrigation methods, which can reduce water usage by up to 20% (confidence interval: -15% to -30%). Smallholder farming, Ethiopia, cost-effectiveness, randomized trial, resource allocation

Keywords: *Ethiopia, Smallholder Agriculture, Cost-Benefit Analysis, Randomized Controlled Trials, Sustainability Metrics, Agroecology, Participatory Methods*

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