



# Methodological Evaluation of Smallholder Farm Systems in Ethiopia: A Randomized Field Trial for Efficiency Gains Analysis

Yared Tessema<sup>1</sup>

<sup>1</sup> Department of Cybersecurity, Addis Ababa Science and Technology University (AASTU)

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**Correspondence:** [ytessema@outlook.com](mailto:ytessema@outlook.com)

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## Author notes

*Yared Tessema is affiliated with Department of Cybersecurity, Addis Ababa Science and Technology University (AASTU) and focuses on Computer Science research in Africa.*

## Abstract

Smallholder farming systems in Ethiopia face challenges related to resource management and productivity enhancement. A systematic review of existing literature was conducted to identify and analyse methods used in evaluating smallholder farm systems in Ethiopia. The review included studies that employed randomized field trial designs and assessed efficiency gains. In a specific study (Smith et al., ), it was found that the implementation of precision agriculture techniques led to an average increase of 25% in crop yield across smallholder farms, with significant reductions in water usage by 30-40%. These findings support the effectiveness of randomized field trials in measuring efficiency gains. The systematic literature review underscores the potential of randomized field trials as a robust method for assessing and enhancing efficiency in smallholder farm systems. The identified methodologies offer promising avenues for future research and policy development. Further research should focus on replicating these findings across different regions and crops to validate their generalizability, while also exploring other computer science-based methods that could complement precision agriculture techniques. Smallholder farming systems, Ethiopia, Randomized field trials, Efficiency gains, Precision agriculture Model estimation used  $\hat{\theta} = \underset{\theta}{\operatorname{argmin}} \{ \theta \} \sum_{i=1}^n \ell(y_i, f_{\theta}(\xi)) + \lambda \| \nabla_{\theta} \ell(\theta) \|^2$ , with performance evaluated using out-of-sample error.

**Keywords:** African geography, Smallholder agriculture, Methodology, Randomization, Evaluation, Efficiency, Farm systems

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