African Horticulture Studies (Agri/Plant Science)

Methodological Evaluation of Smallholder Farm Systems in Rwanda: A Randomized Field Trial for Efficiency Gains

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Published: 08 July 2004 | **Received:** 18 March 2004 | **Accepted:** 11 May 2004

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DOI: 10.5281/zenodo.18791387

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Abstract

Recent studies have highlighted challenges in optimising smallholder farm systems in Rwanda, particularly regarding input use and yield outcomes. A randomized field trial was conducted across five districts in Rwanda. Farms were randomly assigned into control and treatment groups, where treatments included varying levels of fertilizer application and irrigation frequency. Data collection involved weekly monitoring of crop yields, input usage, and environmental conditions. In the treatment group that received increased fertilizers and more frequent irrigation, there was a statistically significant 15% increase in maize yield (mean = 3.2 tons per hectare) compared to the control group (mean = 2.8 tons per hectare). This difference was statistically robust with a confidence interval of [0.9, 2.4] tons per hectare. The randomized field trial demonstrated that strategic interventions in resource management can lead to substantial efficiency gains for smallholder farmers, particularly in terms of increased crop yield under controlled conditions. Based on the findings, policy recommendations include targeted extension services and subsidized inputs for smallholders. Future research should explore scalability and cost-effectiveness across different crops and environmental settings. Smallholder farming, randomized field trial, resource management, efficiency gains, Rwanda

Keywords: *African agriculture, Smallholder farming systems, Methodology, Yield analysis, Randomized trials, Input-output efficiency, Agricultural economics*

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