African Technology Integration in Education

Methodological Evaluation of Process-Control Systems in Yield Improvement: A Randomized Field Trial in Kenya

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Abstract

Recent agricultural studies have highlighted the potential of process-control systems to enhance crop yields in developing countries, particularly in Kenya where climate variability and resource constraints pose significant challenges. A randomized field trial was conducted in two agricultural districts of Kenya. Farmers were randomly assigned to control (non-system) or experimental groups using process-control systems for their staple crops. Data on yield, input usage, and environmental conditions were collected over three growing seasons. Statistical models included a linear mixed-effects model with robust standard errors. The trial showed an average increase in crop yields of 25% in the experimental group compared to controls ($p < 0.01$). Key factors contributing to higher yields included optimised irrigation and fertilization schedules, which reduced water usage by 30% and increased nutrient efficiency by 40%. The randomized field trial confirmed the effectiveness of process-control systems in improving crop yields in a resource-limited setting like Kenya. These findings provide evidence for scaling up interventions to enhance agricultural productivity. Future research should explore longer-term impacts and scalability, while implementation strategies need to consider socio-economic factors affecting farmer adoption of such technologies. The maintenance outcome was modelled as $Y\{\} = beta\,0 + beta\,1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *Kenyan, Geographic Information Systems, Precision Agriculture, Randomized Controlled Trial, Yield Gap Analysis, Adaptive Management, Statistical Process Control*

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