



Longitudinal Effects of Solar Irrigation Systems on Crop Yields in Northern Tanzania: An Intervention Evaluation Study

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Abstract

Solar irrigation systems have been introduced to promote sustainable agricultural practices in arid regions, particularly in Tanzania's northern highlands where water scarcity is a significant constraint to crop productivity. A randomized controlled trial design was employed, with 20 farmers in each control (conventional drip irrigation) and intervention (solar-powered drip irrigation) groups. Data collection included pre- and post-intervention yield measurements using a linear regression model to account for potential confounders. Solar irrigation led to an average increase of 15% in maize yields compared to control conditions, with significant variation among individual farmers (e.g., one farmer saw a 20% increase). The solar irrigation systems demonstrated robust performance in enhancing crop productivity and were found to be economically viable over the long term. Further research should explore scalability of these systems, while policymakers could consider subsidies for farmers adopting such technologies to accelerate adoption in similar contexts. Treatment effect was estimated with $\text{text}\{ \text{logit} \}(\pi) = \beta_0 + \beta_1 X_i$, and uncertainty reported using confidence-interval based inference.

Keywords: African Geography, Solar Irrigation Systems, Sustainable Agriculture, Longitudinal Study, Intervention Evaluation, Crop Yield Analysis, Geographic Information Systems

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