



Designing Low-Cost Irrigation Systems for Sustainable Agriculture in Mali: A Methodological Approach

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Abstract

Irrigation systems are essential for sustainable agriculture in drought-prone areas such as Mali, where water scarcity affects crop yields and rural livelihoods. A mixed-methods approach combining field surveys, expert consultations, and cost-benefit analyses was employed to evaluate the potential of various low-cost irrigation systems. The choice of technology and design parameters were informed by local conditions and stakeholder preferences. Field trials demonstrated that a combination of drip irrigation and mulching significantly increased soil moisture retention (by at least 25%) compared to traditional flood irrigation methods, leading to a 10-20% increase in crop yield across different agricultural zones in Mali. The designed low-cost irrigation systems are effective in promoting sustainable agriculture in Mali's semi-arid regions with potential for wider adoption and replication. Government agencies should invest in pilot projects to demonstrate the efficacy of these systems, while local communities can participate by adopting them to improve their agricultural productivity and resilience against water scarcity. The maintenance outcome was modelled as $Y = \beta_0 + \beta_1 X + u + \epsilon$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *Sub-Saharan, Arid, Systems, Sustainability, Micropile, Multiple-Methods*

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