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Low-Cost Irrigation Systems for Drought-Prone Mali: An Engineering Design Paradigm

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Abstract

Drought-prone regions in Mali face significant challenges in agricultural productivity due to water scarcity. A mixed-method approach combining field surveys, cost-benefit analysis, and prototype testing was employed to develop and assess the efficacy of the proposed irrigation solutions. The designed low-cost drip irrigation system reduced water usage by approximately 30% compared to traditional flood irrigation methods in local conditions. The study demonstrated that a tailored engineering design approach can significantly improve agricultural productivity in Mali's arid regions, with cost-effective and sustainable outcomes. Future research should focus on scaling up the implementation of these systems in various climates and socio-economic contexts. The maintenance outcome was modelled as $Y\{\} = beta0 + beta1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

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