



Designing Economical Irrigation Solutions in Mali's Drought Zones

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Abstract

Irrigation systems are crucial for agricultural productivity in Mali's drought-prone areas, where traditional methods often lead to unsustainable water usage and economic inefficiencies. A mixed-method approach combining field surveys with participatory rural appraisal (PRA) techniques was employed to identify suitable technologies and user preferences. A cost-benefit analysis informed the selection of irrigation systems, ensuring they could be economically viable in local conditions. Field trials demonstrated that a combination of drip irrigation and rainwater harvesting systems increased crop yields by an average of 30% compared to traditional methods, with water savings reaching up to 75%. The designed irrigation solutions not only improved agricultural productivity but also reduced the environmental footprint through efficient water usage. Policy makers should promote public-private partnerships to fund and scale-up these low-cost solutions across Mali's drought zones. Farmers should be educated on maintenance practices to ensure system longevity. Irrigation Design, Sustainable Agriculture, Drought Zones, Low-Cost Solutions The maintenance outcome was modelled as $Y = \beta_0 + \beta_1 X + u + \varepsilon$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *African Geography, Sustainable Agriculture, Water Harvesting, Low-Intensity Irrigation, Micro-Sprinkler Systems, Economic Modelling, Precision Farming*

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