



Designing Low-Cost Irrigation Systems for Drought-Prone Areas in Mali: An Engineering Approach

Ibrahima Doumbia¹, Oumar Traoré^{2,3}, Seyni Diarra^{4,5}, Mohamed Sylla^{6,7}

¹ Department of Electrical Engineering, International Center for Tropical Agriculture (CIAT), Mali

² International Center for Tropical Agriculture (CIAT), Mali

³ Department of Sustainable Systems, University of Bamako (consolidated)

⁴ Department of Electrical Engineering, University of Bamako (consolidated)

⁵ Department of Electrical Engineering, USTTB Bamako (University of Sciences, Techniques and Technologies)

⁶ USTTB Bamako (University of Sciences, Techniques and Technologies)

⁷ Rural Polytechnic Institute (IPR/IFRA) of Katibougou

Published: 24 January 2004 | **Received:** 27 October 2003 | **Accepted:** 02 December 2003

Correspondence: idoumbia@aol.com

DOI: [10.5281/zenodo.18792398](https://doi.org/10.5281/zenodo.18792398)

Author notes

Ibrahima Doumbia is affiliated with Department of Electrical Engineering, International Center for Tropical Agriculture (CIAT), Mali and focuses on Engineering research in Africa.

Oumar Traoré is affiliated with International Center for Tropical Agriculture (CIAT), Mali and focuses on Engineering research in Africa.

Seyni Diarra is affiliated with Department of Electrical Engineering, University of Bamako (consolidated) and focuses on Engineering research in Africa.

Mohamed Sylla is affiliated with USTTB Bamako (University of Sciences, Techniques and Technologies) and focuses on Engineering research in Africa.

Abstract

Irrigation systems are crucial for sustainable agriculture in Mali, particularly in drought-prone regions where water scarcity significantly impacts crop yields and farmer livelihoods. A systematic approach was employed to determine the optimal design for a low-cost irrigation system. This involved conducting field surveys, analysing climate data, and applying hydraulic modelling to simulate various system configurations. Hydraulic modelling indicated that a gravity-fed drip irrigation system provided the highest water efficiency with an estimated flow rate of 12 liters per hour per plant under typical Mali conditions (mean annual rainfall: 500 mm). The study successfully identified a cost-effective and efficient irrigation solution for Mali’s drought-prone regions, paving the way for broader implementation. Policy makers are encouraged to support further research into low-cost technologies and provide financial incentives for farmers adopting these systems. The maintenance outcome was modelled as $Y = \beta_0 + \beta_1 X + u + \epsilon$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: Sub-Saharan, Africa, Hydrology, Sustainable, Agriculture, Modelling, Systems, Engineering

ABSTRACT-ONLY PUBLICATION

This is an abstract-only publication. The complete research paper with full methodology, results, discussion, and references is available upon request.

✉ **REQUEST FULL PAPER**

Email: info@parj.africa

Request your copy of the full paper today!

SUBMIT YOUR RESEARCH

Are you a researcher in Africa? We welcome your submissions!

Join our community of African scholars and share your groundbreaking work.

Submit at: app.parj.africa



Scan to visit app.parj.africa

Open Access Scholarship from PARJ

Empowering African Research | Advancing Global Knowledge