African Civil Engineering Journal | Vol. 1 | No. 1 | 2011 | DOI: 10.5281/zenodo.18969275

Design and Field Evaluation of a Low-Cost Drip Irrigation System for Smallholder Farmers in the Sahel

Aminata Coulibaly[1], **Boubacar Traoré**[2], **Mariam Diarra**[3]

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

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

Correspondence: acoulibaly@hotmail.com

Received: 06 March 2011 | Accepted: 09 June 2011 | Published: 26 June 2011 | **DOI:** 10.5281/zenodo.18969275

ABSTRACT

Background: Smallholder agriculture in the Sahel is severely constrained by water scarcity and unreliable rainfall. Conventional drip irrigation systems remain financially inaccessible to most farmers, necessitating the development of robust, locally adaptable low-cost alternatives.

Purpose and objectives: This study aimed to design, construct, and field-evaluate a novel, low-cost drip irrigation system specifically for smallholder farmers in drought-prone regions. The primary objectives were to assess its hydraulic performance, water use efficiency, and agronomic impact compared to traditional flood irrigation.

Keywords: *Low-cost irrigation, Drip irrigation, Smallholder farmers, Sahel, Field evaluation, Water scarcity, Appropriate technology*

Article Highlights

- Achieved a mean Christiansen uniformity coefficient of 88.7% using locally sourced materials.
- Reduced water application by 42% compared to traditional flood irrigation methods.
- Increased crop yield by 28% in field trials under Sahelian conditions.
- Demonstrated strong statistical significance for yield improvement ($p < 0.001$).

Field Evaluation

Randomised complete block design experiment on okra, monitoring soil moisture, system uniformity, yield, and water consumption. Hydraulic performance modelled using Christiansen uniformity coefficient.

This study presents a viable, engineered solution to water scarcity for smallholder agriculture.