



A Bayesian Hierarchical Model for Reliability Diagnostics in Uganda's Agricultural Field Research Station Network

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ABSTRACT

Background: Agricultural field research stations are critical infrastructure for generating agronomic evidence, yet systematic evaluations of their operational reliability are lacking, particularly in sub-Saharan Africa. This gap hinders the assessment of data quality and the planning of research investments.

Purpose and objectives: This short report presents a novel methodological framework for quantifying the reliability of a national network of agricultural field research stations. The objective is to develop and demonstrate a Bayesian hierarchical model for diagnostic analysis of system performance.

Keywords: *Bayesian hierarchical modelling, agricultural research infrastructure, Sub-Saharan Africa, reliability diagnostics, agronomic field trials, Uganda*

Article Highlights

- Bayesian model quantifies station reliability with probabilities from 0.31 to 0.89
- Identifies dedicated technical staff as critical factor for operational success
- Provides probabilistic diagnostic tool for research infrastructure networks
- Moves beyond descriptive summaries to formal inferential framework

Methodological Core

Bayesian hierarchical model with station-specific random effects analyzes trial success data using posterior distributions with weakly informative priors.

This short report presents a novel framework for quantifying research station reliability.

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