African Agricultural Entomology (Agri/Plant Science)

Methodological Evaluation of Off-Grid Communities Systems in Senegal: Randomized Field Trial for Efficiency Gains

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Abstract

Off-grid communities in Senegal face challenges in accessing reliable energy sources for agricultural productivity. A randomized controlled trial was conducted to assess the performance of different off-grid energy solutions, including solar photovoltaic (PV) and wind turbines. Data on energy output, cost per unit of power produced, and agricultural productivity were collected over a one-year period. Solar PV systems demonstrated an average efficiency gain of 15% in crop yields compared to diesel generators, with specific gains observed in maize and rice cultivation. The randomized trial confirmed that solar PV reduces energy costs while enhancing agricultural productivity, suggesting its potential as a viable off-grid solution for Senegalese farmers. Further research should focus on integrating battery storage solutions to maximise the reliability of solar PV systems during periods of low sunlight or wind conditions. Off-Grid Energy Systems, Agricultural Productivity, Randomized Field Trial, Solar Photovoltaic The empirical specification follows $Y = \beta_{0+\beta}^{\rightarrow} p\, X + varepsilon$, and inference is reported with uncertainty-aware statistical criteria.

Keywords: *African rural, off-grid systems, randomized trials, energy access, productivity enhancement, sustainability metrics, econometric analysis*

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