Solar-Powered Irrigation Systems and Crop Yields in Ethiopian Small Farmer Groups: A Five-Year Review

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Abstract

Solar-powered irrigation systems have been introduced to enhance agricultural productivity in Ethiopia's small farmer groups, particularly in the Eastern Highlands where water scarcity is a significant challenge. A comprehensive search strategy was employed, including databases such as PubMed, Scopus, and Google Scholar. Studies were included if they met specific criteria related to solar-powered irrigation systems and their effects on crop yield in Ethiopia. The review identified a trend towards increased yields with the adoption of these systems, particularly among groups using them for more than three years (72% showed improvement). Solar-powered irrigation systems have shown promise in enhancing crop yields, especially when used consistently over multiple seasons. Further research should focus on long-term yield stability and the economic sustainability of these systems under various climatic conditions. Farmers' training programmes could also be improved to maximise system efficiency. Model estimation used $\hat{\{\theta\}} = argmin\{\theta\}\, sumiell(yi, f\theta(\xi)) + \lambda lVert\theta rVert\, 2^2,$ with performance evaluated using out-of-sample error.

Keywords: *Ethiopia, Highlands, Photovoltaics, Precision Agriculture, Sustainable Development, Smallholder Farming, Remote Sensing*

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