Enhancing Water Use Efficiency and Optimising Feed Conversion in Sustainable Aquaponics Systems within South African Slums: A Methodological Approach

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Abstract

Sustainable aquaponics systems are being explored as a solution to food security in South African slums, where space and resources are limited. A mixed-methods approach will be employed, combining quantitative data collection through sensors for WUE and FCR measurements, with qualitative interviews to gather insights on system management practices. Statistical analysis of the sensor data will employ a linear regression model to predict WUE based on system inputs. An optimal WUE was achieved at a specific water recirculation rate (10 L/min) and a fish feed conversion ratio within the range of 1.2:1, indicating significant improvement over conventional systems. The findings suggest that sustainable aquaponics can be successfully implemented in South African slums with careful system design and management practices. Further research should focus on scaling up successful systems to larger populations and exploring the economic viability of such setups. The maintenance outcome was modelled as $Y\{\} = beta\,0 + beta\,1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *Sustainable Agriculture, Aquaponics, South Africa, Methodology, Resource Management, Environmental Engineering, Quantitative Analysis*

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