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"Food and nutrition security and its resilience to global crises"

Evaluation of the Sustainable Aquaponics for Nutritional and Food Security in Urban Sub-saharan Africa

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Abstract

The combination of hydroponics and aquaculture in a closed system is the essence of aquaponics and soilless agriculture that can contribute to the social, economic and environmental dimensions of sustainability and/or climate smart agriculture (CSA) in urban areas of developing countries. Aquaponics is hypothesised to have the potential to improve nutrition security, conserve the environment and empower youths in developing countries often experiencing population growth and food insecurity. For instance, in certain urban areas in West Africa, e.g. Lagos, Nigeria, vegetable and fish consumption is below the world average of 200 grams, which poses serious nutritional concerns. Furthermore, agriculture land conversion of parks and recreation centres in urban areas to tackle food insecurity may result in land degradation. In sub-Saharan Africa, there is a research gap for aquaponics as a viable option for nutrition security, environmental conservation and youth empowerment. Thus, this study evaluates data from the small-scale aquaponics project "Sustainable Aquaponics for Nutritional and Food Security in Urban Sub-Saharan Africa" (SANFU). SANFU was implemented in Lagos in 2019 to ascertain the feasibility of vegetable and fish production under local conditions. The vegetables cultivated were Lagos Spinach, Igbo vegetable, the fish raised were African catfish and Tilapia fish. The SANFU aquaponics system primarily relied on relatively expensive foreign sourced components to validate the technical feasibility of this production system. This aquaponics set-up can yield ca. 27.9 kg of fish and 3 kg of vegetables per annum with a nitrogen outflow of 48.5 g implying 55% of nutrients for plant use without replenishing fish (waste)water. This corresponds to a rather unfavourable Net-Discounted Benefit-Cost Rate (DBCR) of 0.08 over a 20-year period. Conversely, a comparable system that uses locally sourced components and a higher fish stock density was simulated to have a DBCR of 1.12. Thus, aquaponics systems may be technically set-up such that they are economic feasible, contribute to improve the food and nutrition security of the beneficiaries as well as conserve the environment. The use of African catfish, given its popularity and fast growth, is generally recommended, while a more hybrid tilapia should be considered.

Keywords: Aquaponics, Fish, Nitrogen out-flow, Profitability Analysis, Vegetables

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