Maximizing Efficiency and Sustainability of Aquatic Food Production from Aquaponics Systems - A Critical Review of Challenges and Solution Options ABSTRACT

Aquaponics is an emerging area of ecological aquaculture comprising diverse technologies that converge on integrating recirculating aquaculture and hydroponics in one production unit. It has made possible to simultaneously produce fish and vegetables with nutrient cascading and water conservation as among its core concepts. While production of these food items is the material output of the system, there is a complexity of processes involved which opens a vast scope for innovations. Production of fish and plants integrated in the aquaponics fluctuates depending on the various biodynamic links that influence the nutrient turnover and water quality across the unit. A successful operation of aquaponics production unit, therefore, requires a thorough understanding of the whole system as a functioning ecosystem comprising fish, plant and the nitrifying bacteria. These biological components differ in their optimum requirements but the overall homoeostasis of the composite system can be maintained through regulating the water quality and nutrient profiles by way of adaptive interventions for acceptable tradeoffs. Balancing of nutrients by appropriate rates of stocking of fed and extractor species, feeding based on nutrient composition and anticipated excreted nutrients are essential for sustainability of aquaponics. It deserves emphasis that with so many variables in the system, there is obviously a vast scope for unlimited diversification and innovations to improve the production efficiency and sustainability. Regions facing water stress or where conservation of water is a priority will particularly benefit from aquaponics.