

Title:

Resource use efficiency of aquaculture partially fed with pig manure, fresh or processed through anaerobic digestion

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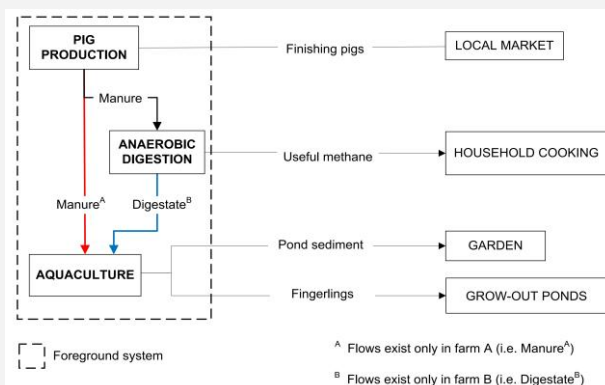
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Abstract:

At small Asian farms, aquaculture is integrated with agriculture and/or anaerobic digestion to reduce pollution of waste streams. A question arises how resource efficient such integrated system is. This was researched for two Vietnamese farms. Resource usage was expressed as the Cumulative Exergy Extraction from Natural Environment (CEENE).

In the studied farms, fresh pig manure was applied as a feedstock for the anaerobic digester. Along with carbohydrate-rich pelleted feed, Snakeskin gourami larvae were fed by pig manure in farm A and digestate (of digested pig manure) in farm B. This practice possibly resulted in an increased microbial production, which was probably due to presence of bioflocs in the pond water or of biofilms on submerged surfaces. The integrated systems obtained a lower Feed Conversion Ratio (FCR, 0.6 for farm A, 0.4 for farm B) for juvenile production than Pangasius mono-intensive aquaculture (FCR of 1.2). However, the ponds had lower areal yields and consumed a much higher amount of water (16 m³ kg⁻¹ fingerlings, compared to 3.2 m³ water kg⁻¹ fingerlings for mono-intensive). Consequently, the integrated systems extracted much more resources (CEENE) per kg fingerling (927 MJ for farm A, 859 MJ for farm B, 314 MJ for Pangasius hatchery). Water and land resources played an important role in the Pangasius hatchery (57% and 37%, respectively) while the integrated system consumed primarily water resources (89% for farm A, 93% for farm B), which is explained by a reduced feed usage and higher water consumption.

Attention should focus on a better water management in the integrated systems, e.g., water use reduction and water recycling. Further research would be defining an optimum application rate of manure and digestate to promote the growth of microorganisms that fish/larvae digest better and highlighting fresh manure or manure-originated digestate as the better additional feed in aquaculture.



Keywords: Integrated aquaculture, Life cycle assessment, Resource footprint