EFFECTS OF PIG MANURE ON POND FISH YIELD AND POND NUTRIENT ACCUMULATION IN THE MEKONG DELTA, VIETNAM

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Three fishponds were monitored during two successive periods to quantify nutrient budgets and to evaluate the effects of pig manure inputs on pond productivity and nutrient accumulation. The ponds were part of integrated aquaculture-agriculture (IAA) systems including intensive fruit, pig and rice production. Pond sediments were used to fertilise fruit trees. The first 10-month monitoring period in 2002-03 aimed to quantify pond budgets for the principal nutrients nitrogen (N), organic carbon (OC) and phosphorus (P). In 2003-04, during the second 11-month monitoring period the farmers applied more pig manure to the ponds. The ponds measured 625, 652 and 1,327 m^2, and they had stocking rates of 7.1, 5.1 and 6.3 fingerlings m^2 in 2002-03, and 4.5, 5.3 and 4.2 fingerlings m^{-2} in 2003-04, respectively. In all cases, farmers stocked various species concurrently. A combined dataset obtained through monthly sampling (pond inputs and outputs, and water quality) during the two periods was analysed using bivariate correlation analysis, multivariate discriminant analysis and canonical correlation analysis to identify differences between monitoring periods and to explore complex relationships and interactions between pond nutrient management (independent) and pond water quality (dependent).

Adding more pig manure to the pond had positive effects on fish yield and bottom soil nutrient accumulation. Discriminant models indicated that in the second period N, OC and P inflows and outflows through water exchange and OC inputs through home-made feed were significantly lower (*P<0.05*), while pig manure inputs were significantly higher than in the first period (*P<0.01*). Values for pond water depth, Secchi visibility, NO_3-N, chlorophyll-a and PO_4-P concentrations were significantly higher in the second than in the first period (*P<0.05*). The canonical correlation analyses explained further the findings from the discriminant analyses. The higher pig manure inputs resulted in higher total and dissolved phosphorous, and in higher afternoon and lower morning dissolved oxygen concentrations. Home-made feed inputs, nutrient inflows and outflows through water exchange were positively correlated together, and these variables were negatively correlated with Secchi visibility. Net fish production averaged 537 kg ha^{-1} $year^{-1}$ in the first monitoring compared with 1,298 kg ha^{-1} $year^{-1}$ in the second one. Bivariate correlations between manure inputs and fish yields, amounts of OC, and concentrations and amounts of P accumulated in pond bottom soil, were positive (*P<0.001*). The study showed that adding pig manure to the pond benefits both aquaculture and agriculture, as fish yield increased and more nutrients accumulated in pond sediments that subsequently can be re-used in the IAA system.

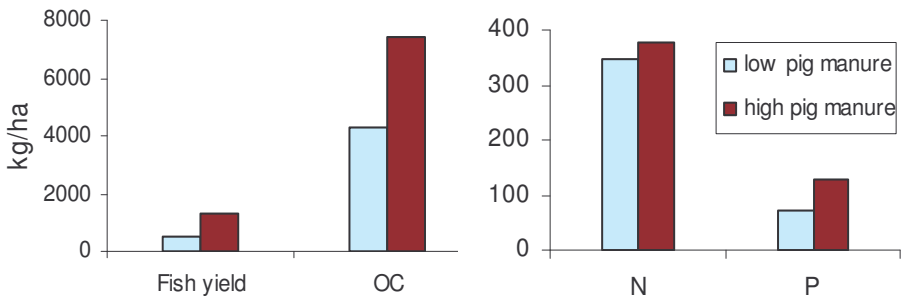

Figure 1:
The effect of increasing pig manure fertilisation on fish yield and pond bottom nutrient accumulation.