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RESEARCH REPORTS

Sustainable Aquaculture for a Secure Future

Title: Effects of Nutrient Availability on Primary Productivity and Fish Production in Fertilized Tropical Ponds

Author(s): Fatimah M. Yusoff
Faculty of Fisheries and Marine Science
University Pertanian Malaysia
Serdang 43400, Selangor, Malaysia

C. D. McNabb
Department of Fisheries and Wildlife
Michigan State University
East Lansing, MI 48824, U.S.A.

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Abstract: Four fish species were grown in earthen ponds for 352 days in three treatments. Reference ponds received no fertilizer, TSP (triple superphosphate) ponds received $5.7 \text{ kg P ha}^{-1} \text{ month}^{-1}$ and TSP-urea ponds received 1.4 kg P and $16.6 \text{ kg N ha}^{-1} \text{ week}^{-1}$. Net fish production was 437 kg/ha , 1034 kg/ha and 1713 kg/ha in reference, TSP and TSP-urea treatments, respectively. Mean gross primary productivity was 0.09 , 0.17 and $0.26 \text{ g C m}^{-2} \text{ h}^{-1}$ and mean net productivity was 0.08 , 0.12 and $0.21 \text{ g C m}^{-2} \text{ h}^{-1}$ for reference, TSP and TSP-urea treatments, respectively. Reference, TSP and TSP-urea treatments had net photosynthesis estimated from dawn to dusk changes of total inorganic carbon of 1.04 , 1.48 and $2.41 \text{ g C m}^{-2} \text{ day}^{-1}$. Chlorophyll *a* concentrations were 12.50 mg/m^3 , 46.71 mg/m^3 and 109.18 mg/m^3 in reference, TSP and TSP-urea treatments, respectively. Differences between treatments for fish production, algal production and chlorophyll *a* were significant ($P < 0.05$) except for net production in reference and TSP treatments. Net fish production was positively correlated to gross and net primary productivity, and chlorophyll *a*. Analyses of orthophosphate-P revealed that mean concentrations were highest in the TSP treatment (0.033 mg/l) followed by the TSP-urea treatment (0.009 mg/l) and the reference treatment (0.003 mg/l). An inorganic nitrogen to orthophosphate-P ratio of 36 in reference ponds indicated phosphorus limitation relative to nitrogen. A ratio of 2 in TSP ponds indicated nitrogen limitation. A ratio of 44 in TSP-urea ponds suggested phosphorus was limiting. Bioassay tests using the alga *Selenastrum capricornutum* Printz, supported the above contention by showing higher growth in response to phosphorus enrichment of reference pond water relative to control cultures, response to nitrogen addition in TSP treatment

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water and response to phosphorus addition in TSP-urea treatment water. Alleviating these limitations on algal productivity by properly designed fertilizing procedures was expected to increase fish yield.

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