

ABSTRACT

The integration of aquaculture and agriculture where water is first used for aquaculture and then for irrigation may be one of the possible ways to overcome the problem of freshwater to meet the demand of growing population. A field trial was conducted with three Indian Major Carps (IMC) and tomato and okra as agriculture crops in sandy loam soil of IIT Kharagpur. Performance of IMC was studied with three stocking densities (S.D) 20,000; 35,000 and 50,000 fingerlings per hectare for S.D-2.0; S.D-3.5, and S.D-5.0 respectively. Water quality parameters such as temperature, pH, dissolved oxygen, nitrite, nitrate, total ammonia nitrogen (TAN), orthophosphate and total suspended solid were monitored. A spreadsheet model was developed to find out the dynamics of TAN in the pond ecosystem using forward finite difference discretization method. The maximum numbers of water exchange for fish ponds were 10, 13 and 17 for S.D-2.0, 3.5 and 5.0, respectively, to control the TAN value. The exchanged water was used for irrigating the vegetable crops. Split-plot design with irrigation as the main plot treatment and doses of nitrogen fertilizer as sub-plot treatments was followed. The highest and lowest yields of 68.27 t ha⁻¹ and of 61.87 t ha⁻¹ for tomato were obtained with irrigation from S.D-5.0 and tubewell water, respectively. There was a recovery of inorganic nitrogen to the tune of 13.36 to 33.27 kg ha⁻¹ and phosphate to the tune of 0.70 to 2.74 kg ha⁻¹ from the fish pond wastewater. For okra grown during the rainy season, only nitrogen doses of fertilizer showed a significant response. The interaction effect of irrigation and nitrogen was non-significant in both the seasons. The crop quality parameters such as fruit pulp, ascorbic acid content total soluble solid and crude fiber content values were found to be non-significant. From the experimental data, the ratio of pond area to crop area for an integrated agri-aquaculture system was estimated to be 35:65 for S.D-2.0; 30: 70 for S.D-3.5 and 22: 78 for S.D-5.0. The various economic indicators were evaluated and the highest values were obtained from the treatment S.D-5.0. Integrated agri-aquaculture system is technically feasible and economically sustainable for water scarcity areas.

Key words: System integration; IMC; TAN; water exchange schedule; tomato; okra; crop quality.