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### Impact of Initial Tilapia (*Oreochromis niloticus*) Stocking Size on Crop-Fish Yield and Soil-Water Quality in Integrated Rice-Fish Farming Systems

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#### Abstract

Integrated rice-fish farming (IRFF) is a system of producing fish in combination with paddy cultivation using the same resources in the same unit area. This study aimed to assess the effects of different initial tilapia (*Oreochromis niloticus* L.) stocking sizes on the growth and yield of rice and fish, economic return, and to evaluate soil fertility and water quality within an IRFF system. A field experiment was conducted using four (T1-T4) stocking sizes: T1:5 g, T2:20 g, T3:35 g, and T4:50 g. Each treatment with three replicates was randomly allocated in a Complete Randomized Block Design. Data were analyzed using ANOVA and Duncan's post hoc test. Stocking sizes influenced both rice and fish performance significantly. The 35 g and 50 g provided the best balance, supporting high yields for both rice and fish without adverse effects on soil fertility or water quality. The 50 g treatment produced the highest rice yield (5.08 t/ha), presenting a 1.8% increase compared to the average regional rice yield (4.99 t/ha). Soil nutrient levels (N, P, K) and organic matter (OM) significantly increased across treatments, with T4 showing the highest enrichment. Water quality parameters including pH (7.36-7.80), EC (376-383  $\mu\text{S}/\text{cm}$ ), temperature (29.26-29.40 °C), DO (4.72-5.08  $\text{mg}/\text{L}^{-1}$ ),  $\text{NO}_3^-$  (0.61-0.86  $\text{mg}/\text{L}^{-1}$ ), and  $\text{NH}_3$  (0.23-0.34  $\text{mg}/\text{L}^{-1}$ ) remained within non-toxic limits. The 50 g stocking size yielded the highest net return (USD 1,047.54  $\text{ha}^{-1}$ ) and benefit-to-cost ratio (BCR) of 1.44, presenting a 290 % increase in profit and a 19 % higher BCR compared to rice monoculture. In conclusion, this study suggests that 35 g and 50 g tilapia stocking sizes optimize rice-fish yields and enhance soil quality without compromising water quality in IRFF systems.

**Keywords:** *Integration, Nutrients, Profitability, Stocking size, Sustainable agriculture*