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Investigating the Efficiency of Different Aeration Systems on Growth Performance of Mono-Sex Nile tilapia *Oreochromis niloticus*

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Aquaculture innovation is critical for a sustainable increase in the global fish supply. The study was conducted at the Noakhali Science and Technology University Pond Complex to examine the effects of different aeration systems on the growth performance of mono-sex male tilapia for a 120-day culture period. No Aeration (T_1), Surface Aeration (T_2), Bottom Aeration (T_3), and Combined Surface and Bottom Aeration (T_4) were evaluated, and each was replicated three times.

Fish were stocked at 400 ind./decimal with an initial individual weight of 0.89±0.02 g. Dissolved oxygen (DO), temperature, pH, salinity, and total dissolved solids (TDS) were taken daily, while NH_3-N, NO_2-N, alkalinity, phosphate, and total hardness were taken biweekly. On the 59th day, the aeration was initiated because the DO level dropped below 4 mg/L and the biomass reached 29.15±4.57 kg/decimal.

Treatments T_4 and T_2 showed significantly ($p<0.05$) enhanced specific growth rates (%SGR), peaking at 4.37±0.06 and 4.33±0.09, respectively. T_4 achieved the highest ($p<0.05$) survival rate (96.88±0.22), showing the highest ($p<0.05$) production of 16.10±0.61 MT/ha and the lowest ($p<0.05$) feed conversion ratio (FCR) of 1.42±0.15. Whereas T_1 found the lowest production (10.22±0.41 MT/ha) and highest FCR (2.00±0.14). There were no significant differences ($p > 0.05$) between the production of T2 and T4 conditions. Analysis also revealed that T_4 incurred the lowest cost for supplementary oxygenation, whereas T_3 incurred the highest. Moreover, the combined aeration approach contributed to disrupting the discomfort zones (water zones with DO < 4 mg/L) by improving water circulation. Integrating IoT devices for aeration scheduling could further optimize these benefits by providing real-time oxygenation adjustments. This research advocates for mechanical aeration adoption, especially combined aeration, to enhance growth, survival rates, and feed efficiency, thereby boosting productivity and promoting sustainable aquaculture practices.

Figure 1: Experimental pond complex and aeration system employed.