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Research on Aquaponics

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This study investigates the performance of a lab-scale aquaponics system integrating Tilapia (*Oreochromis niloticus*) and Tomato (*Solanum lycopersicum*). The system was operated for 45 days with continuous monitoring of water quality, fish growth, and plant yield. The findings show promising outcomes for sustainable food production in controlled environments.

Introduction

Aquaponics is a sustainable food production method that combines aquaculture (fish farming) and hydroponics (soilless plant cultivation). Fish waste provides nutrients for plant growth, while plants help filter and clean the water. This closed-loop system reduces water usage, minimizes waste discharge, and offers dual production outputs. This study focuses on a lab-scale aquaponics system using Tilapia and Tomato.

Literature Review

Numerous studies have highlighted the efficiency of aquaponics systems in producing fish and vegetables simultaneously. Research indicates Tilapia is well-suited for aquaponics due to its hardiness, while tomatoes are a nutrient-demanding crop that thrives in nutrient-rich water. Previous experiments have demonstrated improved resource use efficiency and water conservation compared to traditional farming.

Materials and Methods

System Setup

The system consisted of a 100L fish tank, a 60L grow bed with expanded clay media, a submersible pump (300 L/hr), and a biofilter. The system operated on a continuous flow cycle. Water was recirculated from the fish tank to the grow bed and back.

Species Used

Fish: Tilapia (Oreochromis niloticus), Initial weight: ~30g per fish, 10 fish total. Plant: Tomato (Solanum lycopersicum), Seedlings transplanted at 3-leaf stage.

Water Quality Monitoring

Parameters measured every 3 days:

- pH: 6.5 - 7.5
- Temperature: 25°C - 28°C
- Ammonia (NH3): <0.5 mg/L
- Nitrite (NO2-): <0.3 mg/L
- Nitrate (NO3-): 10 - 50 mg/L
- Dissolved Oxygen: >5 mg/L

Data Collection

Fish weight measured every 15 days. Tomato plant height, leaf number, and fruit count were recorded weekly. Water quality was monitored using API test kits.

Results and Discussion

Fish Growth

Average initial weight: 30g
Average final weight after 45 days: 85g
Survival rate: 100%
Daily Weight Gain (DWG): 1.22g/day

Plant Growth

Average plant height: 52 cm
Average leaf count: 18
Average fruit count per plant: 4
Tomato plants showed healthy growth and bore fruit by day 40.

Water Quality Trends

Water remained within optimal range for both fish and plants throughout the experiment. Nitrate levels increased gradually, indicating active nitrogen cycling.

Conclusion

The lab-scale aquaponics system effectively supported the growth of Tilapia and Tomato. Water quality parameters remained stable, demonstrating the potential for sustainable integrated food production systems. This study confirms that aquaponics can be a viable option for resource-limited environments.

References

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