Research Title: A Comparison of Water Quality in Ponds with Organic and Chemical Fertilizers on the Growth of Azolla at Wichienmatu School, Mueang District, Trang Province

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Abstract

This research aims to compare the water quality of organic and chemical fertilizers and their effects on the growth of Azolla microphylla at Wichienmatu School, Mueang District, Trang Province. Azolla microphylla floats on the water surface, and this study focuses on comparing the effects of organic and chemical fertilizers on water quality and the growth of Azolla microphylla. The study examines key water quality parameters, including temperature, turbidity, and pH, throughout the experimental period from February 11, 2025, to February 26, 2025. The experiment was conducted using two sample ponds: one treated with organic fertilizer and the other with chemical fertilizer. Each pond was dug to a depth of approximately 50 centimeters and lined with PE plastic sheets measuring 3 meters in width and 4.5 meters in length. After lining the ponds, 1,500 liters of water were added. One kilogram of either organic or chemical fertilizer was then applied to each pond, followed by a two-day waiting period to allow the fertilizers to dissolve before introducing Azolla microphylla. After another two days, water quality parameters and the growth rate of Azolla microphylla in both conditions were measured and compared. The results showed that the water in the organic fertilizer-treated pond had a turbidity of 81.03, a stable pH of 7, and a temperature of 30°C. In contrast, the water in the chemical fertilizer-treated pond had a turbidity of 37.13, a pH of 8.5, and the same temperature of 30°C. The findings indicate that water with organic fertilizer had higher turbidity and a more stable pH compared to the chemical fertilizer-treated water, while there was no significant difference in temperature between the two groups. However, the growth rate of Azolla microphylla was higher in the organic fertilizer-treated water than in the chemical fertilizer-treated water. In conclusion, organic fertilizer positively affects water quality and enhances the growth of Azolla microphylla more effectively than chemical fertilizer. These findings suggest that organic fertilizer can be applied in agricultural systems and ecological wastewater treatment.

Introduction

Azolla spp. is an aquatic fern with high potential for use as a green manure, animal feed, and wastewater treatment agent due to its ability to fix atmospheric nitrogen and thrive in nutrient-rich water sources. Among the various Azolla species, Azolla microphylla is one of the fastest-growing and most efficient in nutrient absorption. One of the key factors influencing the growth of Azolla microphylla is water quality, which includes essential parameters such as temperature, turbidity, and pH.Nutrient supplementation in water also plays a crucial role, with organic and chemical fertilizers being widely used in agriculture. Organic fertilizers provide natural nutrients, improve water quality, and help maintain ecological balance. In contrast, chemical fertilizers supply nutrients in a readily available form for plant uptake but may negatively impact water quality and aquatic life if used excessively.
This study aims to investigate the effects of organic and chemical fertilizers on water quality by measuring temperature, turbidity, and pH. Additionally, it compares the growth of Azolla microphylla under different conditions to determine the most suitable approach for promoting its growth and enhancing water quality in sustainable agricultural systems.

Materials and Methods

Research Questions

1.How does the water quality in Azolla microphylla cultivation ponds differ between those treated with chemical fertilizer and those treated with organic fertilizer?
2.How does the growth of Azolla microphylla differ between ponds treated with chemical fertilizer and those treated with organic fertilizer?

Research Hypothesis

1.The water quality differs between ponds treated with organic fertilizer and those treated with chemical fertilizer.
2.The growth of Azolla microphylla differs between ponds treated with chemical fertilizer and those treated with organic fertilizer.

Materials and Methods

Relevant Variables

Hypothesis 1: The water quality in Azolla microphylla cultivation ponds differs between those treated with chemical fertilizer and those treated with organic fertilizer.

Independent Variable: Type of fertilizer used in the Azolla microphylla cultivation ponds (organic fertilizer and chemical fertilizer).

Dependent Variable: Water quality.

Controlled Variables: Azolla microphylla species,Amount of fertilizer used,Pond size,Water volume,Duration of the experiment,Light exposure duration,Age of Azolla microphylla

Hypothesis 2: The growth of Azolla microphylla differs between ponds treated with chemical fertilizer and those treated with organic fertilizer.

Independent Variable: Type of fertilizer used in Azolla microphylla cultivation (organic fertilizer and chemical fertilizer).

Dependent Variable: Growth of Azolla microphylla.

Controlled Variables:Azolla microphylla species,Amount of fertilizer used,Pond size,Water volume,Duration of the experiment,Light exposure duration,Age of Azolla microphylla

Materials and Equipment

1.Universal indicator paper
2.Thermometer
3.Measuring instruments
4.Organic fertilizer
5.Chemical fertilizer (urea)
6.Beaker
7.Digital balance (for measuring substances)
8.Photosynthetic bacteria
9.Experimental ponds (2 ponds)
10.Turbidity meter (for measuring water clarity)
11.Camera (for recording Azolla microphylla growth changes)
12.Azolla microphylla
13.Water

Research Procedures

Part 1: Study Area Selection
1.The study was conducted at Wichienmatu School in Trang Province.
The geographical coordinates of the study area are Latitude 7°30’08.8”N and Longitude 99°37’44.9”E.

2. Preparation of Ponds for Azolla Cultivation
-Prepare two experimental ponds of equal size (2.5 meters wide, 4 meters long, and 50 centimeters deep).
-Clean the ponds thoroughly before starting the experiment.

3. Filling the Experimental Ponds with Water
-Fill both experimental ponds with an equal amount of clean water.
-Measure the water level to ensure it is the same in both ponds.

4. Preparation of Fertilizers for the Experiment
-Weigh 1,000 grams of organic fertilizer for Pond 1.
-Weigh 1,000 grams of chemical fertilizer (urea) for Pond 2.

5. Mixing Fertilizers into the Experimental Ponds
-Dissolve the organic fertilizer in a small amount of water before pouring it into Pond 1 (organic pond)
.-Dissolve the chemical fertilizer in a small amount of water before pouring it into Pond 2 (chemical pond).
-Stir well to ensure the fertilizer is evenly mixed with the water, then add soil.

6. Preparation of Azolla for the Experiment
-Weigh 200 grams of Azolla microphylla of similar age and size for each pond.
-Check the quality of the Azolla by selecting healthy plants free from diseases and pests.
-Distribute the Azolla evenly in both experimental ponds.

7. Monitoring Water Quality and Azolla Growth
-Measure water quality every 7 days by recording the following parameters:
-Measure the water temperature using a thermometer three times, calculate the average, and record the results.
-Measure the pH level using universal indicator paper three times, calculate the average, and record the results.
-Measure water turbidity using a turbidity meter three times, calculate the average, and record the results.
-Observe and record Azolla growth by:-Taking photos of the Azolla coverage in the ponds.And observing the density and number of Azolla layers.

Part 2: Study of Water Quality in Ponds with Chemical and Organic Fertilizers
1.Measuring Water Temperature
-Use a water thermometer and submerge it to a depth of 10 cm.
-Read the temperature value and record the results.
2.Measuring Water Turbidity
-Use a turbidity measuring cylinder.
-Pour water into the cylinder until the black and white markings at the bottom are no longer visible.
-Read the turbidity value and record the results.
3.Measuring Water pH
-Dip universal pH paper into the water.
-Compare the resulting color with the reference chart.
-Record the pH value.

Table 1: Temperature, pH, and Turbidity Measurements from the First Observation (14/02/68)

Studys area	Temperature, pH, and Water Turbidity		
	Temperature	pH scale	Water Turbidity
Organic pond	30°	7	70.3
Chemical pond	30°	11	51

Table 2: Temperature, pH, and Turbidity Measurements from the second Observation (18/02/68)

Studys area	Temperature, pH, and Water Turbidity		
	Temperature	pH scale	Water Turbidity
Organic pond	29°	7	75.5
Chemical pond	29°	7	21.9

Table 3: Temperature, pH, and Turbidity Measurements from the third Observation (26/02/68)

Studys area	Temperature, pH, and Water Turbidity		
	Temperature	pH scale	Water Turbidity
Organic pond	30°	7	97.3
Chemical pond	30°	7	38.5

From the tables, it was found that the water quality measurements for each pond were similar in terms of pH. The average pH of the pond with organic fertilizer was 7, while the average pH of the pond with chemical fertilizer was 8.5. The water temperature had the same average value in both ponds, measuring 30°C.
However, there was a difference in water turbidity. In every measurement, the pond with organic fertilizer showed higher turbidity than the pond with chemical fertilizer. The average turbidity in the organic fertilizer pond was 81.03, whereas the average turbidity in the chemical fertilizer pond was 37.13.

Part 3: Study of the growth of Azolla microphylla in ponds with chemical and organic fertilizers

Studys area	The growth of Azolla microphylla					
	1st		2nd		3rd	
	Number of layer	Density	Number of layer	Density	Number of layer	Density
Organic pond	1	40	3	70	5	100
Chemical pond	1	10	1	20	3	40

From the tables, it was observed that the number of layers and the density of Azolla increased with each measurement in both ponds. However, the pond with organic fertilizer showed a greater increase in both the number of layers and the density of Azolla compared to the pond with chemical fertilizer.In the pond with chemical fertilizer, the average number of Azolla layers was 1.67, with an average density of 23.33. Meanwhile, in the pond with organic fertilizer, the average number of Azolla layers was 3, with an average density of 70.

Conclusion and Discussion

The study found that organic and chemical fertilizers mixed with water had different effects on the growth of Azolla. Azolla in the organic fertilizer pond exhibited better growth than that in the chemical fertilizer pond. This was evident from the greater increase in the number of layers and the higher density of Azolla in the organic fertilizer pond compared to the chemical fertilizer pond.Additionally, the water quality in the organic fertilizer pond was more suitable for Azolla cultivation than that in the chemical fertilizer pond. The organic fertilizer pond had higher water turbidity and a more stable pH compared to the chemical fertilizer pond.Therefore, it can be concluded that organic fertilizer has a more positive impact on both water quality and the growth of Azolla microphylla than chemical fertilizer. This finding can be applied in agricultural systems and ecological wastewater treatment.

Acknowledgements

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Appendix

Image of Pond Preparation for Azolla Cultivation

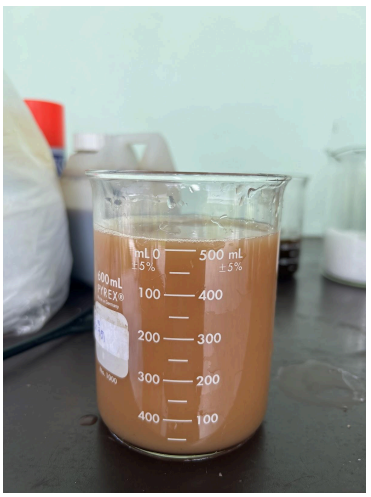

Image of Fertilizer Preparation for the Experiment

Image of Mixing Fertilizer into the Experimental Ponds

Image of Azolla Preparation for the Experiment

Image of Introducing Azolla into the Experimental Ponds

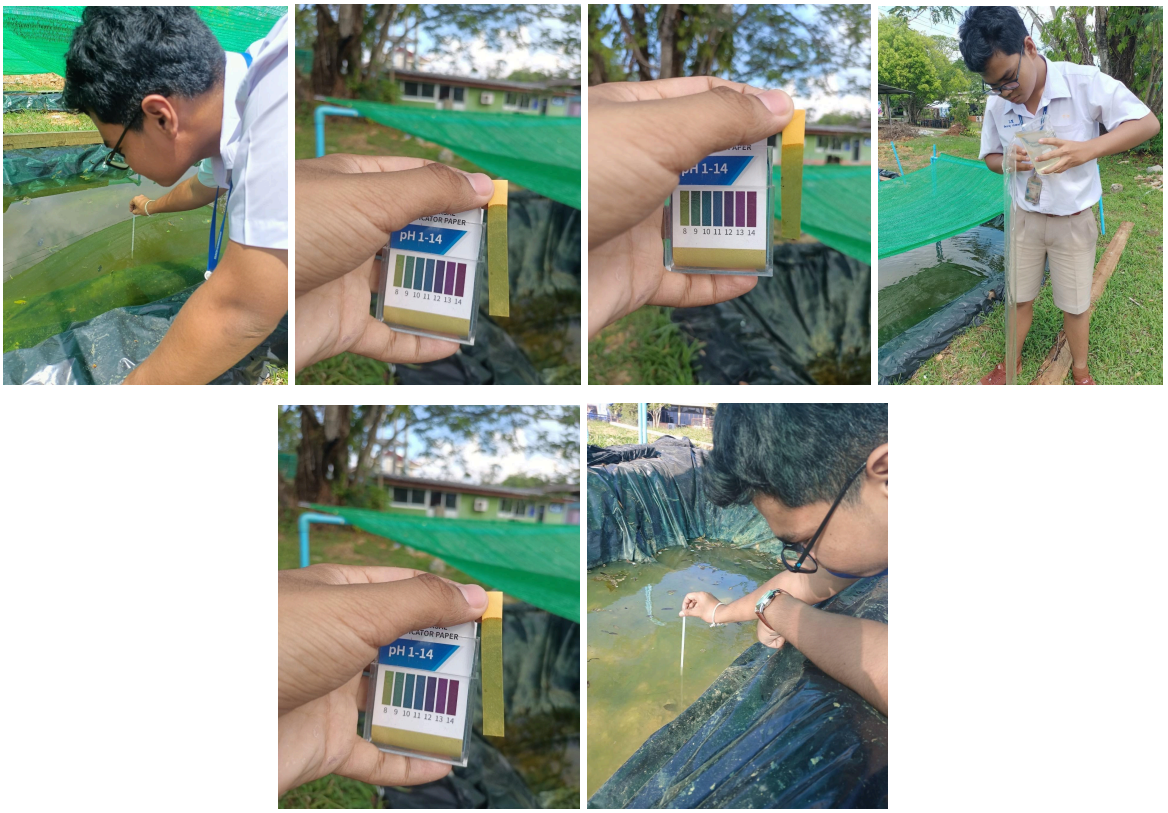

Image of Water Quality Measurement