



# Research proposal on relationship between water quality and the growth of lotus in lotus ponds



Wichienmatu School

## Abstract

Environmental science research on the study of the relationship between water quality and the growth of lotus in lotus ponds supplemented with chicken and cow manure at Wichienmatu School with the objectives of (1) comparing the water quality in lotus ponds supplemented with chicken and cow manure, (2) comparing the growth of lotus in lotus ponds supplemented with chicken and cow manure, and (3) studying the relationship between water quality and the growth of lotus in lotus ponds supplemented with chicken and cow manure. From the study of water quality measurements and lotus growth, it was found that water temperature, pH, dissolved oxygen, and lotus plant height in lotus ponds supplemented with chicken and cow manure at Wichienmatu School were different. It was found that the pond supplemented with cow manure had higher water temperature, pH, dissolved oxygen, and lotus plant height than the pond supplemented with chicken manure, but the pond supplemented with chicken manure had higher water transparency than the pond supplemented with cow manure.

## Research Question

- 1.) Are there differences in water quality, and if so, how? The water quality in the two ponds differed significantly. The pond treated with cow manure had a higher average temperature (30.33°C), an average pH 6.66, and an average dissolved oxygen (3.38 mg/L) than the pond treated with chicken manure. 66.73 cm compared to 25 cm in the cow manure pond.
- 2.) Are there differences in growth, and if so, how? Yes, there were differences. The lotus plants in the pond treated with cow manure showed better height growth, with an average height of 26.66 cm, while those in the chicken manure pond averaged only 25 cm.
- 3.) Relationship between water quality and growth: Higher water quality factors such as temperature, pH, and DO in the cow manure pond had a positive correlation with increased lotus plant height. Although the chicken manure pond had higher water transparency, it did not result in taller lotus plants than the cow manure pond.

## Introduction

Currently, lotus plants are widely cultivated. These plants thrive in wetlands and are commonly found in many areas of Thailand, primarily for their ornamental value. Furthermore, the large amount of animal waste generated from livestock farming necessitates research into growing lotus in ponds supplemented with cow manure versus chicken manure. The study aimed to investigate the water quality and growth of lotus in these ponds, and to examine the relationship between water quality and lotus growth in these two environments. This research was conducted at Wichienmatu School.



## Research Methods

### Planning Investigations Describes the planning process

1. Planning Process, Study Area, and Physical Characteristics  
The planning process began with defining the objective of studying the influence of animal manure (chicken and cow manure) on water quality and the growth of lotus plants. The study area details are as follows:  
(1.) Study Area: Conducted at Wichienmatu School, Mueang Trang District, Trang Province, Latitude 7.5032371 degrees North and Longitude 99.6293169.  
(2.) Climate: The study area is located in Trang Province, which has a tropical monsoon climate with high humidity and heavy rainfall, affecting water volume and temperature in the lotus ponds.  
(3.) Basic Ground Cover Characteristics: The study area is a lotus pond constructed within the school grounds, which is a wetland area suitable for the growth of lotus plants.

2. GLOBE Protocols and NASA Resources Used  
This survey used the GLOBE Protocols, a NASA standard for environmental monitoring:  
Water Quality Monitoring Protocol: Used for measuring water temperature, pH, and water transparency, and the amount of dissolved oxygen in the water.  
Related resources: Using internationally standardized methodologies to ensure the reliability of the collected data and its comparison with other environmental databases.

3. Organization of data collection, materials, and equipment  
Equipment is prepared and calibrated before starting the process as follows:  
Calibration and material preparation: Check the thermometer, DO test kit, and prepare Universal indicator strips for use, as well as prepare cow and chicken manure to be used as independent variables.  
Main tools and equipment  
Dissolved oxygen (DO) test kit  
Thermometer for measuring temperature  
Universal indicator for measuring pH  
Turbidity tube  
Tape measure for measuring the height of lotus plants  
Beakers and bottles for collecting water samples

4. Data collection strategy  
Method of selecting time and frequency: Water quality and lotus growth data are collected a total of 3 times (3 replicates) to find the mean and standard deviation.  
Time and location for sample collection: Temperature is measured by immersing the thermometer in water to a depth of 10 cm for 3-5 minutes.  
pH value: Collect water samples near the temperature measurement point.  
Dissolved oxygen (DO): This test must be performed within 2 hours of collecting the water sample.  
Growth: Measure the distance between the soil surface and the base of the lotus plant using a tape measure.

### Carrying Out Investigations Describes what happened

Investigation Procedure  
1. Describe What Happened  
In conducting this research, the research team conducted experiments comparing the growth of lotus plants under different conditions by preparing two types of lotus ponds.  
One type was filled with cow manure, and the other with chicken manure. The results were then monitored through physical and chemical water quality measurements, along with measurements of the height of the lotus plants, to analyze the relationship between which type of animal manure had a better effect on growth and water quality.

2. GLOBE Protocol and NASA Resources Used  
This study applied the GLOBE Protocols, an international standard supported by NASA for environmental surveys. The Hydrosphere Protocol was used to measure water temperature, pH, water transparency, and dissolved oxygen. This ensured the accuracy of the data according to scientific principles.

3. Data Collection Activities and Specific Data Collection Locations: Data was collected at the lotus pond within Wichienmatu School, Trang Province.  
Specific locations for water temperature measurement were at a depth of approximately 10 centimeters. Water samples for pH measurement were collected from locations near the water temperature measurement point. Transparency is measured by scooping water from the soil surface into a measuring tube. The height of the lotus plant is measured at the distance between the soil surface and the base of the lotus plant.

4. Data Details (Data Type and Quantity)  
Data Type: Quantitative Data, including:  
Temperature (°C)  
PH (Acidity-Basicity)  
Transparency (cm)  
Dissolved Oxygen (mg/L)  
Height of Lotus Plant (cm)  
Data Quantity: Data was collected 3 times for each measurement category to calculate the mean and standard deviation (S.D.).

5. Data Collection Procedure and Roles of Members  
Measurement Frequency: A total of 3 measurements were taken and data collected.  
Protocol Used:  
Temperature: Immerse the thermometer for 3-5 minutes and read the value at eye level.  
pH: Use a Universal indicator strip, dip for 1-2 seconds and compare the color.  
DO: Collect water in an air-tight bottle. And the test must be completed within 2 hours.  
Roles of members: The team (Mr. Potsawee Petin, Mr. Piyaprach Nooket and Mr. Jetrinpat Saengsrijan) divided the tasks of reading the values and recording the results.

## GLOBE Badges

### Be a Earth system scientists

This report clearly explains the interconnectedness of various systems on Earth in the context of research and application of global protocols. It describes the systems of the planet, demonstrating how the difference in organic matter added can drive changes in physical and chemical factors in water, and subsequently affect the life cycle of aquatic plants. This truly studies the balance and interdependence of various systems on Earth.

### Be a Collaborator

The complete list of team members, including researchers from various organizations worldwide, is clearly identified, along with defined roles, how these roles support each other, and descriptions of each researcher's contributions. These descriptions clearly demonstrate the benefits of collaboration, explaining how working with other researchers and organizations improves the research.

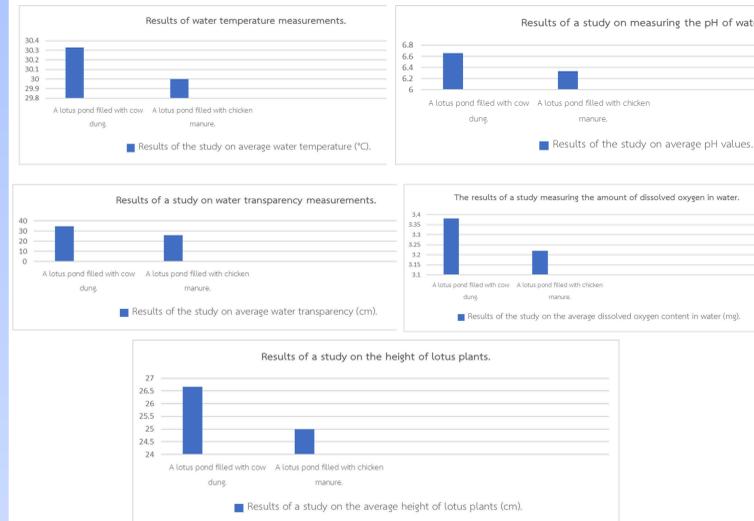
### Be a Data Scientist

This report includes an in-depth analysis of data downloaded from the GLOBE database, as well as data collected by the researchers themselves. Where new data was collected, the researchers discussed the limitations of this data, drew conclusions about past, present, or future events, and used the data to answer questions or solve problems in the presented systems.

## Results

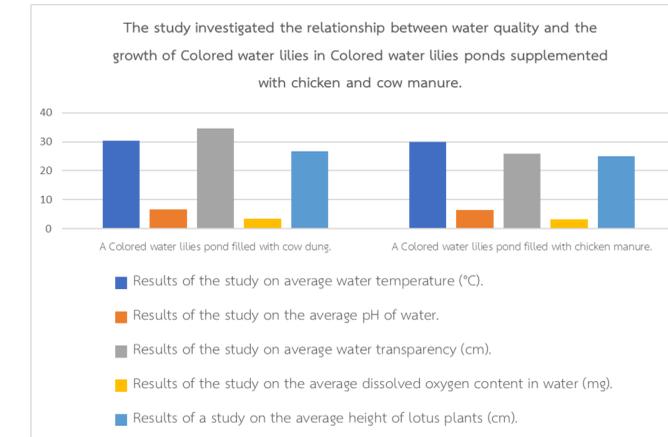
The results of measurements taken from a study on the relationship between water quality and the growth of lotus plants in lotus ponds supplemented with chicken and cow manure at Wichienmatu School showed that ponds supplemented with cow manure had higher water temperature, pH, dissolved oxygen, turbidity, and lotus plant height than ponds supplemented with chicken manure.

The graph shows a comparison of various measurement data points.



The tables and graphs show a comparison of various measurement data between lotus ponds grown with cow manure and lotus ponds grown with chicken manure.

Measuring	A Colored water lilies pond filled with cow dung.	A Colored water lilies pond filled with chicken manure.
Results of the study on average water temperature (°C).	30.33	30
Results of the study on the average pH of water.	6.66	6.33
Results of the study on average water transparency (cm).	34.5	25.83
Results of the study on the average dissolved oxygen content in water (mg).	3.38	3.22
Results of a study on the average height of lotus plants (cm).	26.66	25



## Discussion

The study found that lotus ponds supplemented with cow manure had higher average water temperatures of 30.33 °C, a pH of 6.66, and dissolved oxygen levels of 3.38 mg/L compared to ponds supplemented with chicken manure. These factors resulted in an average lotus height growth of up to 26.66 cm. This result supports the research hypothesis that the addition of different types of animal manure affects water quality and lotus growth differently, particularly in ponds supplemented with cow manure, where the water conditions were more favorable for growth, even though ponds supplemented with chicken manure had a higher average water transparency of 66.73 cm.

## Conclusions

A study on the relationship between water quality and the growth of lotus plants in lotus ponds supplemented with chicken and cow manure at Wichienmatu School found that ponds supplemented with cow manure had higher water temperature, pH, dissolved oxygen, turbidity, and lotus plant height than ponds supplemented with chicken manure.  
Suggestions

## Bibliography

The references and sources used in this research are correctly cited, following the research framework (Applied from Research Framework). This report references research principles and experts, which can be arranged according to the following citation format: Kwanjai Karnchanasrimak. (2023) Guidelines and supporting equipment for water quality measurement in research. Wichianmatu School. Apirak Songrak. (2023) Guidelines for water quality measurement and data collection on aquatic plant growth. Rajamangala University of Technology Srivijaya, Trang Campus; Institute for the Promotion of Teaching Science and Technology (IPST). Teacher's Guide for Supplementary Science and Technology Subject: Biology, Grade 12. Bangkok: Office of the National Education Commission Printing Press, Ladprao. (Referenced from Chapter 2, Natural Resources and Environment, as found in the research source).