

**Research Title:** The Study of Soil Quality Characteristics Affecting the Growth of *Kaempferia galanga* L. (Prao Hom) at Wichienmatu School, Trang

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### Abstract

This environmental science research, titled "A Study of Soil Quality Characteristics Affecting the Growth of Proh Hom (*Kaempferia galanga* L.) at Wichienmatu School, Trang Province," aimed to 1) study soil structure characteristics 2) analyze soil nutrient content, specifically Nitrogen (N), Phosphorus (P), and Potassium (K) 3) examine light intensity 4) determine pH levels (acid-base) 5) study temperature and humidity and 6) observe the growth of Proh Hom within the Wichienmatu School area. Measurements of soil structure, nutrients, light intensity, pH, temperature, and plant growth were conducted following the GLOBE Thailand protocols.

The findings revealed that regarding soil nutrients, Site 3 had higher average Nitrogen and Potassium levels than Sites 1 and 2, while Site 1 recorded the highest average Phosphorus. In terms of soil environment, Site 3 showed the highest average soil moisture and pH levels, whereas Site 2 recorded the highest average temperature. For light intensity, Site 2 had a higher average than Sites 1 and 3. When considering the growth characteristics of Proh Hom—including plant height, leaf length, and leaf count—it was found that Site 3 had the highest overall average growth, followed by Site 2 and Site 1, respectively. In conclusion, Site 3 is the most suitable location for the overall growth of Proh Hom.

**Keywords:** Proh Hom (*Kaempferia galanga* L.), Soil Quality

## Introduction

Proh Hom (*Kaempferia galanga* L.) is a local medicinal herb with significant economic and medical value in Thailand. It is widely cultivated as a raw material for pharmaceuticals and various herbal products. The growth of Proh Hom depends on several environmental factors, particularly the characteristics of the soil used for planting. Well-aerated soil with appropriate pH levels and nutrient content effectively promotes the growth of its stems, leaves, and rhizomes.

Soil is a vital natural resource for plant life and development, serving as an anchor for roots and a reservoir for water, air, and essential nutrients. Both physical and chemical properties of soil, along with nutrient levels, influence nutrient absorption and overall plant development.

The area of Wichienmatu School in Trang Province is utilized for educational purposes and various planting activities. The soil in different sections of the school may possess distinct physical and chemical properties, which can affect the growth of medicinal herbs. Therefore, studying the soil characteristics and properties within the school grounds is essential for understanding the factors that influence plant cultivation.

Consequently, this research project aims to study the physical and chemical properties of the soil at Wichienmatu School, Trang Province, and analyze how these factors affect the growth of Proh Hom. The findings will serve as a guideline for improving soil quality and promoting efficient and appropriate medicinal herb cultivation.

## Research Questions

1. Does the soil structure affect the growth of Proh Hom at Wichienmatu School, Trang Province, and if so, how?
2. Does the amount of soil nutrients (N, P, K) affect the growth of Proh Hom at Wichienmatu School, Trang Province, and if so, how?
3. Does the light intensity affect the growth of Proh Hom at Wichienmatu School, Trang Province, and if so, how?
4. Does the pH level (acid-base) affect the growth of Proh Hom at Wichienmatu School, Trang Province, and if so, how?
5. Do the temperature and humidity levels affect the growth of Proh Hom at Wichienmatu School, Trang Province, and if so, how?
6. Does the growth of Proh Hom differ across various areas within Wichienmatu School, Trang Province, and if so, how?

## Research Hypotheses

1. Soil structure characteristics affect the growth of Proh Hom at Wichienmatu School, Trang Province.
2. The amount of soil nutrients (Nitrogen, Phosphorus, and Potassium) affects the growth of Proh Hom at Wichienmatu School, Trang Province.
3. Light intensity levels affect the growth of Proh Hom at Wichienmatu School, Trang Province.
4. Soil pH levels (acid-base) affect the growth of Proh Hom at Wichienmatu School, Trang Province.
5. Temperature and humidity levels affect the growth of Proh Hom at Wichienmatu School, Trang Province.
6. The growth of Proh Hom varies across different study sites within Wichienmatu School, Trang Province.

## Research Variables

**Hypothesis 1: Soil structure characteristics affect the growth of Proh Hom at Wichienmatu School, Trang Province.**

- **Independent Variable:** Soil structure characteristics
- **Dependent Variable:** Growth of Proh Hom
- **Controlled Variables:** Measurement tools, survey dates, and surrounding environmental conditions.

**Hypothesis 2: The amount of soil nutrients affects the growth of Proh Hom at Wichienmatu School, Trang Province.**

- **Independent Variable:** Amount of soil nutrients (N, P, K)
- **Dependent Variable:** Growth of Proh Hom
- **Controlled Variables:** Measurement tools, survey dates, and surrounding environmental conditions.

**Hypothesis 3: Light intensity affects the growth of Proh Hom at Wichienmatu School, Trang Province.**

- **Independent Variable:** Light intensity
- **Dependent Variable:** Growth of Proh Hom
- **Controlled Variables:** Measurement tools, survey dates, and surrounding environmental conditions.

**Hypothesis 4: Soil pH levels (acid-base) affect the growth of Proh Hom at Wichienmatu School, Trang Province.**

- **Independent Variable:** pH levels (acid-base)
- **Dependent Variable:** Growth of Proh Hom
- **Controlled Variables:** Measurement tools, survey dates, and surrounding environmental conditions.

**Hypothesis 5: Temperature and humidity levels affect the growth of Proh Hom at Wichienmatu School, Trang Province.**

- **Independent Variable:** Temperature and humidity levels
- **Dependent Variable:** Growth of Proh Hom
- **Controlled Variables:** Measurement tools, survey dates, and surrounding environmental conditions.

**Hypothesis 6: The growth of Proh Hom varies across different areas within Wichienmatu School, Trang Province.**

- **Independent Variable:** Growth characteristics of Proh Hom (at different locations)
- **Dependent Variable:** Growth of Proh Hom
- **Controlled Variables:** Measurement tools, survey dates, and surrounding environmental conditions.

## Materials and Equipment

1. NPK Tester (Soil nutrient analyzer)
2. Soil Thermometer
3. Moisture Meter
4. pH Meter
5. Soil Test Kit
6. Light Intensity Meter (Lux Meter)
7. CU SmartLens (Smartphone-based microscope lens)

## Research Methodology

**1. Site Selection (Study Points)** The study was conducted within the grounds of Wichienmatu School, Trang Province, at the following geographic coordinates: Latitude:7.5032371  
Longitude:99.6293169



**Study Site Images** **Figure 1:** Displays the area of *Proh Hom* Site 1 **Figure 2:** Displays the area of *Proh Hom* Site 2 **Figure 3:** Displays the area of *Proh Hom* Site 3

## 2. Study of soil quality affecting the growth of Proh Hom (*Kaempferia galanga* L.)

**2.1 Soil Sampling:** Collect soil samples from the Proh Hom planting areas, place them in soil collection bags for analysis, and record data 3 times.

**2.2 Study of Soil Physical Properties:** Study the soil structure and texture by comparing them with soil charts.

**2.3 Measuring Soil Temperature:** Use a soil thermometer to measure the temperature at depths of 5 cm and 10 cm, and record the readings 3 times.

**2.4 Measuring Soil Moisture:** Use a multi-purpose meter to measure soil moisture at a depth of 5 cm at all study points, and record the data 3 times.

**2.5 Measuring Soil pH (Acid-Base):** Use a multi-purpose meter at a depth of 5 cm to read the pH levels of the soil, and record the data 3 times.

**2.6 Measuring Nitrogen (N), Phosphorus (P), and Potassium (K):** Use an NPK soil nutrient tester to measure the levels of Nitrogen, Phosphorus, and Potassium in the soil, and record the data 3 times.

**2.7 Examining Physical Characteristics of Proh Hom:** Measure the width and length of the leaves, measure the plant height, and count the number of leaves, and record the data 3 times.

## 3. Data Analysis

Analyze soil quality characteristics affecting the growth of Proh Hom at Wichienmatu School, Trang Province—including soil structure, soil texture, pH levels, temperature, primary macronutrients (NPK), moisture, and light intensity. This is conducted by comparing the differences in soil quality across the three study sites using mean values. The data is analyzed using averages (mean) and standard deviations to determine the relationship between soil quality and the growth of Proh Hom. Growth is assessed based on the physical characteristics of the plants, such as plant height, leaf count, and overall plant health, using mean and standard deviation for the data analysis.

Part 1: A study of soil structure characteristics affecting the growth of Proh Hom (Kaempferia galanga L.) across three study sites.

| Site        | Soil structure image                                                                | Soil structure     | Soil adhesion         | Soil texture    |
|-------------|-------------------------------------------------------------------------------------|--------------------|-----------------------|-----------------|
| Study site1 |    | Granular structure | Firm soil consistency | Loamy soil      |
| Study site2 |    | Blocky structure   | Firm soil consistency | Silty clay loam |
| Study site3 |  | Granular structure | Firm soil consistency | Sandy Clay Loam |

**Table 1: Soil structure, consistency, and soil texture across the three study sites at Wichienmatu School, Trang Province.**

Based on the average values shown in the table regarding soil structure, consistency, and texture, it was found that all three study sites exhibited a firm soil consistency. In terms of soil structure, Sites 1 and 3 featured a granular structure, while Site 2 featured a blocky structure.

Part 2: A study of soil nutrient levels, moisture, temperature, pH, and light intensity affecting the growth of Proh Hom (*Kaempferia galanga* L.) across the three study sites.

2.1 Results of the 1st Measurement

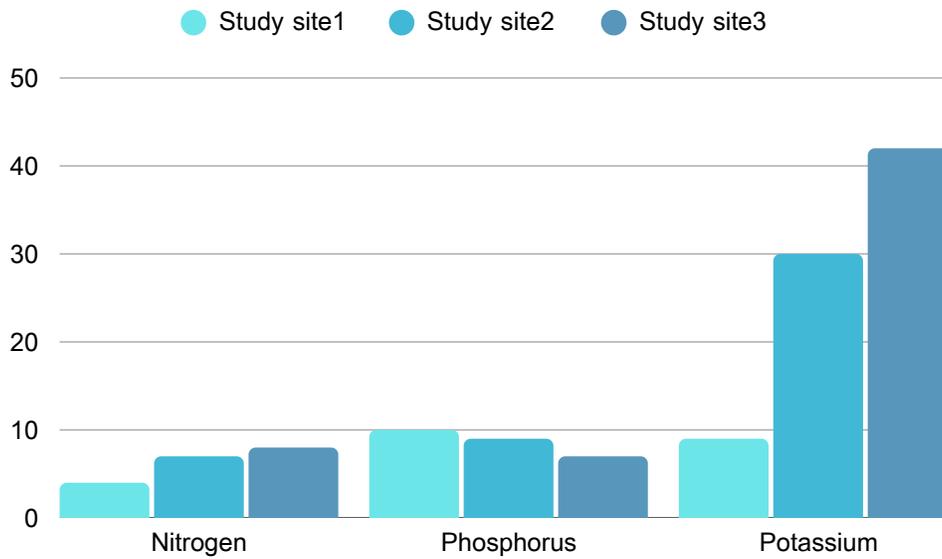


Figure 1: Bar chart displaying soil nutrient levels across the three study sites.

According to the bar chart showing soil nutrient levels across the three study sites, it was found that the Nitrogen (N) and Potassium (K) levels at Site 3 were higher than those at Site 2 and Site 1. Meanwhile, Phosphorus (P) levels were highest at Site 1, followed by Site 2 and Site 3, respectively.

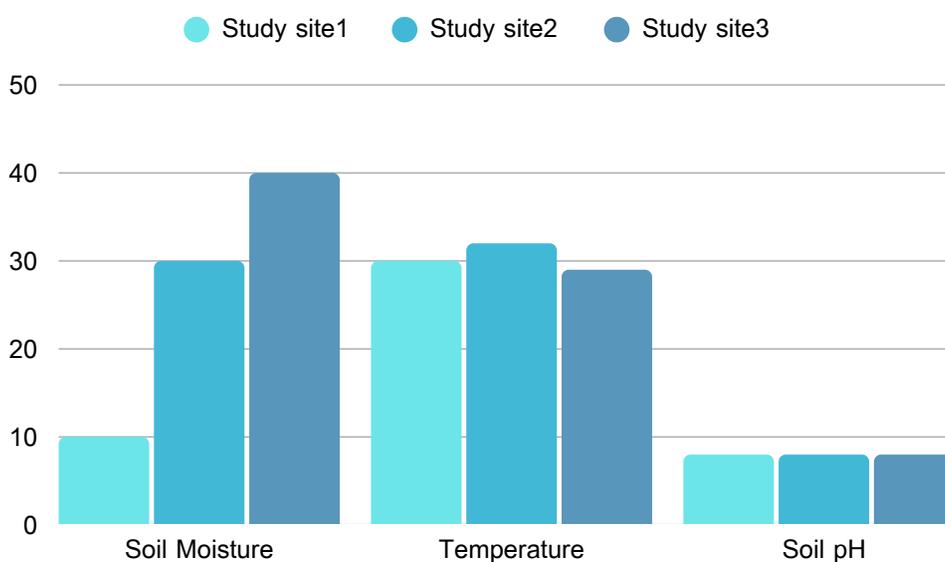


Figure 2: Bar chart displaying soil moisture, temperature, and pH levels across the three study sites.

According to the bar chart showing soil moisture, temperature, and pH levels across the three study sites, it was found that soil moisture was highest at Site 3, followed by Site 2 and Site 1, respectively. In terms of temperature, Site 2 recorded the highest value, followed by Site 1 and Site 3. For the soil pH, the results showed that all three study sites had equal values.

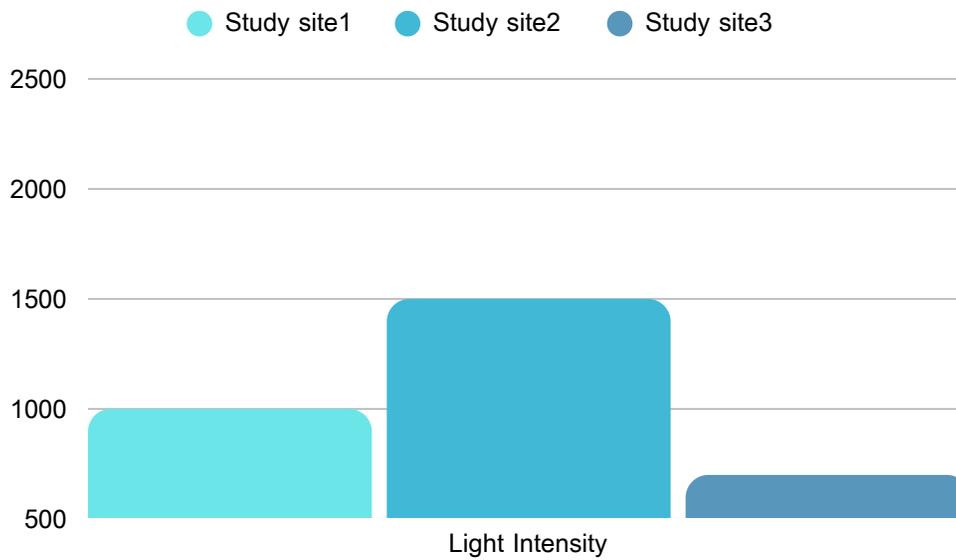


Figure 3: Bar chart displaying light intensity levels across the three study sites.

Based on the bar chart showing the average light intensity across the three study sites, it was found that Site 2 had the highest light intensity, followed by Site 1 and Site 3, respectively.

Part 3: A study of the effects of soil nutrients, moisture, temperature, pH, and light intensity on the growth of Proh Hom (*Kaempferia galanga* L.) across the three study sites.

3.1 Results of the 2nd Measurement

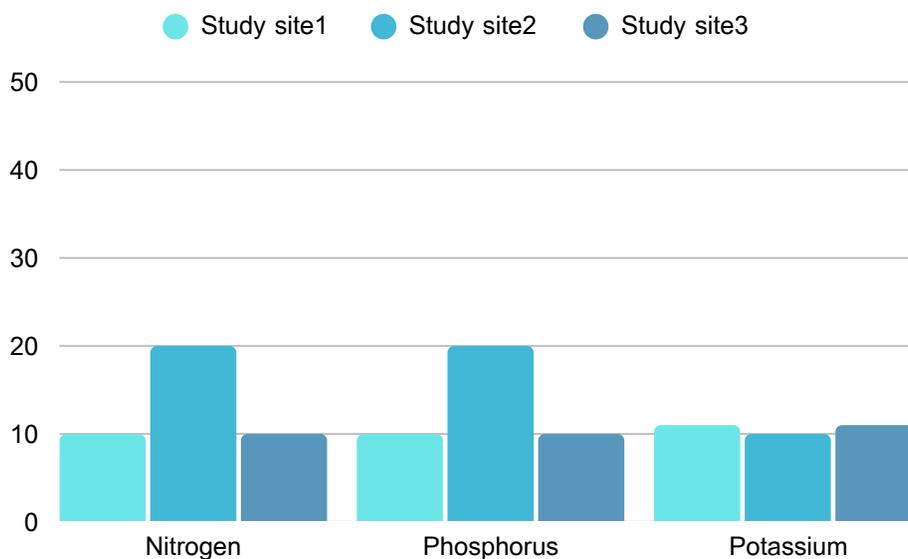


Figure 4: Bar chart displaying soil nutrient levels across the three study sites.

According to the bar chart showing soil nutrient levels across the three study sites, the results indicated that the Nitrogen (N) and Phosphorus (P) levels at Site 2 were higher than those at Site 1 and Site 3. Meanwhile, Potassium (K) levels were highest at Site 3, followed by Site 1 and Site 2, respectively.

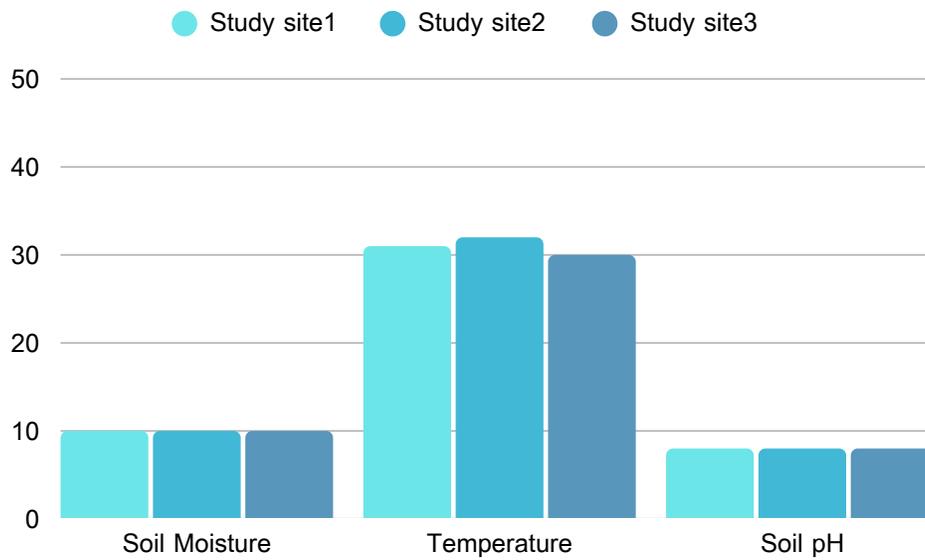


Figure 5: Bar chart displaying soil moisture, temperature, and pH levels across the three study sites.

According to the bar chart showing soil moisture, temperature, and pH levels across the three study sites, it was found that the soil moisture levels at Site 1, Site 2, and Site 3 were similar. Regarding temperature, Site 2 recorded the highest value, followed by Site 1 and Site 3. For the soil pH, the results showed that all three sites had similar values.

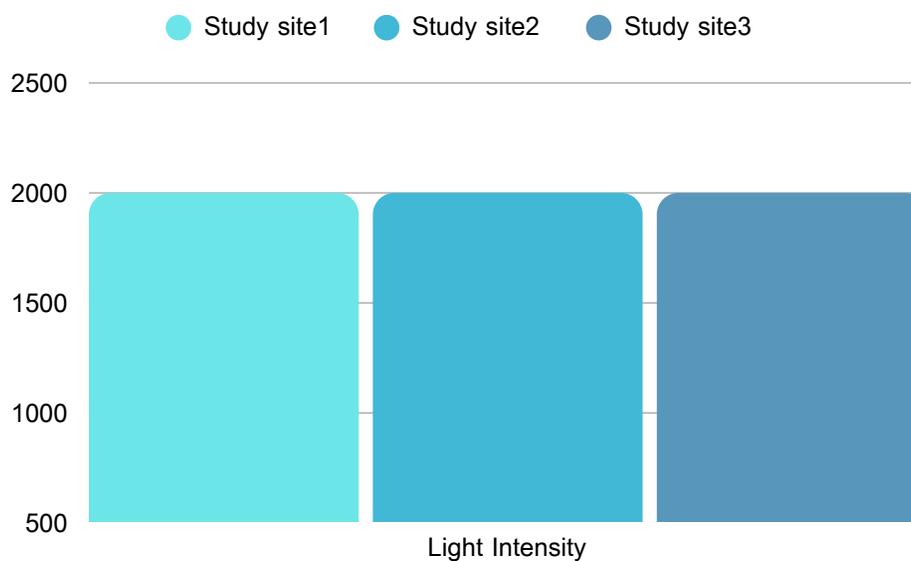


Figure 6: Bar chart displaying light intensity levels across the three study sites.

According to the bar chart showing light intensity across the three study sites, it was found that the light intensity levels at all three sites were similar.

Part 4: A study of the effects of soil nutrients, moisture, temperature, pH, and light intensity on the growth of Proh Hom (*Kaempferia galanga* L.) across the three study sites.

#### 4.1 Results of the 3rd Measurement

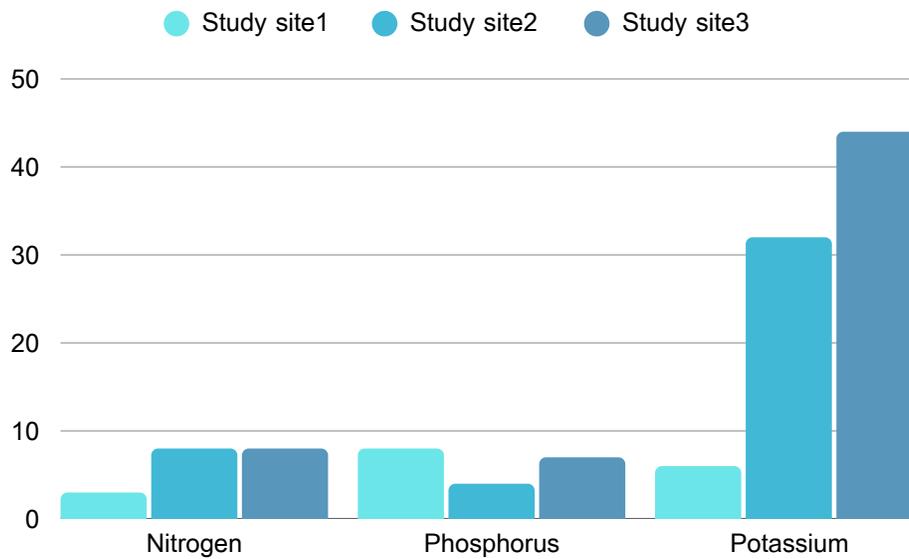


Figure 7: Bar chart displaying soil nutrient levels across the three study sites.

According to the bar chart showing soil nutrient levels across the three study sites, it was found that the Nitrogen (N) levels at Site 2 and Site 3 were higher than those at Site 1, with Site 3 recording the highest value. Regarding Phosphorus (P), Site 1 had the highest levels, followed by Site 3 and Site 2, respectively. For Potassium (K), Site 3 was the highest, followed by Site 2 and Site 1, respectively.

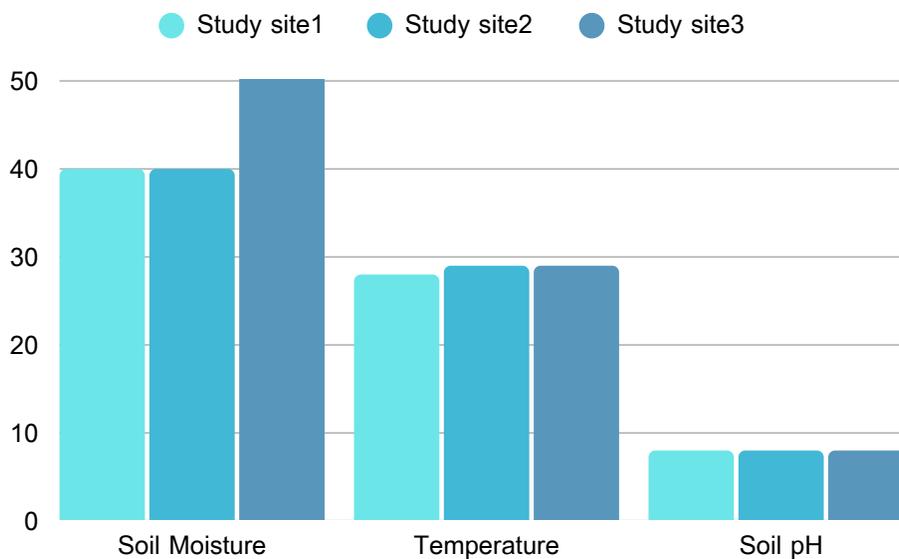


Figure 8: Bar chart displaying soil moisture, temperature, and pH levels across the three study sites.

According to the bar chart showing soil moisture, temperature, and pH levels across the three study sites, it was found that soil moisture was highest at Site 3, while Site 1 and Site 2 had similar values. Regarding temperature, Site 2 and Site 3 showed similar levels, both of which were higher than Site 1. As for the soil pH, the results indicated that all three sites had similar values.

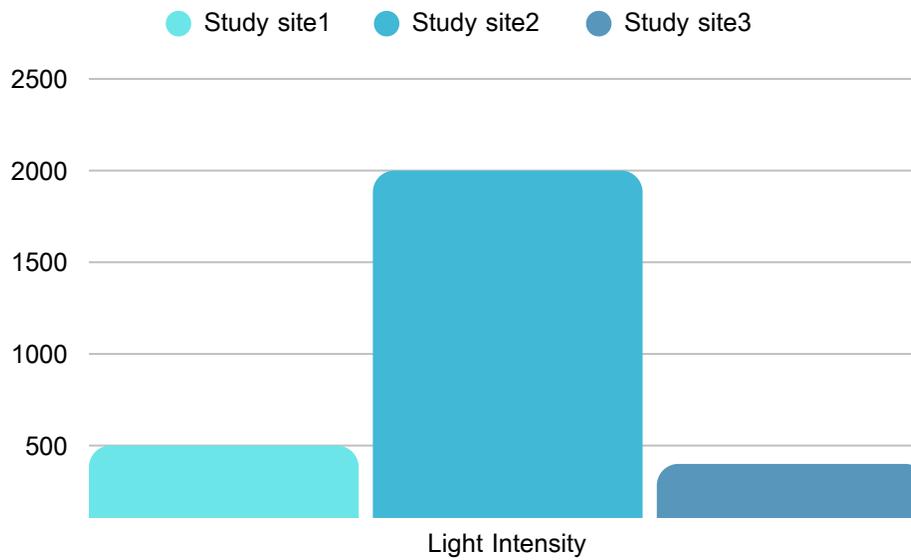


Figure 9: Bar chart displaying light intensity levels across the three study sites.

According to the bar chart showing light intensity across the three study sites, it was found that Site 2 received the highest amount of light, followed by Site 1 and Site 3, respectively.

Part 5: A study of the growth characteristics of Proh Hom (*Kaempferia galanga* L.) across the three study sites.

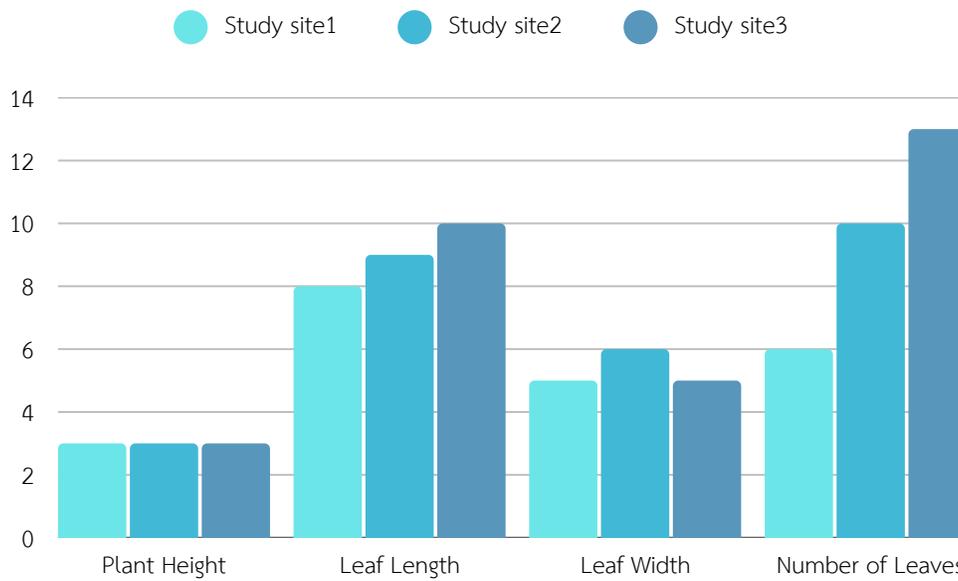


Figure 10: Bar chart displaying the growth characteristics of Proh Hom across the three study sites.

According to the bar chart showing the growth characteristics of Proh Hom across the three study sites, the average values indicated that the plant height was similar across all three sites. Site 3 recorded the highest leaf length and number of leaves, followed by Site 2 and Site 1, respectively. Regarding leaf width, Site 2 had the highest value, while Site 1 and Site 3 showed similar values.

## Conclusion and Discussion

Based on the study of environmental factors and the growth characteristics of Proh Hom (*Kaempferia galanga* L.) across three measurements, it was found that soil nutrient factors—namely Nitrogen (N), Phosphorus (P), and Potassium (K)—along with physical and chemical properties, including soil moisture, temperature, pH levels, and light intensity, significantly influenced the growth of Proh Hom. These findings support the hypothesis that soil quality and environmental conditions directly affect plant development.

The analysis of average values revealed that Site 3 had higher average Nitrogen and Potassium levels compared to Sites 1 and 2, while Site 1 recorded the highest average Phosphorus levels. Regarding soil environmental conditions, Site 3 exhibited the highest average soil moisture and pH levels. In contrast, the highest average temperature and light intensity were recorded at Site 2.

When considering these factors alongside growth characteristics—including plant height, leaf length, and the number of leaves—the results showed that Site 3 achieved the highest overall average growth, followed by Site 2 and Site 1, respectively. Therefore, it can be concluded that Site 3 provides the most optimal environment for the overall growth of Proh Hom.

## Suggestions

1. Conduct further studies on other varieties of Proh Hom: To compare growth patterns and environmental responses across different species or cultivars.
2. Expand the study area: To include a wider range of geographical locations and soil types for more comprehensive and generalized results.

## Acknowledgements

This environmental science research project, titled "A Study of Soil Quality Characteristics Affecting the Growth of Proh Hom (*Kaempferia galanga* L.) at Wichienmatu School, Trang Province," has been successfully completed with the generous support of Mr. Sakda Praisomboon, the Director of Wichienmatu School.

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Finally, the research team would like to extend our highest appreciation to everyone involved for this opportunity.

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## Supplementary sign

### 1.problem solver

Our study, based on GLOBE Thailand standards, reveals that the success of Aromatic Ginger at Wichienmatu School depends on a perfect ecological balance rather than a single factor. Site 3 showed the best growth because it offered the ideal mix of high Nitrogen (N) and Potassium (K), balanced soil pH, and high moisture.

Interestingly, while Site 1 had the most Phosphorus, the plants grew poorly due to a lack of moisture. Similarly, Site 2 had the highest light and temperature, which actually caused plant stress rather than growth. This proves that Aromatic Ginger thrives best in shady, moist, and nutrient-balanced environments. These findings serve as a "roadmap" for improving soil and plant management across the school.

### 2.Collaborator

By applying GLOBE Thailand protocols across all six objectives, we discovered that 'ecological harmony' is the ultimate key to success. Site 3 outperformed the others in height, stem quality, and leaf count because it provided a perfect synergy of high Nitrogen (N) and Potassium (K), balanced pH, and optimal moisture for efficient root absorption.

Our data also challenges the myth that 'more light is always better.' Site 2, despite having the highest light and temperature, saw stunted growth compared to the cooler, shadier conditions of Site 3. This proves that Aromatic Ginger thrives in stable moisture and cooler soil. This discovery isn't just luck; it's a blueprint for success that we can now use to replicate these ideal conditions across Wichienmatu School.

### 3.create an impact

Our findings at Site 3 provide clear evidence that Aromatic Ginger thrives on multidimensional synergy rather than just one factor. We've successfully debunked the myth that 'more sunlight' or 'maximizing a single nutrient' leads to better growth. Instead, our data proves that balanced pH, high moisture, and the right mix of N and K create the 'happiest' environment for these plants.

By following GLOBE Thailand standards, we didn't just collect data—we created a credible 'Ecological Blueprint' for our school. This creates an immediate impact, offering a practical solution to transform less ideal areas (like Sites 1 and 2) by adjusting soil moisture, pH, and

shading to replicate the success of Site 3.