

Research Title: A Study of Soil Quality to Compare the Growth of Lemongrass in Integrated Farming Areas, Nong Bo Sub-district, Yan Ta Khao District, Trang Province

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Abstract

Soil Quality Study To compare the growth of lemongrass in an integrated plantation area, Nong Bo Sub-district, Yan Ta Khao District, Trang Province. The objective was to study soil quality in relation to the growth of lemongrass by measuring soil quality according to GLOBE protocols, including soil temperature, pH, soil structure, soil texture, soil consistency, and soil fertility affecting the biomass of lemongrass. It was found that Area 1 had a higher soil temperature than Area 2. The soil pH in Area 1 was lower than that of Area 2. The soil structure in Area 1 and Area 2 was similar, and the soil texture in both areas was the same. The soil consistency in Area 1 was "very firm," while Area 2 was "firm." These factors affected the growth of lemongrass in the two areas differently, resulting in Area 1 having a lower biomass than Area 2.

Keywords: Soil quality, Lemongrass, Biomass

Introduction

Lemongrass (*Cymbopogon citratus*) is a medicinal herb native to tropical Asia and has been significant to the Thai way of life for generations. Belonging to the grass family, Poaceae, it is a perennial herbaceous plant that grows in clumps with long, slender leaves. It possesses a unique aroma due to its essential oil content. Lemongrass thrives in Thailand's humid tropical climate and is easily cultivated in various areas without requiring high costs or complex maintenance. In daily life, lemongrass is utilized in a wide variety of ways, particularly in culinary applications. It is a key ingredient in many Thai dishes, such as Tom Yum, curries, and various local cuisines, as it enhances fragrance and neutralizes fishy odors. Furthermore, lemongrass plays a vital role in traditional Thai medicine and herbal therapy. Its properties include aiding digestion, relieving flatulence, alleviating muscle aches, reducing fever, and stimulating the digestive system. Additionally, its essential oils possess antibacterial and antifungal properties and can be used as a natural insect repellent. Beyond health benefits, lemongrass is utilized in industrial and community products, such as soaps, shampoos, cleaning agents, and mosquito repellents. These applications add value to local herbs and promote the efficient and sustainable use of natural resources. Processing lemongrass into various products also generates supplementary income for communities and strengthens the local economy.

PictureThisAI (2024) states that lemongrass thrives in well-drained soil rich in organic matter, which promotes robust growth and superior flavor. Monitoring soil pH is essential to maintain an optimal range between 6.5 and 7.5. This slightly acidic to neutral pH range enables the plant to efficiently access essential nutrients such as Nitrogen (N), Phosphorus (P), and Potassium (K). Maintaining the correct pH level is critical, as soil that is too acidic or too alkaline can lead to nutrient deficiencies and stunted growth. Lemongrass requires a variety of nutrients to flourish. The primary macronutrients include: Nitrogen (N): Crucial for healthy green foliage. Phosphorus (P): Vital for strong root development. Potassium (K): Enhances overall plant health and disease resistance. Consequently, the researchers conducted this study to compare soil quality and its effects on the growth of lemongrass in an integrated plantation area in Nong Bo Sub-district, Yan Ta Khao District, Trang Province, to provide beneficial data for future applications.

Research Objectives

1. To study the effect of soil quality on the growth of lemongrass in an integrated plantation area, Nong Bo Sub-district, Yan Ta Khao District, Trang Province.

2. To compare soil quality and its impact on the growth of lemongrass in an integrated plantation area, Nong Bo Sub-district, Yan Ta Khao District, Trang Province.

Research Question

How do different soil qualities affect the growth of lemongrass in the integrated plantation area of Nong Bo Sub-district, Yan Ta Khao District, Trang Province?

Research Hypothesis

Different soil qualities result in different growth rates of lemongrass in the integrated plantation area of Nong Bo Sub-district, Yan Ta Khao District, Trang Province.

Scope of the Study

This research focuses on the study of soil quality to compare the growth of lemongrass in an integrated plantation area in Nong Bo Sub-district, Yan Ta Khao District, Trang Province. The scope of the soil quality analysis includes measuring soil temperature, pH, soil structure, soil consistency, and soil fertility. Additionally, the study examines biomass to compare the growth of lemongrass within the specified plantation areas. The period of study was conducted from August 17, 2025, to January 25, 2026.

Materials and Equipment

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|--------------------------------------|-----------------------------|
| 1. Soil texture classification guide | 8. Soil structure charts |
| 2. Soil pH test kit | 9. NPK soil tester |
| 3. Soil thermometer | 10. Sampling cans |
| 4. Soil pH test kit | 11. Light intensity meter |
| 5. Weighing scale | 12. Beakers |
| 6. Blades | 13. Photography equipment |
| 7. Marking pen | 14. Notebook and stationery |

GLOBE Protocols

Soil (Pedosphere) Protocols

Research Methodology

Study Site Selection

This research was conducted in two specific locations within an integrated plantation in Nong Bo Sub-district, Yan Ta Khao District, Trang Province. The study involved on-site field visits to perform random sampling of the areas.

Research Planning

- 1.) Identify the research topic Select the topic intended for study.
- 2) Research and gather knowledge and theories related to the research Study, search, and collect information and theories relevant to the study.
- 3) Define the objectives of the study Establish the purpose of the research.
- 4) Determine sampling points within the study area Specify the locations for random sampling within the designated study area.

Research Implementation

- 1) Plan the research operations
- 2) Survey the area to be researched
- 3) Measure soil quality according to GLOBE soil measurement protocols

Soil Temperature Measurement

Determine the sampling points by collecting soil samples from 2 areas. Measurements are taken starting from the soil surface to a depth of 5 centimeters and 10 centimeters. Measure the temperature of the soil sediment at these 2 points using a soil thermometer. Read the soil sediment temperature values and repeat the process 3 times.

Soil pH Measurement

Measure the acidity and alkalinity (pH) using a pH Meter. Read the values and collect the data 3 times.

Soil Structure and Soil Consistency

Use the soil structure charts and the guide for soil texture by feel in the field to examine the collected soil samples.

Soil Fertility

Take soil samples from the 2 areas and measure the Nitrogen (N), Phosphorus (P), and Potassium (K) levels. Use an NPK meter to read the measured values and record the results.

Soil Quality Study

Survey and collect soil samples from 2 lemongrass cultivation plots: Plot 1 at Latitude (N) 7.4188493, Longitude (E) 99.7412571 and Plot 2 at Latitude (N) 7.4188360, Longitude (E) 99.7411371, located in an integrated plantation, Nong Bo Sub-district, Yan Ta Khao District, Trang Province. Perform random sampling covering all surrounding areas of the lemongrass plants grown in Plot 1 and Plot 2 within the integrated plantation.

Record soil temperature, pH, soil structure, soil texture, soil consistency, and soil fertility by following the GLOBE soil measurement protocols.

Biomass Study

Take 3 lemongrass plants from each of the 2 plots and weigh the entire plants. Afterward, dry them using a solar dryer. Once the lemongrass is completely dry, weigh them again and use the weights to calculate the biomass using the formula.

$$\frac{(Fresh\ weight - Dry\ weight)}{Fresh\ weight} \times 100$$

Data Analysis

1) Analyze and compare soil temperature, pH levels, soil structure, and soil consistency, as well as the average values of Nitrogen (N), Phosphorus (P), Potassium (K), and biomass across three experimental replicates.

2) Conclusion.

Research Results

Table 1: Geographical coordinates of the study sites for lemongrass two locations.

Study Area	Geographic Coordinates	
	Latitude(N)	Longitude(E)
Area 1	7.4188493	99.7412571
Area 2	7.4188360	99.7411371

According to Table 1, the geographical coordinates of the study sites are located within a mixed orchard in Nong Bo Sub-district, Yan Ta Khao District, Trang Province. This study focuses on two specific areas of lemongrass (*Cymbopogon citratus*). Site 1 is located at

Latitude 7.4188493 N and Longitude 99.7412571 E, while Site 2 is located at Latitude 7.4188360 N and Longitude 99.7411371 E.

Table 2 : Soil temperature in the mixed orchard study area

Study Area	Depth	Soil Temperature (Degrees Celsius)			
		Trial 1	Trial 2	Trial 3	Average
Area 1	5 Centimeters	36	35	34	35
Area 2	10 Centimeters	35	34	34.5	34.5

According to Table 2, the soil temperatures in two areas of the integrated farm were measured. The average soil temperature in the first area (Area 1) was 35 Degrees Celsius, while the second area (Area 2) recorded an average of 34.5 Degrees Celsius

Table 3 : shows the soil pH values of the two studied areas.

Trial	Area 1	Area 2
Trial 1	6.6	6.8
Trial 2	6.4	6.9
Trial 3	6.6	6.8
Average	6.53	6.83

According to Table 3, the soil pH levels of the two areas were measured. Area 1 had an average pH of 6.53, while Area 2 had an average pH of 6.83.

Table 4 : Soil structure, soil texture, and soil consistence.

Area	Soil Structure	Soil Texture	Soil Consistence
Area 1	Blocky	Sandy loam	Extremely Firm
Area 2	Blocky	Sandy loam	Firm

According to Table 4, both study areas exhibit a blocky soil structure. The soil texture in both Area 1 and Area 2 is classified as sandy loam. Regarding soil consistence, Area 1 is characterized as very firm, while Area 2 is described as firm.

Table 5 : shows the soil fertility levels.

Trial	Soil fertility status of Area 1			Soil fertility status of Area 1		
	N	P	K	N	P	K
Trial 1	2	2	8	2	2	10
Trial 2	2	2	7	2	3	11
Average	Low	Low	Low	Low	Low	Low

According to Table 5, the soil fertility values of Area 1 found that the average of Nitrogen (N) is low, the average of Phosphorus (P) is low, and the average of Potassium (K) is low. And Area 2 found that the average of Nitrogen (N) is low, the average of Phosphorus (P) is low, and the average of Potassium (K) is low.

Table 6: Soil biomass values in two areas of the integrated farm. (คำว่า Soil biomass

Area	Fresh Weight (g)	Dry Weight (g)	Biomass (%)
Area 1	47.67	11.92	74.99
Are 2	82.11	21.69	73.58

According to Table 6, the plant biomass percentage in Area 1 was 74.99%, while Area 2 was recorded at 73.58%.

Conclusion

Part 1: Physical Characteristics of Soil Sediment Affecting Lemongrass Growth in Two Areas of an Integrated Farm

Soil Temperature

According to the study of soil temperature, it was found that the temperature should be approximately 35 degrees Celsius.

Soil pH levels

According to the study, the soil pH should be between 6.8 and 7.0.

Soil Structure Soil Texture and Soil Consistence

According to the study, Area 1 exhibited a blocky soil structure, a sandy loam texture, and a firm soil consistence.

Part 2: Soil Quality Factors Affecting the Growth of Lemongrass in Two Areas of an Integrated Farm

According to the study of soil fertility, Area 1 was found to have low average levels of Nitrogen (N) , low average levels of Phosphorus (P) , and low average levels of Potassium (K). Similarly, Area 2 was found to have low average levels of Nitrogen (N) , low average levels of Phosphorus (P) , and low average levels of Potassium (K).

Plant Biomass

The plant biomass of Area 1 was 74.99%, and the plant biomass of Area 2 was 73.58%.

Discussion

The results showed that the average soil temperature was 35 degrees Celsius in Area 1 and 34.5 degrees Celsius in Area 2. These findings are consistent with PictureThisAI (2024), which states that lemongrass is native to tropical regions and requires a warm temperature range between 20 degrees Celsius and 38 degrees Celsius. The average soil pH was 6.53 in Area 1 and 6.83 in Area 2. These results are consistent with PictureThisAI (2024), which states that for optimal growth, lemongrass prefers consistent warmth and thrives in well-drained soil. Furthermore, maintaining the soil pH within the ideal range of 6.5 to 7.5 ensures that the plants can effectively access essential nutrients. The soil structure in Area 1 was characterized as subangular blocky, with a sandy loam texture and a very firm soil consistence. These findings are consistent with PictureThisAI (2024), which states that the ideal soil type for growing lemongrass is loam. Loam is a balanced mixture of sand, silt, and clay that provides excellent structure and fertility, allowing for easy root penetration, good water retention, and proper aeration. These characteristics are essential for lemongrass as they enable the plant to absorb nutrients and moisture efficiently. The soil fertility analysis showed that in both Area 1 and Area 2, the levels of nitrogen (N), phosphorus (P), and potassium (K) were low. These findings are inconsistent with the study 'Estimation of Plant Nutrient in Fingerroot Grown on Sandy Clay Loam Soil at Nakhon Pathom Province, which states that high levels of nitrogen (N), phosphorus (P), and potassium (K) are essential for promoting plant development. Such nutrients ensure that crop yields meet both quantity and quality standards, thereby enhancing production levels and the long-term potential of the soil for agricultural purposes. The plant biomass was recorded at 74.99% in Area 1 and 73.58% in Area 2. It was observed that the growth rate in Area 2 was superior to that of Area 1. These findings are consistent with the Thailand Voluntary Emission Reduction Program (2022), which states that biomass should exhibit a trend of steady or accelerated increase relative to the age of the plant.

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