Research Title: Comparison of the physical and chemical properties of soil and the yield of Jasmine rice variety in paddy fields with different irrigation systems and terrain characteristics affecting rice yield in Lamoh Subdistrict, Nayong District, Trang Province

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Abstract

This study investigates the physical and chemical properties of soil in the paddy fields of Lamoh Subdistrict, Nayong District, Trang Province. The objective was to study the soil quality in paddy fields characterized by sloping terrain and using water from a recirculating irrigation system. Physical properties such as soil color, soil moisture, light intensity in the soil, and temperature were measured following the soil measurement methods of Pedosphere (Soil) by Golbe. Chemical properties of the soil, such as the pH, nitrogen, phosphorus, and potassium content, were also measured. The results showed that in the lowland area, the soil had a gray color, soil moisture level of 7, light intensity of 1,200 LM, and a temperature of 27.0°C. The chemical properties showed a pH of approximately 8.0, nitrogen content of 7.50%, phosphorus content of 120 mg/kg, and potassium content of 45 mg/kg, yielding 31 sacks (approximately 1,240.00 kg). In contrast, the soil in the hilly area had a brown color, soil moisture level of 7.75, light intensity of 675 LM, and a temperature of 27.0°C. The chemical properties showed a pH of approximately 8.0, nitrogen content of 5.0%, phosphorus content of 55.0 mg/kg, and potassium content of 27.5 mg/kg, yielding 22 sacks (approximately 880.00 kg).

Keywords:
Soil quality, Jasmine rice variety, Recirculating irrigation system, Sloping terrain

Introduction

Rice is an essential economic crop in Nayong District, Trang Province, particularly in Lamoh Subdistrict, where the geographical conditions, including sloped terrain, soil characteristics, and a circulating irrigation system, make it suitable for rice cultivation. The climate in this area is also favorable, with monsoon winds prevailing throughout most of the year.

Farmers in Nayong District cultivate rice using both broadcasting and transplanting methods. The Jasmine rice variety is the preferred choice among local farmers due to its quality and yield. Since soil quality plays a significant role in determining rice production, this research focuses on studying the physical and chemical properties of soil in different terrains. The study also examines chemical interactions, such as the use of chemical fertilizers and organic matter. Key soil characteristics analyzed include temperature, moisture content, nitrogen, phosphorus, and potassium levels, both during the growing period and after harvest.

Research Questions

1. In the paddy fields of Lamoh Subdistrict, Nayong District, Trang Province, which have sloped terrain and use a circulating irrigation system, does the NPK fertilizer dissolve and accumulate in the lower-lying areas?
2. Does the accumulation of dissolved NPK fertilizer in lower-lying areas contribute to an increase in Jasmine rice yield?

Research Hypotheses

1. The physical and chemical properties of soil in the elevated areas of Lamoh Subdistrict, Nayong District, Trang Province, differ from those in the lower-lying areas.
2. Differences in the physical and chemical properties of soil in these two areas affect the yield of Jasmine rice.

2. Research Methodology

2.1 Study Area

This research was conducted in Jasmine rice paddy fields in Lamoh Subdistrict, Nayong District, Trang Province. The study site is located at the coordinates 7.5896008°N latitude and 99.780946°E longitude.

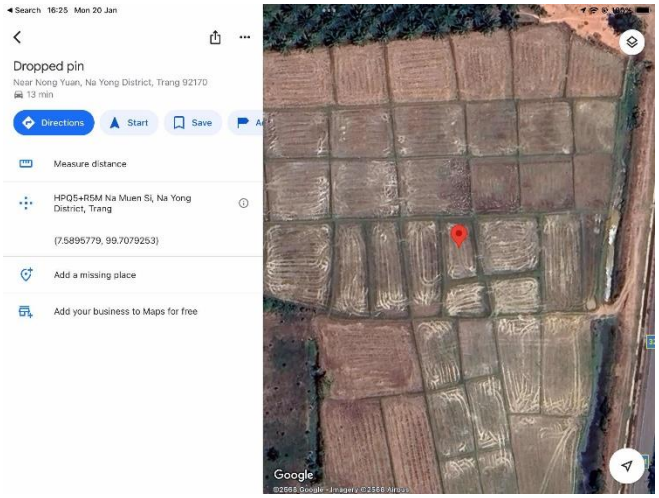

Figure 1 Study site: Jasmine rice paddy fields in Lamoh Subdistrict, Nayong District, Trang Province (Source: Google Maps)

2.2 Soil Sampling and Preparation

Soil samples were collected from the Jasmine rice paddy fields in Lamoh Subdistrict, Nayong District, Trang Province, both during the growing period and after harvest. The soil was prepared for rice cultivation through plowing and sun-drying.

The sampling process involved randomly collecting soil from four points within a single rice field and combining them into two representative samples in plastic bags. These samples were taken during the rice-growing period in December 2024 and again after harvest in January 2025. Additionally, in another field, five points were sampled and combined into two representative samples in January 2025.

All four soil samples were collected at a depth of 15 cm and then sun-dried for three days. The dried soil was ground using a mortar and pestle to ensure it could be sieved. Any plant debris or roots were removed, and the soil was passed through a 2-mm sieve (according to the Land Development Science Bureau, 2004, and the Land Development Department, n.d.).

Figure 2 Sampling locations: Five sampling points, with soil samples combined into plastic bags as representative samples (Source: Google Maps).

2.2 Analysis of Soil Physical Properties

2.2.1 Soil Moisture Measurement

Soil moisture content was measured using a Richmoto analog soil meter. The probe was inserted to a depth of 15 cm, and the readings were recorded.

2.2.2 Soil Light Intensity Measurement

Light intensity within the soil was measured using a Richmoto analog soil meter. The probe was inserted to a depth of 15 cm, and the readings were recorded.

2.2.3 Soil Temperature Measurement

Soil temperature was measured using a thermometer following the Pedosphere (Soil) measurement methodology. The thermometer was inserted at three different depths, and the readings were recorded:

- **3 cm depth** – Measurement recorded
- **5 cm depth** – Measurement recorded

- **10 cm depth** – Measurement recorded
- Data was logged into the **GLOBE Data Entry System**.

2.2.4 Soil pH Analysis

Soil pH was measured using a Richmoto analog soil meter. The probe was inserted to a depth of 15 cm, and the readings were recorded.

2.3 Analysis of Soil Chemical Properties

Soil organic matter content was analyzed using an NPK and pH soil testing kit.

2.3.1 Nitrogen Content Analysis

- 1 drop of **Ammonia Nitrogen Activator** and 2 drops of **Ammonia Nitrogen Solution** were added to 5 mL of soil extract.
- The resulting color change was analyzed to determine the nitrogen concentration.

2.3.2 Phosphorus Content Analysis

- 1 drop of **Phosphorus Extractant Solution** was added to 5 mL of soil extract.
- The color change was analyzed to determine phosphorus concentration.

2.3.3 Potassium Content Analysis

- **Potassium Extractant Solution** was added to 5 mL of soil extract.
- The color change was analyzed to determine potassium concentration.

2.3.4 Soil pH Analysis in Solution

- **pH Test Solution** was added to 5 mL of soil extract.
- The color change was analyzed to determine the pH level of the soil solution.

Materials and Equipment Used in the Research

1. Beaker
2. Thermometer
3. Richmoto analog soil meter
4. Soil test kit for **pH** and **NPK** analysis
5. Test tubes
6. Glass stirring rod

3.1 Results of Soil Physical Properties Analysis After Harvest

Table 1: Soil Temperature Analysis in Paddy Fields (Lamoh Subdistrict, Nayong District, Trang Province)

place	1 st	2 nd	3 rd	average
Paddy field	28	27	27	27.33
Upland rice field	31	30	31	30.67

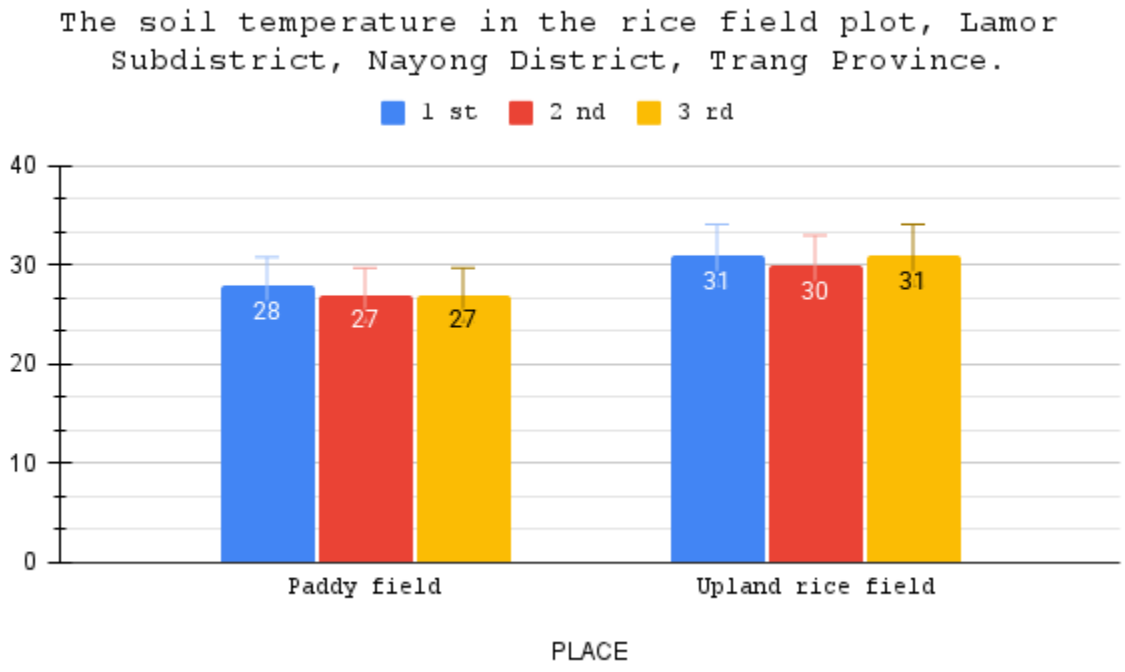

Figure 1 Graph comparing soil temperature in lowland and upland areas during cultivation and after harvest.

Table 2: Analysis of Soil Physical Properties in Paddy Fields (Lamoh Subdistrict, Nayong District, Trang Province)

Physical Properties	Paddy field		Upland rice field	
	During planting	After harvesting	During planting	After harvesting
Temp.(℃)	27.0	26.0	28.0	27.0
Time	2.46 P.M.	2.54 P.M.	9.36 A.M.	10.00 A.M.
Light intensity in soil (LM)	350	350	1800	1000
Moisture (level)	7.0	8.0	8.0	8.5
pH value	8.0	8.0	8.0	8.0
The color of the soil particles	-	 Gray	-	 Brown

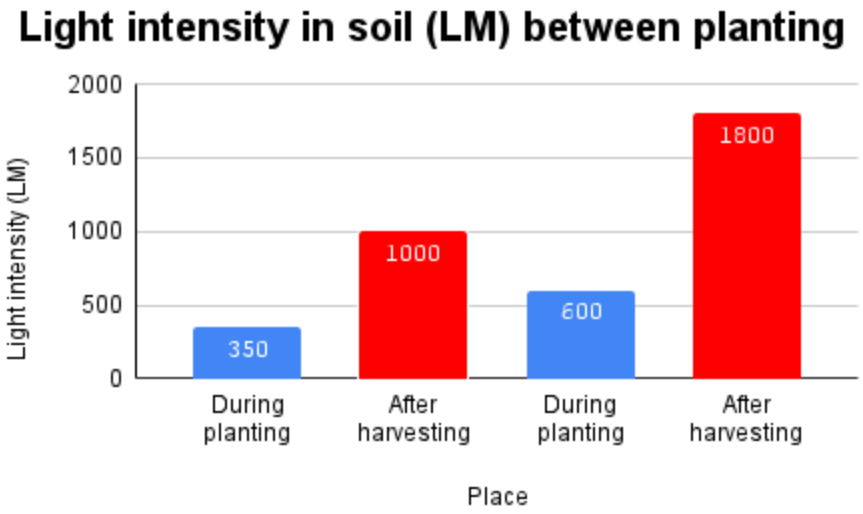

Figure 3 Graph comparing soil light intensity in lowland and upland areas during cultivation and after harvest.

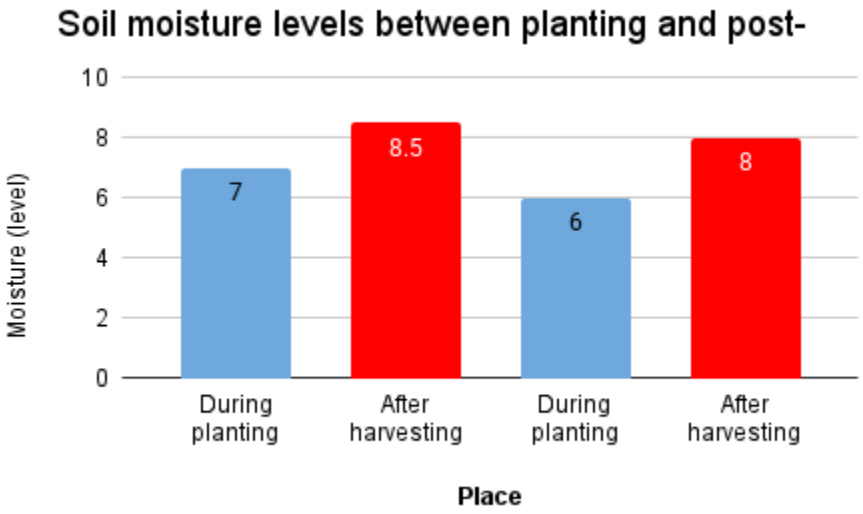

Figure 4 Graph comparing soil moisture content in lowland and upland areas during cultivation and after harvest.

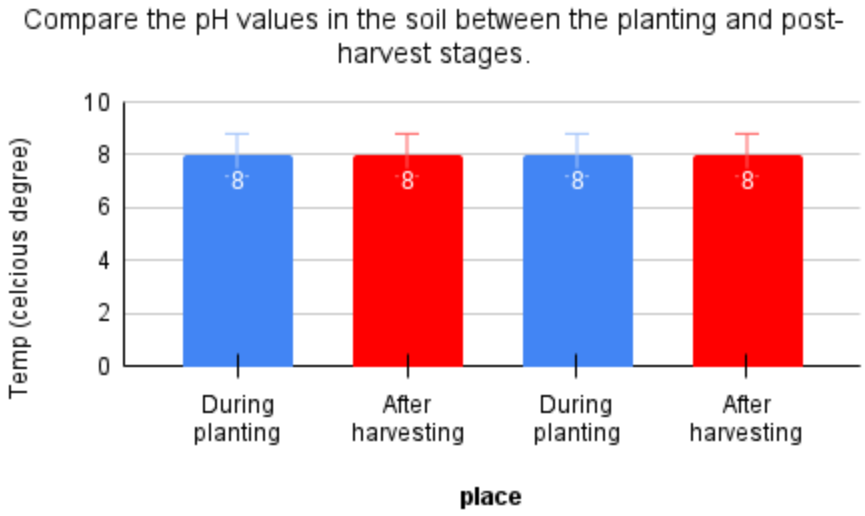

Figure 5 Graph comparing soil pH levels in lowland and upland areas during cultivation and after harvest.

3.2 Soil Chemical Properties

The chemical properties of the soil were analyzed during the cultivation period (December 2024) and after harvest (January 2025) in the paddy fields of Lamoh Subdistrict, Nayong District, Trang Province.

Table 3: Analysis of Soil Chemical Properties in Paddy Fields (Lamoh Subdistrict, Nayong District, Trang Province)

	Paddy field		Upland rice field	
Chemical Properties	During planting	After harvesting	During planting	After harvesting
pH value	**8.0**	**8.0**	**8.0**	**8.0**
Nitrogen content (%m/m)	**5**	**10**	**10**	**10**
Phosphorus Content (mg/kg)	**60**	**120**	**120**	**50**
Potassium Content (mg/kg)	**35**	**50**	**50**	**20**

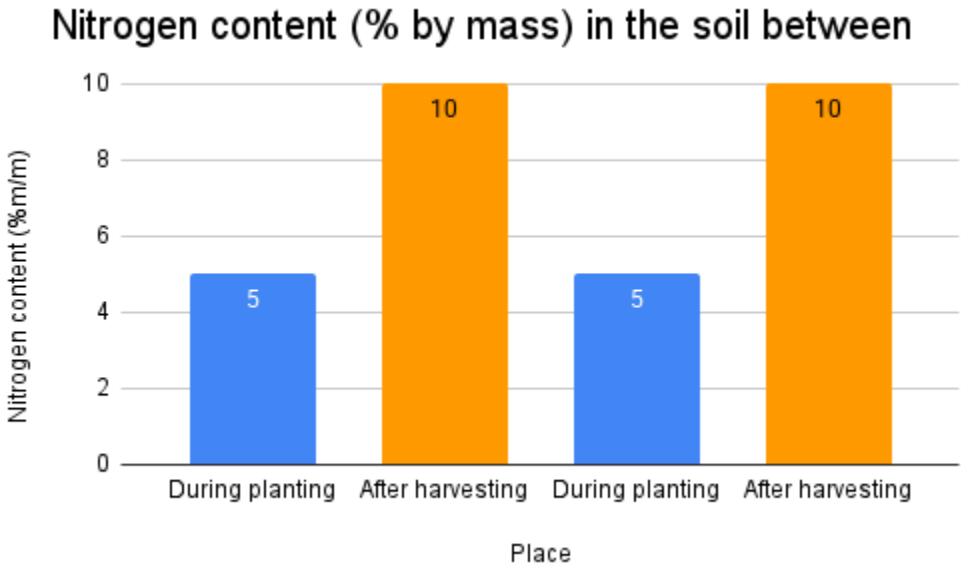

Figure 6 Graph comparing the percentage of nitrogen in soil between lowland and upland areas during cultivation and after harvest.

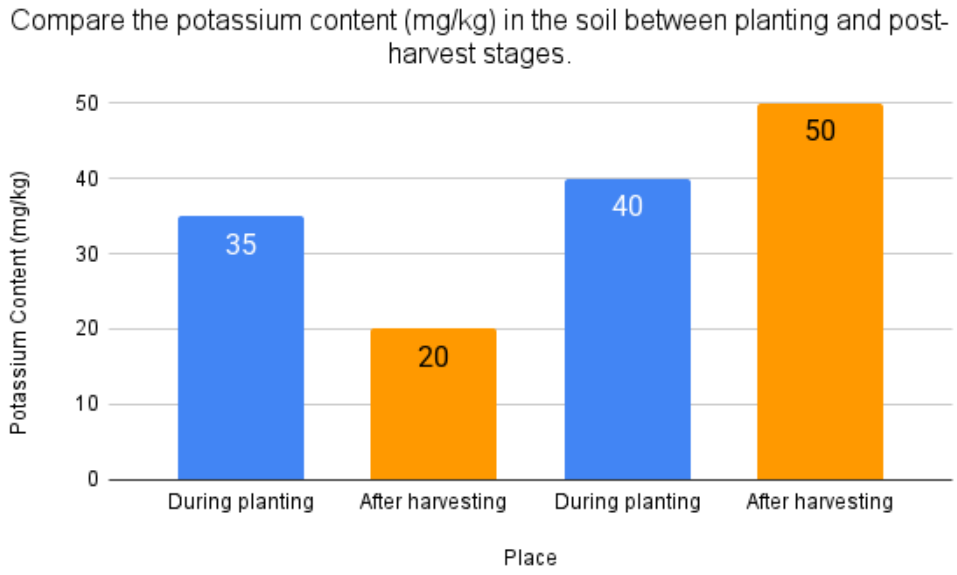

Figure 7 Graph comparing the potassium content in soil between lowland and upland areas during cultivation and after harvest.

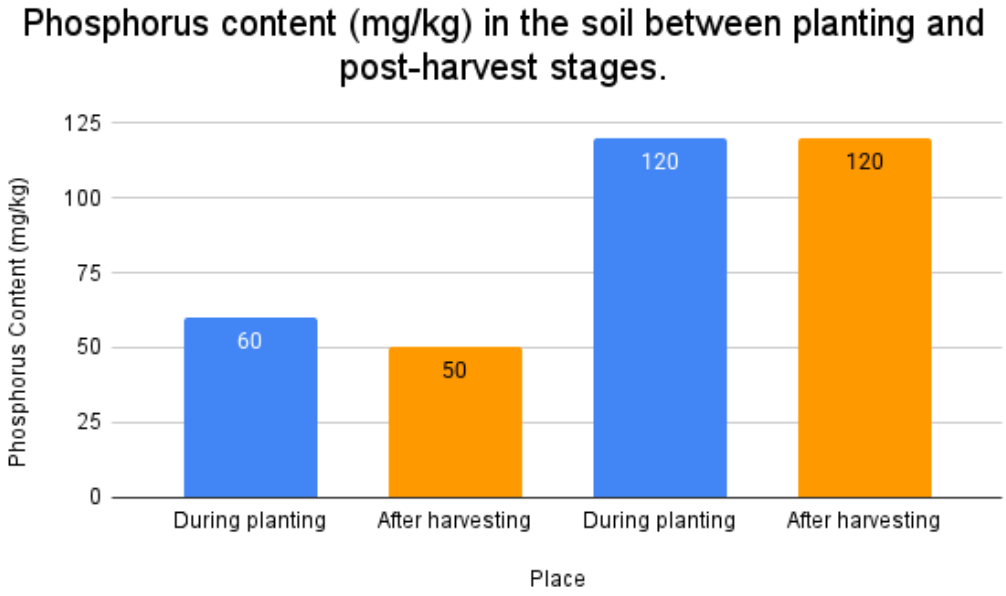

Figure 8 Graph comparing the phosphorus content in soil between lowland and upland areas during cultivation and after harvest.

3.3 Jasmine Rice Yield

Table 4: Yield of Jasmine Rice After Harvest in Paddy Fields (Lamoh Subdistrict, Nayong District, Trang Province)

Place	Sack quantity	kilograms
Paddy field	31	1,240.00
Upland rice field	22	880.00

Note:

Each sack weighs approximately 40 kilograms.

Research Summary

Part 1: Physical Properties of Soil in Paddy Fields (Lamoh Subdistrict, Nayong District, Trang Province)

The study of soil physical properties revealed that the lowland paddy field had clay-textured soil. After sun-drying for 3-4 days, the soil was ground into a fine texture (Land Development Science Bureau, 2004; Land Development Department, n.d.). The soil particles exhibited a gray color, with an in-field soil temperature of 27°C, moisture level 7, and light intensity 1,200 LM.

The upland paddy field also had clay-textured soil, which, after sun-drying and grinding, appeared brown. The in-field soil temperature was 27°C, moisture level 7.75, and light intensity 675 LM.

Part 2: Chemical Properties of Soil in Paddy Fields (Lamoh Subdistrict, Nayong District, Trang Province)

The study analyzed pH levels, nitrogen, phosphorus, and potassium content. The results showed that soil in both the lowland and upland paddy fields had a basic pH of approximately 8.0.

- Lowland paddy field soil contained 7.5% nitrogen by mass, 100 mg/kg phosphorus, and 45 mg/kg potassium.

- Upland paddy field soil contained 7.5% nitrogen by mass, 55 mg/kg phosphorus, and 27.5 mg/kg potassium.

Part 3: Jasmine Rice Yield in Paddy Fields (Lamoh Subdistrict, Nayong District, Trang Province)

- Lowland paddy field: 31 sacks (1,240 kg).
- Upland paddy field: 22 sacks (880 kg).

Discussion

The study of physical and chemical properties of soil in lowland and upland paddy fields during and after the rice cultivation period in Lamoh Subdistrict, Nayong District, Trang Province showed that the circulating irrigation system caused fertilizers and dissolved nutrients from upland areas to flow down to the lowland fields. This resulted in higher rice yield in lowland areas compared to upland areas.

Jasmine rice typically grows best in slightly acidic soil and requires about four months (120 days) for cultivation. However, this study found that both soil samples had a pH of 8 (alkaline). This alkaline condition might have resulted from fertilizer application and incomplete nutrient dissolution. Despite this, the rice still grew successfully within three months (90 days).

Recommendations

The study found that lowland fields with a circulating irrigation system tend to accumulate essential fertilizers, increasing rice yield. To prevent nutrient loss from upland fields, additional measures such as constructing bunds (levees) or calculating water flow rates should be considered to reduce fertilizer runoff and maximize plant nutrient retention.

Acknowledgments

The researchers would like to express gratitude to:

- Ms. Wannalee Srichai, Principal of Sawat Rattanaphimuk School, for facilitating the field study and providing access to necessary equipment.
- Mr. Rabiab Chairat, a local farmer and agricultural expert, for granting access to the rice fields and sharing valuable insights.
- Ms. Sirikwun Nuphutti, teacher at Princess Chulabhorn's College Trang, for guidance on data collection methods.
- Mr. Tullawat Ketwaraporn, researcher from Chiang Mai University, for assisting in soil sample collection and chemical analysis techniques.
- Ms. Kamolpan Anglong, teacher at Amartpanichnukul School, for helping with the research paper structure and proofreading.

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