Abstract

Research Title : Study of the impacts of rice cultivation on soil and water in Moo 7, T. Nangam , A. Mueang , Trang Province.

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The objective of this study is to compare the soil quality in rice fields, as well as the water quality in nearby water sources and within the rice fields, both before and after rice cultivation, in terms of physical and chemical properties in Moo 7, T. Nangam , A. Mueang , Trang Province. Data was collected from June 11, 2024, to January 31, 2025, to study soil quality (pH, electrical conductivity, salinity, organic matter, nitrogen, phosphorus, potassium) and water quality (temperature, nitrate, phosphate, oxygen, salinity). The results showed that during the rice cultivation period, the soil quality was slightly higher than before cultivation, with an average nitrogen level of 5.33 mg/L, phosphorus averaging 0.67 mg/L, and potassium averaging 17.11 mg/L. Electrical conductivity had an average of 0.10 cos, and salinity averaged 60.44 ppm. The pH values ranged from 5.44 to 6.44. After the rice harvesting period, it was found that electrical conductivity, salinity, and organic matter in the soil tended to increase, while nitrogen and potassium levels showed a tendency to decrease. The water quality in the rice fields during the cultivation period showed an average pH range of 5.33 to 7.0, with an average salinity of 73.50 ppm, nitrate averaging 0.5 mg/L, and phosphate averaging 0.28 mg/L. The water quality in nearby water sources during rice cultivation showed an average pH of 7.5, with an average salinity of 54.67 ppm and phosphate averaging 0.33 mg/L. After harvesting, the water quality in both the rice field water and nearby water sources showed an increasing trend in pH, salinity, and phosphate levels.

Keyword : Soil Quality ; Water Quality ; Rice field

Introduction

Rice farming is one of the important agricultural activities that has long been closely tied to Thai people. Today, rice cultivation still plays a vital role in the economy of Thailand, particularly in Southeast Asia. Rice farming requires the use of water to nourish the rice plants, as well as the application of chemical fertilizers and pesticides to promote growth and increase yields. Before harvesting, water is drained from the rice fields, which causes pollutants in the water—such as suspended solids, nitrogen, BOD (biochemical oxygen demand), phosphorus, and pesticides—to be released into surrounding water sources.

Trang province still practices rice in Moo 7, T. Nangam , A. Mueang , Trang Province., a long-established agricultural region. This has led to the need for studies on the impact of rice cultivation on both soil and water quality, comparing water quality in the rice fields and nearby water sources before and after cultivation.

Objective of the research

1.Compare soil quality before and after rice cultivation (June - January) in Moo 7,
T. Nangam , A. Mueang , Trang Province.

2. Compare the water quality in nearby water sources and the water in the rice fields before and after rice cultivation (June - January) in Moo 7,
T. Nangam , A. Mueang , Trang Province.

3. To study the impact of soil and water quality before and after rice cultivation (June - January) in Moo 7, T. Nangam , A. Mueang , Trang Province.

Research Question

1. Soil quality in Moo 7, T. Nangam , A. Mueang , Trang Province. Is there any change in soil or water quality before and after rice cultivation, and if so, what are the changes?

2. Water quality in nearby water sources and water in Moo 7, T. Nangam , A. Mueang , Trang Province. Is there any change in water quality in nearby water sources and rice field water before and after rice cultivation, and if so, what are the changes?

3. Rice cultivation in Moo 7, T. Nangam , A. Mueang , Trang Province. Does it impact the physical and chemical quality of soil and water, and if so, how?

Research hypothesis

1. Soil quality will decrease after rice cultivation due to the use of soil nutrients and the application of agricultural chemicals, such as chemical fertilizers and pesticides.

Independent variable: Minerals and chemicals in the soil from agriculture

Dependent variable: Soil quality

Controlled variable: Study area in Moo 7, T. Nangam , A. Mueang , Trang Province. equipment and tools.

2. The water quality in nearby water sources and the water in the rice fields will change after rice cultivation, with water in the fields having lower quality compared to before cultivation. This is due to the use of fertilizers and chemicals in rice farming, which may increase the levels of toxins or nutrients in the water.

Independent variable: The use of fertilizers and chemicals in rice cultivation

Dependent variable: Water quality in nearby water sources and in the rice fields

Controlled variable: Study area in Moo 7, T. Nangam , A. Mueang , Trang Province. equipment and tools

3. The water quality in the rice cultivation area will decrease after rice farming due to contamination from agricultural chemicals such as pesticides, chemical fertilizers, or herbicides.

Independent variable: Concentration of contaminants

Dependent variable: Water quality

Controlled variable: Study area in Moo 7, T. Nangam , A. Mueang , Trang Province. equipment and tools.

Materials and equipment, and research methodology

1) Water in the rice fields at 3 points: upstream, midstream, and downstream.
2) Soil samples from 3 plots, with 3 points per plot.
3) Field guide for soil texture classification by tactile method.
4) Nitrate Test Kit HI3874
5) DO test kit
6) Thermometer
7) NPK Soil Meter
8) Soil structure plate
9) Salinity meter
10) Hanna Phosphate Test kit
11) Beaker
12) glass stirring rod

13) Distilled water
14) pH meter
15) Laboratory Balance
16) Filter funnel and Filter paper
17) Soil organic Matter test kit

Determination of study sites

Rice field in Moo 7, T. Nangam , A. Mueang , Trang Province 92000 "The fieldwork will be conducted in three phases: before rice cultivation, during cultivation, and after harvesting. Soil samples will be collected at 9 points each time, at a depth of 5-10 cm. Water samples will be taken from nearby sources at the headwater, midstream, and downstream, with a 3-meter distance between each sampling point and water samples will be collected from the rice field water during the cultivation period. Two sampling points will be taken from each of the three plots, with a 1.5-meter distance between each point. The sampling period will be from June 11, 2024, to January 31, 2025
(7 months and 20 days).

Research Implementation Method

1. Preparation Phase
 1) Define the research topic and select the subject to be studied
 2) Conduct a literature review and gather relevant knowledge and theories related to the research
 3) Define the objectives of the study
 4) Determine the sampling points within the study area
2. Steps of Implementation
 1) Plan the research operation.
 2) Conduct a site survey.
 3) Collect soil and water samples from the selected areas to analyze and measure various factors affecting soil and water quality for farming. Factors related to the study and measurement to be analyzed within the soil include Temperature , pH (acidity and alkalinity) , Electrical conductivity , Salinity , Nutrient levels (Nitrogen, Phosphorus, Potassium - N/P/K) , Organic matter in the soil , Dissolved Oxygen (DO) ,
Nitrate , Phosphate

Methodology for testing Globe

pedosphere Soil

Hydrosphere

➢ **Section 1: Comparative Study and Analysis of Soil Quality Before and After Rice Cultivation in Terms of Physical and Chemical Properties**

1) Define the water sampling points and survey the water sources.
2) Collect samples once a month. Soil samples will be taken from 3 plots, with 3 points in each plot. The soil samples at each point will be collected at a depth of 5-10 centimeters.

Soil quality assessment in rice fields

Check the pH (acidity-alkalinity) level

1) Calibrate the pH meter before use.
2) Mix the soil sample with distilled water in a 1:1 ratio and place it in a beaker.
3) Immerse the pH meter electrode into the water from the soil sample (after the soil has settled), ensuring that the water covers the pH meter's sensor bulb.
4) Wait for the reading on the pH meter to stabilize. Record the measured pH value.

Checking the Nutrient Levels (NPK) in the Soil

1) Mix the soil sample with distilled water in a 1:1 ratio and place it in a beaker.
2) Immerse the NPK Soil Meter into the soil-water mixture.
3) Wait for the reading on the NPK Soil Meter to stabilize. Record the measured NPK values.

Checking the Soil Salinity

1) Mix the soil sample with distilled water in a 1:1 ratio and place it in a beaker.
2) Immerse the Salinity Meter probe into the water sample, ensuring that the water level covers the sensor bulb of the Salinity Meter.
3) Wait for the reading on the Salinity Meter to stabilize. Record the measured salinity value.

Checking Electrical Conductivity (EC)

1) Mix the soil sample with distilled water in a 1:1 ratio and place it in a beaker.
2) Immerse the Conductivity Meter probe into the soil-water mixture, ensuring that the water level covers the sensor bulb of the Conductivity Meter.
3) Wait for the reading on the Conductivity Meter to stabilize. Record the measured electrical conductivity value.

Checking Soil Organic Matter (SOM) Using a Soil Organic Matter Test Kit

1) Grind the soil sample finely using a mortar and pestle.
2) Use a spoon to measure a full scoop of the finely ground soil, tapping gently, and level it off before transferring it to the reaction bottle.
3) Add the provided reagent into the reaction bottle, then shake the bottle gently for 5 minutes to mix the soil with the reagent.
4) Add 30 milliliters of water to the bottle, then let the soil settle at the bottom for 10-20 minutes.
5) Compare the color of the solution with the provided color chart to determine the % Organic Matter (OM) in the soil.

➢ **Section 2: Comparative Study and Analysis of Water Quality Before and After Rice Cultivation in Terms of Physical and Chemical Properties.**

1) Define the water sampling points and survey the water sources.
2) Collect water samples once a month, with 3 sampling points in total, divided into upstream, midstream, and downstream locations, with a 3-meter distance between each point.
3) Collect water samples from the rice fields during the rice cultivation period (November - December).
4) Collect water samples from 3 plots, with 3 points per plot, totaling 600 milliliters per sample.

Water Quality Assessment in Rice Fields and Nearby Water Sources.

Check the pH (acidity-alkalinity) level

1) Calibrate the pH meter before use.
2) Take 20 milliliters of the water sample and pour it into a beaker.
3) Immerse the pH meter electrode into the water sample, ensuring that the water level covers the pH meter's sensor bulb.
4) Wait for the reading on the pH meter to stabilize. Record the measured pH value.

Measuring Dissolved Oxygen (DO) in Water

1) Rinse the sample collection bottle underwater 2-3 times, then fill it with water completely. Close the cap underwater to avoid air being trapped, and ensure there are no air bubbles in the sample.
2) Slowly open the cap, then add 2 drops of Reagent #1 and 2 drops of Reagent #2. Close the cap carefully, making sure no air bubbles enter the bottle.
3) Shake the bottle gently. A yellow-brown precipitate will form, indicating the presence of dissolved oxygen in the water.
4) Wait for the precipitate to settle to about half of the bottle.
5) Open the cap and add 5 drops of Reagent #3 to the sample, then close the cap carefully to avoid air entering. Shake the bottle to mix thoroughly and wait until the precipitate dissolves completely, causing the sample to turn yellow.
6) Pour the sample from step 5 into a new test tube up to the 5 mL mark.
7) Add Reagent #4 drop by drop, shaking gently after each drop. Count the number of drops used. When the sample turns a pale yellow, add 2 drops of Reagent #5. The sample will change to blue. Continue adding Reagent #4 drop by drop, counting the number of drops, until the sample turns colorless.
8) Record the total number of drops used and use the table to determine the oxygen concentration in milligrams per liter (mg/L).

Measuring Nitrate in Water

1) Add 1 milliliter of the water sample into a test tube or container add 4 drops of reagent #1 to the sample.
2) Add 1 spoonful of reagent #2 (using the spoon provided in the test kit) to the water sample.
3) Gently shake the mixture for about 30 seconds. Then, let the mixture settle and wait for about 3 minutes for the reaction to complete.
4) Compare the color of the water sample with the color chart provided in the test kit to determine the nitrate concentration.

Measuring Phosphate in Water

1) Clean the glass bottle before conducting the test, then pour 10 mL of the water sample into the bottle.
2) Add Reagent #1 to the bottle (6 drops), then shake the bottle to mix the contents thoroughly.

3) Add Reagent #2 to the bottle (6 drops), then shake the bottle again to ensure the mixture is well-blended.
4) Add Reagent #3 powder to the bottle (1 spoonful, leveled). Close the cap tightly and shake vigorously to ensure the reagent dissolves properly.
5) Open the bottle cap and wait for 5 minutes. Then, compare the color of the sample with the color chart, using the "10 mL + 0 mL" reference to determine the result. If the color turns dark green, the phosphate concentration is 2 mg/L.
6) Clean the glass bottle with the same water sample that is being tested. Then, add 5 mL of the test solution and 5 mL of distilled water into the bottle.

Measuring Salinity of Water

1) Add 20 milliliters of the water sample into a beaker.
2) Submerge the probe of the Salinity Meter into the water sample, ensuring that the water completely covers the probe.
3) Wait for the reading on the Salinity Meter to stabilize. Once it does, record the salinity value displayed on the screen. This is the salinity level of the water sample.

3. Data Analysis and Research Conclusion

1) Analyze and compare the data from the experiment to identify relationships, using statistical methods for data analysis.

2) Create graphs to show the average comparison of the data.

3) Summarize the experimental results.

Research results

Geographic coordinates Conduct a study on rice fields in Moo 7, T. Nangam , A.Mueang , Trang Province. The coordinates are as shown in Table 1.

Table 1: Geographic Coordinates

Study site and collection of soil and water samples	Geographic Coordinates	
	Latitude (N)	**Longitude (E)**
rice fields in Moo 7	7.5752601	99.6532049

Figure 1 shows the map of the water and soil sample collection points at Ban Suan 75/5, Moo 9, Ko Klo Subdistrict, Mueang District, Trang Province.

Source: Map application on the iOS system.

Results of the Study

1. Soil Quality: Physical and Chemical Properties

Table 1: Details of Soil Sample Collection and Analysis in Rice Fields at Moo 7, T. Nanagm , A. Mueang, Trang Province

Quality of soil in rice fields								
Survey time	pH	Electrical conduc-tivity (ms)	Salinity (ppm)	degree	Organic matter (%)	Nitrogen (mg/l)	Phospho-rus (mg/l)	Potassium (mg/l)
11 June 2024 (Before rice farming)	6.24±0.4	0.00±0	0.00±0	29.79±0.7	2.40±0.9	0.22±0.4	0.11±0.3	1.89±1.3
7 November 2024 (During rice farming 1)	6.44±0.5	0.06±0.05	38.2±23.4	27.46±0.85	2.67±0.82	0.67±0.5	0.67±0.5	3±1.41

8 December 2024 (During rice farming 2)	5.44±0.5	0.10±0	60.44±13.21	28.33±0.3	2.58±0.9	5.33±2.9	0.6±2.4	17.11±8.3
31 January 2025 (After rice farming)	6.27±0.2	0.06±0.05	46.22±17.6	30.44±2.7	3.40±0.2	0.11±3.0	0.11±0.3	1.56±1.5

Based on Table 1, the soil analysis results for the rice fields in Village 7, Na Ngam Sub-district, Mueang District, Trang Province, are as follows: pH (Acidity-Alkalinity): The soil's pH values range from 5.44 to 6.44. During rice cultivation, the soil exhibited higher acidity, with the lowest pH recorded at 5.44. Electrical Conductivity (EC): The EC values range from 0.00 to 0.10 mS/cm. The highest conductivity during cultivation was 0.10 mS/cm. Salinity: Salinity levels range from 0.00 to 60.44 ppm. The maximum salinity observed during cultivation was 60.44 ppm. Organic Matter (OM): Organic matter content ranges from 2.40% to 3.40%. The highest value of 3.40% was recorded after cultivation. Plant Nutrients:Nitrogen (N): Concentrations range from 0.11 to 5.33 mg/L, with the highest value of 5.33 mg/L observed during cultivation.Phosphorus (P): Levels range from 0.11 to 0.67 mg/L, with a maximum of 0.67 mg/L during cultivation.Potassium (K): Values range from 1.56 to 17.11 mg/L, with the highest concentration of 17.11 mg/L recorded during cultivation. These findings indicate that during rice cultivation, the soil exhibited increased acidity, electrical conductivity, salinity, and nutrient concentrations. Post-cultivation, organic matter content was at its peak, suggesting that rice farming practices influence both the chemical and physical properties of the soil.

Table 2: Details of Soil Sample Collection and Analysis in Rice Fields at Moo 7, T. Nangam, A. Mueang, Trang Province

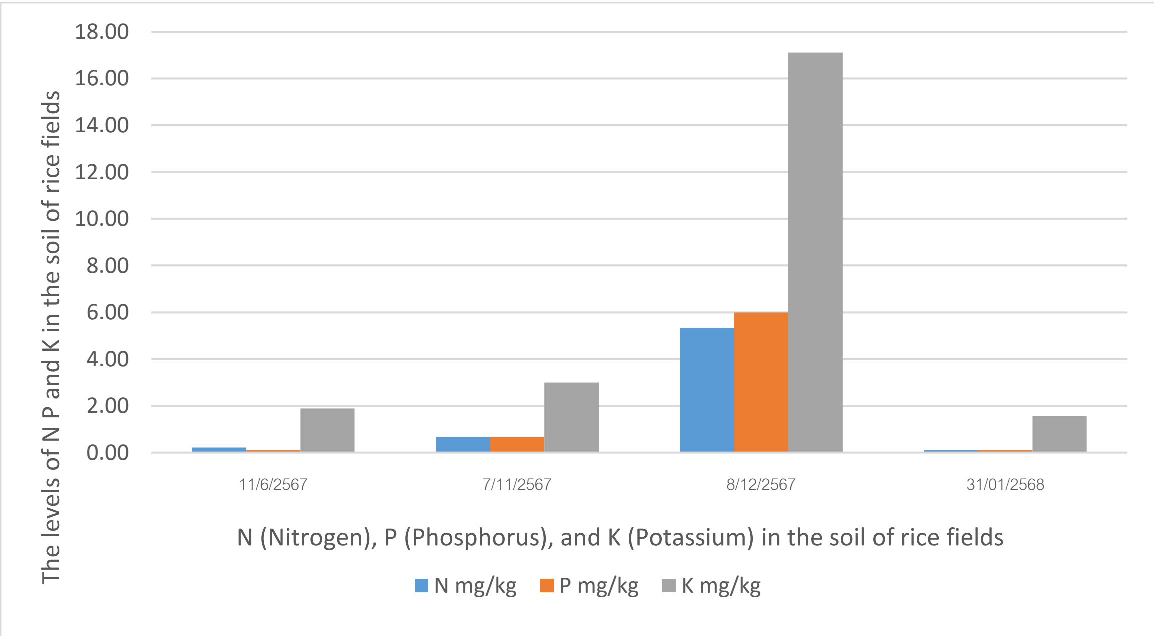
Soil structure								
Field 1			Field 1			Field 1		
Plot 1	Plot 2	Plot 3	Plot 1	Plot 2	Plot 3	Plot 1	Plot 2	Plot 3
Clay loam	Clay loam	Clay loam mix loose soil	Clay loam mix loose soil	Clay loam mix loose soil	Clay loam	Clay loam	Clay loam	Clay loam mix loose soil

According to Table 2, the analysis of soil structure in rice fields using tactile field classification revealed similarities between Plot 1 and Plot 3. Both plots predominantly consist of clay loam soil, with portions of silty clay loam. In contrast, Plot 2 is mainly composed of silty clay loam, with some areas of clay loam. This indicates that while all three plots primarily feature clay loam and silty clay loam soils, the proportions vary across each plot.

Graph showing the analysis of soil quality in rice fields

1.1 Nutrients

Graph 1 presents a comparison of nutrient levels—Nitrogen (N), Phosphorus (P), and Potassium (K) in the soil of rice fields.



It was found that the nutrient levels in the soil during rice cultivation tended to be higher than before planting. During cultivation, the average concentrations of nitrogen (5.33 mg/kg), phosphorus (6.0 mg/kg), and potassium (17.11 mg/kg) were higher compared to before and after cultivation. These nutrient levels showed a decreasing trend after the cultivation period.

1.2. Acidity-alkalinity (pH)

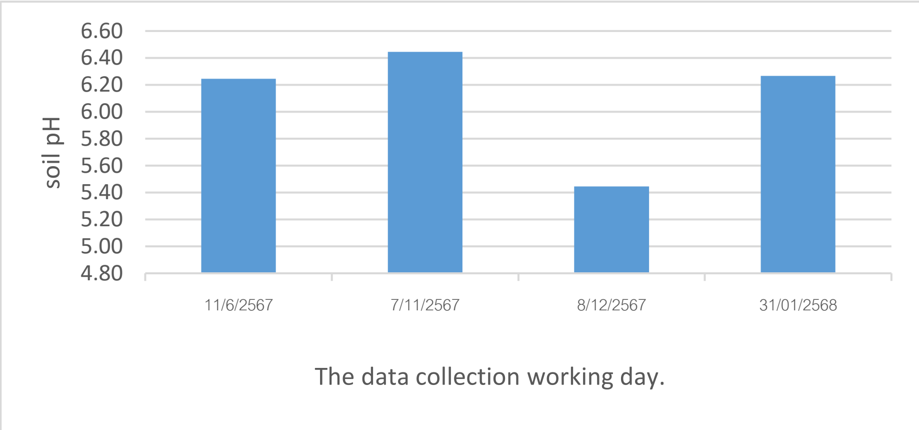
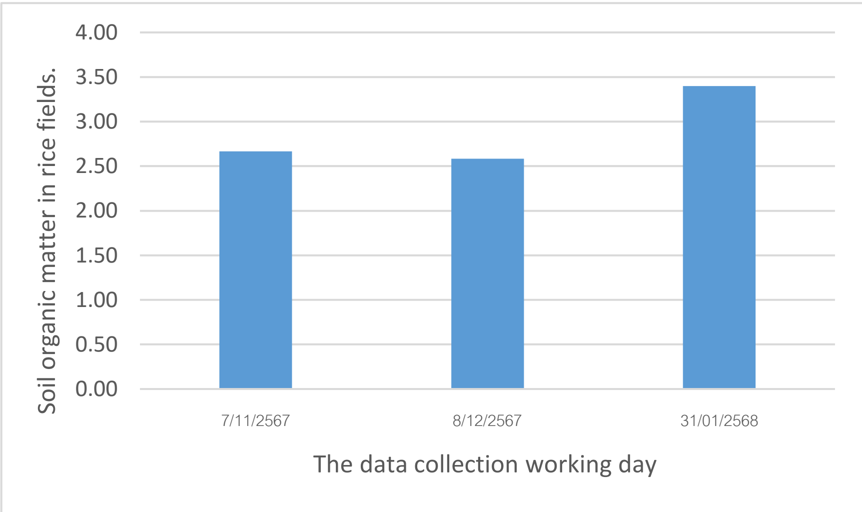


Figure 2 shows the comparison of acidity-alkalinity (pH) values. From the pH graph of the soil before and after rice cultivation, the average pH ranged from 6.24 to 6.44. During rice cultivation, the average pH decreased, reaching 5.44, indicating a higher acidity compared to before and after cultivation.

1.3.ปริมาณสารอินทรีย์ภายในดิน

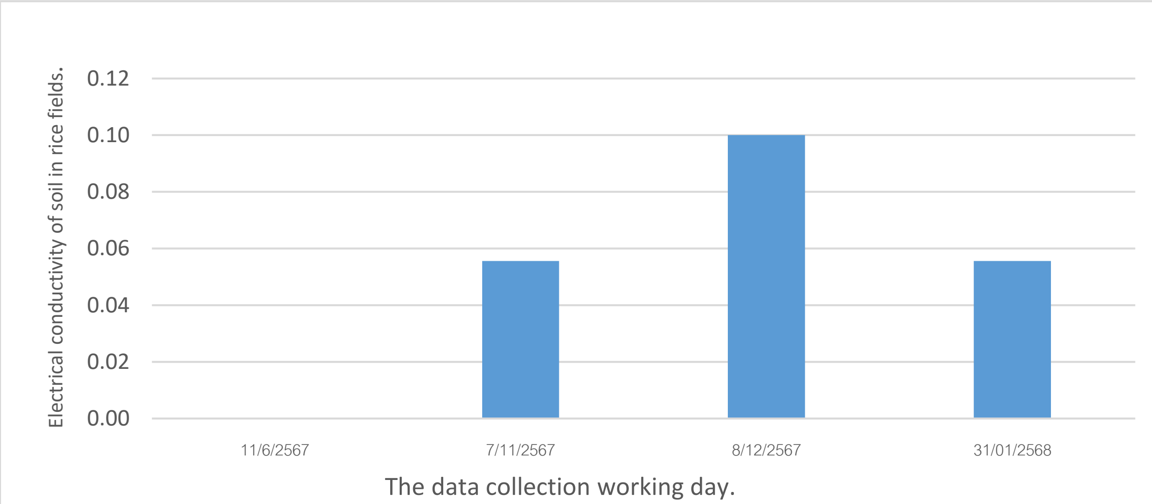


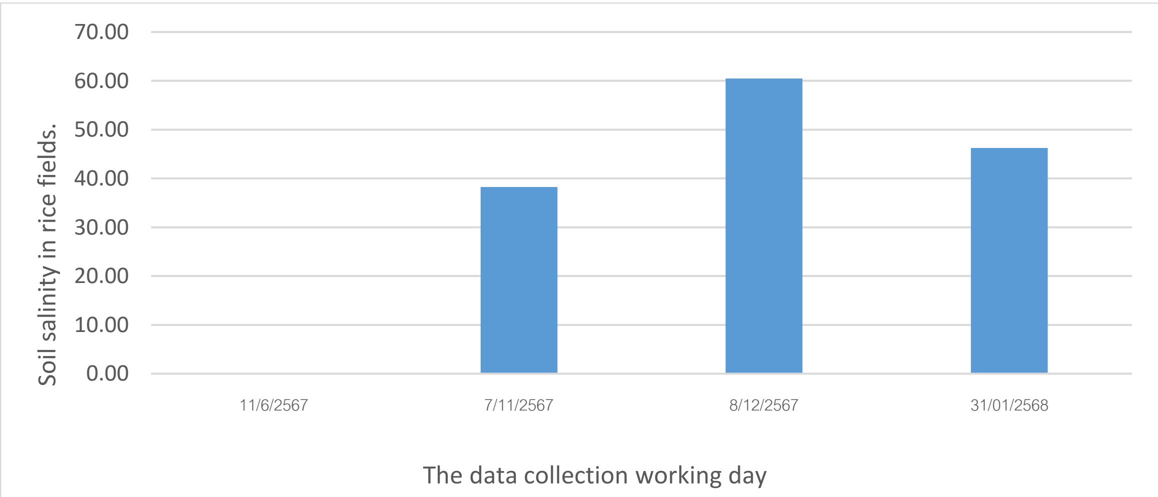
Graph 3 Organic matter concentration in soil (%)

The graph indicates that after rice cultivation, the organic matter content tends to increase, reaching an average of 3.40%. In contrast, before and during cultivation, the average organic matter content ranged between 2.58% and 2.67%.

1.4.Electrical Conductivity (EC) and Soil Salinity

The electrical conductivity (EC) value in soil correlates with the concentration of ions from dissolved salts, reflecting the soil's salinity level. These ions are primarily associated with mineral salts from agricultural chemicals. Monitoring EC and salinity is essential, as excessive salinity can adversely affect plant growth and soil health.





Graphs 4 and 5 show the values of Electrical Conductivity and Soil Salinity (ppm) in the soil. Analysis of the graphs indicates that during rice cultivation, the average electrical conductivity was high at 0.1, and the average soil salinity was 60.44 ppm.In contrast, after rice cultivation, the average electrical conductivity remained the same at 0.06, and the average salinity ranged between 38.22 and 46.22 ppm.

2. Physical and Chemical Quality of Water

Table 3 shows the analysis of water samples from a nearby water source near the rice fields at Moo 7, Nangam Subdistrict, Mueang District, Trang Province.

	water quality in the surrounding water sources					
Survey time	pH	Survey time	pH	Survey time	pH	Survey time
11 June 2024 (Before rice farming)	7±0	0±0	0±0	5±2	40±0	27.83±0.8
7 November 2024 (During rice farming 1)	7±0	0±0	0.25±0	4±1.3	54.24±2.34	26.67±0.6
8 December 2024 (During rice farming 2)	5±0	0±0	0.33±0.1	4.33±1.5	54.67±2.3	25.67±0.6
31 January 2025 (After rice farming)	7.57±0.2	0±0	0.23±0.2	6.67±1	54.00±8.7	20±0

From Table 3, it was found that before rice cultivation, the pH ranged around 7, with an oxygen concentration of 5 mg/L and an average water salinity of 40 ppm. During cultivation, the pH, water salinity, and phosphate levels increased, while the oxygen concentration decreased. After cultivation, the pH was 5.57, the average water salinity remained at 40 ppm, and the average phosphate level was 0.23 mg/L, which was higher than during cultivation. The highest oxygen concentration in water was found to be 6.67 mg/L.

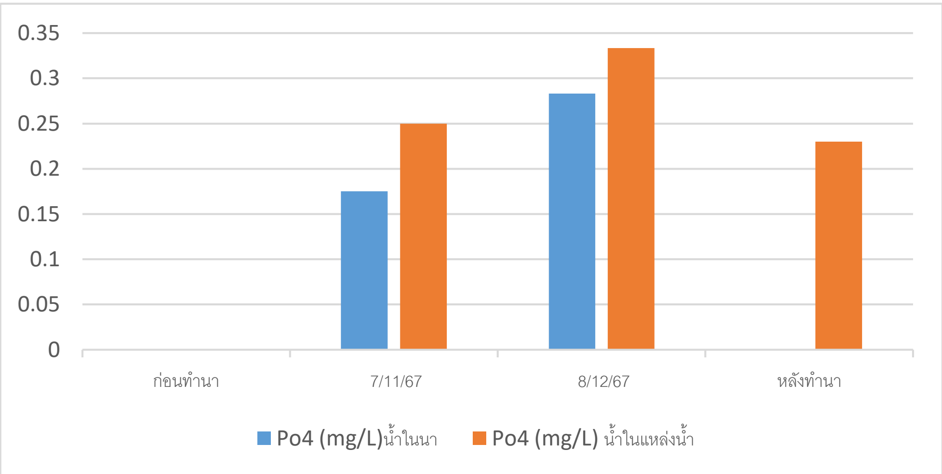
Table 4 details the storage and analysis of water samples from the rice field water in Moo 7, T. Nangam, A. Mueang, Trang Province.

	Water quality in the rice field water				
Survey time	**Degree (^{O}C)**	**Survey time**	**Degree (^{O}C)**	**Survey time**	**Degree (^{O}C)**
7 November 2024 (During rice farming 1)	27.08±1.02	7±0	63.17±46.05	0.5±1.22	0.18±0.08
8 December 2024 (During rice farming 2)	27.17±0.3	5.33±0.5	73.50±23.02	0.01±0.02	0.28±0.18

From Table 4, it was found that during rice cultivation, the pH ranged around 7, with an average soil salinity of 63.17 ppm. Nitrate had an average value of 0.5 mg/L, and phosphate had an average value of 0.18 mg/L. During cultivation, both water salinity and phosphate levels increased, with a pH of 5.33. Nitrate levels decreased to an average of 0.01 mg/L

Graph Comparison of water quality analysis between nearby water sources and water from the rice field.

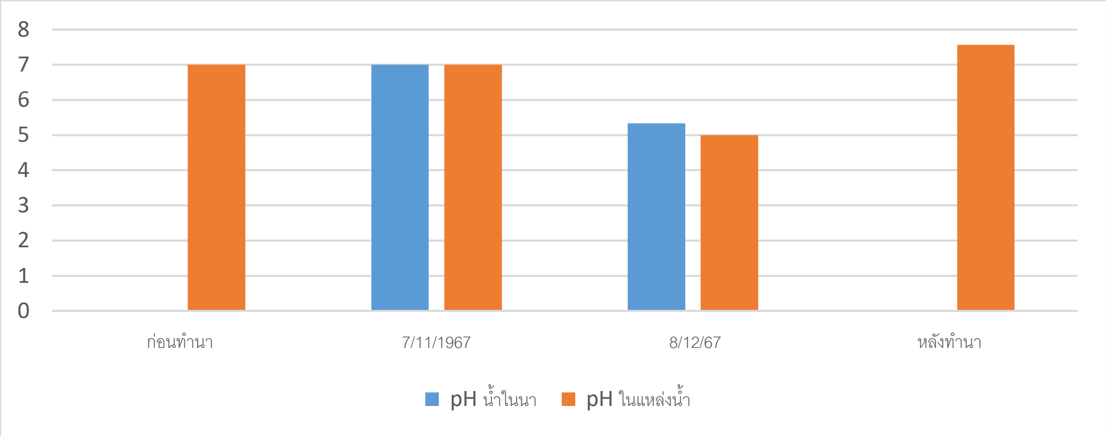
2.1. Phosphate levels in nearby water sources and rice field water.



Graph 7 compares the phosphate levels in nearby water sources and rice field water.

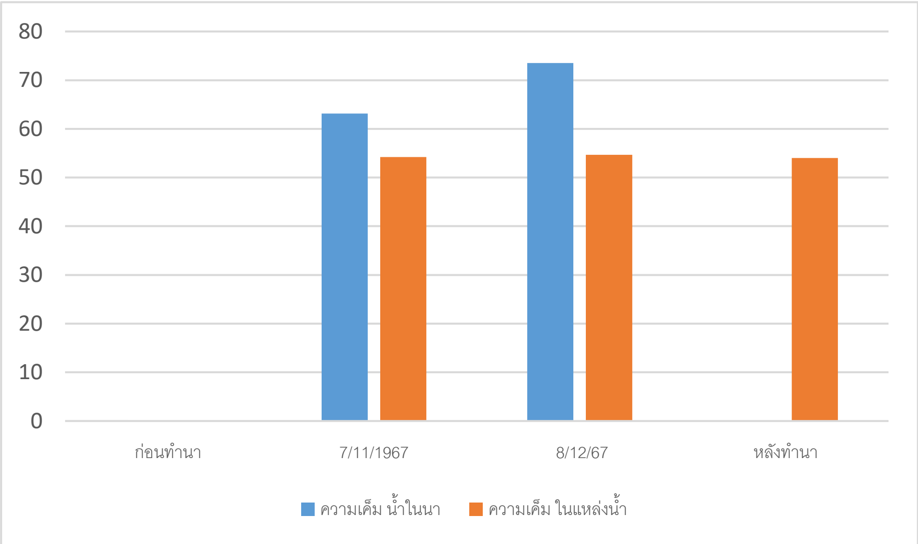
From the graph, it is observed that during rice cultivation, phosphate levels in both rice field water and nearby water sources tended to increase, averaging between 0.175-0.33 mg/L. After cultivation, the phosphate levels decreased, with an average ranging from 0.33-0.23 mg/L.

2.2. pH levels in nearby water sources and rice field water.



Graph 8 shows the comparison of pH levels in nearby water sources and rice field water. From the graph, the pH levels in both rice field water and nearby water sources during the first and second cultivation periods tended to decrease, averaging between 7-5.33 and 7-5, respectively. After cultivation, the pH levels in the nearby water sources increased, averaging between 5-7.6.

2.3. Salinity levels in nearby water sources and rice field wate



Graph 9 shows the comparison of salinity levels in nearby water sources and rice field water.

From the graph, the salinity levels in both rice field water and nearby water sources during rice cultivation tended to increase, ranging from 63.17-73.5 ppm and 54.24-54.67 ppm, respectively. After cultivation, the salinity levels in the nearby water sources decreased, averaging between 54.67-54 ppm.

Summary and Discussion of the Research Findings

1. The study aimed to examine the impact of rice cultivation on soil and water quality before and after cultivation (June to January) in Moo 7, T. Nangam, A. Mueang , Trang Province. The soil chemical properties investigated include pH, electrical conductivity, organic matter content, and the levels of primary nutrients such as nitrogen, phosphorus, and potassium.

The results showed that the soil from the rice field in Moo 7, T. Nangam, A. Mueang , Trang Province is moderately acidic (pH 6.27), which falls within the standard range (5.0-6.5). This pH level is considered suitable for crop cultivation (Department of Soil Science for Land Development, 2004). This finding aligns with the research conducted by Kanya Sittitho and colleagues (2014) and Piyaporn Srisom and colleagues (2017).

In terms of electrical conductivity, the soil in the rice field was found to be within the acceptable range, with a conductivity below 2 dS/m, indicating a low salt concentration that does not negatively affect plant growth (Department of Land Development, 2010).

Regarding organic matter content, the soil from the rice field in Moo 7 had 3.40% organic matter, which is considered high, and higher than the findings of Somkid Deejing and Warangkanan Sanguanpong (2015).

For the primary nutrients (nitrogen, phosphorus, and potassium), the study found that the levels of these nutrients were lower than in other studies, such as the work by Kanya Sittitho and colleagues (2014). Therefore, it is recommended to improve nitrogen levels by applying fertilizers such as compost, manure, or by cultivating leguminous plants, as nitrogen is a crucial nutrient required for plant growth in large amounts (Department of Soil Science for Land Development, 2004).

2. Water Quality in Nearby Water Sources:

The water quality analysis revealed that the pH and electrical conductivity in both the canal and rice field water in the area were similar. However, the rice field water showed higher salinity and more acidic pH levels compared to the water from nearby sources.

These results suggest that rice cultivation can impact water quality, particularly in terms of pH and salinity, due to the water’s exposure to fertilizers and other agricultural chemicals. Further measures may be required to monitor and maintain water quality for sustainable agricultural practices.

Acknowledgement

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References

Department of Land Development, Ministry of Agriculture and Cooperatives. (2010). *Manual for Chemical Soil Analysis Procedures. Available at:* https://www.ldd.go.th/PMQA/2553/Manual/OSD-03.pdf.

Kanya Sittitho, Chuanphit Jarat, Napaporn Kaenket, Prateep Duangwaew, Uruporn Boonman. (2014). *Study of Soil Quality in Rice Fields, Ta Tum District, Surin Province.* Kosit Sarn Science Journal, 36(1), 42-49.

Piyaporn Srisom, Jinda Sirita, Piyada Yotsuntorn, Walepan Rakitikun, Supawadee Kaewphama. (2017). *Evaluation of Soil Quality for Agricultural Use in Nanglae Village, Nanglae Subdistrict, Mueang District, Chiang Rai Province.* Kasalongkam Research Journal, 11(3), 61-68.

Patcharee Theerajindakhajorn. (2011). *Manual for Chemical Soil Analysis*. (3rd ed.). Khon Kaen: Khon Kaen University Press, 141-150.

Soil Science for Land Development, Department of Land Development. (2004). *Manual for Soil, Water, Fertilizer, Plant, Soil Amendments Sample Analysis and Standards Certification Procedures*. Available at: https://oer.learn.in.th/ebook/result/113553/176834#page/1.

Somkid Deejing and Warangkanan Sanguanpong. (2015). Evaluation of Soil Quality in Organic Rice Fields. The 11th Naresuan Research Conference Proceedings (pp. 150-156). Phitsanulok: Naresuan University.

Badge

I am a data scientist

We conducted field visits to collect data and soil and water samples in rice fields, Village 7, Na Ngam Subdistrict, Mueang District, Trang Province. The data were analyzed for soil nutrients, temperature and moisture measurements, sample collection, and oxygen measurements in water sources in rice fields and nearby water sources. The data were analyzed using in-depth analysis of data downloaded from the GLOBE soil and water databases. The data was collected, graphs and tables were created, and statistical/mathematical analysis was conducted appropriately. The data was presented in a format that illustrates the data and analysis, along with references from related research.

I am a collaborator

Our research team has a clear and efficient division of work. All members cooperate and do their assigned tasks to the fullest extent throughout the work. We emphasize unity and mutual assistance. When a problem occurs during work, we help each other solve it by brainstorming with everyone in the team. Therefore, we can successfully solve the problem. The problem that occurs will be an important experience in developing teamwork skills and developing ourselves to work effectively with others.

I make an impact

Our research team is interested in studying the physical and chemical characteristics of soil and water before, during, and after rice farming to compare each round. We go to the area where we want to study and collect soil and water samples or other related information, examine, analyze, and interpret the results to make them easier to understand so that the knowledge we study reaches farmers in that area. We also recommend solutions to farmers so that they can use the knowledge they have gained to improve their farming in the future..

Appendix


1.Field study at the rice field location in Moo 7, Nangam Subdistrict, Mueang District, Trang Province



2. Measure the soil temperature in the rice field before cultivation, during cultivation (1st and 2nd cycles), and after cultivation.


3. Measurement of NPK in the soil and electrical conductivity in the water source.

4. Measurement of organic matter in the soil.

5. Measurement of phosphate in the water source and rice field water.

6. Measurement of nitrate in the water source

7. Measurement of dissolved oxygen in the water source