Proposal Title: Comparing soil quality through the use of volcanic soil combined with organic fertilizers for soil improvement in the integrated organic farming garden.

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Abstract

Research comparing soil quality using volcanic soil combined with organic fertilizer to improve soil quality in mixed organic agriculture gardens according to the principles of the Royal Initiative of Her Royal Highness Princess Maha Chakri Sirindhorn, in Nayong District, Trang Province, aims to: 1) Study the physical characteristics of soil, soil moisture content, soil temperature, soil acidity, soil alkalinity, and nutrient content in soils using and not using volcanic soil combined with organic fertilizer to improve soil quality in mixed organic agriculture gardens. 2) Study the soil quality in mixed organic agriculture gardens using volcanic soil and organic fertilizer to improve soil quality during different time periods. The researchers were interested in studying the physical characteristics of soil, moisture, temperature, acidity-alkalinity, and soil nutrients as indicators of soil quality. It was found that before using volcanic soil combined with organic fertilizer, the soil was relatively acidic, the soil texture was dense, soil moisture was low, and soil nutrients were low. After using volcanic soil combined with organic fertilizer to improve soil quality in mixed organic agriculture gardens, there were differences, with the soil becoming less acidic, the soil texture becoming looser, soil moisture and soil nutrients increasing. The soil quality in mixed organic agriculture gardens using volcanic soil and organic fertilizer to improve soil quality during different time periods varied. During the period of soil improvement by adding volcanic soil, the soil became less acidic, moisture and soil temperature increased, and minerals, especially potassium, increased. After adding organic fertilizer, soil moisture and temperature

increased, nitrogen levels increased significantly, and when adding chemical fertilizer by 10%, the physical characteristics of the soil were good, with suitable moisture, acidity, alkalinity, and temperature. The soil became fertile.

Keywords: Organic Integrated Farming, Volcanic Soil, Organic Agriculture

Introduction:

Integrated farming following the Royal Agricultural Wisdom is a multi-faceted agricultural system in the same area. Each activity synergizes in a cycle, encompassing food, air, minerals, and energy, maximizing benefits and efficiency. The organic integrated orchard, inspired by the royal wisdom, operates as a community enterprise named " Aunt Saiyud Garden" in Noyong District, Trang Province. This integrated orchard faced initial challenges with acidic soil and mineral deficiencies, hindering initial plant growth. Applying the Royal Agricultural Wisdom, the soil was transformed using volcanic soil (50%), organic fertilizer (40%), and chemical fertilizer (10%) at different stages, enhancing soil quality. This resulted in the successful cultivation of various fruits, such as durian, crystallized Longan, Abiu Taiwan, and cocoa.Typically, durian trees yield fruit around 4-5 years of age, but in this integrated orchard, they bear fruit within 3 years. Crystal Longan trees usually yield fruit at 3 years, providing harvest in just 1 year and 8 months. Abiu Taiwan trees generally produce fruit at 1 year and 6 months, with a harvest period of 8 months. Cocoa trees usually yield fruit at 3 years, but in this system, they produce fruit at 2 years. This agricultural approach has proven successful in increasing income and reducing expenses.The researchers are particularly interested in studying factors related to soil quality, utilizing volcanic soil combined with organic fertilizer for soil improvement in the integrated organic orchard following the Royal Agricultural Wisdom. This study aims to provide valuable data for further application in community agricultural development, contributing to the overall success of agriculture in the region. The research focuses on environmental aspects, comparing soil quality using volcanic soil and organic fertilizer for soil enhancement in the integrated organic orchard following the Royal Agricultural Wisdom in Aunt Saiyud Garden, Nayong District, Trang Province.

Research Objectives:

1. To examine the physical characteristics of the soil, soil moisture content, soil temperature, soil pH, and nutrient elements in the soil, comparing the use of volcanic soil combined with organic fertilizer for soil improvement in the integrated organic orchard**.**

2. To assess soil quality in the integrated organic orchard using volcanic soil and organic fertilizer for soil enhancement at different time intervals.

Research Questions:

1. Are there differences in the physical characteristics of the soil, soil moisture content, soil temperature, soil pH, and nutrient elements in the soil when using volcanic soil combined with organic fertilizer for soil improvement in the integrated organic orchard compared to not using volcanic soil?

2. Does the soil quality in the integrated organic orchard differ when using volcanic soil and organic fertilizer for soil enhancement at different time intervals?

Research Hypotheses:

1. The physical characteristics of the soil, soil moisture content, soil temperature, soil pH, and nutrient elements in the soil differ before and after using volcanic soil combined with organic fertilizer for soil improvement in the integrated organic orchard.

2. The soil quality in the integrated organic orchard varies when using volcanic soil and organic fertilizer for soil enhancement at different time intervals.

Materials and Equipment Research Procedure:

1. Materials and Equipment:

- Soil color book
- Soil classification handbook
- Acidity-alkalinity testing kit
- Globe Observer Application
- Thermometer
- Universal soil corer
- Funnel
- Soil testing kit for NPK
- Digital soil meter
- Multifunctional measuring device
- Soil samples
- Auger
- Filtering paper
- Graduated cylinder

Research Procedure:

Study Area

Figure 1 shows the integrated organic orchard at Aunt Saiyud Garden

This research was conducted at Aunt Saiyud Garden orchard, Noyong District, Trang Province, located at coordinates 7.50905° N latitude and 99.71338° E longitude.

Steps in Research Procedure and Data Collection Soil Quality Data Collection Part 1: Studying the Physical Characteristics of Soil, Soil Moisture, Temperature, Acidity-Alkalinity, and Nutrient Content in Organic Integrated Farming

1. Collecting Soil Quality Data using GLOBE Protocol - Determine sampling points in the organic integrated farm at Aunt Saiyud Garden Select 5 areas: Point 1 - soil without volcanic rock and organic fertilizer, Points 2-5 - soil with volcanic rock and organic fertilizer. Different crops are planted in each area: Point 2 - Durian, Point 3 - Avocado, Point 4 - Crystal Lychee, and Point 5 - Cocoa. Collect soil samples at 3 points in each area, totaling 15 points.

2. Studying Soil Physical Characteristics Use CU Smart Lens to study soil structure. Examine soil texture and color by comparing them with soil maps and soil color books.

3. Measuring Soil Temperature Measure soil temperature at each point using a soil thermometer at a depth of 10 cm. Record data in triplicate.

4. Measuring Soil Moisture Use a soil moisture sensor at a depth of 5 cm. Record soil moisture data in triplicate.

5. Soil Sampling Collect soil samples at each point for laboratory analysis. Study soil properties such as pH, N, P, and K indices. Measure soil pH using indicator paper and N, P, and K values using a soil testing kit."

Part 2: Studying Soil Quality in Organic Integrated Farming using Volcanic Rock and Organic Fertilizer to Improve Soil Quality at Different Time Intervals

Define soil sampling in the organic integrated farming by using volcanic rock and organic fertilizer to improve soil quality at different time intervals as follows Time Interval 1 Adding volcanic rock at 50% on the 1st day of the month. Soil samples collected on the 8th of the month. Time Interval 2 Adding organic fertilizer at 40% on the 10th day of the month. Soil samples collected for analysis on the 17th of the month.Time Interval 3 Adding chemical fertilizer at 10% on the 20th day of the month. Soil samples collected for analysis on the 27th of the month. - Evaluate the physical characteristics of the soil, soil moisture, soil temperature, soil acidity-alkalinity, and nutrient content at different time intervals. Record and analyze the results."

Data Analysis:

1. Analyze soil data, including soil moisture, soil temperature, soil acidity-alkalinity, and nutrient content, using both mean values and standard deviations.

2. Evaluate soil quality in the organic integrated farming by using volcanic rock and organic fertilizer to improve soil quality at different time intervals. Compare soil quality differences over time using mean values and standard deviations.

Research Findings:

Comparison of soil quality using volcanic rock along with organic fertilizer to enhance soil quality in the integrated organic farm, following the agricultural principles of the royal garden at Aunt Saiyud Garden, Nayong Dis

Table displaying the physical characteristics of soil in the integrated organic farm at Aunt Saiyud garden.

Area of Study		Soil Structure	Soil Color	Soil Texture
Point 1 Area	of soil without volcanic soil and organic fertilizer use	Single grain	5R 6/3 Pale Red	Compact
Point 2 Area	of durian cultivation with volcanic soil and organic fertilizer use	Rounded clods	5R4/2 Weak Red	Loamy
Point 3 Area	of avocado cultivation with volcanic soil and organic fertilizer use	Rounded clods	5R3/4 Dusky Red	Loamy
Point 4 Area	for planting Crystal lychee with the use of volcanic soil and organic fertilizer	Round lump	5R 5/3 Weak Red	Loamy
Point 5 Area	for planting cocoa without the use of volcanic soil and organic fertilizer	Round lump	5R 7/3 Pale Red	Dense

Chart shows the temperature, pH, and soil moisture before and after using volcanic soil along with organic matter in the integrated organic farming garden at Aunt Saiyud Garden, Nayong District, Trang Province.

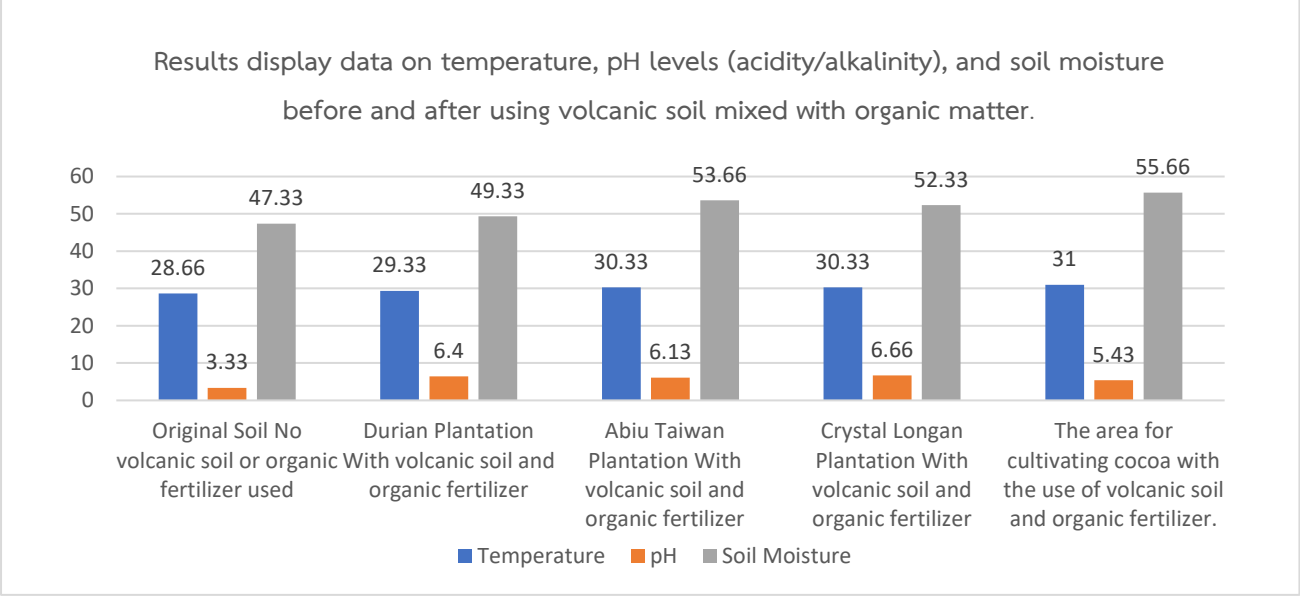


Table illustrates the primary nutrient elements after adding volcanic soil in the organic mixed farming garden at Aunt Saiyud Garden, Nayong District, Trang Province.

Study Area	Show the average quantity of mineral elements in the soil.											
	After use			After adding volcanic soil			After adding organic fertilizer			After adding chemical fertilizer		
	N	P	K	N	P	K	N	P	K	N	P	K
Durian Plantation With volcanic soil and organic fertilizer	2	2	3	2	2	3	2	3	3	3	2	1
Abiu Taiwan Plantation With volcanic soil and organic fertilizer	2	1	3	2	1	3	2	1	2	3	3	1
Crystal Longan Plantation With volcanic soil and organic fertilizer	2	1	3	2	1	3	2	1	2	3	3	1
The area for cultivating cocoa with the use of volcanic soil and organic fertilizer	1	1	2	1	1	2	2	1	1	1	1	2

Table illustrates the physical characteristics of soil after filling volcanic soil in the integrated organic farming garden at Aunt Saiyud Garden, Nayong District, Trang Province.

Study Area	Soil Structure	Soil Color	Soil Texture
Durian cultivation area with the use of volcanic soil and organic fertilizer.	Granular	5YR 3/4 Dk Red Brown	Loamy
Abiu Taiwan cultivation area with the use of volcanic soil and organic fertilizer.	Granular	5YR 4/4 Reddish Brown	Loamy
Crystal Longan cultivation area with the use of volcanic soil and organic fertilizer.	Granular	5YR 4/4 Reddish Brown	Loamy
Cocoa cultivation area with the use of volcanic soil and organic fertilizer.	Granular	5R 7/3 Pale Red	Compact

Chart illustrates the temperature, pH, and soil moisture after filling volcanic soil in the integrated organic farming garden at Aunt Saiyud Garden, Nayong District, Trang Province.

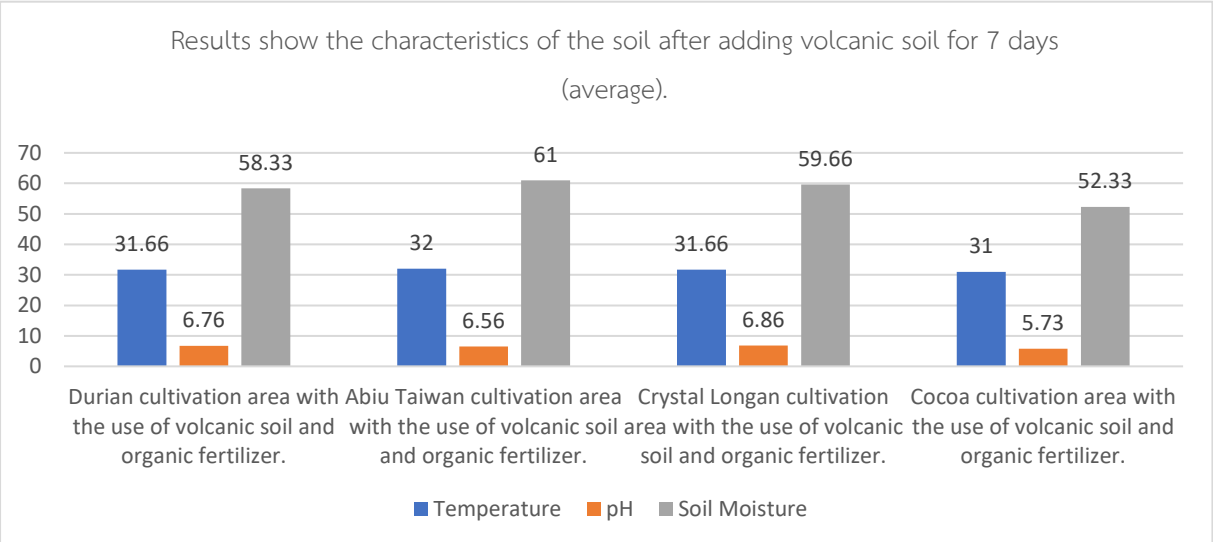


Table displays the primary nutrients in the soil after the application of volcanic soil amendments in the organic integrated farming garden of Aunt Saiyud Garden, Nayong District, Trang Province.

Study Area	Soil Structure	Soil Color	Soil Texture
Durian cultivation area with the use of volcanic soil and organic fertilizer	Spherical	5YR 3/2 Dk Red Brown	Loamy
Abiu Taiwan cultivation area with the use of volcanic soil and organic fertilizer.	Spherical	5YR 4/2 Dk Red Gray	Loamy
Crystal Longan cultivation area with the use of volcanic soil and organic fertilizer.	Spherical	5YR 4/4 Reddish Brown	Loamy
Cocoa cultivation area with the use of volcanic soil and organic fertilizer	Spherical	2.5YR 5/2 Weak Red	Loamy

Chart displays the temperature, pH, and soil moisture after applying organic fertilizer in the integrated organic farming garden of Aunt Saiyud Garden, Nayong District, Trang Province.

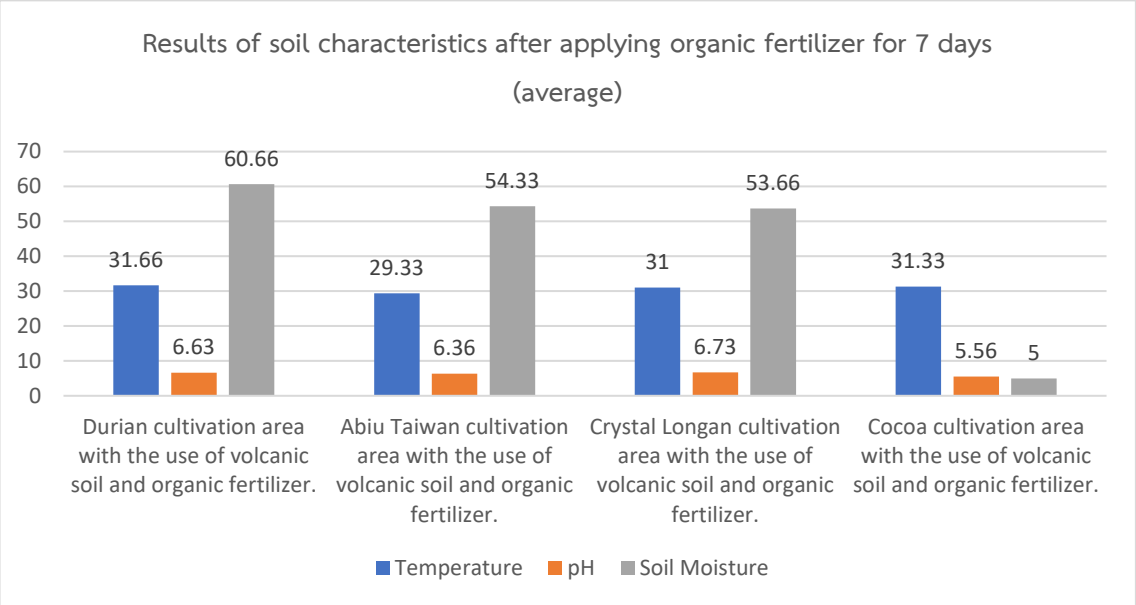
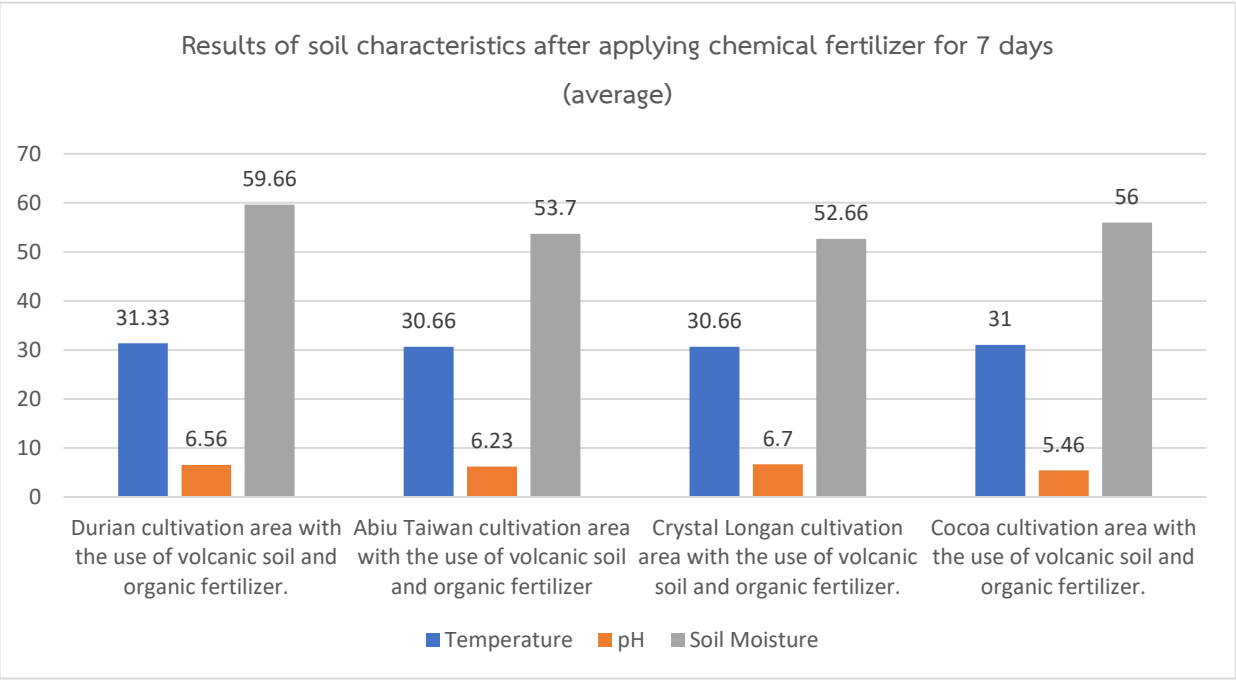


Table shows the physical characteristics of the soil after applying chemical fertilizer in the integrated organic farming garden of Aunt Saiyud Garden, Nayong District, Trang Province.

Study Area	Soil Structure	Soil Color	Soil Texture
Durian cultivation area with the use of volcanic soil and organic fertilizer.	Spherical	5R4/2 Weak Red	Loamy
Abiu Taiwan cultivation area with the use of volcanic soil and organic fertilizer	Spherical	5R3/4 Dusky Red	Loamy
Crystal Longan cultivation area with the use of volcanic soil and organic fertilizer.	Spherical	5R 5/3 Weak Red	Loamy
Cocoa cultivation area with the use of volcanic soil and organic fertilizer.	Spherical	5R 7/3 Pale Red	Compact

Chart displays the temperature, pH, and soil moisture after applying chemical fertilizer in the integrated organic farming garden of Aunt Saiyud Garden, Nayong District, Trang Province.



Summary of the study:

Before using volcanic soil with organic fertilizer, the soil was relatively acidic, compact, low in soil moisture, and had low nutrient content. After using volcanic soil with organic fertilizer for soil improvement in the mixed organic farming garden, there were differences observed. The soil became less acidic, looser, with increased soil moisture and nutrient content. In the period of soil improvement by adding volcanic soil, the soil became slightly acidic, loamy, with higher soil moisture and increased mineral nutrients, especially phosphorus. After adding organic fertilizer, it was found that soil moisture and temperature increased. Nitrogen levels significantly increased, and with the addition of chemical fertilizer (10%), the soil physical properties improved, maintaining suitable levels of moisture, acidity, and temperature. The soil became more fertile.

Recommendation:

For future research, it is suggested to collect additional data on understory plants and natural organic matter decomposition to obtain information on factors influencing the efficiency of mixed organic farming practices comprehensively.

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Reference Documents:

Soil Survey Division Staff (1993). Soil survey manual. United States Department of Agriculture. pp. 63–65. Retrieved from the original source on 2022-01-19.

Lindbo, Hayes, Adewunmi (2012). Know Soil Know Life: Physical Properties of Soil and Soil Formation.