A Study of the Correlations of Soil Properties with Growth and Yield of Sudan Roselle (Hibiscus sabdariffa L.) in Post-Harvest Rice Fields in Phak Mai Subdistrict, Huai Thap Than District, Sisaket Province, Thailand

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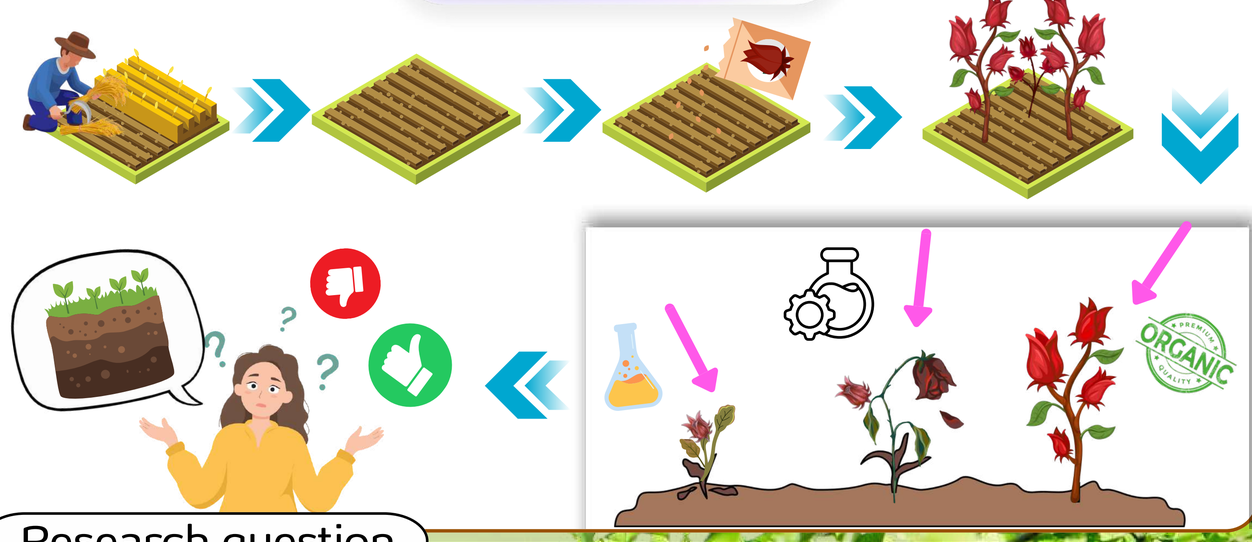
Abstract

This research investigates the Correlations of soil properties and the growth and yield of Sudan strain Roselle in post-harvest rice fields in Phak Mai Subdistrict. The study was conducted at Khok Samrong village using three soil management models: organic, control, and chemical fertilizer plots. Data collection followed **GLOBE Protocols** to measure soil physical and chemical properties, including texture, color, structure, temperature, moisture, pH, and N-P-K levels. Growth were assessed based on plant height, leaf count, stem diameter, and the number of pods per plant. The results aim to provide scientific data for effective community soil management and sustainable agriculture.

Introduction



Materials

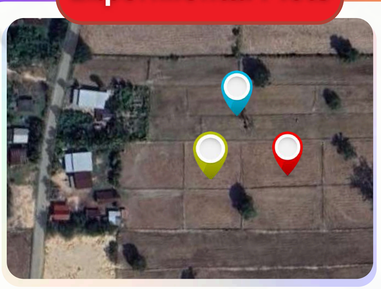
Research question

1. How do the physical and chemical properties of soil in post-harvest paddy fields differ under various soil management practices during the pre-planting and post-harvest periods of Sudanese Roselle?
2. What is the Correlations between soil properties and the growth of Sudanese Roselle?
3. What is the Correlations between soil properties and the yield quality of Sudanese Roselle?

Research hypothesis

1. Physical and chemical soil properties in post-harvest rice fields are different under different soil management practices, both before planting and after harvesting Sudan Roselle.
2. Soil properties are related to the growth of Sudan Roselle.
3. Soil properties are related to the yield quality of Sudan Roselle.

Experimental Plots



Chemical Fertilizer Plot

Control Plot

Organic Fertilizer Plot

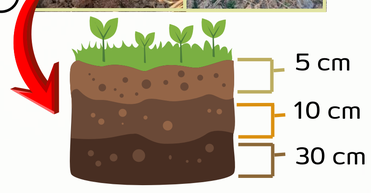
Research Methods

1

Designated study point
The study was conducted at Ban Khok Samrong, Phak Mai Subdistrict, Huai Thap Than District, Si Sa Ket Province.

2

collect soil sample from 3 different plots



3

4

Study the growth and yield of Sudan strain roselle by collecting data on growth parameters and yield characteristics.

5

Collect yield data from three plots of cultivated Sudan strain roselle.

6

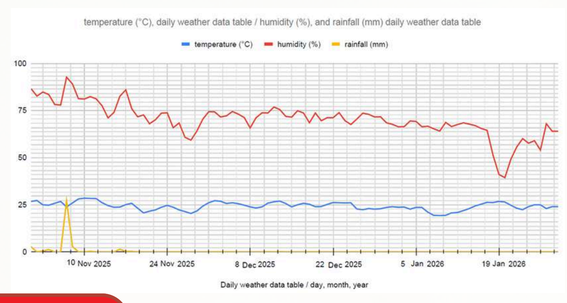
Data Reporting

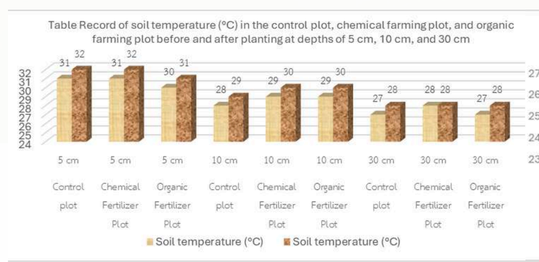
All collected environmental and soil data were uploaded to the GLOBE Program database via the Data Entry system at https://www.globe.gov.

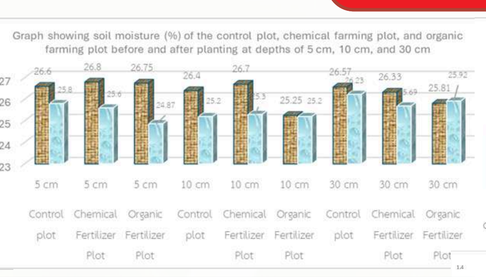
Result

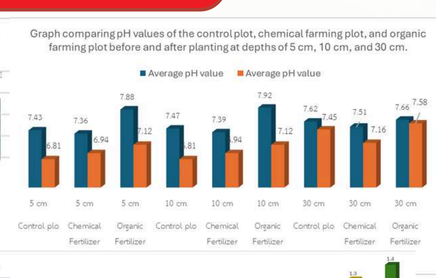
agricultural plot	Depth	period	Soil structure	Soil compaction	Soil texture	Soil Color
Control plot	5 cm	Before sowing	Granular	Friable	SANDY CLAY LOAM	2.5Y 4/4 olive brown
		After sowing	Granular	Friable	SANDY CLAY LOAM	2.5Y 4/1 dark gray
	10 cm	Before sowing	Granular	Friable	SANDY CLAY LOAM	2.5Y 4/3 olive brown
		After sowing	Granular	Friable	SANDY CLAY LOAM	2.5Y 4/2 dark grayish brown
	30 cm	Before sowing	Granular	Friable	SANDY CLAY LOAM	2.5Y 4/4 olive brown
		After sowing	Granular	Friable	SANDY CLAY LOAM	2.5Y 4/2 dark grayish brown
Chemical Fertilizer Plot	5 cm	Before sowing	Granular	Friable	SANDY CLAY LOAM	2.5Y 4/4 olive brown
		After sowing	Granular	Friable	SANDY CLAY LOAM	2.5Y 4/1 dark gray
	10 cm	Before sowing	Granular	Friable	SANDY CLAY LOAM	2.5Y 4/3 olive brown
		After sowing	Granular	Friable	SANDY CLAY LOAM	2.5Y 4/2 dark grayish brown
	30 cm	Before sowing	Granular	Friable	SANDY CLAY LOAM	2.5Y 4/3 olive brown
		After sowing	Granular	Friable	SANDY CLAY LOAM	2.5Y 4/2 dark grayish brown
Organic Fertilizer Plot	5 cm	Before sowing	Granular	Friable	SANDY CLAY LOAM	2.5Y 4/3 olive brown
		After sowing	Granular	Friable	SANDY CLAY LOAM	2.5Y 4/2 dark grayish brown
	10 cm	Before sowing	Granular	Friable	SANDY CLAY LOAM	2.5Y 4/3 olive brown
		After sowing	Granular	Friable	SANDY CLAY LOAM	2.5Y 4/2 dark grayish brown
	30 cm	Before sowing	Granular	Friable	SANDY CLAY LOAM	2.5Y 4/3 olive brown
		After sowing	Granular	Friable	SANDY CLAY LOAM	2.5Y 4/2 dark grayish brown

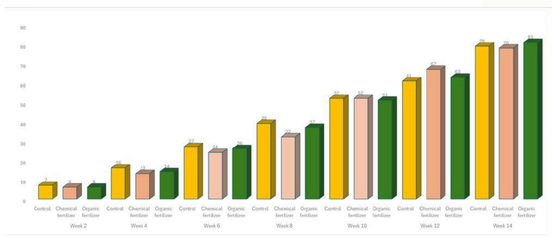
Depth	agricultural plot	period	pH	Soil fertility		
				Nitrogen (N)	Phosphorus (P)	Potassium (K)
5 cm	Control plot	Before sowing	Neutral	Low	Moderate	Low
		After sowing	Slightly acidic	Very low	Low	Very low
	Chemical Fertilizer Plot	Before sowing	Neutral	Moderate	Moderate	Moderate
		After sowing	Slightly acidic	Low	Low	Very low
	Organic Fertilizer Plot	Before sowing	Neutral	Low	Moderate	Low
		After sowing	Neutral	Very low	Low	Very low
10 cm	Control plot	Before sowing	Neutral	Low	Moderate	Low
		After sowing	Neutral	Very low	Low	Very low
	Chemical Fertilizer Plot	Before sowing	Neutral	Moderate	Moderate	Low
		After sowing	Neutral	Low	Low	Very low
	Organic Fertilizer Plot	Before sowing	Neutral	Low	Moderate	Moderate
		After sowing	Neutral	Very low	Low	Very low
30 cm	Control plot	Before sowing	Neutral	Low	Moderate	Low
		After sowing	Neutral	Very low	Low	Low
	Chemical Fertilizer Plot	Before sowing	Neutral	Moderate	Moderate	Low
		After sowing	Neutral	Low	Low	Very low
	Organic Fertilizer Plot	Before sowing	Neutral	Low	Moderate	Moderate
		After sowing	Neutral	Very low	Low	Very low

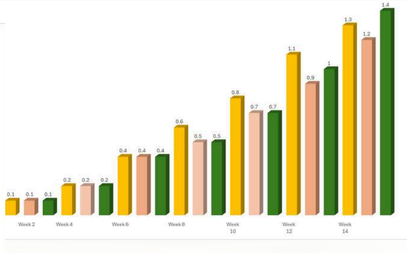


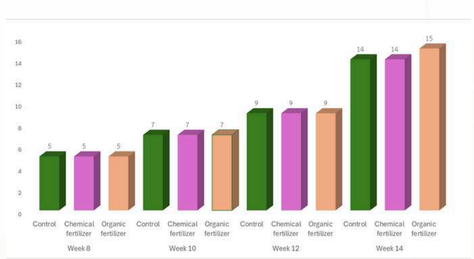


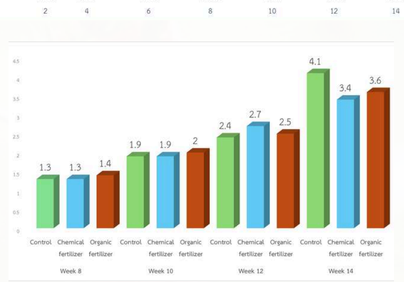


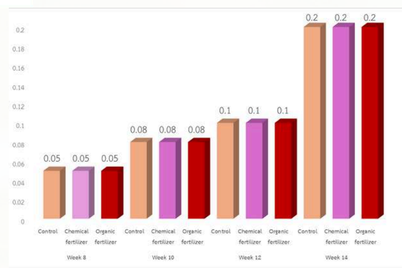












Discussion

1. Soil Management and Growth Impacts

- Organic Farming is Superior: It produces the best growth results, with plant heights reaching 81 cm and stem diameters of 1.4 mm, outperforming other methods.
- Maintaining Soil Balance: Organic fertilizers help maintain a neutral soil pH (7.12) and keep soil temperatures cooler (31 °C). This creates a better environment for nutrient absorption compared to chemical fertilizers, which tend to increase soil acidity.

2. Climate Adaptation

- Cool and Dry Conditions Stimulate Yield: When temperatures drop to 20 °C with low humidity (40%), the Roselle plant accelerates the development of its calyx thickness to 0.2 mm as a survival mechanism.
- Natural Mechanisms: In nutrient-poor areas (control plots), the plant compensates by producing the highest number of leaves (63 leaves) to maximize photosynthesis, resulting in calyx lengths of up to 4.1 cm.

3. Economic Value and Sustainability

- Maximum Profitability: Organic management yields the highest net profit (2,550 THB per Ngan) and the highest number of pods per plant (15 pods) due to lower input costs and higher market prices.
- Long-term Sustainability: Chemical fertilizers involve high costs and degrade soil quality over time through acid accumulation. In contrast, organic farming better preserves topsoil health, especially when integrated into post-rice paddy rotations.

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