A Study of Soil Properties Affecting Growth and Yield of Sudan Roselle (Hibiscus sabdariffa L.) in Post-Rice Organic Farming Fields in Phak Mai Subdistrict, Huai Thap Than District, Sisaket Province

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Abstract

The objective of this research was to study the relationship between soil properties in post-rice harvest organic farming plots and the growth and yield of Roselle (Sudan variety) in Phak Mai Subdistrict, Sisaket Province. The study area comprised three organic farming plots located in Ban Khok Samrong, Ban Kud Kwang, and Ban Nong Lung, all of which employed similar organic fertilizer management practices.

The research methodology involved collecting soil samples at depths of 5, 10, and 30 cm, both before planting and after harvest. Soil physical properties, chemical properties, and fertility were measured according to GLOBE Protocols, including soil texture, soil structure, consistency, moisture, soil temperature, pH, and macronutrients (N, P, K). Subsequently, the Sudan variety of Roselle was cultivated to gather growth data (plant height, number of leaves, and stem diameter) and yield data (number of pods per plant, flower diameter, and calyx length and thickness). Data were analyzed using mean and percentage statistics to compare differences across the study areas.

The results indicated that the soil physical properties, chemical properties, and fertility in each area significantly influenced the growth and yield of Roselle at varying levels. Areas with optimal soil properties—specifically higher moisture content and macronutrient levels—resulted in greater average plant height and number of pods per plant compared to other areas. The findings of this study serve as a scientific baseline for farmers in the Phak Mai community to manage soil and plan post-rice harvest land use effectively, aligning with local potential and promoting sustainable organic agriculture.

Keywords: Soil properties, Organic farming, Sudan Roselle, Growth, Yield

Research Question and Hypothesis

1. How do soil properties in post-rice organic farming fields relate to the growth and yield of Sudan roselle (Hibiscus sabdariffa L.)?
2. How do soil properties in post-rice organic farming fields differ between the pre-planting period and after harvest?

1. Soil properties in post-rice organic farming fields are related to the growth and yield of Sudan roselle (Hibiscus sabdariffa L.).
2. Soil properties in post-rice organic farming fields differ between the pre-planting period and after harvest.

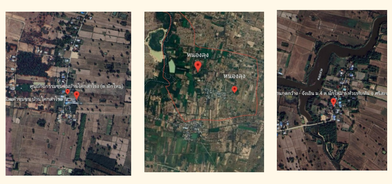
Introduction

Soil is an essential resource for plant growth, as its physical and chemical properties directly affect crop productivity. Organic farming focuses on conserving soil and enhancing natural fertility. After rice harvesting, soil properties may change and influence the cultivation of subsequent crops such as Sudan roselle, which requires soils with good water-holding capacity and nutrient availability. This study examines the relationship between soil properties in post-rice organic fields and the growth and yield of Sudan roselle in Sisaket Province, providing baseline information for soil management, post-rice land-use planning, and the promotion of sustainable agriculture in the community.

Materials, Equipment, and Chemicals

Hoe and spade		HI 3895 N, P, K chemical test kit	
Ziplock bags and labels		Soil drying oven	
Metal probe thermometer		Pipettes and test tubes	
Digital balance		Measuring tape	
pH meter		Vernier caliper	

Research Method



Study area selection

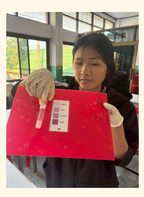
Soil sampling

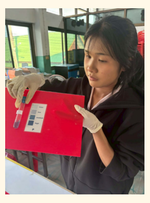
Soil structure measurement

Soil temperature measurement

Soil moisture measurement

Measurement of soil acidity (pH).





Measurement of major soil nutrients, including nitrogen (N), phosphorus (P), and potassium (K).

Study of the growth and yield of Sudan roselle.

Enter the data into the Data Entry system

Results

Study area (villages)	Depth (cm)	Soil texture		Soil structure		Soil expansion	
		Before	After	Before	After	Before	After
Khok Samrong	5	Sandy clay loam	Sandy clay loam	Granular	Granular	Loose and friable	Loose and friable
	10	Sandy clay loam	Sandy clay loam	Granular	Granular	Loose and friable	Loose and friable
	30	Sandy clay loam	Sandy clay loam	Granular	Granular	Loose and friable	Loose and friable
Kut Kwang	5	Sandy clay loam	Sandy clay loam	Granular	Granular	Loose and friable	Loose and friable
	10	Sandy clay loam	Sandy clay loam	Granular	Granular	Loose and friable	Loose and friable
	30	Sandy clay loam	Sandy clay loam	Granular	Granular	Loose and friable	Loose and friable
Nong Lung	5	Sandy clay loam	Sandy clay loam	Granular	Granular	Loose and friable	Loose and friable
	10	Sandy clay loam	Sandy clay loam	Granular	Granular	Loose and friable	Loose and friable
	30	Sandy clay loam	Sandy clay loam	Granular	Granular	Loose and friable	Loose and friable

Table 1 shows the physical properties of soil in each study area before and after planting.

Study area (villages)	Depth (cm)	Soil temperature			Soil moisture (%)		
		Before	After	Difference	Before	After	Difference
Khok Samrong	5	29	29	0	16.22	15.20	1.02
	10	30	30	0	15.35	14.22	1.13
	30	30	30	0	14.55	13.55	1.00
	Average	30	30	0	15.37	14.32	1.05
Kut Kwang	5	29	29	0	14.12	13.20	0.92
	10	29	29	0	12.25	11.24	1.04
	30	29	29	0	11.48	10.12	1.36
	Average	29	29	0	12.61	11.52	1.10
Nong Lung	5	29	29	0	15.72	15.10	0.62
	10	29	29	0	14.32	13.22	1.10
	30	30	30	0	13.67	12.52	1.15
	Average	30	30	0	14.57	13.61	0.96

Table 2 Comparison of soil temperature and soil moisture before and after planting

Study area (villages)	Depth (cm)	pH value		Nitrogen		Phosphorus		Potassium	
		Before	After	Before	After	Before	After	Before	After
Khok Samrong	5	7.88	7.80	Moderate	Low	Moderate	Low	Moderate	Low
	10	7.80	7.77	Moderate	Low	Moderate	Low	Moderate	Low
	30	7.66	7.65	Moderate	Low	Moderate	Low	Moderate	Low
	Average	7.78	7.74						
Kut Kwang	5	7.08	7.05	Moderate	Low	Moderate	Low	Moderate	Low
	10	7.97	7.67	Moderate	Low	Moderate	Low	Moderate	Low
	30	7.20	7.1	Moderate	Low	Moderate	Low	Moderate	Low
	Average	7.74	7.20						
Nong Lung	5	6.47	6.40	Moderate	Low	Moderate	Low	Moderate	Low
	10	6.57	6.50	Moderate	Low	Moderate	Low	Moderate	Low
	30	6.44	6.34	Moderate	Low	Moderate	Low	Moderate	Low
	Average	6.46	6.40						

Table 3 shows soil chemical properties and soil fertility before and after planting.

Study area (villages)	Growth	Plant age (days)								Average
		14	28	42	56	70	84	98	112	
Khok Samrong	Plant height (cm)	6	14	26	37	51	63	81	96	0.74
	Stem diameter (mm)	0.1	0.2	0.4	0.5	0.7	1	1.4	1.7	0.01
	Number of leaves (leaves)	3	9	24	33	36	39	40	42	0.4
Kut Kwang	Plant height (cm)	20	23	24	25	26	28	29	30	0.45
	Stem diameter (mm)	1.4	1.5	1.6	1.7	1.8	1.9	2	2.2	0.02
	Number of leaves (leaves)	14	16	17	19	20	22	23	24	0.30
Nong Lung	Plant height (cm)	47	48	48	50	51	52	53	55	0.83
	Stem diameter (mm)	3	3.2	3.3	3.4	3.5	3.6	3.7	3.8	0.04
	Number of leaves (leaves)	52	55	59	61	62	64	66	67	0.96

Table 4 Growth of Sudan roselle from planting to harvest, with data collected every 14 days.

Discussion

The three study sites—Khok Samrong, Kut Kwang, and Nong Lung villages—had sandy loam soils with stable soil structure and expansion across depths (5, 10, and 30 cm), while soil temperature and moisture varied with time and weather. Soil pH was generally suitable for crop cultivation. Major nutrients (N, P, K) were higher before planting than after harvest due to nutrient uptake by Sudan roselle during growth.

Sudan roselle grown in fields with adequate moisture and higher nitrogen levels, particularly at Khok Samrong Village, showed greater plant height, leaf number, and stem diameter. Yield components, such as pod number and calyx thickness, were clearly associated with soil phosphorus and potassium levels.

The results indicate that nitrogen primarily influences vegetative growth, whereas phosphorus and potassium affect flowering and yield quality. Upper soil layers (5–10 cm) were more important for early growth, while deeper soil (30 cm) played a key role in maintaining plant vigor during the dry period. The use of GLOBE standardized methods ensured reliable and systematic data, supporting the conclusion that soil properties are closely related to the growth and yield of Sudan roselle.

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