Research Name: The quality of water and soil that affect the carbon storage of the Tenera palm, Na P la Subdistrict, Mueang District, Trang Province.

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Abstract

The study aims to study the effect of water quality and soil quality on carbon storage of Tenera palm oil in Na Phi Subdistrict, Mueang District, Trang Province. By comparing areas with 10 × 10 meters of water storage in each area, analysis of soil quality factors such as humidity, pH and main nutrient content (N, P, K) Includes estimates of carbon retention in oil palm trees.

The results showed higher moisture content in soil, pH and nutrients (N, P, K) than in waterless areas. The average moisture content in soil and waterless areas was 1.83% and 1.32%, pH in soil and 6.83%, and 6.83%, respectively. 60 In addition, the average N, P, K nutrients in the soil with water sources were 7.83 mg/L, 7.50 mg/L, 29.97 mg/L respectively, higher than the average 4.11 mg/L, 3.72 mg/L, 11. 44 mg/L respectively. In terms of carbon retention, oil palm trees in areas with water sources averaged 378 KgCO 2eq, higher than 270 KgCO 2eq, showing that water and soil quality, especially moisture and nutrient content, are directly related to the carbon retention capacity of Tenera palm trees.

Keywords, Carbon Storage Volume, pH Paper, NPK Check Set, Clinometer, Temperature Gauge, Humidity Gauge

Acknowledgements

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I would like to thank my advisor, Mr. Jiraporn Sirirat, who gave us useful advice and opinions throughout the project and gave us knowledge on the process of carbonation assessment and exchange of trees. That supports and approves the budget for the implementation of this research project.

Thanks to Wichienmatu School for its support in experimental equipment and facilities, and to all of its friends and related parties for their assistance and consultation throughout the field collection process.

Finally, I would like to thank all the researchers for their cooperation in this study, their knowledge, their ability, and their determination.

Project Team

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Introduction

Thailand is one of the countries where Tenera palm is widely cultivated, especially in the southern region where climate and terrain are suitable. Tenera palm is not only an economic plant for generating income for the country but also plays a role in carbon storage in soil and wood. This reduces the amount of carbon dioxide in the atmosphere that is the main cause of global warming. A comparison study of carbon storage in Tenera palm trees in areas with and without water sources will help understand the impact of water on plant carbon storage. In addition, it will also enhance the efficiency of oil palm cultivation in order to achieve sustainable carbon retention.

The project examines the relationship between water and soil quality with the carbon storage capacity of Tenera palm trees by comparing the carbon storage volume of palm trees in water-based and palm trees in water-free areas to understand the role of environmental factors that affect carbon storage. It also proposed ways to grow oil palm to be efficient in carbon storage, such as selecting suitable soil and water quality areas, improving soil, which will help promote sustainable oil palm cultivation, reduce environmental impact, and increase carbon absorption capacity in agricultural ecosystems.

The objectives of the research

1. To study how water quality affects the carbon sequestration capacity of Tenera oil palm in Napla Subdistrict, Mueang District, Trang Province.
2. To study how soil quality affects the carbon sequestration capacity of Tenera oil palm in Napla Subdistrict, Mueang District, Trang Province.

Research questions

1. Does the presence of a water source affect the carbon sequestration capacity of Tenera oil palm more than areas without a water source?
2. Does soil quality affect the carbon sequestration capacity of Tenera oil palm more than areas with water sources?

Research hypotheses

1. Water quality affects the carbon sequestration capacity of Tenera oil palm.
2. Soil quality affects the carbon sequestration capacity of Tenera oil palm.

Materials and equipment and research methodology

1. Flask
2. pH paper
3. Foil Paper
4. Beaker
5. Glass Rod
6. Distilled Water
7. Filter Paper
8. Dropping Pipette
9. Balance Scale
10. Spatula
11. Filter Funnel
12. Moisture Meter
13. Thermometer
14. Clinometer
15. NPK Test Kit

The GLOBE Measurement Protocols

Soil Measurement Protocols (Pedosphere)

Soil Cover Measurement Protocols (Biosphere)

Study Area Determination

To examine carbon sequestration in Tenera oil palm trees within the Napla Subdistrict, Mueang District, Trang Province, the study is divided into two areas: one with a water source and one without a water source. Each study area covers 3 rai of land, and a sample plot of 10 × 10 meters has been designated for data collection in each area. Additionally, soil samples were randomly collected by digging 20 cm deep at 24 points per area for analysis of soil composition that may affect the carbon sequestration of the oil palm trees.

Research methodology

1. Research Preparation Phase

1.) Study carbon storage in two nearby cultivated areas of Tenera palm species using a sample area of 10 × 10 meters in Na Phi Subdistrict, Mueang District, Trang Province.

Some properties of soil in palm orchards are sampled at a depth of 20 centimeters, 12 points in total, 2 areas with and without water sources to analyze soil particles, N, P, K, acidity and moisture content within the soil.

2.) Study, research, collect knowledge and theories related to work.

- Principles of Soil Temperature Measurement
- Principle of determination of NPK values in soil
- the principle of measuring air temperature
- Principles of soil moisture measurement
- Principles of soil pH monitoring
- the carbonation of a palm tree
- Estimation principle of carbon retention of palm trees
- The process of carbon exchange in the ecosystem
- Estimation principle of carbon retention of palm trees
- Related Documents and Research

3.) Establish the purpose of education

1. To compare the carbon footprint of the Tenera palm.
2. To compare the physical and chemical soil quality of the Tenera palm tree.

4.) Determine the sampling point in the area to be studied.

Collect soil samples in a 10-year-old palm garden near the area where the water source is located and where there is no water source. Randomly collect each area in 10 × 10 meters, depth 20 centimeters, 12 points each.

2. a process of proceeding

Physical soil quality study

1) Measurement of soil temperature

1.1 Use a shovel to dig about 20 centimeters deep.

1.2 Take the thermometer for measuring the temperature at a depth of 20 centimeters by putting it into a trench of soil prepared. Wait 1 minute to keep the temperature value still. Read the first soil temperature value recorded on the data sheet.

1.3 Read the earth temperature 2 more times, waiting for only 1 minute at a time to read the value.

1.4 If the three readings differ by not more than 1 degree Celsius, it is considered acceptable. Then record the value.

2.) Measurement of moisture content in soil

2.1 Use a shovel to dig about 20 centimeters deep.

2.2 Take the soil moisture meter for measuring soil temperature at a depth of 20 centimeters by inserting it into the prepared soil groove. Wait 1 minute to read the temperature value.

3) Preparation of soil samples

3.1 Designate a soil sampling point.

3.2 Take a total of 12 soil samples at a depth of 20 centimeters, 2 areas in total.

3.3 Collect soil samples in a designated area along the plane, and use a shovel to dig the soil to a depth of about 20 centimeters.

3.4 Put the soil in a jar. Close the lid tightly.

4) Measurement of soil fertility

4.1 Weigh 20 grams of soil

4.2 Take 10mL of distilled water.

4.3 Dissolve the collected soil with distilled water with a soil and water ratio of 2:1.

4.4 Check with a nitrogen, phosphorus and potassium monitoring kit, and compare them with the standard values, and record the values.

5.) Acid-base measurement

5.1 Take 20g of collected soil and dissolve it with 20mL of distilled water.

5.2 Apply water-soluble soil to filter by filter paper.

5.3 Set aside for settling

5.4 Use Universal Indicator paper, dip it in a solution, and soak it for about 30 seconds.

5.5 Compare the obtained color with the standard value next to the box.

Analysis and summary of research results

1. analyze and compare the relationship using the statistics used in the data analysis, including soil temperature, soil pH average, soil humidity average, nitrogen, phosphorus average, and potassium in soil.

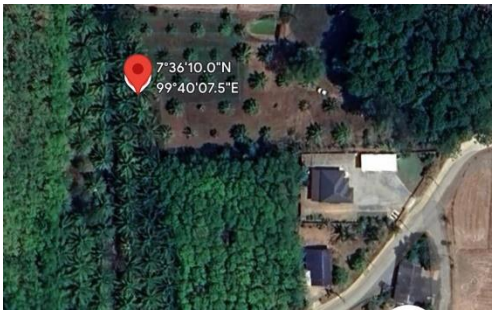
2. Graph a mean comparative data

Research Results

Geographical coordinates Study the area of the Tenera palm tree, Na Phi Subdistrict, Mueang District, Trang Province. The coordinates are as shown in Table 1.

Table 1 Geographical coordinates

Zone	**Geographical coordinates**	
	Latitude (N)	**Longitude (E)**
Tenera palm, Watery area.	7.601973	99.668772
Tenera palm, Waterless area.	7.6027675	99.6687620

Zone	Geographical coordinates
Tenera palm, Watery area.	
Tenera palm, Waterless area.	

2. Measurement of soil quality

Table 2 The soil structure of the Tenera palm at Na Phi Subdistrict, Mueang District, Trang Province, areas with water sources and areas without water sources.

Area	Measured value		
	Adhesion	**Soil color**	**Soil texture.**
Watery area	Tighter	7.5 YR 3/3	Silty clay loam
Waterless area	Tighter	7.5 YR 2.5/3	Silty clay loam

According to Table 2, soil adhesion characteristics at a depth of 20 cm were found. It is located in the area with a water source. It has the same adhesion characteristics: tight, soil color has the same value of

7.5YR 3/3 and soil adhesion characteristics at a depth of 20 cm. It is in an area where there is no water source. It has the same characteristics as tight. The soil color has the same value of 7.5 YR 2.5/3.

Table 3 compares the mean, humidity, pH temperature of the area with the water source and the area without the water source.

Area	Average moisture values (%)	Average temperature values (° C)	Average pH values	Average N P K values (mg/L)		
				N	P	K
Watery area	1.83	25.58	6.83	7.83	7.50	29.97
Waterless area.	1.32	26.39	6.60	4.11	3.72	11.44

Table 3 shows the mean soil moisture, the mean soil temperature, the pH of soil, and the average soil temperature. The N P K of soil in each area was found to have the following values:

3.1) The area with water sources has an average soil humidity of 1.83% with an average soil temperature of 25.58%, a pH of 6.83%, an N P K average of 7.83 mg/L, 7.50 mg/L, 29.97 mg/L, respectively.

3.2) Areas without water sources have an average soil humidity of 1.32% with an average soil temperature of 26.39% with a pH of 6.60 with an NPK average of 4.11 mg/L 3.72 mg/L 11.44 mg/L, respectively.

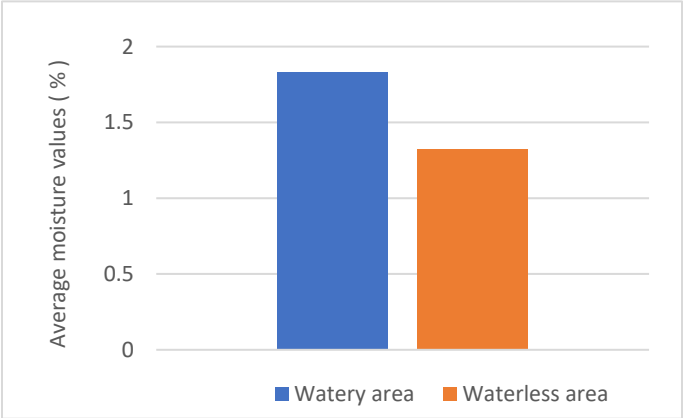


Chart 1 Comparison moisture values of Tenera palm Watery area and Waterless area

Shows a comparison from bar chart 1 where the average soil moisture content in each area was found to have the following values: The average humidity in the area where there is a water source is 1.83% and the average humidity in the area where there is no water source is 1.32% and the average humidity in the area where there is a water source is higher than in the area without water source.

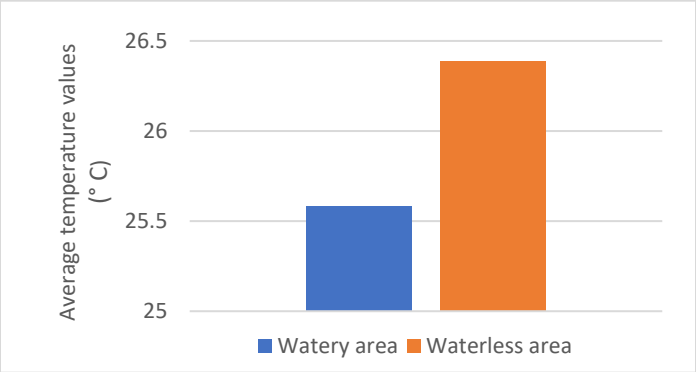


Chart 2 Comparison temperature values of Tenera palm Watery area and Waterless area

From the 2nd bar chart graph showing the comparison of average soil temperature in each area, it was found to have the following values:

The average temperature is 25.58 °C in the water supply area, and the average temperature is 26.39 °C in the water supply area. The average temperature is higher than the water supply area.

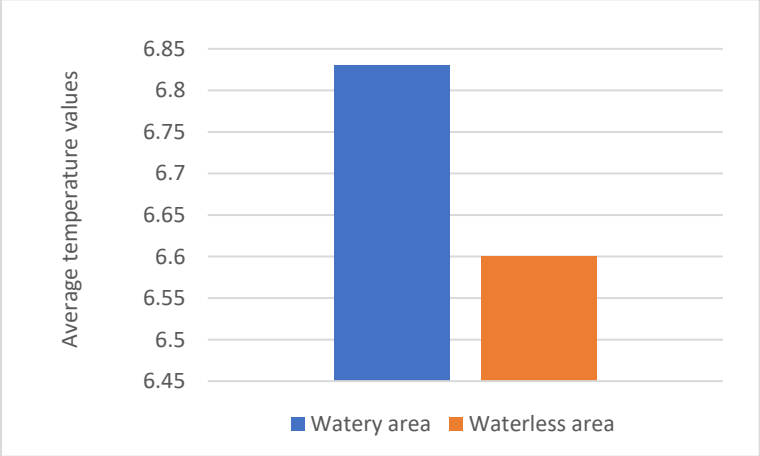


Chart 3 Comparison pH values of Tenera palm Watery area and Waterless area

From the 3rd bar chart showing the pH comparison in each soil area, it was found that the pH in the water supply area was 6.83 and the pH in the water supply area was 6.60. The pH of the water supply area was higher than the water supply area.

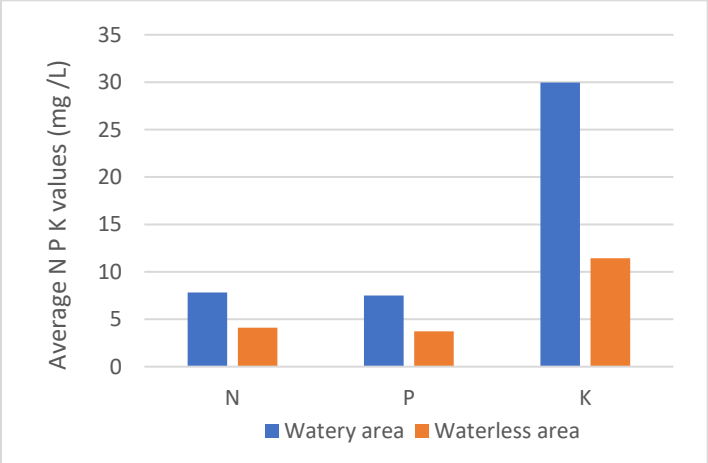


Chart 4 Comparison N P K values of Tenera palm Watery area and Waterless area

From the fourth bar chart showing the comparison of NPK in each soil area, it was found that the average NPK was 7.83mg/L, 7.50mg/L, 29.97mg/L, and the average NPK was 4.11mg/L, 3.72mg/L, 11.44mg/L, respectively.

Table 4 compares the carbon footprint of areas with water sources and areas without water sources**.**

Area	Average carbon sequestration values ($KgCO_2eq$)	Average "Bio-molecular mass above all ground. WT" (kg)	Average Biomass underground (Ratio)	Average Total Biomass (kg)	Average carbon content (kgC)
Watery area	378	88.62	36.33	124.94	51.61
Waterless area	270	74.04	30.36	104.40	43.12

Table 4 shows the average carbon retention for each area. It was found to have the following values:The average carbon footprint of the water area was 378 KgCO2eq and the average carbon footprint was 270 KgCO2eq, the total surface area was 88.62 kg, and the total surface area was 74.04 kg. The average underground surface area was 36. 33 Ratio and non-aqueous area average underground biological mass at

30.36 Ratio average total biological mass at 124.94 kg and non-aqueous area average 104.40 kg, carbon content at 51.61 kgC and carbon content at 43.12 kgC.

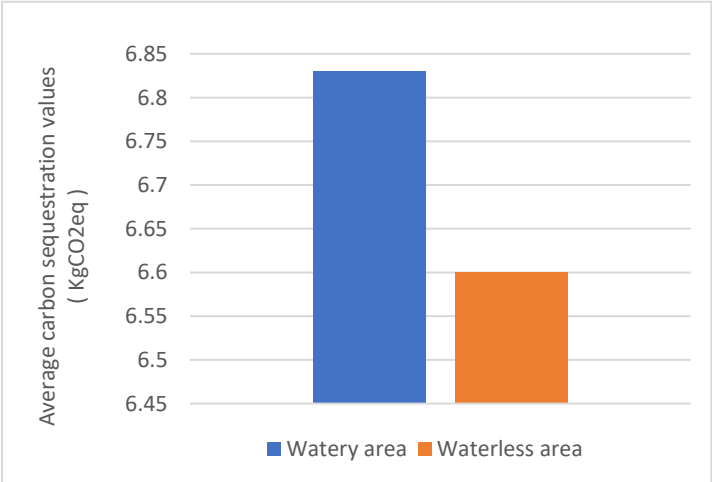


Chart 5 Comparison carbon sequestration values of Tenera palm Watery area andWaterless area

From the 5th bar chart graph showing the comparison, the carbon storage volume in each soil area was found to have the following values:

In areas near water sources, the average carbon retention was 378 KgCO2eq, and in areas without water sources, the average carbon retention was 270 KgCO2eq. It was found that areas with water sources had higher carbon retention than areas without water sources.

Summary of Research Results

Based on the study of carbon retention values in the Tenera palm tree by comparing whether the area with or without water sources has better carbon retention efficiency, the following information is available:

1. Total carbon storage. Palm trees in the water source area have a carbon storage capacity of 378 KgCO2eq and palm trees in the water source area have a carbon storage capacity of 270 KgCO2eq, which has a better carbon storage capacity than in the water source area.

2. Carbon storage volume per area (with and without water sources), palm trees in areas with carbon storage of 378 KgCO2eq and areas without water and carbon storage of 270 KgCO2eq were found to have better carbon storage than areas without water sources. But the carbon retention of palm trees does not

depend solely on water factors, but may depend on other environmental factors such as light intensity, soil temperature and

Moisture value in the air, etc. This survey shows that palm trees help reduce greenhouse gases and absorb carbon dioxide in the air.

Discuss the research results

Based on the study of carbon retention in Tenera palm trees, the comparison between areas near or far from water sources has improved carbon retention efficiency, which is for both purposes:

1) To study the quality of water has an effect on carbon storage of Tenera palm, Na Phi Subdistrict, Mueang District, Trang Province. The survey was conducted on the basis that Tenera palm in the vicinity of water is more carbon storage than in the vicinity of water.

2.) to study the quality of soil affecting the carbon retention of Tenera palm, Na Phi Subdistrict, Mueang District, Trang Province. The survey was conducted on the basis that soil in the area has higher mineral value than soil in the area.

It was found to have the following values: The water area has an average carbon retention rate of 378 KgCO2eq and the non-aqueous area has an average carbon retention rate of 270 KgCO2eq, the water area has a total biological mass of 88.62 kg, and the non-aqueous area has an average biological mass of 74. 04 kg The water area has an average subterranean biological mass of 36.33 ratio and the non-aqueous area has an average subterranean biological mass of 30.36 ratio, the average total biological mass of 124.94 kg and the non-aqueous area 104.40 kg, the average carbon content of 51.61 kgC, and the average carbon content of 43. 12 kgC

Reference Document

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Yupayao Tokiri, Chuanpit Charat, Taeng Nova Sheikh and Nong Nuchasaraphi, Faculty of Science and Technology, Surin Rajabhat University's Faculty of Science and Technology, Surin Rajabhat University's Research Report on Carbon Storage in the Biosphere of Ban Saeng Sun Community Forest [Online]
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Mr. Asamon Limsakul, Mr. Sunthorn Ngam, Ms. Nantheera Sriburin, Ms. Paritda Suwanee, Ms. Ratchanikorn Paisan, presented a complete research report on the development of carbon-exchange methods and equipment.
https://eservice.dcce.go.th/storage/Media/C201912236906.pdf

Measurement of carbon retention of trees in landscape, Nodesak Sukwong and faculty 1-2 March 2016.
https://shorturl.asia/G4AJ8

I AM A DATA SCIENTIST

We conducted this project using the principles of scientists studying the relationship between soil quality and carbon capture capabilities of Tenera palm trees using quantitative research processes focusing on field data and statistical analysis. To analyze chemical and physical properties, the data were recorded and processed using statistical methods to compare soil quality differences. The results are presented in tabular and chart form to show the relationship between soil quality and carbon retention potential, which is beneficial to soil resource management and palm forest conservation. To improve carbon capture efficiency and reduce the impact of climate change, and then use the information to further develop.

I AM A COLLABORATOR

We've been working effectively on a multi-party collaboration, whether it's a dedicated research team planning, designing experiments, collecting data, analyzing results and summarizing findings systematically, and sharing our responsibilities for accurate and complete information. The project also received support and cooperation from external agencies. Wichianmat School supported the necessary budget, equipment, and technical support. Farmers and communities in the Tenera palm plantation area provided information about the experimental area and allowed full research. These demonstrate that sharing of knowledge and collaboration not only improves research efficiency, but also helps to analyze and solve problems creatively, making our project successful and highly reliable at every stage of the project.

I MAKE AN IMPACT

We conducted a study on water and soil quality that affects the carbonation of Tenera palm trees to assess the water and soil quality that affects the carbonation of Tenera palm trees. The study found that water and soil quality influenced the carbon retention of Tenera palm trees and that the results of the study could be disseminated to palm growers that cultivating palm trees would increase carbon retention, resulting in strong, sustainable and fruitful palm trees.

Raw data: Tenera palm trees, areas with water sources

ลำดับ	ชนิดไม้	ประเภทพรรณไม้	ความสูงของต้นไม้ H	ความโต (เส้นรอบวงที่ระดับเพียงอก) GBH	เส้นผ่านศูนย์กลางที่ระดับสูงเพียงอก DBH	มวลชีวภาพเหนือพื้นดินในส่วนลำต้น W_S	มวลชีวภาพเหนือพื้นดินในส่วนกิ่ง W_B	มวลชีวภาพเหนือพื้นดินในส่วนใบ W_L	มวลชีวภาพเหนือพื้นดินทั้งหมด W_T	มวลชีวภาพใต้ดิน	มวลชีวภาพรวม	ปริมาณคาร์บอน carbon content	ปริมาณก๊าซเรือนกระจกที่กักเก็บได้	
			(m)	(cm)	(cm)	(kg)	(kg)	(kg)	(kg)	ratio	(kg)	(kgC)	($kgCO_2e$)	(tCO_2e)
1	ปาล์ม	กลุ่มปาล์ม	12.304	279	88.77	ไม่มี	ไม่มี	ไม่มี	119.59	49.03	168.62	69.64	255.34	0.255
2	ปาล์ม	กลุ่มปาล์ม	11.237	270	85.91	ไม่มี	ไม่มี	ไม่มี	110.68	45.38	156.06	64.45	236.32	0.236
3	ปาล์ม	กลุ่มปาล์ม	9.971	259	82.41	ไม่มี	ไม่มี	ไม่มี	99.80	40.92	140.72	58.12	213.10	0.213
4	ปาล์ม	กลุ่มปาล์ม	15.344	298	94.82	ไม่มี	ไม่มี	ไม่มี	143.86	58.98	202.84	83.77	307.17	0.307
5	ปาล์ม	กลุ่มปาล์ม	11.237	250	79.55	ไม่มี	ไม่มี	ไม่มี	110.68	45.38	156.06	64.45	236.32	0.236
6	ปาล์ม	กลุ่มปาล์ม	11.58	312	99.27	ไม่มี	ไม่มี	ไม่มี	113.57	46.56	160.13	66.13	242.49	0.242
7	ปาล์ม	กลุ่มปาล์ม	11.237	250	79.55	ไม่มี	ไม่มี	ไม่มี	110.68	45.38	156.06	64.45	236.32	0.236
8	ปาล์ม	กลุ่มปาล์ม	13.498	246	78.27	ไม่มี	ไม่มี	ไม่มี	129.30	53.01	182.32	75.30	276.09	0.276
9	ปาล์ม	กลุ่มปาล์ม	11.237	289	91.95	ไม่มี	ไม่มี	ไม่มี	110.68	45.38	156.06	64.45	236.32	0.236
10	ปาล์ม	กลุ่มปาล์ม	12.686	280	89.09	ไม่มี	ไม่มี	ไม่มี	122.72	50.32	173.04	71.47	262.04	0.262
11	ปาล์ม	กลุ่มปาล์ม	11.58	295	93.86	ไม่มี	ไม่มี	ไม่มี	113.57	46.56	160.13	66.13	242.49	0.242
12	ปาล์ม	กลุ่มปาล์ม	13.929	313	99.59	ไม่มี	ไม่มี	ไม่มี	132.75	54.43	187.18	77.30	283.45	0.283

Raw data: Tenera palm trees, areas without water sources

ลำดับ	ชนิดไม้	ประเภทพรรณไม้	ความสูงของต้นไม้ H	ความโต (เส้นรอบวงที่ระดับเพียงอก) GBH	เส้นผ่านศูนย์กลางที่ระดับสูงเพียงอก DBH	มวลชีวภาพเหนือพื้นดินในส่วนลำต้น W_S	มวลชีวภาพเหนือพื้นดินในส่วนกิ่ง W_B	มวลชีวภาพเหนือพื้นดินในส่วนใบ W_L	มวลชีวภาพเหนือพื้นดินทั้งหมด W_T	มวลชีวภาพใต้ดิน	มวลชีวภาพรวม	ปริมาณคาร์บอน carbon content	ปริมาณก๊าซเรือนกระจกที่กักเก็บได้	
			(m)	(cm)	(cm)	(kg)	(kg)	(kg)	(kg)	ratio	(kg)	(kgC)	($kgCO_2e$)	(tCO_2e)
1	ปาล์ม	กลุ่มปาล์ม	11.237	240	76.36	ไม่มี	ไม่มี	ไม่มี	110.68	45.38	156.06	64.45	236.32	0.236
2	ปาล์ม	กลุ่มปาล์ม	13.929	270	85.91	ไม่มี	ไม่มี	ไม่มี	132.75	54.43	187.18	77.30	283.45	0.283
3	ปาล์ม	กลุ่มปาล์ม	10.584	260	82.73	ไม่มี	ไม่มี	ไม่มี	105.11	43.10	148.21	61.21	224.44	0.224
4	ปาล์ม	กลุ่มปาล์ม	10.904	300	95.45	ไม่มี	ไม่มี	ไม่มี	107.85	44.22	152.07	62.81	230.29	0.230
5	ปาล์ม	กลุ่มปาล์ม	9.393	260	82.73	ไม่มี	ไม่มี	ไม่มี	94.72	38.83	133.55	55.16	202.24	0.202
6	ปาล์ม	กลุ่มปาล์ม	9.971	295	93.86	ไม่มี	ไม่มี	ไม่มี	99.80	40.92	140.72	58.12	213.10	0.213
7	ปาล์ม	กลุ่มปาล์ม	8.582	272	86.55	ไม่มี	ไม่มี	ไม่มี	87.44	35.85	123.29	50.92	186.70	0.187
8	ปาล์ม	กลุ่มปาล์ม	11.237	248	78.91	ไม่มี	ไม่มี	ไม่มี	110.68	45.38	156.06	64.45	236.32	0.236
9	ปาล์ม	กลุ่มปาล์ม	9.393	249	79.23	ไม่มี	ไม่มี	ไม่มี	94.72	38.83	133.55	55.16	202.24	0.202
10	ปาล์ม	กลุ่มปาล์ม	7.354	258	82.09	ไม่มี	ไม่มี	ไม่มี	76.06	31.19	107.25	44.29	162.41	0.162
11	ปาล์ม	กลุ่มปาล์ม	8.074	230	73.18	ไม่มี	ไม่มี	ไม่มี	82.79	33.94	116.73	48.21	176.77	0.177
12	ปาล์ม	กลุ่มปาล์ม	8	246	78.27	ไม่มี	ไม่มี	ไม่มี	82.10	33.66	115.76	47.81	175.31	0.175

Appendix

Collect soil samples in the area where water is supplied

Collect soil samples in areas where there is no water supply

Measure the height of a palm

Measure the girth of a tree

weigh 20 grams of soil

Measure water to get 10mL of it.

Measure the NPK value in the soil.

Measure the pH in the soil.