Study of soil quality affecting tuber size, weight, starch content, and starch quality of *Tacca leontopetaloides* in the Rajamangala Beach, Trang.

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Abstract

The study of soil quality that affects the size of the tuber, tuber weight, starch content, and starch quality of *Tacca leontopetaloides*, in the Rajamangala Beach, Trang Province, Thailand. divided into 2 areas: the area near the beach (0-50 meters) and the area away from the beach (60-110 meters) with a small canal separating the 2 areas. The study was conducted by randomly collecting soil samples from both areas. Soil quality analysis revealed that The moisture, organic matter and phosphorus values in the soil near the beach were lower than those away from the beach. However, the pH, nitrogen and potassium values in the soil were not different. The soil texture found in the area near the beach was sandy loam soil, while the area away from the beach was clay loam soil. Both areas had brownish-yellow soil, but the area away from the beach was darker. When analyzing the size and weight of *Tacca leontopetaloides*, it was found that the area near the beach had larger and heavier starch than the area away from the beach. The amount of starch in the area near the beach was 150.15 grams per 5 kilograms of starch weight. The starch quality analysis It was found that the starch quality of both areas was not different. Therefore, it can be concluded that the different soil quality affects the size, weight of the tubers and the amount of starch from the tubers. The sandy loam soil is the most suitable soil for growing the tubers because it gives higher yields in the form of tubers and starch than other soil types.

Keywords: Soil quality, Starch quality, *Tacca leontopetaloides*

Introduction

Tacca leontopetaloides is a native starchy plant that has generated income for people in the community for a long time (Department of Agricultural Extension, 2021). It is mostly found in the eastern and southern regions. It is a seasonal herbaceous plant that naturally grows for at least 3 years from seeds. It is a plant with starch-accumulating tubers. It is popular to use the tubers to produce flour called *Tacca leontopetaloides* flour, which is a local wisdom that has been made since ancient times. The resulting flour has a fine texture and becomes clear and shiny when heated.

At present, *Tacca leontopetaloides* is a native plant that is not well-known and is not widely cultivated. Therefore, the local wisdom in *Tacca leontopetaloides* flour is still quite limited. It is found only in some areas because the production process is quite complicated, takes a long time, and requires higher precision than flour from general plants. In other words, from the diversity survey, it was found that the development of urban society and the change of areas to be transformed into tourist attractions from development have caused more buildings, which puts them at risk of extinction.

The production team therefore sees the importance of the study of soil quality that affects the size of the tuber, tuber weight, starch content, and starch quality of *Tacca leontopetaloides* in the Rajamangala Beach, Trang. which will be useful in conserving and promoting the planting of taro root to maintain the biodiversity of native plants as a valuable resource for the community's livelihood, preventing extinction, and promoting the community to conserve and use it sustainably. It is also a way to conserve local wisdom in the agricultural field of making *Tacca leontopetaloides* flour, which is important knowledge that should be preserved for future generations.

Research Question:

1. Is there a difference in soil quality between near the beach and away from the beach? How?
2. How does soil quality influence the size and weight of *Tacca leontopetaloides*?
3. Does soil quality affect the starch quantity and quality of *Tacca leotopetaloides*?

Objectives:

1. Soil quality near the beach and away from the beach is different. Soil in away from the beach is better than soil near the beach.
2. Soil quality affects the size and weight of *Tacca leontopetaloides*.
3. Soil quality affect the starch quantity and quality of *Tacca leotopetaloides.*

Materials

1. Scale
2. Tape measure
3. Temperature control cabinet
4. 1 mm. and 5 mm. mesh screens
5. Soil burning furnace
6. Soil NPK test kit
7. Concentrated sulfuric acid (H_2SO_4)
8. Sodium hydroxide (NaOH) 60% concentration
9. Methyl red
10. Hydrochloric acid (HCI) 0.02 N concentration
11. Copper sulfate ($CuSO_4$)
12. Potassium sulfate (K_2SO_4)

13. Petroleum ether
14. Ethyl alcohol
15. Boric acid
16. Pure distilled water

Methods

1. **Study sites**

This research was conducted at the area of Rajamangala Beach, Mai Fat Subdistrict, Sikao District, Trang Province, located at latitude (7.3130 degrees) and longitude (99.1829 degrees). The study area was divided into two areas, each measuring 100x50 meters: the area near the beach (a) and the area away from the beach (b), as shown in Figure 1. Both areas were separated by a small canal, as shown in Figure 2.

(a) (b)

Figure 1: Shows the study area near the beach (a) and the area away from the beach (b).

Figure 2: Shows the canal separating the study areas.

2. **Data collection**

- **Collection of Soil Quality**

Measured soil quality according to the GLOBE method by measuring pH, soil NPK, organic matter, texture and color in the soil as follows:

1. Determine the sampling point. The sampling area was randomly divided into 5 points per study site.
2. Collect soil samples. By laying out quadrate size 100X50 cm. and collecting soil samples within the quadrate from the surface of the soil down to a depth of 10 cm. Soil is mixed

before randomly collecting 600 grams of soil samples of each sample (total 10 samples). put in separate bags to study soil properties according to different indices in the laboratory including pH, nitrogen, phosphorus, potassium, and soil organic matter. Soil pH was measured using a pH Meter. Soil NPK values were measured using a soil NPK test kit and the remaining soil samples were weighed before drying. The soil samples were dried at 105°C for 24 hrs. and the moisture content was calculated. Then measure the organic matter. by bringing the soil that has been treated to remove moisture to be dried at a temperature of 450°C for 4 hrs. The soil was weighed and the organic matter content in the soil was calculated. Measure the soil texture by placing the soil on your hand, spraying water to make the soil moist, rolling the soil according to the GLOBE procedure and analyzing the soil texture. Measure the soil color by comparing the color of the soil according to the Munsell principle.

3. Send data to GLOBE Data Entry.

- **Study of *Tacca leontopetaloides***

1. The study area was divided into 2 areas, each measuring 100x50 meters. In each study area, *Tacca leontopetaloides* tubers were randomly collected, observing the plants whose leaves began to turn yellow and wither, or shrivel and die. The plants were cut off, leaving stumps approximately 30-50 centimeters long. In the study area with very loose sandy soil, uprooting or digging with a hoe was used. In the study area with dry or hard topsoil, a hoe was used for digging. After that, *Tacca leontopetaloides* tubers were chopped off from the rhizomes and processed into *Tacca leontopetaloides* flour.
2. Fresh weight, horizontal head circumference (X) and vertical head circumference (Y) were measured from the study area as shown in Figure 3.

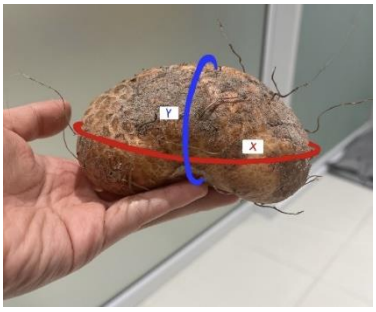

Figure 3: Shows how to measure the horizontal and vertical circumference of the head of *Tacca leontopetaloides.*

- **Making *Tacca leontopetaloides* 's Flour**

Take 5 kilograms of *Tacca leontopetaloides* from the beach and away from the beach, wash the soil clean, peel, cut into small pieces and blend finely. Put the blended *Tacca leontopetaloides* pulp in a thin cloth, squeeze with clean water, remove the starch. Then boil *Tacca leontopetaloides* starch water until it sediments, then pour out the water, add clean water again, leave it until the starch settles to the bottom, then pour out the water. Repeat this about 6-7 times, then you will get *Tacca leontopetaloides* starch that sticks

together tightly. Spread the resulting starch on a tray and dry it (Supinya, 2021), as shown in Figure 4.

Figure 4: Processing of *Tacca leontopetaloides* 's Flour.
Source: https://shorturl.asia/nmNfd

- **Study of the quality of *Tacca leontopetaloides* 's Flour**

Ash content analysis

1. Fire the glazed ceramic cups with lids in a kiln at 550°C for 5 hours. Turn off the kiln switch and wait for about 30-45 minutes to allow the temperature inside the kiln to cool down. Then remove the ceramic cups from the kiln and place them in a desiccant jar. Leave them until the temperature drops to room temperature (this takes about 15-30 minutes). Weigh and record the results.
2. Fire the glazed ceramic cup again for about 30 minutes each time and do the same as step 1 until a constant weight is obtained (the difference between the weights of the two consecutive weighings is no more than 0.001-0.003 grams). Record the obtained weight.
3. Weigh the sample to an exact weight of approximately 3-5 grams (record it as the weight before firing). Place it in a glazed ceramic cup with an exact weight known (repeat **3** times for each sample).
4. Take the ceramic cups containing the samples and burn them at 550 °C with the lid open for about 3-4 hours until the samples turn into white or light gray ash. When the time is up, turn off the kiln switch and wait about 30-45 minutes to allow the temperature inside the kiln to decrease. Then take the ceramic cups out of the kiln and place them in a desiccant jar, covering each sample cup. Leave them until the temperature drops to room temperature (it takes about 15-30 minutes). Weigh and record the results.
5. Burn again for about 30 minutes each time and do the same until a constant weight is obtained (the difference between the weights of the two consecutive weighing is no more than 0.001-0.003 grams). Record the lowest weight and calculate the ash content from the formula.

$$\text{Ash content (percent by weight)} = \frac{\text{Weight of sample after burning (grams)}}{\text{Weight of sample before burning (grams)}} \times 100$$

Protein quantification

1. Weigh the sample to obtain the exact weight of 1-5 g. Place in a digestion tube, add 10 g of mixed catalyst ($CuSO_4$: K_2SO_4 in a ratio of 1:10), add 25 ml of concentrated sulfuric acid and add 2-3 boiling chips.
2. Place the insert ract with all the sample digestion tubes in each slot into the digester and turn on the acid vapor limiter. Set the sample digestion temperature at 200 °C for 30 minutes, then increase the temperature to 350 °C. Digest the sample until a clear solution is obtained, which takes about 60 minutes. Wait for all the acid vapor to be absorbed and leave to cool.
3. Turn on the distillation switch, wait for the signal that the machine is ready to work, then connect the sub-tube to the distillation machine. Take a 250 ml. Enamel flask, which contains 25 ml. of 4% concentrated boric acid solution. Drop 2-3 drops of mixed indicator and place it on the distillation machine support position.
4. After the distillation is complete, the machine stops working and removes the digester tube and boric acid solution in the rosin flask.
5. Titrate the boric acid solution with 0.1 N hydrochloric acid standard solution until the color of the solution changes from green to pinkish purple (do 3 replicates).
6. Make a blank according to the method in steps 1-6 without adding a sample and calculate the nitrogen quantity from the formula.

$$\text{Nitrogen content (percent by weight)} = \frac{(A-B) \times N\ HCl \times 14.007}{\text{Wt.sample} \times 1000} \times 100$$

$$\text{Protein content (percent by weight)} = \text{Nitrogen content} \times F$$

Fat quantification analysis

1. Bake the beaker in an electric oven at 105 °C for 2-3 hours. Leave it to cool in a desiccant jar and weigh the exact weight. Record the results.
2. Weigh 1-2 grams of sample onto a filter paper, wrap the sample tightly with the filter paper, and place it into a sample tube.
3. Place the tube support wire into the fat beaker and insert the tube. Turn on the fat extractor, set the temperature to 105 °C, add 150 ml of petroleum ether to the beaker containing the sample, connect it to the fat extractor. When the time is up, remove the beaker from the heat and leave it for about 15 minutes.
4. Reduce the temperature of the fat extractor from 150 to 0°C. Remove the beaker from the fat extractor. Place the beaker in an electric oven at 102°C for 30 minutes. Cool in a desiccator. Weigh, record the values, and calculate the fat content from the formula.

$$\text{Fat content (percent by weight)} = \frac{\text{Fat weight (grams)}}{\text{Sample weight (grams)}} \times 100$$

Moisture content analysis

1. Bake the container with the lid in an electric oven at 105 °C for 2-3 hours. Remove from the oven and place in a desiccator jar. Leave until the temperature of the container drops to room temperature (it takes about 15-30 minutes). Weigh and record the result. Repeat until the aluminium container has a constant weight. Record the weight.
2. Weigh the sample to obtain an exact weight of approximately 3-5 grams (record it as the sample weight before drying). Place it in a container to determine the moisture content of the exact weight (repeat 3 replicates for each sample).
3. Place in an electric oven with the lid open at 105 degrees Celsius for approximately 3-4 hours. When the time is up, close the lid, remove from the oven and place in a desiccant jar until the temperature drops to room temperature. Weigh and record the results.
4. Repeat baking for 30 minutes each time until the weight is constant. Record the weight and calculate the moisture content from the formula.

$$\text{Moisture content (\% by weight)} = \frac{(\text{Weight before baking - Weight after baking})(\text{g})}{\text{Weight before baking (g)}} \times 100$$

3. Statistical analysis

1. Analysis of soil quality, tuber size and tuber weight, starch content and starch quality from cassia tuber using mean and standard deviation.
2. Nitrogen, phosphorus and potassium were compared using One-way ANOVA.
3. Comparison of moisture content, organic matter, pH, tuber size and tuber weight, average starch content from cassava tubers, and quality of cassava flour using t-test: Two-Sample Assuming Equal Variances.

Results

1. Study of soil quality

The study of soil quality in area near the beach and the area away from the beach found that the moisture content and organic matter in the soil were different. The area near the beach had lower moisture content and organic matter than the area away from the beach. The soil pH in both areas was not different. The nitrogen and potassium values were not different between the two areas. However, the phosphorus value in the area near the beach was lower than the area away from the beach. The soil textures found were different. The area near the beach had sandy loam soil, while the area away from the beach had clay loam soil. Both areas had brownish-yellow soil, but the area away from the beach had a darker color, as shown in Tables 1 and 2.

Table 1: shows the soil quality.

Study sites	Soil quality (%)		pH	Soil fertility		
	Moisture	Organic matter		Nitrogen	Phosphorus	Potassium
near the beach	8.21 ± 2.15[a]	1.12 ± 0.62[a]	7.5 ± 1.30[a]	trace	trace	trace
away from the beach	14.21 ± 1.76[b]	2.20 ± 0.56[b]	7.2 ± 1.21[a]	trace	low	trace

Note: Different letters in the columns indicate significant statistical difference ($p \leq 0.05$).

Table 2: shows the soil texture and color characteristics.

Study sites	Soil texture	Color
near the beach	Sandy loam	Yellowish brown (2.5Y 5/3)
away from the beach	Clay loam	Yellowish brown (2.5Y 7/4)

2. Study of the size and weight of the head of *Tacca leontopetaloides*

The study of head size and weight found that the mean horizontal and vertical head circumference of the stingrays near the beach were higher than those far from the beach, and the mean head weight of the stingrays near the beach was higher than those away from the beach, as shown in Table 3.

Table 3: Show the size and weight of the head of *Tacca leontopetaloides.*

Study sites	Average data of *Tacca leontopetaloides* (per capita)		
	Horizontal head circumference (cm)	Vertical head circumference (cm)	Head weight (grams)
near the beach	37.3 ± 5.27[a]	15.8 ± 3.94[a]	633.92 ± 221.68[a]
away from the beach	26.6 ± 4.22[b]	15.2 ± 4.73[a]	256.23 ± 81.6[b]

Note: Different letters in the columns indicate significant statistical difference ($p \leq 0.05$).

3. Study of the quantity and quality of flour from the head of *Tacca leontopetaloides*

The study of starch quantity and quality found that the amount of starch obtained from the head of *Tacca leontopetaloides* near the beach was higher than that obtained from the head away from the beach and the quality of the starch obtained was not different between the two areas as shown in Table 4.

Table 4: Shows the amount of starch and chemical composition of *Tacca leontopetaloides* 's Flour.

Study sites	Starch quantity (grams)	Chemical composition (percent)			
		Water	Protein	Fat	Ash
near the beach	959.34	5.88 ± 0.39^{a}	0.41 ± 0.17^{a}	0.02 ± 0.02^{a}	0.44 ± 0.05^{a}
away from the beach	809.21	4.56 ± 1.39^{a}	0.32 ± 0.13^{a}	0.03 ± 0.02^{a}	0.62 ± 0.12^{a}

Note: Different letters in the columns indicate significant statistical difference ($p \leq 0.05$).

Discussion

Soil quality analysis found that Moisture, organic matter and phosphorus values in soil near the beach were lower than those away from the beach. However, pH, nitrogen and potassium values in soil were not different. The soil texture found near the beach was sandy loam soil, while away from the beach was clay loam soil. Both areas had brownish-yellow soil, but away from the beach was darker. When analyzing the size and weight of *Tacca leontopetaloides*, it was found that *Tacca leontopetaloides* near the beach were larger and had higher weighed *Tacca leontopetaloides* than those away from the beach. The starch content near the beach was 150.15 grams per 5 kilograms of *Tacca leontopetaloides* weight compared to those found away from the beach. The starch quality analysis found that the starch quality in both areas was not different. Therefore, it can be concluded that different soil qualities affect the size, weight of *Tacca leontopetaloides* and the amount of starch from *Tacca leontopetaloides*. Sandy loam soil is the most suitable soil for growing *Tacca leontopetaloides* because it produces more *Tacca leontopetaloides* and starch than other soil types.

Conclusion

Soil quality, soil texture, and soil color of the two areas are different. Since the area near the beach is sandy loam, it has less moisture, organic matter, and phosphorus than the area away from the beach, which is clay loam. Soil quality also affects soil color. The soil near the beach has low organic matter, making the soil lighter in color than the area away from the beach. The soil pH, nitrogen, and potassium values in the two areas are not different.

The soil quality near the beach results in larger *Tacca leontopetaloides*, with higher average

horizontal and vertical circumferences and average taro weights than the area away from the beach. This is because *Tacca leontopetaloides* can store food and grow well in soils that can drain well, such as sandy soil or sandy loam soil, which has low soil moisture (Department of Agricultural Extension, 2021). It can also grow in soils with low organic matter and grow well in soils with low phosphorus values. Because phosphorus is a limiting factor for plant growth, *Tacca leontopetaloides* has adapted by inhibiting the growth of the taproot. Increase the number of lateral roots to absorb nutrients and accumulate nutrients in the tuber (Khanitha and Waraporn, 2020). The amount of starch from the tuber of *Tacca leontopetaloides* was different between the two study areas. The area near the beach had a higher average amount of starch than the area away from the beach. The quality of the starch from the tuber was not different because the area near the beach had a larger tuber than the area away from the beach, resulting in a larger volume inside the tuber, allowing it to accumulate more starch and reserve food. Therefore, it yielded a higher amount of starch, but it did not affect the quality of the obtained starch. This is consistent with the experiment of Supinya (2015) who found that different sizes of *Tacca leontopetaloides* tuber gave a starch amount of 30% of the fresh tuber weight and the protein obtained was not statistically different.

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GLOBE's databases

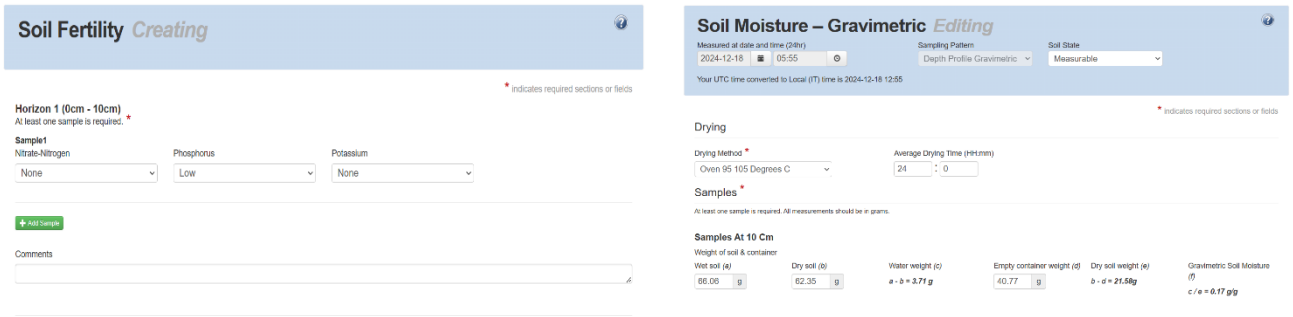

Figure 6. Soil quality data is entered into the database.

Optional Badge

1. **I AM A DATA SCIENTIST**

We are a leader in various tools, both technical and statistical. We collect data for analysis from raw data. We are good communicators with management and pay attention to every detail in operations. We have problem-solving skills, including presentation skills, and the ability to explain complex ideas in an easy-to-understand format.

2. **I MAKE AN IMPACT**

Our research aims to show that *Tacca leontopetaloides* is a rare plant that is about to become extinct. However, because the flour from *Tacca leontopetaloides* is of good quality, different from the general flour in the market, it can generate income for the community up to 500 baht per kilogram. Therefore, the study results will show the properties of the soil that are suitable for the growth of *Tacca leontopetaloides*, as a guideline to promote the conservation of *Tacca leontopetaloides* and the wisdom in making *Tacca leontopetaloides*to's flour, including being able to disseminate knowledge about *Tacca leontopetaloides*to make it more well-known.

3. **I WORK WITH A STEM PROFESSIONAL**

We are STEM professionals because we have STEM scientists to advise us throughout the project. Our research uses scientific methods to study *Tacca leontopetaloides*, mathematical knowledge to collect and interpret statistical data, and the use of technological tools in research. And the method of studying *Tacca leontopetaloides* 's flour quality has a professional team from Rajamangala University of Technology Srivijaya, Trang Campus, to help and teach us to conduct the study.

Appendix with raw data

Conduct an experiment

Picture 1: Example of a giant yam tree.

Figure 2: Results of NPK testing in soil.

Picture 3: Analysis of flour quality

Picture 4: Filtering tapioca flour.

พื้นที่	น้ำหนักถ้วย	ดินก่อนอบ	ดินหลังอบ	สูตร	ผลต่าง	ค่าความชื้น	%โดยน้ำหนัก
1/1	38.04	25.19	62.04	24	1.19	0.04958333	4.95833
	38.16	25.72	62.69	24.53	1.19	0.04851203	4.8512
	44.96	25.23	69	24.04	1.19	0.04950083	4.95008
	38.31	25.42	62.59	24.28	1.14	0.04695222	4.69522
	44.44	25.08	68.34	23.9	1.18	0.04937238	4.93724
	43.17	25	66.96	23.79	1.21	0.05086171	5.08617
						0.04913042	4.91304
1/2	42.4	25.32	66.03	23.63	1.69	0.07151926	7.15193
	44.33	25.41	68.38	24.05	1.36	0.05654886	5.65489
	39.32	25.12	62.91	23.59	1.53	0.06485799	6.4858
	48.33	25.4	71.93	23.6	1.8	0.07627119	7.62712
	40.19	25.58	63.9	23.71	1.87	0.07886968	7.88697
	45.05	25.28	68.82	23.77	1.51	0.06352545	6.35255
						0.06859874	6.85987
1/3	39.6	25.24	62.43	22.83	2.41	0.10556286	10.5563
	42.22	25.57	65.21	22.99	2.58	0.11222271	11.2223
	44.44	25.53	67.43	22.99	2.54	0.11048282	11.0483
	42.67	25.72	65.91	23.24	2.48	0.10671256	10.6713
	37.9	25.34	60.81	22.91	2.43	0.10606722	10.6067
	39.67	25.75	62.98	23.31	2.44	0.1046761	10.4676
						0.10762071	10.7621
1/4	42.55	25.24	65.59	23.04	2.2	0.09548611	9.54861
	41.2	25.28	64.4	23.2	2.08	0.08965517	8.96552
	44.44	25.7	68.1	23.66	2.04	0.08622147	8.62215
	39.23	25.58	62.67	23.44	2.14	0.09129693	9.12969
	41.99	25.1	64.97	22.98	2.12	0.09225413	9.22541
	47.24	25.66	70.71	23.47	2.19	0.09331061	9.33106
						0.09137074	9.13707
1/5	39.23	25.04	62.01	22.78	2.26	0.09920983	9.92098
	38.83	25.2	61.79	22.96	2.24	0.09756098	9.7561
	41.93	25.15	64.94	23.01	2.14	0.09300304	9.3003
	40.66	25	63.64	22.98	2.02	0.08790252	8.79025
	35.87	25.94	59.62	23.75	2.19	0.09221053	9.22105
	41.59	25.7	65.08	23.49	2.21	0.09408259	9.40826
						0.09399491	9.39949

Table 1: Soil moisture data in the beach and away from the beach.

พื้นที่	ค่า pH	พื้นที่	ค่า pH
1/1	9	2/1	9
	8		8
	8		8
1/2	8	2/2	6
	8		6
	9		7
1/3	6	2/3	6
	6		7
	7		6
1/4	5	2/4	5
	9		9
	8		7
1/5	9	2/5	8
	6		8
	7		8

Table 2: pH data in soil

พื้นที่	N	P	K
1	Trace	Low	Trace
	Trace	Low	Trace
	Trace	Low	Trace
	Trace	Trace	Trace
	Low	Trace	Trace
	Trace	Trace	Trace
	Trace	Trace	Trace
	Trace	Low	Low
	Trace	Trace	Trace
	Trace	Trace	Trace
	Trace	Trace	Trace
	Trace	Trace	Trace
	Trace	Trace	Trace
	Trace	Trace	Trace
	Trace	Trace	Trace

Table 3: NPK value data

พื้นที่	ความชื้น(%)	โปรตีน(%)	ไขมัน(%)	เถ้า(%)
ติดชายหาด	5.482224	0.241931	0.007628	0.488719
	6.271469	0.582712	0.037886	0.510155
	5.8767	0.4123	0.022757	0.452609
ห่างชายหาด	3.325905	0.451831	0.009979	0.848107
	6.057229	0.192683	0.018746	0.493583
	4.286397	0.316012	0.046976	0.577743

Table 4: Flour quality data

พื้นที่	ความยาวรอบหัวแนวนอน	ความยาวรอบหัวแนวตั้ง	น้ำหนักหัว	ปริมาณแป้ง
ติดชายหาด	43	12	840	959.34
	41	16	740.12	
	39	14	640.87	
	30	12	350.11	
	33	14	420.83	
	37	20	630.18	
	41	18	800.06	
	32	12	395.5	
	32	16	490.71	
	45	24	1030.86	
ห่างชายหาด	24	18	200.32	809.21
	23	24	283.55	
	32	18	394.37	
	21	12	156.56	
	24	18	232.7	
	26	18	220	
	31	14	329.13	
	32	10	336.92	
	30	10	267.5	
	23	10	141.28	

Table 5: Data on tuber size, tuber weight and starch content.