

Research title Soil types affecting survival and growth rate of broken *Enhalus acoroides* washed on shore.

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Abstract

The purpose of this research study the type of soils suitable for nursing *Enhalus acoroides* that were blown along the coast. Study the survival rate of *Enhalus acoroides* were planted in natural sites after nursing. By surveying 3 sites of *Enhalus acoroides*, namely the Rajamangala Beach, Makham Bay and Boonkong Bay then collected soil samples and check soil quality. After that, the *Enhalus acoroides* were blown along the coast was fed in 3 boxes divided into 3 sets of experiments. Each experiment set was different that was the soil came from 3 sites. Added oxygen to the water as well. Record the growth of *Enhalus acoroides*. We also measured length and width of leaf and also number of leaves that increase every 3 days for a period of 1 month, checked the quality of the soil after planting and recorded the survival rate of *Enhalus acoroides*. After that, the nursed *Enhalus acoroides* were planted at Boonkong Bay, which is a site of planting *Enhalus acoroides* in the nature. By comparing *Enhalus acoroides* seeding with seed, checking the survival rate of *Enhalus acoroides* after 1 month of planting, the study found that the soil type affects the growth of *Enhalus acoroides*. They growth in the soil of Makham Bay and they have 100% survival rate, while soil from Rajamangala Beach and Boonkong Bay have survival rate 93.75%. When the nursed *Enhalus acoroides* is planted in natural sites, it is found that the *Enhalus acoroides* obtained from the nursing is about 3 times more likely to survive than the *Enhalus acoroides* obtained from seeding.

Keywords: *Enhalus acoroides*, soil type, survival rate

Introduction

Seagrass is very important plant for the ecosystem, as seagrass is food source for many aquatic animals. In addition, seagrasses sources in nature have the capacity to absorb 10% of the carbon in the entire ocean (Bluecarbonsociety, 2018), which is currently decreasing in the number of seagrass sources in Thailand (Office of Environment and Pollution Control No. 13 Chonburi, 2016). The seagrasses are decreasing in Thailand due to many factors. One of the reasons for the decline in seagrass habitats is the severe impact of seagrass waves causing damage to seagrass (Marine and Coastal Resources Knowledge Archives, 2019). This causes the seagrasses to break and then float along the waves and get stuck along the shore. So, the beach become dirty. Increasing the number of seagrasses is increasing *Enhalus acoroides* which is one of seagrass. Seeding is popular way to increase them, as their seeds can be planted and then planted in natural areas. However, seeding takes up to 3 months to grow, but when the *Enhalus acoroides* is planted in natural areas, the survival rate is small compared to the

total number planted. Therefore, the researchers were interested in trying to plant *Enhalus acoroides* that was blown along the coast to be planted in the soil that are from different areas. Studying the types of soil that are most suitable for growing and nursing *Enhalus acoroides* that is blown along the coast, and whether the nursed *Enhalus acoroides* is planted in the natural *Enhalus acoroides* habitat to compare with the survival rate of *Enhalus acoroides* planted by seeding method to see if there is a higher survival rate.

Research question

1. Does each soil type affect the growth of *Enhalus acoroides*? How?
2. What type of soil is the most suitable for the nursed *Enhalus acoroides* that are blown along the coast?
3. After releasing recovered seedling into the sea. Does the nursing seedling establish as good as normal seedling?

Research hypothesis

1. Different soils affect the growth rate of *Enhalus acoroides* differently.
2. The soil in Makham Bay is the most suitable for nursed *Enhalus acoroides* that have been blown along the coast.
3. *Enhalus acoroides* that is nursed when grown in natural areas has a higher survival rate than *Enhalus acoroides* grown from seeds.

Materials and methods of conducting research

Equipment materials

1. Box size 30×30×30 cm
2. Aquarium oxygen
3. pH meter
4. Salinity meter
5. N P K Test kit
6. Hot Air Oven
7. Muffle furnace
8. Soil from Rajamangala, Beach, kham Bay Boonkong Bay
9. Sea water
10. measure tap
11. Water Tank

Methodology

1. Study Site

Study the types of soil suitable for growing and nursing *Enhalus acoroides* that are blown along the coast. Boonkong Bay, Makham Bay, Sikao District, Trang Province, and bring soil from the Rajamangala Beach, Makham Bay Boonkong Bay. Then *Enhalus acoroides* were planting in the soil samples. They also are checked the soil texture, pH, nutrient content and organic matter content in the soil. In addition, seawater samples were collected to check salinity, pH and water temperature to control the experiment series. The method of monitoring water quality and soil quality is in line with GLOBE principles.

2. Preparation of equipment for nurseing *Enhalus acoroides*

2.1 Preparation of boxes

The process of preparing *Enhalus acoroides* boxes

1. Prepare a box of 30×30×30 centimeters and 12 experimental sets divided into 3 experimental sets Each set uses different types of soil, including sandy soil at Rajamangala Beach. Soil in Boonkong Bay and Makham Bay using 4 laboratory cabinets per 1 experimental set.

2. Bring the soil around Rajamangala Beach Boonkong Bay and Makham Bay checked the soil texture. Acidity – base, soil fertility according to GLOBE principles and check the amount of nutrients in the soil.

3. Bring sandy soil around Rajamangala Beach. Soil in Boonkong Bay and Makham Bay Put 7.2 cubic centimeters in the boxes and put 10 liters of seawater in every box.

4. Install oxygen booster using oxygen booster 1 machine per 4 trial cabinets After that, wait for the sediment waterfall for 3 days.

2.2 Preparation of *Enhalus acoroides* plants

The process of preparing seagrass plants

48 seagrasses collected from the coast were trimmed, each with a trunk size about 10 centimeters long, and trimmed the rotten leaves.

3. *Enhalus acoroides* planting and data collection

Experimental *Enhalus acoroides* planting. First, measure *Enhalus acoroides* the length, width, and number of leaves of *Enhalus acoroides* to compare the growth rate before and after the experiment. In each experiment, *Enhalus acoroides* will be planted on the edges of the cabinet on all 4 sides, about 5 centimeters away from the edge of the cabinet. While planting, control acidity – Bass in the range of 7.7-8.4, salinity in the range of 30-31 ppt. and water temperature between 27 - 32 degrees. as follows

1. *Enhalus acoroides* growth by recording the results the total data was collected for 3 days per session after the *Enhalus acoroides* was nursed in the experiments.

2. Inspection of soil texture characteristics the amount of organic matter in the soil and soil fertility from all three sites.

3. Survival rate of *Enhalus acoroides* in nature.

4. Planting *Enhalus acoroides* in natural

Planting of *Enhalus acoroides* to their habitats is 47 N , x = 532574 , y = 830888 and take the *Enhalus acoroides* that is grown from the seeding of community nature. 47 N , x = 532580 , y = 830887 planted 40 plants each. Follow up on the survival of nursed *Enhalus acoroides* and seeded *Enhalus acoroides*, and compare the survival rates of the two types of *Enhalus acoroides*.

5. Data analysis

1. Analyze *Enhalus acoroides* growth rate data with arithmetic averages and compare soil differences in all 3 sites using one-way ANOVA statistics at a significant level of .05.
2. Analyze the amount of organic matter in the soil using arithmetic mean and present it with a bar chart comparing values before and after the experiment.
3. Analyze soil fertility from all 3 sites using nitrogen comparison table. Phosphorus and potassium before and after the experiment

Result

1. The results of the study of the growth rate of *Enhalus acoroides* by the results are as follows:

In one-month period, the growth rate of leaf length in each area of the soil varied at a statistically significant level .05 and leaf width growth rates in each soil area do not differ at the .05 significance level shown in the Figure 1 and 2.

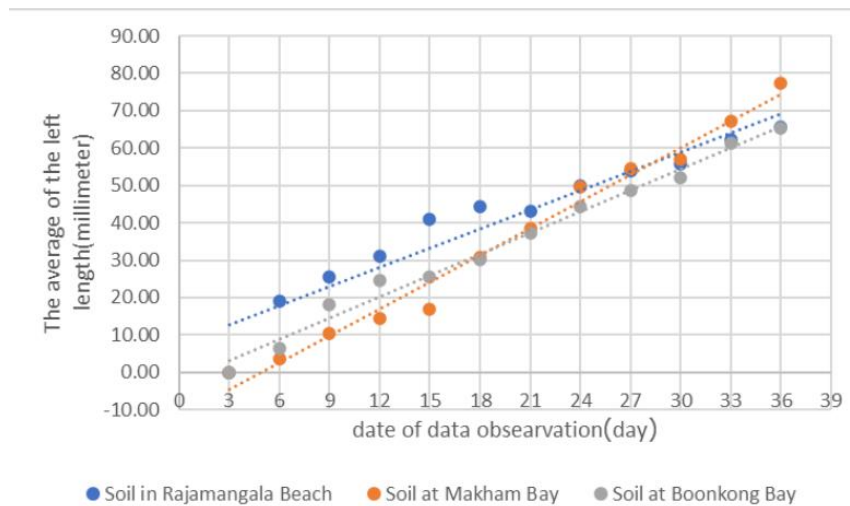


Figure 1 Shows the growth rate, leaf length, *Enhalus acoroides* of the soil from three sites.

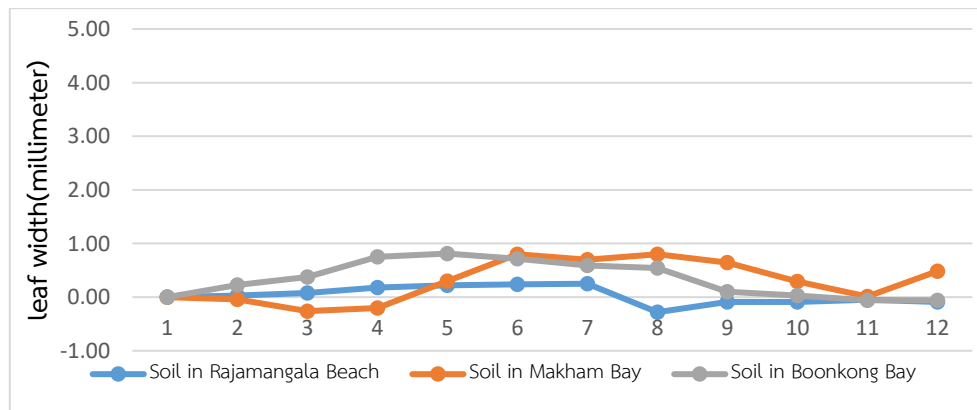


Figure 2 Shows the growth rate, blade width, *Enhalus acoroides* of the soil from three sites.

The average number of leaves of *Enhalus acoroides*. The soil from the Makham Bay site has the largest average increase in the number of leaves. Soil from Rajamangala Beach sites and soil from Boonkong Bay sites in order respectively. As shown in Figure 3.

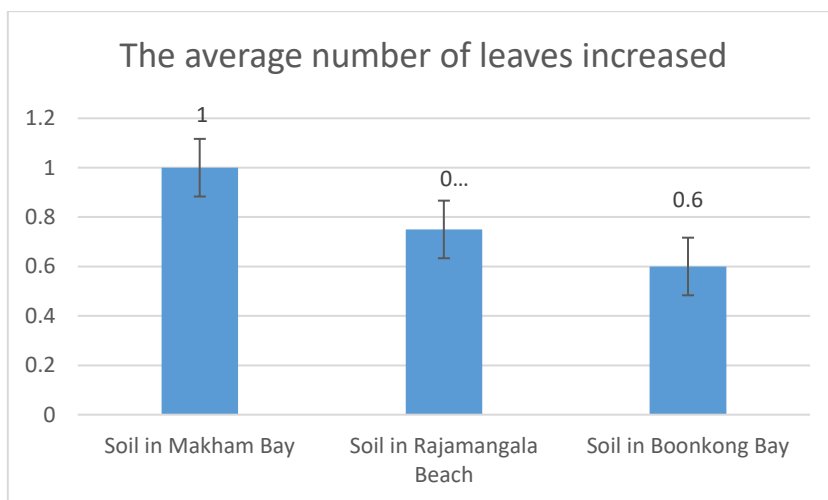


Figure 3 The chart shows the average increase in the number of *Enhalus acoroides* leaves after nursing in the three soils.

2. Inspection of soil texture characteristics the amount of organic matter in the soil and soil fertility from all three sites.

2.1 Results of soil characteristics inspection

Table 1 shows the characteristics of the soil texture at the study site from Rajamangala Beach. Makham Bay and Boonkong Bay sites.

Soil sample	Soil texture
Soil in Rajamangala Beach	Sandy soils
Soil in Makham Bay	Loamy mixed sandy soils
Soil in Boonkong Bay	Sandy soils, loamy soils.

2.2 Amount of organic matter in the soil

Organic matter determination before conducting soil experiments in all three soil sites. Shown in Figure 4.

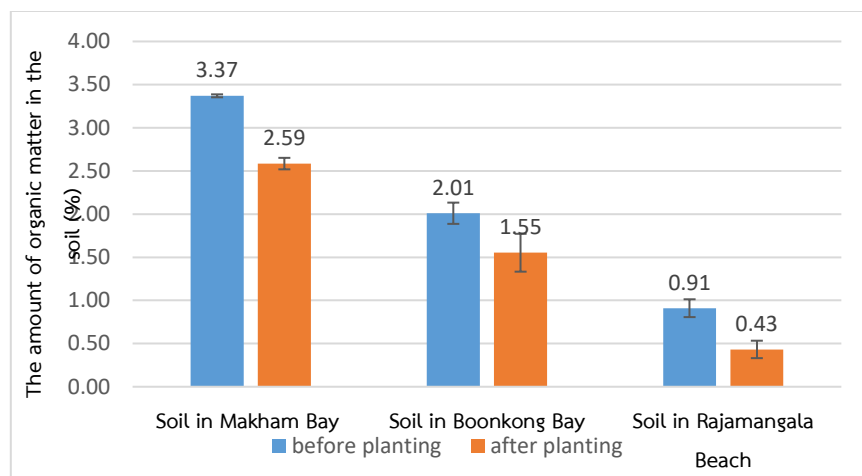


Figure 4 Shows the amount of organic matter in the soil before and after the experiment

2.3 Results of soil fertility inspection in all three areas

The results of the soil fertility inspection in all three sites by examining the amount of nitrogen, potassium and phosphorus in the soil are shown in table 2.

Table 2 shows a comparison of nutrient content in the three soil sites before and after the experiment

Experimental series	Nutrient content in the soil					
	N		P		K	
	before	back	before	back	before	back
Soil in Rajamangala Beach	trace	trace	trace	trace	trace	trace
Soil in Makham Bay	low	trace	low	low	low	trace
Soil in Boonkong Bay	low	trace	low	low	low	trace

3. Survival rate of *Enhalus acoroides* in nature

The survival rate of *Enhalus acoroides* in the cultivation showed that the *Enhalus acoroides* in Makham Bay had a survival rate of 100% and *Enhalus acoroides* from the soil at Rajamangala Beach and Boonkong Bay accounted for 93.75%.

4. Monitoring the survival rate of nursed *Enhalus acoroides* when planted in natural environments.

When tracking the survival rate of reconstructed *Enhalus acoroides*, it is planted in a natural environment. It was found that 40 nursed *Enhalus acoroides*, the survival rate was 14, and compared to the 40 *Enhalus acoroides* planted by seeding the survival rate was only 5. Shown in Figure 5.

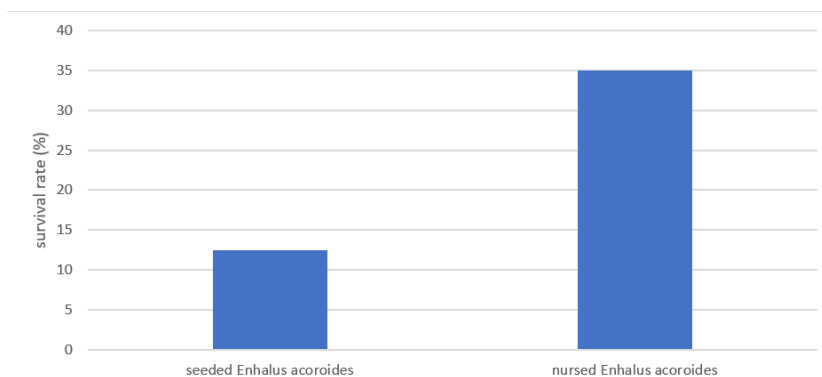


Figure 5 The bar chart shows the survival rate of nursed *Enhalus acoroides* and *Enhalus acoroides* caused by seeding after planting in Boonkong Bay.

Conclusion

From the study of soil characteristics suitable for the growth of *Enhalus acoroides* washed along the coast. Summary of experimental results and discussed as follows:

Nursing *Enhalus acoroides* washed by waves along the coast from 3 soil sites, namely the soil at Rajamangala Beach; Soil around Boonkong Bay and the soil around Makham Bay. By studying the growth rate from leaf length and leaf width, it was found that *Enhalus acoroides* had the highest growth rate in the soil of Makham Bay. Followed by soil at Rajamangala Beach and Soil at Boonkong Bay, respectively. The soil type suitable for the growth of *Enhalus acoroides* is sandy loam. And the research results are consistent with the real space. That is, in the area of Makham Bay, there are large and very long *Enhalus acoroides*. Rajamangala Beach area, where the condition of the area is generally still abundant. However, due to encroachment on the natural area of Rajamangala Beach, there were no *Enhalus acoroides* in the surveyed area. The coastline of Rajamangala Beach has changed. Characteristics of erosion and deposition of coastlines the erosion rate is greater than the accumulation rate. making the coastline of Rajamangala Beach unstable due to the loss of coastal areas caused by coastal erosion (Rajamangala Research Journal Srivijaya University of Technology, 2016). and Boon Khong Bay where there is a *Enhalus acoroides* plant, so it found a small *Enhalus acoroides*. The study was therefore consistent with the physical characteristics of the three sites and each soil type affecting the growth of *Enhalus acoroides*.

The nursed *Enhalus acoroides* absorbs nutrients and organic matter. in the soil to produce food and growth while in a medical facility because when comparing the amount of nutrients and organic matter before and after the experiment in all 3 soil types. It was found that the amount of nutrients and organic matter in the soil were different because most of the organic matter was carbon. *Enhalus acoroides* have a very good ability to absorb carbon. When absorbed, it accumulates in rhizomes with roots as absorbers. The amount of organic matter in the soil after the experiment decreased. The average *Enhalus acoroides* absorbs 29.91% of the total organic matter in the soil after nursing.

Soil nutrient content from the soils of Makham Bay and Boonkong Bay decreased due to the nursing of *Enhalus acoroides* used for various growth. *Enhalus acoroides* phosphorus is

used to accelerate the growth and spreading of the root parts of *Enhalus acoroides* potassium is used for sugar synthesis and to promote leaf and stem vigor. The *Enhalus acoroides* in the nursed center exhibited a variety of growths, such as increasing leaf length and leaf width, increasing the number of leaves and roots branching from the rhizome.

Comparison of survival rates of recovered *Enhalus acoroides* and seeded *Enhalus acoroides* at Boonkong Bay for 1 month found that survival rates were higher than those of seeded *Enhalus acoroides* because the nursed *Enhalus acoroides* has a stem structure and stronger roots. Therefore, when the *Enhalus acoroides* that has been nursed is hit by waves, it will have a chance to drift away. according to the current that is less than that of the *Enhalus acoroides* produced by seed and the structure of the nursed *Enhalus acoroides* leaves is stronger. Therefore, when there is a low tide phenomenon, it is more resistant to dryness and death than the *Enhalus acoroides* that grows from seed as well.

Economic value the nursed *Enhalus acoroides* were made by taking advantage of *Enhalus acoroides* that was washed off the shore, which was easily found, to increase its numbers. *Enhalus acoroides* in nature It takes 3 times less recovery time than seeding and the use of *Enhalus acoroides* Blown along the coast to help reduce the cost of buying seeds. Currently, the seeds of *Enhalus acoroides* have relatively high price because there are fewer

Benefits

Research Results A study of soil species suitable for the growth of *Enhalus acoroides* blown along the coast. The benefits of the study are as follows:

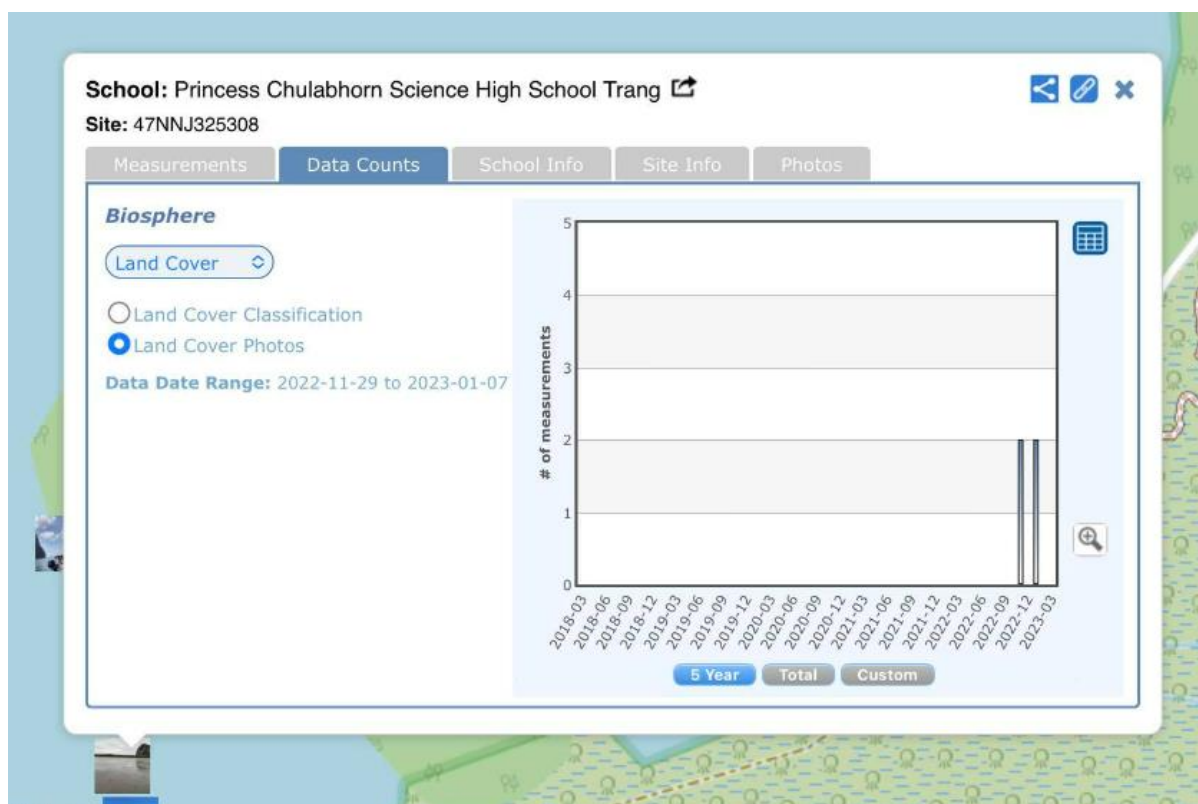
1. It is possible to nurse the *Enhalus acoroides* that has been blown along the coast so that it can be replanted further. Shorten the recovery time and provide a strong *Enhalus acoroides* plant, since it already has roots and leaves.
2. It is possible to know the characteristics of the soil that affects the growth of *Enhalus acoroides* that is blown along the coast.
3. It can increase the chances of survival of *Enhalus acoroides* in greater quantities. As a result, manatees and aquatic animals have increased food sources and thus increase fishermen's incomes.

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Badges

I am collaborator

Our research was conducted in collaboration with our team. In our team we have 3 people who are Woramat Prayoonhong, Natthawat Soontreewong, Kitiphop Yimyong. First, we brainstormed the title of the project from the problem in our community. Then we surveyed the studies site where are Rajamangala Beach, Makarm Bay and Boonkong bay. While surveying the Natthawat looked for physical appearances of the seagrasses and soils and Woramat collected the data. Kitiphop took pictures from everywhere went.

After that, we tested the soils and seawater. First, we incubate and burned the soils together and then Woramat and Kitiphop tested the N, P, K and the organic matters while Natthawat was collecting the data.

Then we nursed *Enhalus acoroides* when we collected the data (length and wildth of leaves, pH and salinity of seawater) we also work together to collect the data all 12 boxes per person. When we were collecting data, we have 2 persons measured and one person collected. We did every 3 days for 1 month.

After that, we came back to Boonkong Bay for planting the *Enhalus acoroides*. And we came back again to check the survival rate of our *Enhalus acoroides*.

For the last, we also conclude all about our research together and prepare for presentation, research report by Woramate, Power Point presentation by Kitiphop and VDO clip by Natthawat

The advantages of collaboration are that we can spend less time working and have a higher quality of work than working alone because each person have different abilities.

I make an impact

Seagrass is currently decreasing in the number of seagrass sources in Thailand the seagrasses are decreasing in Thailand due to many factors. One of the reasons for the decline in seagrass habitats is the severe impact of seagrass waves causing damage to seagrass. So, we did this project to increase the number of seagrasses in the nature. This study makes us know that we can enlarge huge numbers of them seedling needed only 3 times shorter than the traditional way. And this project makes another people know how to increase the number of seagrasses to balance the ecosystem.

I am a Data Scientist

In this research work, Data from various locations were collected for use in the experiment. And analysis of the results of the experiment. The data was collected from various sources, such as the Marine and Coastal Resources Knowledge Library, which is an important information in discussing the results of the experimental, as well as the research of Srivichai University of Technology to be used in a series of experiments and variable control. The speakers from BoHin Farmstay Community Enterprise Group are the important helpers in helping to conserve and nurse seagrass in Trang Province. After collecting the data, the panel conducted the experiment as planned. The research team periodically collects the results of the experiment using scientific tools, analyzes the data using test statistics, and draws conclusions that are in accordance with scientific principles.

