The Study of Planting Materials from Natural Organic Waste on the Beach Location: Sikao District, Trang Province

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Abstract

This project aims to study the feasibility of using organic waste from beach areas as planting materials, focusing on analyzing the properties of organic waste from the beach to assess its suitability for planting. The planting materials must be rich in minerals and have a soil structure conducive to growth. The experiment involved collecting organic waste samples from the beach, preparing the planting material, and testing the pH, main nutrient levels (nitrogen, phosphorus, and potassium), organic matter content, and carbon-to-nitrogen ratio (C/N Ratio). The appropriate formula was adjusted, and the growth of plants in the planting material derived from organic waste was compared with that in standard planting materials. The study found that the planting medium made from organic waste had a pH level within the appropriate range after improvement and contained sufficient nutrients for plant growth, particularly high levels of phosphorus and organic matter, which positively affected plant growth. Therefore, organic waste from beach areas can be improved and used as an effective planting medium. It contains sufficient minerals for plant growth, which not only helps reduce the amount of waste that causes pollution but promotes the sustainable use of resources in agriculture.

Keywords: planting materials, beach organic waste, waste utilization, coastal area development

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Research Questions

1. Can organic waste from the beach be used as planting material?
2. Is the planting material made from beach organic waste sufficient in nutrients for plant growth or not? How?
3. Does planting material made from beach organic waste affect plant growth? How?

Hypothesis

1. To study the use of organic waste from the beach as a planting material
2. To develop a growing medium formula from beach organic waste that contains essential nutrients for the growth of plants
3. To study and compare the growth effects of beach organic waste as a planting medium. For plants

Introduction

Organic waste is a significant problem that needs to be managed appropriately, especially in beach areas, which are tourist destinations and fragile ecosystems. Traditional methods of organic waste disposal often focus on quick removal to reduce pollution and maintain cleanliness. However, these methods often come with limitations and long-term environmental impacts. One commonly used method is collection and landfill, which is simple and low-cost. Local authorities or responsible organizations often dispose of organic waste in designated areas. However, landfilling waste can impact the environment, such as methane emissions from anaerobic decomposition, which is one of the greenhouse gases contributing to global warming. It can also cause groundwater contamination and requires large areas for management. Another method used is incineration, which helps reduce waste volume quickly, especially in land-constrained areas. However, incinerating organic waste can release toxic gases and dust harmful to human health and the environment, and it results in the loss of resources that could be reused. Some areas may choose to use.

The method of disposing of organic waste in natural water bodies, such as the sea or rivers, although it quickly reduces the amount of waste on the beach, adversely affects the marine ecosystem. Decomposing organic waste can deplete oxygen in the water, impacting aquatic life and potentially disrupting the ecological balance in the long term. In some cases, organic waste is allowed to decompose naturally on the beach. This method does not require

additional resources for management, but if the waste volume is too high, it can cause unpleasant odors, attract flies and pests, and affect the beach's scenery, making it less appealing to visitors. Additionally, some organic waste may be transported to central waste management facilities or recycling centers for further processing. This method helps reduce environmental impact in beach areas but incurs high costs in terms of transportation and energy used in the management process. Although these traditional methods of organic waste disposal help reduce waste in the short term, they are not sustainable in the long term due to their environmental impact, resource depletion, and loss of opportunities to repurpose organic waste. Therefore, finding environmentally friendly and sustainable methods of managing organic waste, such as converting it into biofertilizers or plant-growing materials, should be considered to reduce the impact on nature and promote resource efficiency.

Using organic waste from beaches as planting materials is one approach to sustainable resource management. This not only helps reduce the amount of waste that causes pollution but also adds value to the waste. Some types of organic waste, such as seaweed and plant debris, contain essential minerals necessary for plant growth, such as nitrogen (N), phosphorus (P), and potassium (K), as well as other trace elements that strengthen plants. Therefore, we are interested in studying this, focusing on analyzing the properties of planting materials derived from organic waste along the beach. Analyze the minerals and nutrients suitable for plant cultivation, including the examination of pH, organic matter content, and carbon-to-nitrogen (C/N Ratio) ratio to assess the potential of these planting materials in supporting plant growth. The goal is also to find new alternatives for organic waste management and to promote the efficient and sustainable use of natural resources, which will help reduce environmental impacts and increase agricultural production efficiency in the long term.

Materials

1. Organic waste from the beach area
2. Coffee grounds
3. Phosphate rock
4. Ash

Methods

1) Defining the Study Area

1.1) Study Area Defined: Hat Wiwha Tai Samut, Sikao District, Trang Province

Coordinates: Latitude 7.2020° North and Longitude 99.2210° East

Figure 1 : shows the study area.

1.2) Measure the distance from the high tide line 150 meters to the area with waste. Define the study area size at 5 points, each with an area of 1*1 meter.

2) Collection, sorting, and cleaning of organic waste.

Sorted organic waste will undergo a cleaning process by washing with clean water to reduce contaminants such as sea salt, sand, and other impurities. After that, it will be subjected to a sieving and grinding process to make it suitable for use as a growing medium.

Figure 2 : shows the collection, sorting, and cleaning of organic waste.

3) Analysis of Beach Organic Waste and Preparation of Growing Medium Formulation by GLOBE Data entry

3.1) Organic beach waste that has been sorted and cleaned will be analyzed for its properties. pH value, organic matter in the soil The main nutrients for plants in the growing medium include nitrogen (N), phosphorus (P), potassium (K), and the carbon-to-nitrogen ratio (C/N Ratio).

3.2) Analyze the results of the analysis of beach organic waste and find the appropriate formula and ratio to increase the nutrients in the organic waste to meet the compost standard. This is to ensure that the planting material from beach organic waste has sufficient nutrients for growth. The ratio obtained is beach organic waste: coffee grounds: rock phosphate: ash in the ratio of 2:2:1:1. Mixing these components helps to enhance nutrients and adjust the growing medium to be suitable for plant growth. Coffee grounds help to supplement nitrogen (N), rock phosphate helps to supplement phosphorus (P), and ash helps to supplement potassium (K).

4) Determining the experimental planting set and recording the experimental results

4.1) Sow eggplant seedlings in trays with 100 holes per tray using seedling growing media for eggplants. Drop one seed into each hole, water them morning and evening until the seedlings sprout, which takes about 35 days or when they have 3-4 true leaves, then transplant them into experimental bags.

4.2) Transplant the seedlings into the nursery. Watering schedule: twice daily, morning and evening.

4.3) Experimental Design

The eggplant planting experiment was designed to compare the effectiveness of planting materials made from beach organic waste with conventional planting soil, using a factorial experimental design in RCB (Randomized Complete Block Design). 12 experiments Each experiment was repeated 3 times (R1, R2, R3). A total of 36 experiments.

Experimental variables

Growing medium (T, Treatment)

- T1: 100% beach organic debris
- T2: 100% market-standard soil
- T3: Mix 50% beach organic matter + 50% planting soil

Fertilizing (B, Fertilizer)

- B1: No fertilizer
- B2: Apply 100% chemical fertilizer.
- B3: Apply 100% organic fertilizer.
- B4: Apply organic fertilizer + chemical fertilizer 50:50

4.4) Experiment and collect experimental results

4.5) Analyze the experimental results

Figure 3 : shows the experimental plan for the planting materials

Planting according to the experimental plan:

12 experiments, 3 repetitions per experiment.

1. Growing medium (T - Treatment)
- T1: 100% beach organic debris
- T2: 100% market-standard soil
- T3: Mix 50% beach organic matter + 50% planting soil

2. Fertilizing (B, Fertilizer)
- B1: No fertilizer
- B2: Apply 100% chemical fertilizer.
- B3: Apply 100% organic fertilizer.
- B4: Apply organic fertilizer + chemical fertilizer 50:50

Number of replicates (Replication - R): 3 replicates (R1, R2, R3)

Blue	Red	Green	Orange
T1 B1 R1	T1 B2 R1	T1 B3 R1	T1 B4 R1
T1 B1 R2	T1 B2 R2	T1 B3 R2	T1 B4 R2
T1 B1 R3	T1 B2 R3	T1 B3 R3	T1 B4 R3
T2 B1 R1	T2 B2 R1	T2 B3 R1	T2 B4 R1
T2 B1 R2	T2 B2 R2	T2 B3 R2	T2 B4 R2
T2 B1 R3	T2 B2 R3	T2 B3 R3	T2 B4 R3
T3 B1 R1	T3 B2 R1	T3 B3 R1	T3 B4 R1
T3 B1 R2	T3 B2 R2	T3 B3 R2	T3 B4 R2
T3 B1 R3	T3 B2 R3	T3 B3 R3	T3 B4 R3

Figure 4 : shows an overview of the entire experiment.

5) Analysis of Experimental Results By GLOBE Data entry

Analysis of the properties of compost and planting materials with eggplant cultivation

5.1) Properties of Growing Media

Analyze the pH value of organic matter in the soil. The main nutrients for plants in the growing medium include nitrogen (N), phosphorus (P), potassium (K), and the carbon-to-nitrogen ratio (C/N Ratio). These are compared with the standard values of compost to summarize the effectiveness of the growing medium from beach organic waste, using the mean and standard deviation.

5.2) Growth rate of eggplant plants

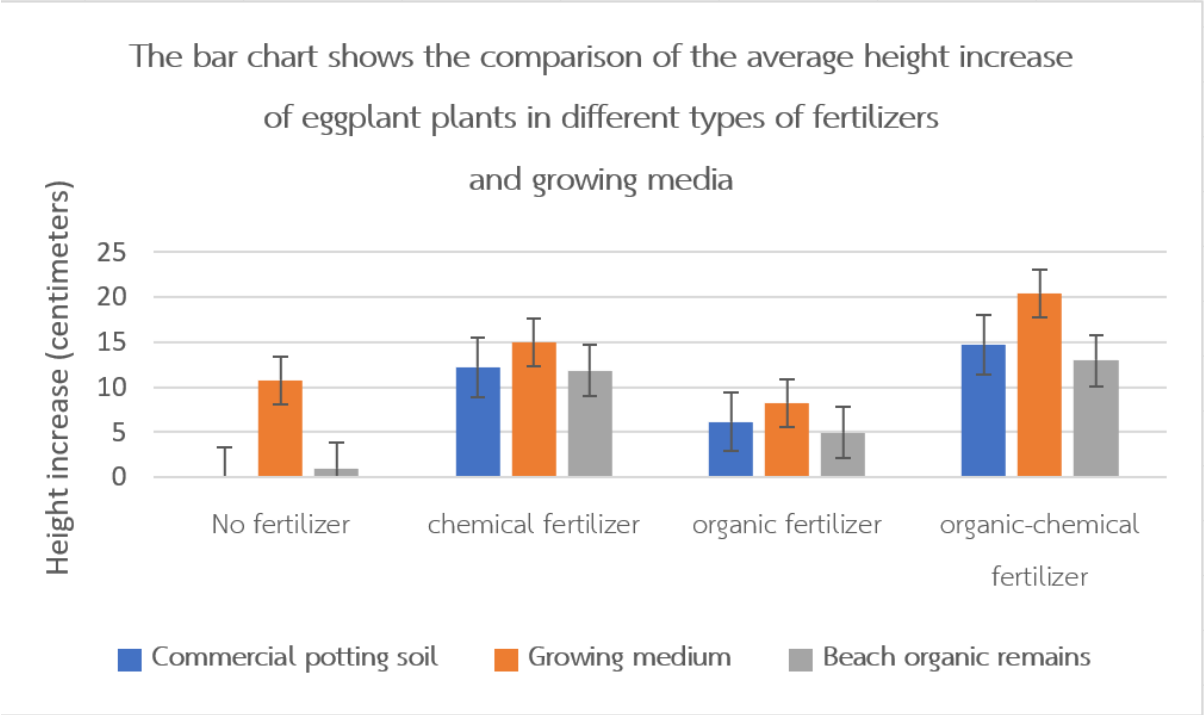
The height of the plant is measured from the base of the stem to the tip of the apex. The width of the leaf is measured from the widest part of the leaf blade. The length of the leaf is measured only from the base of the leaf blade to the tip of the leaf.

	Criterion (minimum value)	Beach organic waste	Growing medium from Beach organic waste Ratio 2:2:1:1
pH	5.5	7.24	6.8
N	1	0.49	1.86
P	0.5	0.31	2.70
K	0.5	0.18	1.03
OM	20	58.99	34.66
C/N Ratio	20	70	30

Results

Figure 5 : Table showing the analysis results of beach organic waste and planting materials from beach organic waste compared to the standard values of compost.

Figure 6 : The bar chart shows the comparison of the average height increase of eggplant plants in different types of fertilizers and growing media



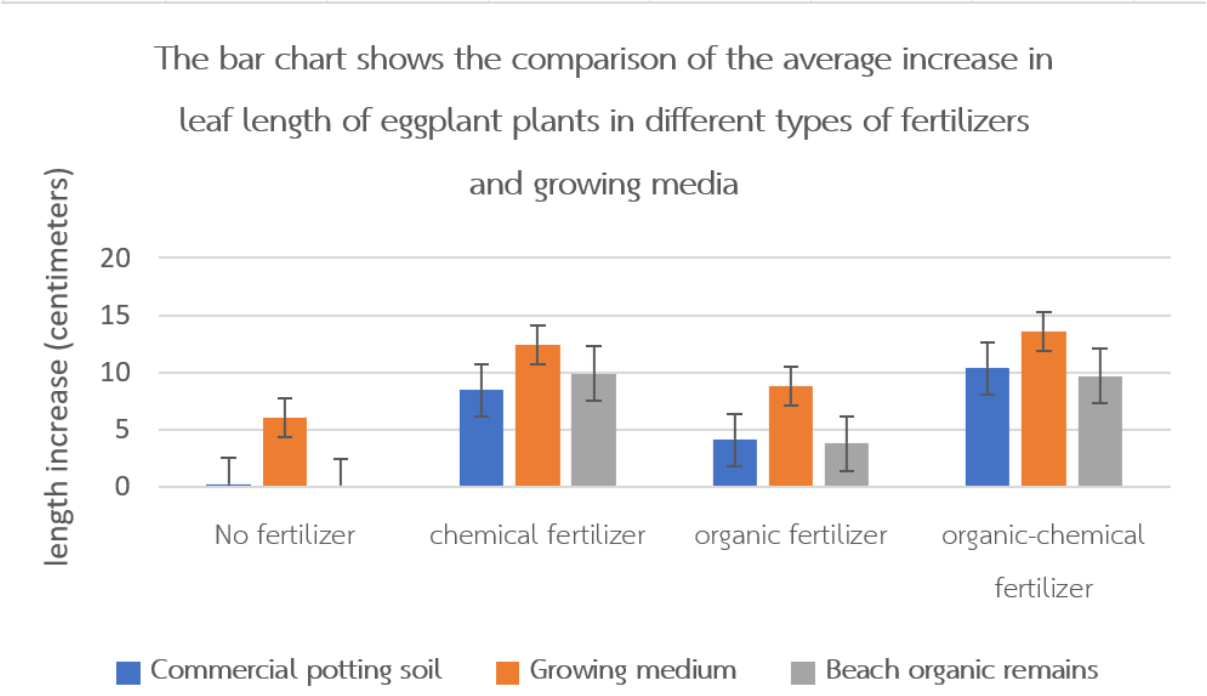


Figure 7 : The bar chart shows the comparison of the average increase in leaf length of eggplant plants in different types of fertilizers and growing media

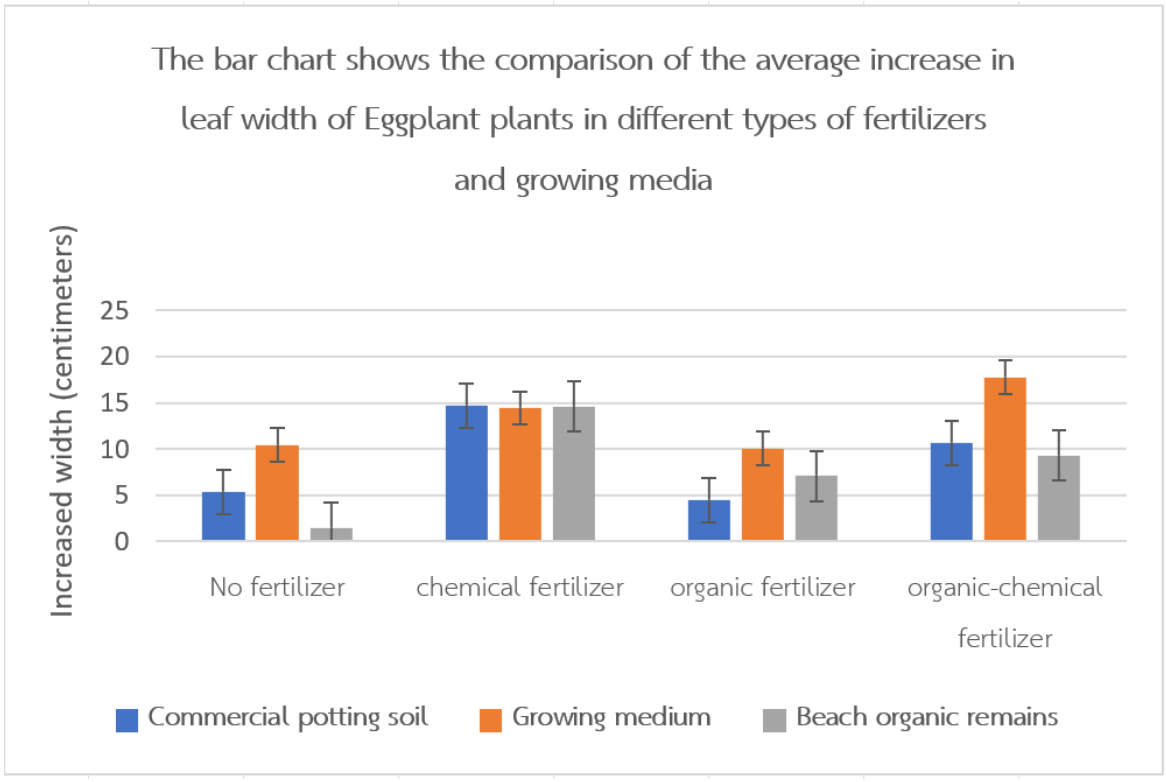


Figure 8 : The bar chart shows the comparison of the average increase in leaf width of Eggplant plants in different types of fertilizers and growing media

Discussion and Conclusions

From the experiment, it was found that beach organic waste has properties that can serve as a nutrient reserve for plants, act as a water reservoir, support plants to stand upright, and facilitate gas exchange between plants and the surrounding spaces due to its high organic matter content. When an appropriate planting material formula is found, such as coffee grounds:Ash: rock phosphate: beach organic waste In a ratio of 2:1:1:2, the planting material made from beach organic waste has properties suitable for plant growth. The pH value, organic matter content in the soil, and the main nutrients for plants in the planting material, including nitrogen (N), phosphorus (P), potassium (K), and the carbon-to-nitrogen ratio (C/N Ratio), meet the compost standards. The eggplants grown in the planting medium made from beach organic waste showed the most outstanding results. The organic-chemical fertilizer treatment had the highest growth rate, followed by the chemical fertilizer alone, and then the organic fertilizer and no fertilizer treatments, which were similar. The growth rate of plants using commercial planting soil was lower, with the chemical fertilizer treatment yielding the highest growth rate, followed by the organic-chemical fertilizer, and then the organic fertilizer and no fertilizer treatments, which were similar. Using beach organic waste alone as a planting medium resulted in the lowest growth rate. However, in the chemical fertilizer treatment, the growth rate of eggplants in all planting media was similar. Therefore, the planting medium made from beach organic waste is an interesting and potentially effective option for managing waste generated in beach areas. In addition to helping reduce waste, it also creates agricultural benefits as it results in a higher growth rate compared to using commercially available soil. It utilizes organic materials, reducing the cost of cultivating soil, and promotes environmental conservation and sustainable tourism development.

Acknowledgements

This project has been successfully completed with the help and support from various parties. Special thanks to Professor Boonchongrak Jiewtan from Rajamangala University of Technology Srivijaya, Trang Campus, for providing guidance and advice on the process of this project. We would like to express our deepest gratitude to Professor Sirikwan Nuputhi and Professor Patchara Pongmanawut for their valuable advice and suggestions throughout the project. We also extend our thanks to all the professors who provided academic assistance, advice, and support at every stage, making this project proceed smoothly and successfully.

Project team

Citations

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GLOBE's databases

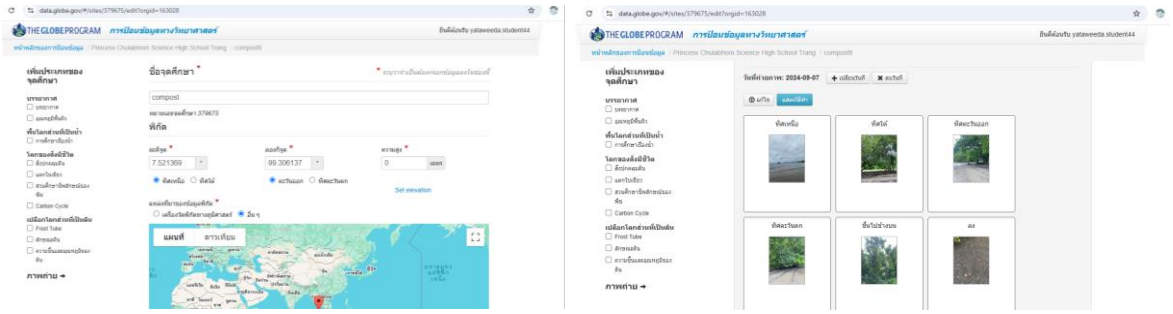

Figure 9 and 10 : Shows the land cover at under wedding beach on GLOBE Data Entry

Badges

I MAKE AN IMPACT

This research focuses on assessing the suitability of organic waste from beach areas as a potential planting medium. The study aims to repurpose organic waste into a valuable agricultural resource, which not only reduces pollution but also supports sustainable resource usage. The experiment involved collecting organic waste from the beach and testing its physical and chemical properties, such as pH, nutrient levels (nitrogen, phosphorus, and potassium), organic matter content, and the carbon-to-nitrogen ratio (C/N Ratio). The results showed that, with adjustments, the organic waste could be used as a planting medium with a suitable pH level and sufficient nutrients, particularly phosphorus and organic matter, which positively impact plant growth. This project demonstrates the potential of using organic waste to enhance agriculture while simultaneously addressing waste management and environmental concerns.

I AM A COLLABORATOR

This project was a collaborative effort involving a research team and the local community from the beach areas, where organic waste was collected for the experiment. Researchers worked closely with the community to understand their environmental challenges and concerns. The team also collaborated with faculty members from Rajamangala University of Technology Srivijaya, Trang, to ensure that the planting medium developed met the necessary criteria for successful plant growth. Throughout the project, responsibilities were divided, including sample collection, data analysis, report writing, and the creation of visual presentations, ensuring thoroughness and clarity in each phase of the study.

I AM A DATA SCIENTIST

The research began with an analysis of the properties of organic waste collected from the beach, including key parameters such as pH, nitrogen, phosphorus, potassium levels, and the C/N Ratio. Statistical analyses were performed to evaluate the suitability of the waste as a planting medium, comparing its nutrient content with that of standard planting materials. The study revealed that the organic waste had sufficient levels of key nutrients, particularly phosphorus, and organic matter, which are crucial for plant growth. Additionally, the C/N Ratio was adjusted to optimize the material for agricultural use. This data-driven approach helped ensure that the findings were both reliable and relevant to the goal of repurposing waste for sustainable farming.

Appendix with raw data

T1												
Width	**B1**			**B2**			**B3**			**B4**		
	T1B1-R1	**T1B1-R2**	**T1B1-R3**	**T1B2-R1**	**T1B2-R2**	**T1B2-R3**	**T1B3-R1**	**T1B3-R2**	**T1B3-R3**	**T1B4-R1**	**T1B4-R2**	**T1B4-R3**
10/12/2024	**5.5**	**8**	**8.5**	**6**	**8**	**9**	**7**	**5.5**	**5.5**	**6**	**8**	**8.5**
20/12/2024	5.5	8	7.5	17	19	12.2	7.2	9	10	10.7	15.8	13.9
30/12/2024	5.9	8.2	7.6	17.6	17.5	15.8	8.7	10.2	10.2	19.8	16	16.3

Lenght	B1			B2			B3			B4		
	T1B1-R1	T1B1-R2	T1B1-R3	T1B2-R1	T1B2-R2	T1B2-R3	T1B3-R1	T1B3-R2	T1B3-R3	T1B4-R1	T1B4-R2	T1B4-R3
10/12/2024	7	10	11.5	8	10	11.5	8.5	7.5	7	7.5	10	11
20/12/2024	6.7	10.2	10	19	22.2	16	9.2	11	12	13.6	18.6	17.8
30/12/2024	7.1	10.3	10.2	21.8	23.5	19.6	11	13.9	12.9	25	20.9	21

T2												
Width	B1			B2			B3			B4		
	T2B1-R1	T2B1-R2	T2B1-R3	T2B2-R1	T2B2-R2	T2B2-R3	T2B3-R1	T2B3-R2	T2B3-R3	T2B4-R1	T2B4-R2	T2B4-R3
10/12/2024	8.5	7.4	8.5	5.7	7.5	9	5.6	8	8.6	8	8	7
20/12/2024	11.5	10.7	11.4	12	10	14.6	7.8	7.5	12.5	15.4	14.5	12.3
30/12/2024	16	14.9	14.6	19.7	20.4	19.3	14.5	15.6	18.5	22.2	20.8	20.6

Lenght	B1			B2			B3			B4		
	T2B1-R1	T2B1-R2	T2B1-R3	T2B2-R1	T2B2-R2	T2B2-R3	T2B3-R1	T2B3-R2	T2B3-R3	T2B4-R1	T2B4-R2	T2B4-R3
10/12/2024	9.5	9.2	10	6.5	9.5	11.5	7	10	10.3	10	8.5	9
20/12/2024	14	14	13.6	10.5	13	17.1	8.1	10	15.6	19.6	19.2	15.6
30/12/2024	22.6	19.8	18.6	27.5	25.7	25.1	18.1	18.1	25.7	31.5	26.9	30.1

	T3

Width	T3B1-R1	T3B1-R2	T3B1-R3	T3B2-R1	T3B2-R2	T3B2-R3	T3B3-R1	T3B3-R2	T3B3-R3	T3B4-R1	T3B4-R2	T3B4-R3
10/12/2024	7	7.5	7.4	6	7.5	8	9	8.4	6	8	7.5	8
20/12/2024	7.5	7.5	6.5	15.1	12.9	12.3	9	11.5	11.9	18.2	12.2	16.4
30/12/2024	7.6	7.6	7.2	18.5	15.5	12.8	11.3	11.3	12.6	17.3	20.2	17.1

Lenght	B1			B2			B3			B4		
	T3B1-R1	T3B1-R2	T3B1-R3	T3B2-R1	T3B2-R2	T3B2-R3	T3B3-R1	T3B3-R2	T3B3-R3	T3B4-R1	T3B4-R2	T3B4-R3
10/12/2024	9	9	9	7.5	9.5	10	10	10	7	10	9	7
20/12/2024	9.5	9	8.7	18.1	17.1	16.2	10.4	14	15.4	18.2	12.2	16.4
30/12/2024	9.5	8.5	9.1	25.3	20	18.2	14.6	14.7	16.1	23.1	24.3	22.7

Height

	T1											
	B1			B2			B3			B4		
	T1B1-R1	T1B1-R2	T1B1-R3	T1B2-R1	T1B2-R2	T1B2-R3	T1B3-R1	T1B3-R2	T1B3-R3	T1B4-R1	T1B4-R2	T1B4-R3
10/12/2024	14	10.2	13.8	10.4	12.8	12.5	9.7	10.2	12.9	12.8	10.4	12.2
20/12/2024	14.1	11.5	16.3	13.7	17.2	17.6	13	13.9	15.5	18.7	15.4	17
30/12/2024	12.17	15.4	14.9	20.8	31.3	27.4	19.4	16.4	18.3	21.2	22	20

	T2											
	B1			B2			B3			B4		
	T2B1-R1	T2B1-R2	T2B1-R3	T2B2-R1	T2B2-R2	T2B2-R3	T2B3-R1	T2B3-R2	T2B3-R3	T2B4-R1	T2B4-R2	T2B4-R3
10/12/2024	8.9	11.2	10.5	9.7	12	12	12	10.9	11	9.2	11	11.4
20/12/2024	9.5	13.5	12	13.5	17	15	14.8	13.6	13	11.5	14	15.2
30/12/2024	22	19.9	20	25	24	26	26.5	19	19.5	27.5	28	26

	T3											
	B1			B2			B3			B4		
	T3B1-R1	T3B1-R2	T3B1-R3	T3B2-R1	T3B2-R2	T3B2-R3	T3B3-R1	T3B3-R2	T3B3-R3	T3B4-R1	T3B4-R2	T3B4-R3
10/12/2024	11.5	13	13	10.5	14.2	14.5	11.2	14	15	12	12.5	12.5
20/12/2024	17	17.3	18	14.5	17	17	13.5	14.2	17.5	16.3	17.5	14
30/12/2024	17.6	14.5	18.5	26.2	27.6	29.4	15.9	17.5	20.3	30.3	30.7	31

	Criterion (minimum value)	Beach organic waste	Growing medium from Beach organic waste Ratio 2:2:1:1
pH	5.5	7.24	6.8
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C/N Ratio	20	70	30

results of beach organic waste and planting materials from beach organic waste compared to the standard values of compost.