Implementation of Coconut Waste Processing Technology to Support Agricultural Sustainability in Coastal Tourism Areas

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ABSTRACT

Beach tourism is identical to coconut. Almost all beach tourists will look forward to enjoying fresh coconut water under the hot beach atmosphere. High coconut consumption in tourist areas greatly benefits the economy of traders in tourist areas. On the other hand, it creates a problem due to increased coconut waste. Coconut waste is large and difficult to decompose, resulting in a buildup that could disrupt coastal tourism. Goa Cemara Beach in Bantul, Yogyakarta, is one of the areas affected by coconut waste accumulation, hence warranting proper management of coconut shell waste. Coconut shell waste Management is expected to be a new source of income for the local community. Community service activities are carried out to apply coconut waste processing technology. This technology is carried out to overcome the problem of accumulation of waste and utilize waste as a support for sustainable agriculture. Applying this waste treatment technology involves two community groups, namely the "Pantai Goa Cemara" tourism awareness group and the "Tani Raharjo" farmer's group. Each group has a synergistic role in the processing and utilization of waste. The Goa Cemara Beach tourism awareness group, processes the destruction of coconut shell waste with a mill. The crushed coconut shell waste will produce small pieces. Sorting the crushed coconut waste will produce two forms, namely cocopeat, and cocofiber. Laboratory tests are carried out to see the content of cocopeat and the safe amount that can be applied to agriculture. Laboratory results showed organic matter 19.51-28.70%, Nitrogen 0.69-0.88%, Phosphorus 0.40-0.58%, Potassium 0.26-0.33%, and pH 7.66-7.95 depending on the age of the waste. Community service activities are carried out to utilize cocopeat to become an environmentally friendly seedling medium. Seedling media with cocopeat printed in squares can sow plant seeds. This box media is often called a soil block and does not require small plastic pots for seeds. Thus, it can reduce plastic waste on agricultural land. In addition, the utilization of processed coconut shell waste can support sustainable agriculture.

Keywords: Agricultural Sustainability, Waste Processing, Coastal Tourism, Coconut Waste.

1 Introduction

Coconut (*Cocos nucifera*) is an inseparable aspect of the tropical beach. The tree evokes an atmosphere of languid relaxation and self-indulgence [1]. This makes beach tourism synonymous with coconut. Almost all tourists will enjoy the fresh coconut water under the shady pine trees. The more tourists, the more profitable it will be for the people around the beach, but on the other hand, the amount of coconut shell waste will also increase. Coconut waste can become a problem if left to accumulate because it is difficult to decompose.

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Waste will not be an obstacle if appropriately managed, as it can become a new source of income for the community around the tourism area. The results of processing business analysis calculations using tools have been tested for feasibility. With the application of the right technology for the community around coastal tourism, the accumulated coconut shell waste can be processed into various products that are useful for agriculture. Therefore, the UGM community service team is working with the community around coastal tourism to apply processing technology crushing coconut shells into various products that can be utilized, one of which is in the agricultural sector, and become a new source of income for the community. Coconut coir, through a crushing process, is converted into fiber and fine powder [2]. This fine powder is then referred to as cocopeat. Cocopeat can be used as an environmentally friendly planting medium since it is an organic material. Indirectly, using cocopeat as a planting medium also increases the value of cocopeat, which is currently a waste from the coconut industry. Cocopeat has advantages as a planting medium due to its characteristics of being able to bind and store a huge amount of water and containing essential nutrients, such as calcium (Ca), magnesium (Mg), potassium (K), sodium (N), and phosphorus (P) [3]. Cocopeat media will increase plant weight because it increases the ability to absorb nutrients and nutrients [4].

Cocopeat is a material that is often used as a seedling medium. This material made from coconut coir can be used to reduce the use of topsoil as a planting medium; This media can bind a huge amount of water [5]. In this study, cocopeat will be used to utilize coconut waste. Cocopeat will be mixed with soil and manure according to certain ratios to determine the composition of cocopeat, soil, and manure, which is compact (not easily crushed) and can support seedling growth and conventional methods so that it can be an alternative seedling medium without plastic. Soil and manure are the most frequently used planting and/or seedling media. In addition, soil and manure also tend to be easy to find.

Seedling media is the initial growth place for plants so they can germinate and grow properly [6]. Seedling media also allows plant seeds to withstand the environment when transferred to a broader planting area. There are various types of seedling media, one of which is derived from coconut powder or cocopeat. The coconut powder used to become a seedling medium is obtained from separating old coconut coir [7]. Cocopeat seedling media has the advantage of large water-holding capacity and slow degradation. Water will slowly come out of the seedling media and can provide nutrients to plants for a long time. However, cocopeat also has ingredients that can affect plant growth. One of the ingredients in cocopeat is tannin. Tannins are toxic and can inhibit the growth of plant roots [8]. The way to overcome this is by soaking the cocopeat in clean water before being used as a medium for plant seeds.

Through this community service activity, the community around the coast, especially Goa Cemara Beach, is expected to be able to optimize the management of coconut waste to support agricultural sustainability and can increase income from processed coconut waste products. Thus, this dedication aims to apply waste treatment technology to support sustainable agriculture in Goa Cemara based on smart eco-bio production.

2 Research Methodology

This paper aims to describe the implementation of coconut waste processing technology to solve the waste problem in beach tourism. The location used for the study is Goa Cemara Beach in Bantul, Yogyakarta. This beach tourism has problems due to the accumulation of coconut waste, which is difficult to decompose. This service activity is in collaboration with the tourism awareness group "Pantai Goa Cemara " and the farmer group "Tani Raharjo" and receives support from the local government.

The activity was implemented by identifying the problems obtained by the UGM team for Student Community Service for Empowerment (KKN-PPM UGM) in 2020. Then a participatory observation approach was carried out by involving the surrounding community, traders in the tourist environment, and

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tourism managers at Goa Cemara Beach, and coordinating with the local Regency Government and other related parties. The method used in the stages of the activity is as follows:

- Focus Group Discussions are carried out in identification, problem mapping, alternative solutions, discussions, to evaluation.
- Counseling with resource persons from the UGM team who have capacities from agriculture, land quality, and industrial engineering related to waste processing equipment.
- Periodic training and assistance while using the tools and ongoing while processing chopped coconut products.
- Practice providing examples of using cocopeat seedling media for sustainable agricultural systems.
- Evaluation and monitoring of activities to ensure activities are running according to the planned targets.

The stages of the activity lasted for two years after the identification of the 2020 problem by the KKN-PPM UGM. In the first year of 2021, the focus of activities on processing coconut shell waste will be smaller. In this stage, we designed a counter that is suitable for the location of the Cemara Cave beach. The tool is adjusted to the volume of coconut waste generated regularly. In calculating the volume, the activity was carried out with a group of farmers aware of the "Pantai Goa Cemara" tourism. The tool evaluation is held at the Department of Industrial Engineering, Faculty of Engineering UGM. In the second year of 2022, the activities focus on cocopeat products resulting from the processing. Cocopeat, the result of processing coconut shells, is then tested for its content at the Plant Management and Production Laboratory, Faculty of Agriculture UGM. Laboratory tests were carried out to evaluate the content of tannins, organic matter, nitrogen, phosphorus, potassium, and pH level. After being tested for feasibility in the laboratory, it is continued by processing cocopeat into printed seedling media. Seedling media is printed according to the needs of plant seeds. The adjustment of the seedling media was carried out together with the "Tani Raharjo" farmer group. The printout of the seedling media was then evaluated by testing the percentage of chili seeds that could grow on the media.

3 Result and Discussion

The results of community service activities based on appropriate technology applications are carried out in various stages so that they can be easily adapted. The steps are as follows:

3.1 Identification and Mapping of the Problem

The UGM 2020 KKN-PPM Team discussed the management of coconut shell waste with the Sanden District Government. Coconut is very synonymous with the atmosphere of the beach. Almost all tourists will enjoy the fresh coconut water under the shady pine trees. The more tourists, the more profitable it will be for the people around Goa Cemara Beach, but on the other hand, the amount of coconut shells will also increase. The Sanden Sub-District Government has tried to anticipate using coconut shells to level the parking area, which is then covered with soil. However, the amount of coconut shells has not decreased due to the accumulation of long periods. At first, people thought coconut shell waste was an organic waste that would decompose. However, it takes quite a bit of time until the coconut shell is weathered and can blend with the soil. Finally, the pile of coconut shells was arranged to look like an inscription, said the Head of Sanden Sub-District, Mr. Drs. Wake Rahina, M.M.

Management of coconut shells properly can become a new source of income for communities around tourist areas. The results of processing business analysis calculations using tools have been tested feasible [9]. With the application of the right technology for the community around Goa Cemara tourism, the accumulated coconut husk waste can be processed into various products that are useful for agriculture. Therefore, we are collaborating with the tourism awareness group "Pantai Goa Cemara" and the farmer

group "Tani Raharjo" to apply processing technology or crushing of coconut shells so that they can become various products that can be utilized in agriculture and become a new source of income for the public, as shown in Figure 1.

Figure 1: *Potential Observations with Local Government and Community Groups.*

3.2 Training on the use of a Shredder

The discussions with the community and the government resulted in the idea of looking for technology that could break down or destroy coconut shells which were then utilized as planting media with a sale value. Finally, an in-depth discussion of the problem with the "Pantai Goa Cemara" Tourism Awareness Group as one of the managers of the beach tourism area in the Sanden District area was held. Therefore, from discussions with the Pokdarwis facilitated by the District Economic, Development, and Environment Sector, it was agreed to apply appropriate technology for the community with assistance and training (Figure 2). Applying coconut shell crushing technology can solve the waste problem in coastal tourism areas and increase farmer groups' income.

Figure 2: *Training on shredder use with the Goa Cemara Beach tourism awareness group*

Producing coconut shell waste found in coastal tourism areas, which generates local income, should utilize a technology that can be easily adopted and accessed. The technology provided is a coconut shell crusher that can process young coconut waste that has just been produced without any drying process to reduce the water content. The tool designed follows the needs, namely by using diesel fuel and the volume of processing capacity that has been adjusted.

3.3 Compound Content of Coconut Shell Waste

Figure 3: *Grading shell based on the age of the waste.*

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As shown in Figure 3, producing coconut shell waste found in coastal tourism areas, which generates local income, should utilize a technology that can be easily adopted and accessed. The technology provided is a printing media for seedlings sourced from coconut shell waste containing 28% organic matter. The printing tool is designed according to the size of the plant seed. This year, the seedling media developed is mainly cultivated on sandy beaches for chili. Around three months, the biodegraded cocopeat had a lower C/N ratio and higher CEC and humic acid than the raw cocopeat. The lowering of the C/N ratio was due to the addition of N and the reduction of carbon, mainly the hemicellulose, cellulose, and to a lesser extent, the lignin components [10]. The results are compiled in Table 1.

Table 1: *The compound content of coconut shell waste at various time durations.*

Compound	Sample 1 Waste < 1 month	Sample 2 Waste ± 6 month	Sample 3 Waste < 12 month
Tannin (%)	1.50	1.67	1.66
Organic Carbon (%)	19.51	28.70	24.43
Nitrogen (%)	0.69	0.88	0.80
Phosphorus (%)	0.40	0.58	0.51
Potassium (%)	0.33	0.41	0.26
pH	7.95	7.66	7.71

3.4 Training on Printing Block Media Making

The assistance combining aspects of technology application and community empowerment, as well as support from the local government, can be used as an efficient mentoring model according to the challenges faced by the community. The assistance model is based on community needs and the Bantul district's vision: "Bantul will be free of waste by 2025". This activity involves community groups in every activity starting from 1) activity socialization; 2) assembly of print media for seedlings; 3) training on the use of printing media for seedlings; 4) training on the utilization of processed waste products; and 5) evaluation and plans for follow-up activities. This activity model is expected to be efficient because it combines the application of technology and community empowerment (Figure 4).

This seedling media varies greatly depending on the type of plant [11], type of seed, needs, techniques, and the weather during the nursery process. Each region also has seedling media that are sometimes unique compared to other regions. The seeds are sown in a seedling medium mixed with topsoil and manure. Fertilizer is a substance to overcome the soil's weaknesses as a planting medium [12].

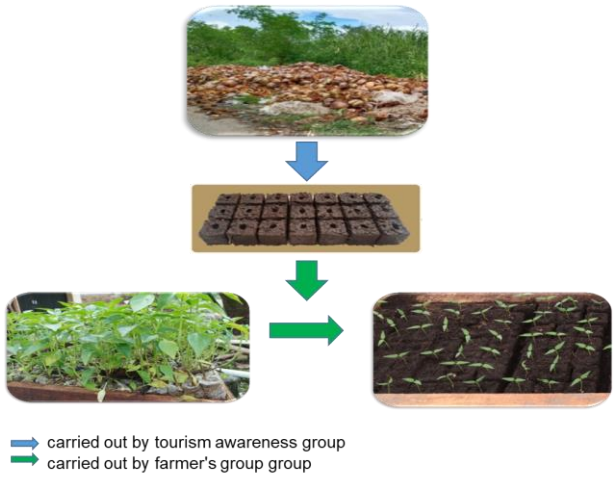

Figure 4: *Flowchart for making media block seedlings*

Soil block seedling is a method of planting seeds or seeds by forming and compacting (printing) certain media to create blocks to produce seedlings with good roots and growth when transplanting. The seedling media will be printed with a specific size, so it doesn't need a container like a polybag anymore. Besides reducing waste, soil blocks will save planting media, water, costs, and space, speed up processing time, and not interfere with plant growth when transplanting later. This soil block can be made from various media that are compressible and easy to form, including cocopeat.

Cocopeat soil block media has a higher porosity value than soil seedling media and manure. This is because the BV value of soil block media is smaller, while the BJ value of the two is not much different. BV values less than 0.5 g/cm3 are categorized as organic soils [13]. This is appropriate because the organic matter content in the cocopeat block soil treatment is higher. High porosity means that the soil has a lot of pore space and a crumbly soil structure. The large porosity of the media will help the germination process because the availability of more space will facilitate the development of seeds into seedling candidates. In addition, the presence of large macro pores will increase the availability of water and air needed by sprouts.

4 Conclusions

Implementing coconut waste processing technology can be a solution for handling beach tourism problems due to coconut waste. Coconut waste that is difficult to decompose can be processed using a chopping machine. The chopping machine produces two products, namely cocopeat, and cocofiber. Furthermore, cocopeat is used for the agricultural sector because it is rich in organic matter. Apart from organic matter, cocopeat contains 0.69-0.88% nitrogen, 0.40-0.58% phosphate, and 0.26-0.33% potassium, with a pH of 7.66-7.95. The utilization of cocopeat is usually only used as a soil enhancer.

As a part of the UGM team community service, cocopeat was developed as a seedling media. Seedling media consisting of a mixture of cocopeat and manure has the advantage of storing water. Water is a significant factor in the imbibition process at the start of germination. Seedling media with adequate water and nutrients from manure can support seedling growth. Another advantage of this media is printed in a block shape that fits the needs of the seedling media. Printed seedling block media does not require additional containers such as plastic seedlings. The seedling block media from cocopeat can be a solution for processing coconut waste and reducing the use of plastic seedlings. In collaboration with the tourism awareness group "Pantai Goa Cemara" and the farmer group "Tani Raharjo," the UGM community service team solved the problem of coconut waste by processing it into supporting materials for agricultural sustainability in coastal tourism areas.

5 Declarations

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