STUDY THE POTENTIAL OF LIQUID ORGANIC FERTILIZER PRODUCTION PROCESS FROM CRYSTAL GUAVA WASTE (*Psidium Guajava* L.) AS AN ENRICHMENT FOR EDUTOURISM IN "KEBUN BUAH DAN EDUWISATA BENDOSARI"

Adinda Intan Melina, Ahmad Dafa Audi Hafiz, Fikri Ramadhan, Kurnia Yulita Sari, dan Wardatul Jannah, Dias Idha Pramesti, M.Si.

UIN Sunan Kalijaga, Yogyakarta

Abstract - *Crystal guava (Psidium guajava L.) is one of the most popular fruits in Indonesia, even though this guava comes from Taiwan. This is due to the crunchy texture of the guava and has few seeds. In its growth, there are fruits that fail to harvest, the presence of this fruit waste can cause environmental pollution due to fruit decay and the presence of plastic wrappers. Previously, this guava waste was only burned to reduce its presence, but this clearly increases the environmental pollution that occurs. To minimize pollution, a study was conducted on the potential utilization of crystal guava waste as organic fertilizer and is expected to be an alternative in the utilization of guava waste. The purpose of the study was to determine the potential of the process of making organic liquid fertilizer from crystal guava waste as a learning source to support educational programs. The type of data used is secondary data, namely data obtained from research that has been done previously in the form of journals, theses, and literature. The analysis was carried out by reading, comparing, summarizing, and collecting theories regarding the potential use of guava waste as organic fertilizer and the studies on edutourism programs. The results of the study stated that the potential for utilization of guava waste which was processed into fertilizer had great potential for the development of edutourism programs in the garden.*

Keywords *: crystal guava (psidium guajava L.), liquid organic fertilizer, guava waste, learning source, edutourism*

1. INTRODUCTION

Orchard is form of agro-tourism that are located in open spaces and are planted with plants that have agricultural commodities that are selling value for tourists. The management is directly carried out by the community or local farmers by adjusting to their daily lives. Some of the attractions of visitors to orchards are related to their historical side, beautiful natural scenery, values that are maintained during planting, maintenance, and management, and types of plants (Hasan, 2014).

Kebun Buah dan Eduwisata Bendosari is a joint venture that was initiated since January 3rd, 2011 by the "Kelompok Tani Hutan" and the "Kampung Jamur" Farmer Group, and has been legalized by a legal entity with the number: AHU-0077245.AH.01.07 Tahun 2016 dated November 1, 2016. This garden is located in Bendosari, Sumbersari, Moyudan, Sleman, DIY. It is managed by 20 people. There are approximately 1000 trees planted on this 3 hectare land, including crystal guava trees, hana avocados, lemons, and several other plants (*The interview with the Kebun Buah dan Eduwisata Bendosari's superintendent, Mbah Sagiman*).

The management of this garden is carried out jointly by the "Kelompok Tani Hutan" and the "Kelompok Tani Jamur". Generally, the routine activities are cultivate to harvest and market the fruits. Farming activities are carried out to manage the land as a whole, starting from land preparation, fertilizer making, fertilizer application, and plant care using both organic and semi-organic farming patterns (an interview with one of the gardeners, Pak Jazim).

The managers strive collaborations with several institutions, such as: LPK Kayu Manis which is engaged in the development of food processing, and LPPM UIN Sunan Kalijaga as one of the partners who will contribute in several fields of study. Cooperation with various agencies aims to increase the productivity of the garden and to develop the potential of the garden as a tourist spot. It is hoped that the garden can continue to be managed properly so that tourists can directly enjoy the atmosphere of picking and enjoying fruit directly at the beautiful Kebun Buah dan Eduwisata Bendosari. Beside, the managers expect the garden to be an edutourism spot.

The edutourism vision is going to be realized to make this garden as an agricultural learning centre. In addition, the garden is also expected to be a forum that can embrace the potential of the surrounding community in developing joint businesses. The farmer group hopes that the other farmers from various regions can learn to grow crops, and return home with knowledge to develop the potential in their regions.

The concept of edutourism is one of the attractions in developing an agro-tourism in orchards to better uphold its economic value. According to Kurniati, edutourism is a tourism concept whose purpose is to prioritize education aspects for visitors to get a direct learning experience through tourist objects at the tourist sites (Kurniati, 2015). The characteristics of edutourism facilities and services described by Wood (2002), quoted by Nur R., Suryokusumo, and Sudjiwono (2013), in Faridah's writing, 2021 are the types of ecotourism facilities and services that are

committed to the surrounding environment, namely the natural environment, and the local culture, as well as offering quality programs and informing true and relevant knowledge about the natural environment and local culture for tourists, and being open to external colleague to conduct research that can contribute to the development of edutourism.

One of the problems encountered by researchers who are garden partners is the presence of crystal guava waste which is often found before the harvest season. The guava waste is very polluting the land as a result of the decay of the guava which is still in the plastic wrap. Guava waste itself is an organic waste of crystal guava that decomposes before harvest time, resulting in pathogenic bacteria that live in the soil and can affect the quality of plants on the land (Sastrahidayat, 2013). Plastic waste can also pollute the soil because its components are difficult to decompose in the soil. Even if it decomposes, it will not be perfect so that it can damage the surrounding environment by becoming a component of microplastics. For this reason, the collection of garbage is carried out so that the cleanliness and naturalness of the soil on the land is maintained.

However, the accumulation of guava and plastic waste in landfills then creates new problems. This is because the pile of guava waste pollutes the air from its odor and pollutes eyesight (observation from the landfield). Therefore, the researchers formulated a study to determine the potential of guava fruit waste. In this case, the study is attempted to make guava waste as an alternative material for making Liquid Organic Fertilizer independently. The process of making the Liquid Organic Fertilizer can also be used as a learning moment for visitors and local farmers in strengthening the edutourism program that is being initiated.

Crystal guava itself is certainly not a foreign commodity among farming communities and researchers of plantation products. There have been many articles, journals, and other research about this fruit that have been published in the last ten years. However, research about processing of crystal guava waste itself, as far as the author observes, is still very rare. Especially if the implications are associated with the concept of edutourism.

There are several studies about crystal guava that relate with this research are mentioned here. The following studies focus more on the issue of crystal guava as a business commodity, which of course have distinctions with the focus of the author's research :

Sunarti Poppie S. Datundugon, Femi Hadidjah Elly, and Jolanda Kitsia Juliana Kalangi, *Analisis Kelayakan Finansial Usahatani Jambu Biji Kristal (Psidium Guajava L.) (Studi Kasus: Petani Jambu Biji Kristal Di Desa Warisa Kecamatan Talawaan Kabupaten Minahasa Utara)*. As described in the title, this research does not discuss about the processing of crystal guava fruit waste at all. Candra Ramdhona, Dini Rochdiani, and Budi Setia, *Analisis Kelayakan Usahatani Jambu Kristal (Psidium Guajava L.) (Studi Kasus Pada Pengembang Budidaya Jambu Kristal Di Desa Bangunsari Kecamatan Pamarican Kabupaten Ciamis).* Similar to the research of Sunarti and colleagues, the study conducted by Candra focused more on discussing

the crystal guava cultivation business rather than highlighting the crystal guava itself. Although research on crystal guava outside of business or farming issues is relatively rare, there are still some studies which, although indirectly, highlight problems regarding crystal guava fruit itself. The following studies, although not directly related to the research focus, still provide information that can make this research much more in-depth and comprehensive:

Ari Kurniawan Sudiarto, Khoirida Aelani, and Fresa Dwi Juniar, *Identifikasi Penyakit pada Daun Jambu Kristal Berbasis Android dengan Metode Enterprise Unified Process*. The paper from Ari Kurniawan and his friends does discuss the problem of crystal guava, namely diseases of the leaves, but does not discuss about processing guava crystals as plantation waste. Dona Rustani dan Slamet Susanto, *Kualitas Fisik dan Kimia Buah Jambu 'Kristal' pada Letak Cabang yang Berbeda Physical and Chemical Quality of 'Crystal' Guava on Different Branch Position*. The analysis in this journal is very in-depth on the discussion of fruit quality based on the location of the branches, but once again does not discuss the processing of crystal guava fruit waste. Due to the scarcity of research related to the processing of crystal guava as plantation waste, there is only one journal that approaches the focus of the study in this study. The following research does not thoroughly discuss the processing of crystal guava waste, but only the skin waste.

Akhmad Endang Zainal Hasan dan Ulya Utami. *Pemanfaatan Kulit Jambu Kristal dan Daun Ubi Jalar sebagai Pupuk Cair dengan Cara Polinasi untuk Meningkatkan Produksi Jambu Kristal.* In addition to focusing on the processing of crystal guava leaves, this study also includes other materials in the form of sweet potato leaves as the main ingredient for making fertilizer. On the other hand, research emphasizes social impacts in the form of community response or acceptance of plantation waste treatment methods, instead of focusing on plantation waste processing itself. From the literature review above, it can be concluded that this research is relatively new, even the first to discuss the processing of crystal guava waste. This research is certainly expected to enrich the treasures of studies on crystal guava that have existed before.

2. METHOD

This type of research is a qualitative research with a descriptive approach. Qualitative research is research that has the aim of understanding phenomena from the researcher's point of view, namely people who take part in observing, thinking, providing opinions and data, and perceptions about research (Sukmadinata, 2005). Mulyana also explained that qualitative research methods in a subjective perspective begin with unstructured interviews, document analysis, and interpretations that lead to observational objectives (Mulyana, 2010). The descriptive approach aims to describe the facts or characteristics of the phenomenon in detail (Yusuf, 2017).

This research which intends to examine the potential of fertilizer from crystal guava waste as a source of learning and educational enrichment uses data collection

methods in the form of literature studies, observations, and interviews with garden managers. Preliminary research was carried out for approximately 12 days from May 28, 2021 to June 10, 2021 and located at Bendosari Fruit Garden and Education, Sumbersari, Moyudan, Sleman.

The population is approximately 1000 guava trees located in the western part of an area of 3 hectare land. The sample of this research is ¾ from the population of guava fruit in the garden that can produce 2 sacks of guava waste x 10 days = 20 sacks of guava waste (gross), approximately. This research was conducted by interviewing the gardener, such as Mr. Sagiman, Mr. Jazim as representatives of the garden by digging up information about the history of the establishment of the Kebun Buah Bendosari, the land area, the number of trees, fertilization, and plans for garden development. After that, the direct observation of the land was carried out. This observation is in the form of observing the process of collecting organic waste of crystal guava waste which is still in the plastic wrap to be collected in a landfill.

Follow-up research was conducted on September 1 - 7, 2021, using the literature study method. The source itself is taken from journals and other scientific works that can be accessed via the internet. The presentation of the data uses a qualitative descriptive method by describing the potential for making fertilizer from guava fruit waste as a learning resource for visitors.

3. RESULT AND DISCUSSION

A. Crystal Guava

1) About Crystal Guava Waste in Kebun Buah dan Eduwisata Bendosari

As previously explained, before the harvest season the garden can produce a lot of crystal guava waste. This waste consists of rotten guava fruit and plastic as a wrapping medium. Each tree can produce an average of 3-7 pieces of crystal guava waste per week. So if multiplied by 1000 the number of trees, then every week Bendosari garden can "produce" 3000-7000 crystal guava fruit waste. With this amount, it is not surprising that within 2 weeks, the plastic and rotten guava have piled up in the garbage disposal area. This causes air pollution around the garden and creates an unsightly effect.

2) The Potential of Crystal Guava Waste Processing into Liquid Organic Fertilizer

If not handled, the problem of crystal guava waste will certainly be a minus for Kebun Buah dan Eduwisata Bendosari. For this reason, a best handling effort is needed, either in the form of distributing it to the nearest garbage dump or processing the waste into new goods that have use value and selling value. In the case of Kebun Buah dan Eduwisata Bendosari, the second option is considered more appropriate to implement. Given the waste treatment process itself can be used as a means of education to the general public in dealing with environmental problems. One form of processing is guava fruit waste that may be processing it into Liquid Organic Fertilizer.

3) Making Liquid Organic Fertilizer as an Alternative Solution

Liquid Organic Fertilizer is a solution resulting from the process of decaying organic materials such as plant residues, plantation waste, and animal and human wastes which contain more than one nutrient element. It is seen as an environmentally friendly alternative to soil fertilizer. This is because in general, liquid organic fertilizer does not damage soil and plants, even though they are used as often as possible in a sustainable manner.

With the advantages of liquid organic fertilizer characteristics as described in the previous paragraph, it would be very appropriate if it became an alternative solution to the problem of crystal guava waste in Kebun Buah dan Eduwisata Bendosari. The large amount of waste production that was previously a problem will soon be resolved, and even has the opportunity to increase the plantation's finances when there is a surplus.

As for the process itself, making liquid organic fertilizer by utilizing crystal guava waste at Bendosari Fruit Gardens and Eduwisata can be carried out in several stages of production. Following are the possible procedures to do:

1) Separation of rotten guava from its plastic wrap

This stage is carried out considering that each crystal guava fruit in the Bendosari garden is covered with plastic wrap. This process, in addition to aiming for rotten crystal guava fruit to be processed, also serves to separate plastic as inorganic waste from rotten guava as organic waste. This will make it easier to recycle the plastic wrap.

2) Cutting rotten crystal guava into small pieces

This second stage aims to facilitate the compaction process later, on the other hand it also ensures that the fermentation solution will be able to absorb maximum into the fruit. With this step, it is hoped that the fermentation process can be more effective. After being cut into small pieces, this rotten crystal guava can temporarily be collected in a special container.

3) Composting using a composter

After collecting enough pieces of rotten crystal guava fruit, the next step is to put them in a composter bin to be fermented into fertilizer (composting). Before fermenting, fruit pieces need to be compacted first to maximize the use of space in the composter. After solidification, then the fermentation formula consisting of a solution of sugar, coconut water, and water is mixed into the composter.

4) Storage

After that, the composter needs to be stored in the shade and protected from sunlight so that composting can run well. As for the storage period itself, it is in the range of 10-14 days. An indication of the success of the composting process itself is indicated by the appearance of white spots on the surface of the water.

5) Filtering

This stage is the separation of the fermented solution with the dregs. The two composting products have a use value and a selling value. The dregs from this composting can be used as compost, while the solution is called liquid organic fertilizer.

6) Packaging

After the composting dregs have been successfully filtered clean, which means that only the solution or the liquid organic fertilizer itself is left, the next step is packaging. Packaging in this case means pouring the liquid organic fertilizer solution into bottles or other special containers. This aims to maintain the cleanliness of the liquid organic fertilizer solution and to make it easier when it is stored and wants to be used. liquid organic fertilizer is also ready to use.

The six stages above are certainly not an absolute format that cannot be changed according to garden conditions. In practice, considering that there are stalls in the garden area, as well as the presence of fruits and plants other than crystal guava, the materials for making POC can be combined according to the organic waste/waste in the garden that day.

B. Implications of Waste Treatment in Enrichment the Edutourism Side

Every activity carried out in the garden area certainly has its own implications for the image of the garden in general, in this case including the processing of crystal guava waste. Especially if the processing activity is indeed regulated as one of the programs supporting the edutourism side of the Kebun Buah dan Eduwisata Bendosari.

1) Providing Education About Waste Treatment

Every garden visitor will be able to learn about the process of making liquid organic fertilizer. Not only knowing the theory, but everyone will be able to directly try each stage in the processing procedure. Starting from the process of collecting crystal guava fruit waste that is spread over an area of three hectares, separating the fruit as organic material from its inorganic plastic wrapping, getting to know various fermentation formulas, carrying out direct composting practices, packaging, until later being able to participate in providing liquid organic fertilizer to the community each production plant in Kebun Buah dan Eduwisata Bendosari. These series of activities, in addition to providing new insights, will certainly add to the experience that can be experience by every visitor.

2) Instilling Awareness to Care for Environmental Cleanliness

Providing education about waste management also means instilling awareness of the importance of environmental cleanliness. This is important considering that environmental hygiene problems can be found in people's daily lives. With the crystal guava waste treatment program at the Bendosari Fruit Garden

and Eduwisata, it is hoped that the community around the garden and visitors can be moved to be more concerned about environmental hygiene issues.

3) Creating a Cleaner Garden Environment

As previously explained, the presence of the crystal guava waste treatment program at Bendosari Fruit Gardens and Eduwisata can overcome the problems of the garden environment and also provide more comfort services for everyone who comes to visit, especially in terms of free air from unpleasant odors.

4) Becoming a Model for Farmer Communities Around Jogja

The processing of crystal guava waste at Bendosari Fruit Garden and Eduwisata is an effective form of garden management, because it maximizes the utilization of plant parts that are considered waste to be converted into commodities that have use value and selling value. This can be an inspiration for pilot communities around the Special Region of Yogyakarta in terms of processing and utilizing plantation waste, especially crystal guava waste.

5) Opening Research Opportunities Related to Fertilizer Processing

With the implementation of the Crystal Guava waste treatment program at the Bendosari Fruit Garden and Eduwisata, it will automatically increase the research options that academics and plantation researchers can do in the garden. This will later be able to make a major contribution to the development of garden management in the future, especially in the concept of edutourism.

6) Providing learning Related to Liquid Organic Fertilizer (POC) Marketing

With the processing of crystal guava fruit waste into POC, of course it will create new opportunities for Bendosari Fruit Gardens and Eduwisata to market the POC products. From this marketing process, each visitor will be able to learn the POC marketing flow, starting from where to sell it, at what price, and in what way or mechanism. So it is hoped that visitors and the community around the garden will not only be able to independently make POC, but also know and be able to market it.

7) Opening the Opportunity for the Garden to Become a POC Research Center

Of course, with the activity of processing guava fruit waste in the garden, especially considering that this garden carries the concept of edutourism, it can open up opportunities in the future to make Bendosari Fruit Garden and Edutourism a center or center for research and development of Liquid Organic Fertilizers (POC). From this research, it will be possible to create a new variant of POC that has better quality and nutritional power as well as with more economical production costs. This will certainly add more value to the edutourism side of the Bendosari Fruit Garden and Educational Tourism. So that the grand vision of the garden to become a plantation-based non-school education facility can be more actualized.

8) Opening the Opportunity for the Garden to Become a Village POC Production Center

Due to the potential that the plantation is able to manage the process of making and marketing POC, this has the opportunity to attract the interest of the people living around the plantation to participate in producing POC independently and take advantage of the business relations owned by the garden as collectors. If this is realized, the Bendosari Fruit Garden and Edutourism will not only become a center for learning about fertilizers for the village, but more than that, the garden will become a village POC Shelter Center. That way, every POC production in Bendosari hamlet, Sumbersari village, will be managed in a centralized and organized manner by Bendosari Fruit Gardens and Eduwisata.

9) Opening the Gardens Opportunity to Become a Village Organic Waste Treatment Center

In addition to having the opportunity to become a center for collecting village POC production, Bendosari Fruit Gardens and Edutourism also have great potential to treat organic waste found in Sumbersari village, especially the Bendosari hamlet itself. This is very possible considering the area of Bendosari and its surroundings is an area of rice fields and plantations which of course has an abundant production of organic waste. This has not been added to the contribution of organic waste from house to house (domestic). So it is very possible for Bendosari Fruit Garden and Edutourism to become a Village Organic Waste Treatment Center.

10) Opening Garden Opportunities to Become an Education Center for Plantation Business Management in Indonesia

Due to the large potential that is possible to achieve by Bendosari Fruit Gardens and Eduwisata, such as becoming a village liquid organic fertilizer collection center, a pilot garden, to becoming an organic waste treatment center, if all of them are managed properly, it is possible that the garden will become a Business Management Education Center. This is very possible considering how complex the roles are that have the potential to be successfully carried out, so that success can make Bendosari Fruit Gardens and Edutourism an opportunity to become a Plantation Business Management Education Center in Indonesia.

4. CONCLUSION

The problem of crystal guava waste that occurs in Bendosari Fruit Gardens and Eduwisata is caused by the absence of good waste management regulations. As an alternative, processing guava waste into Liquid Organic Fertilizer is the right solution to increase the effectiveness of garden performance. This Liquid Organic Fertilizer has environmentally friendly characteristics, besides the presence of a waste treatment program is able to reduce the costs needed to meet the needs of garden fertilizers and support the edutourism side of the Bendosari Fruit Garden and Eduwisata. In addition, with the implementation of the waste treatment program, there will be many great opportunities that can be achieved by Bendosari Fruit Gardens and Edutourism. These opportunities include; to become a means of

education on waste management, to become a pilot program for farming communities around Yogya, to make the garden an educational center for plantation business management in Indonesia.

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