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Damen (Rice Straw) Waste and Eggshell as Liquid Organic Fertilizer: An Effort for New Business Opportunities

Luluk Muthoharoh*
Sumatran Institute of Technology, INDONESIA

Reni Permata Sari
Nahdlatul Ulama University Lampung, INDONESIA

Muhammad Putra Pamungkas
Nahdlatul Ulama University Lampung, INDONESIA

Agus Komarudin
Nahdlatul Ulama University Lampung, INDONESIA

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Abstract

The dissemination activity of exploring damen (rice straw) waste as liquid organic fertilizer is a form of Tridharma of higher education for community service practiced by four lecturers. This activity has several main goals: increasing public awareness, particularly among residents of RT 20 Sadar Sriwijaya Village, Bandar Sribhawono District, about the importance of utilizing damen waste to be used as liquid organic fertilizer, rather than being thrown away or simply burned after the harvesting process is complete. Socialization activities are carried out in two ways: material delivery and practice daily. Based on the socialization, it was discovered that the participants achieved the socialization's objectives with good criteria in general. As a result, the public knowledge, particularly among residents of RT 20 Sadar Sriwijaya Village, Bandar Sribhawono District, East Lampung Regency, on the use of damen waste and chicken eggshell waste is still low, so socialization is required to raise awareness of the use of agricultural waste as fertilizer.

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INTRODUCTION

Plants require proper and sufficient nutrients to carry out the process of growth and development (Eka et al., 2018; Koch et al., 2020). Plant nutrients can come from nutrients in the soil or outside the soil, such as fertilizer application to meet soil nutrient limitations (Kleiber et al., 2019; Neina, 2019). According to the Department of Agriculture and Food Crops, the difficulties encountered in developing an agricultural business in the agricultural sector are influenced by a lack of access to capital, technology, and the ability to market agricultural products. Land use is not optimal, and irrigation is limited. As a business capital, there is limited human resource capacity due to a lack of intensive guidance and assistance. The livestock waste (solid and liquid) has not been managed or processed properly to become quality fertilizer.

Furthermore, the biogas and plant waste as animal feed has also not been managed or processed into quality animal feed (Fuglie, 2010). Fertilization is one of the efforts made to increase agricultural product productivity. Fertilization is a process for maintaining activity that aims to improve soil fertility by providing nutrients needed by plants in the soil (Lasmini et al., 2018; Sukmasari et al., 2019).

* **Corresponding author:**
Luluk Muthoharoh, Sumatran Institute of Technology, INDONESIA. ✉ lulukmuthoharoh04@gmail.com

Using inorganic fertilizers in plants increases the nutrient content of the soil and can help plant growth grow faster, increasing agricultural production (Purbajanti et al., 2019). However, the increased productivity of agricultural land will only last for a short time (Kugbe, 2019; Stewart et al., 2020) because the continuous use of inorganic fertilizers will cause changes in soil structure, compaction, decreased nutrient content in the soil, and environmental pollution (Triyono et al., 2013). For fertilization to be effective and efficient, the method of fertilization must be adjusted to the conditions of the land (Klimczyk et al., 2021). Using specific technologies regarding the number, location, and requirement of plants for fertilizers can optimally save natural resources (Irawan et al., 2015).

Increasing agricultural production to meet the community's food needs is necessary. The most dominant elements found in inorganic fertilizers are elements of N, P, and K (Oldham, 2017; Rahmawati & Widyasari, 2022). Compound fertilizer from (N, P, K) is one of the inorganic fertilizers that can be used efficiently in increasing the availability of macronutrients (N, P, and K), replacing single fertilizers such as SP-36, ZA, and KCL, which are difficult to obtain in the market and very expensive. On the one hand, the price of inorganic fertilizers such as N, P, and K is getting increasingly expensive (Sukmasari et al., 2019). The level of consumption of inorganic fertilizers is also getting higher while the raw materials for fertilizers are getting thinner (Lestari & Muryanto, 2018).

The development of the agricultural sector has increased the need for all agriculture facilities, including fertilizers (Ranathilaka & Arachchi, 2019). If the need for increased fertilizer is not balanced with sufficient availability, it will affect the increase in market prices and production. Not infrequently, when farmers need fertilizer disappears in the market, and if there is, the price soars (Cotty et al., 2020; Yamin et al., 2021). This unfavorable condition can be overcome and balanced by increasing the use of organic fertilizers (compost)(Adugna, 2016; Michelson, 2017). Simultaneously with removing subsidies for chemical fertilizers, it is necessary to develop the widest possible use of fertilizers made from local raw materials, such as manure and organic fertilizers (Karyaningsih, 2012).

Efforts to increase productivity can be made through intensification and efforts to improve and restore land through organic fertilizers. Alternative efforts to improve soil physical properties or sustainably increase agricultural soil fertility include improving cultivation techniques through organic matter (Leroy et al., 2008; Sukmasari et al., 2019). Therefore, it is necessary to take in nutrients that can efficiently use organic fertilizers and are safe for the environment. Many plants can be used as a source of N, including damen rice and chicken eggshells (Khairnar & Nair, 2019; Minakshi et al., 2019).

The high demand for rice has some consequences on food availability to maintain the sustainability of rice production (Minakshi et al., 2019). Problems such as climate deviation, degradation of paddy fields, and the ongoing conversion of paddy fields make rice production even more difficult (Aprillya et al., 2019). Rice straw waste (*damen padi*) is an agricultural waste that can be used as an ingredient for making organic fertilizers. According to Karyaningsih (2012), the straw waste contains elements of C by 30-40%, N by 1.5%, P2O5 by 0.3%, K2O 2%, and SiO2 0.3% and also contains micronutrients in the form of Cu, Zn, Mn, Fe, Cl, and Mo. Eggshell waste contains 97% calcium stored in the form of calcium carbonate (Karyaningsih, 2012). Organic fertilizers are thought to contribute nutrients, especially N needed by plants. It also can increase the efficiency of N and K nutrients in inorganic fertilizers (50%) due to the improvement in soil chemical properties, especially soil CEC. Thus, plant growth is better than without organic fertilizers (Rosinta et al., 2017).

The potential of agricultural resources for food crops cultivated by farmers in the village of Sadar Sriwijaya, East Lampung Regency, is quite large because almost every resident has a rice field or fields that can be planted with rice. So the agricultural resources of food crops, especially rice in this area, significantly contribute to the food supply. Farmers in the local Sadar Sriwijaya Village make compost, which is still very simple. That is, they only collect straw from the harvest and then pile it on the edge of the rice field near the embankment without further processing. The finished compost is used for basic fertilizer in the next growing season. Rice straw and crop residues are significant organic fertilizer sources in the farming system.

The use of natural organic fertilizer that can be used to help overcome agricultural production constraints is liquid organic fertilizer. Liquid organic fertilizers are mostly applied through the leaves, referred to as foliar liquid fertilizers containing essential macro and micronutrients. Liquid organic fertilizer has several benefits, including encouraging and increasing the formation of leaf chlorophyll and the formation of root nodules in leguminous plants. Increasing the efficiency of fertilization can be done by giving organic matter. Thereby increasing the photosynthetic ability of plants and absorption of nitrogen from the air, increasing plant vigor, making plants strong and strong, increasing plant resistance against drought, weather stress, and attack of disease-causing pathogens, stimulating the growth of production branches, increasing the formation of flowers and ovules, and reduce the fall of leaves, flowers, and ovules (Marpaung et al., 2016).

Socialization activities for making fertilizer have been carried out in various regions and various types of fertilizers, such as training on making liquid fertilizer in Jombang (Ma'arif et al., 2020), composting cow dung in Semarang (Sutrisno & Priyambada, 2019), making organic fertilizer from organic waste in Yogyakarta (Shitophyta et al., 2021), making organic fertilizer from banana tree trunks in Karawang (Efelina et al., 2018). However, no socialization activities have been carried out in this area, namely in the village of Sadar Sriwijaya, East Lampung Regency. Outreach activities about the manufacture of liquid organic fertilizer are hoped to increase the awareness of the residents of RT 20 Sadar Sriwijaya Village, East Lampung Regency, about the importance of increasing knowledge of the benefits of rice and agricultural livestock waste in the form of chicken eggshells which can later be used for fertilizer and sold as an additional source of economic income. Through this program, the participants were given material related to the importance of nutrition for plant growth, the benefits of rice seedling waste and eggshell waste, especially chicken eggs, the content of organic compounds from damen waste and eggshell waste, introduction to liquid organic fertilizer, and how to make organic fertilizer liquid. The purpose of this socialization, among others, is to provide knowledge to the residents of RT 20 Sadar Sriwijaya Village, Bandar Sribhawono District, about the benefits of rice damen waste and eggshell waste, especially chicken eggs, and to teach basic skills in the practice of making liquid organic fertilizer.

METHOD

Several methods were used in this activity, including counseling, training, and discussion. Socialization activities are carried out in two ways: material delivery and practice in one day. The materials presented included information on the importance of nutrition for plant growth, the advantages of rice paddy waste and chicken eggshell waste, the content of organic compounds in damen waste and eggshell waste, an introduction to liquid organic fertilizer, and instructions on how to make liquid organic fertilizer. The following activity is producing liquid organic fertilizer, which can then be used to start a liquid organic fertilizer sales business. During the material delivery, a discussion with the surrounding community was interspersed to allow for two-way socialization. Figure 1 depicts the sequence of socialization activities in brief.

As part of an effort to reduce the use of inorganic fertilizers for agriculture, community service activities include lectures, discussions, and practices related to the manufacture, storage, and use of liquid organic fertilizers in the home. The socialization took place on March 21, 2021, at the home of one of the RT 20 residents. The activity was carried out with the participation of 12 people.

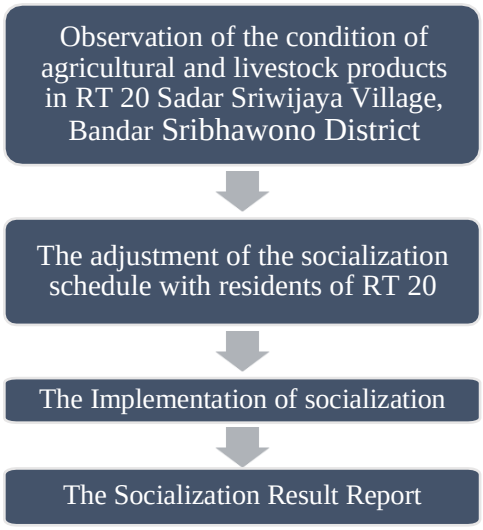

Figure 1. The Stages of Community Service

RESULTS AND DISCUSSION

The presentation of the socialization material began with a light discussion about the fertilization method that farmers typically use. This is done to assess residents' understanding of organic fertilizers, particularly liquid organic fertilizers, and their awareness of the importance of protecting agricultural land by reducing the use of inorganic fertilizers and replacing them with organic fertilizers. This discussion will also provide some information about residents' challenges when obtaining fertilizers and the current price of inorganic fertilizers.

The first stage involves distributing information about the importance of nutrition for plant growth, the advantages of rice waste and chicken eggshell waste, the content of organic compounds in damen waste and eggshell waste, an introduction to liquid organic fertilizer, and how to make liquid organic fertilizer. At this point, the presentation of the material refers to several sources conducted by previous researchers. N levels in organic fertilizers were determined using the CNS Analyzer Truspec Leco, P using the spectrophotometer method, K using a flame photometer, and Ca, Mg, Cu, Zn, Fe, and Mn using AAS (Atomic Absorption Spectrometry). Elemental N is measured using combustion in an oxygen and nitrogen atmosphere. Wet ashing was used to determine the elements K, P, Ca, Mg, and microelements (Rosinta et al., 2017). The documentation for the socialization activities is depicted in Figure 2.

(a) (b)

Figure 2. Documentation of Socialization Activities (a) inside of the House (b) outside of the House

The second stage is the practice of making liquid organic fertilizer. First, the participants were invited to prepare all the tools and materials needed. Most of the participants are farmers, so getting the ingredients for rice and chicken egg shells is not difficult. After all the equipment is complete, the practice of making it begins. The participants were very enthusiastic about this

activity. They even went so far as to use their hands without a stirrer directly to crush the egg shells. This session was also interspersed with many discussion processes with the surrounding community, so this socialization activity could be two-way. Figure 3 presents the state of the participants enthusiastically in this activity.

(a) (b)

Figure 3. Enthusiastic Participants in the Activity (a) Material Input Process (b) Material Mixing Process

The third stage is the practice of the process of storing liquid organic fertilizer. Overhauling organic fertilizers causes volume shrinkage of organic fertilizers and volume shrinkage. This occurs due to changes in the particle size of organic matter and the release of carbon compounds, water, NH3+, and volatile organic acids (Widarti et al., 2015). Heterotrophic microbes use organic carbon compounds from organic fertilizers as a source of energy for their lives. Because this process produces a lot of gas, participants are advised not to close the storage area tightly and mix once a few days. This fermentation is done because, based on research conducted by Meriatna et al., (2018), fermentation aims to make the nutrients contained will be absorbed and available to plants. The following is presented in Figure 4, which is the third stage.

(a) (b)

Figure 4. Third stage (a) Final Mixing Process (b) Process of Closing the Bucket.

The fourth stage is the practical activity of packaging liquid organic fertilizer. This activity is an important aspect because later, after the liquid organic fertilizer is fermented, a finishing stage is required. It takes several small bottles of about 1500mL to transfer the fermented fertilizer, which can later be used to open a sales business.

The fifth stage is the discussion and evaluation of activities. The committee invited the participants to discuss the socialization activities on that day and ask for opinions. Most participants were satisfied and helped by the knowledge given because previously, they did not know that liquid organic fertilizer is very easy to make. The raw materials are often found in the surrounding environment. Figure 5 is the final documentation of the activity.

Figure 5. The Final Documentation of the Activity.

Table 3. The Rundown of Socialization Events

No.	Time (GMT+7)	The Agenda of Activities	Responsible Person
1.	10.00-10.30	Registration	Committee
2.	10.31-10.45	Opening	Head of RT
3.	10.45-11.15	Material distribution on the importance of nutrition for plant growth, the advantages of damen waste and chicken eggshell waste, the content of organic compounds in damen waste and eggshell waste, and an introduction to liquid organic fertilizer	Luluk Muthoharoh, S.Si., M.Si.
3.	11.16-11.45	The practice of making liquid organic fertilizer	Reni Permatasari, S.Si. M.Si.
4.	11.46-12.00	The practice of storing liquid organic fertilizer	Muhammad Putra Pamungkas, S.T., M.T.
5.	12.01-12.30	Rest	Committee
6.	12.31-14.45	The practice of packing liquid organic fertilizer	Agus Komarudin, S. Kom., M. Ti
7.	14.45-15.00	Discussion and evaluation of activities	All Participant
8.	15.01-15.15	Closing	Committee

All stages of socialization activities were completed correctly and promptly. Residents of RT 20 Sadar Sriwijaya Village, Bandar Sribhawono Subdistrict, listened intently to the socialization materials presented. Residents provided positive feedback on basic socialization activities to investigate waste and eggshell waste as liquid organic matter for new business opportunities in the village.

CONCLUSION

Based on the findings and discussions about the basic socialization of making liquid organic fertilizer, it is possible to conclude that the general public's knowledge of liquid organic fertilizer, particularly among residents of RT 20 Sadar Sriwijaya Village, Bandar Sribawono District before socialization, is still limited. People's awareness of the importance of using organic fertilizers, particularly liquid organic fertilizers made from rice straw and chicken egg shells, was raised due to socialization. The activities could help residents improve their skills in various fertilizer-making processes, including preparing tools and materials, the production of liquid organic fertilizer, and storing and using plants.

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