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Production of Bokashi and Liquid Organic Fertilizer (LOF) with Trichoderma Sp. Decomposer Based on Agricultural Waste and Its Application to Horticultural Plants

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Abstract: Horticulture farmers in Rasau Jaya 2 Village, Kubu Raya Regency, cultivate plants on peatlands using large amounts of inorganic fertilizers. Continuous use degrades the peat soil and drastically reduces its organic matter content. This reduction leads to soil hardening, poor water flow, and impaired root development, causing decreased horticultural production. Using LOF and organic matter applications is recommended to address these issues. The PKM (Community Service Program) was implemented through lectures, discussions, training, and demonstrations on making bokashi and LOF with Trichoderma sp. decomposer and their application to horticultural plants. Additionally, monitoring and evaluation of PKM activities were conducted in Rasau Jaya 2 Village. This activity's achieved targets and outcomes include farmers' independence in utilizing agricultural waste as raw materials to produce bokashi and LOF, reducing inorganic fertilizer use. Horticulture farmers were highly enthusiastic about the materials for making bokashi and LOF.
Keywords: inorganic; bokashi; poc; horticulture; trichoderma sp.

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INTRODUCTION

Rasau Jaya District comprises six villages with a total area of 11.07 km². It is the smallest district in Kubu Raya Regency, covering only 2% of its total area. The population of Rasau Jaya District is 30,745, with 15,855 males and 14,890 females (BPS, 2021). It borders Sungai Raya and Sungai Kakap Districts to the north, Kubu and Teluk Pakedai Districts to the south, Sungai Kakap District to the west, and Sungai Raya District to the east. The residents' occupations include fishermen, farmers, livestock breeders, service providers, labourers, traders, and civil servants.

Most Rasau Jaya 2 Village farmers grow horticultural crops such as long beans, green beans, spinach, water spinach, mustard greens, squash, chilli, and tomatoes. They use high inputs, including large quantities of inorganic fertilizers. Continuous use of inorganic fertilizers over a long period degrades soil quality and drastically reduces organic matter content. Organic matter in soil is crucial for improving its physical properties. Its reduction causes

soil hardening, poor water flow, and impaired root development, decreasing horticultural production. Using LOF and organic matter applications can address these issues.

LOF is a solution containing multiple nutrients derived from the decomposition of natural materials, including plant waste, animal manure, and human waste. LOF offers complete macro and micro-nutrients in small quantities, improves soil structure, enhances water holding capacity, boosts soil microorganism activity, and leaves a positive residue effect (Nur et al., 2016; Oktavia et al., 2020; Prasetyo & Evizal, 2021; Ramadhan et al., 2019). Organic matter in soil comes from decomposed plant, animal, and human residues (Indrawati & Hazriani, 2023).

Compost production involves microbes in EM4 solution, which, according to Wulandari et al. (2024), can decompose organic matter into valuable compost, enhancing soil fertility. Organic matter, whether composted or fresh, benefits the soil by (1) increasing its organic matter content, (2) improving its physical, chemical, and biological fertility, (3) increasing microbial diversity, population, and activity, facilitating nutrient availability, and (4) providing macro and micro-nutrients (Kalay et al., 2020). The role of compost, in addition to providing nutrients, can also reduce the process of nutrient loss from the washing process due to high rainfall, due to the presence of functional clusters that can strongly bind nutrients, both positively charged and negatively charged (Indrawati et al., 2021).

Based on the above explanation, the PKM activities aim to provide training on producing bokashi and LOF using Trichoderma sp. decomposer based on agricultural waste and applying them to horticultural plants in Rasau Jaya 2 Village.

METHOD

The Community Service Activity was conducted in Rasau Jaya 2 Village, Kubu Raya Regency, on October 25, 2020, with the participation of 10 horticultural farmers. The activity took place at the house of the Head of Rasau Jaya Village. The community service program method to address the problems faced by horticultural farmers included lectures and discussions, demonstrations and training, and assistance or guidance and evaluation of the activities. The detailed procedures of the activities conducted in this PKM are as follows:

1. Lectures and Discussions to enhance farmers' knowledge about the theory of making LOF and organic materials. The material provided consisted of:
   a. Procedures and steps for making LOF from agricultural waste.
   b. Procedures and steps for making organic materials from agricultural waste.
   c. Business management, including simple bookkeeping, production planning, and marketing.

2. Training, which included:
   a. Methods for making LOF and organic materials from agricultural waste.
   b. Creation of simple bookkeeping for production planning and marketing.

3. Monitoring and Assistance:
   a. Making LOF and organic materials from agricultural waste.
   b. Creation of simple bookkeeping for production planning and marketing.

4. Evaluation of all training and assistance activities based on several indicators and benchmarks, as follows:
   a. Partners are able to practice the techniques of processing LOF and

organic materials using agricultural waste as the basic material.

b. Partners are able to create business management bookkeeping.

RESULT AND DISCUSSION

During the counselling and question-and-answer session, the community showed great enthusiasm for acquiring skills in processing agricultural waste, especially with simple methods and products already well-known but previously unknown production methods. These methods are easy and can be done with simple, affordable equipment (Figure 1).

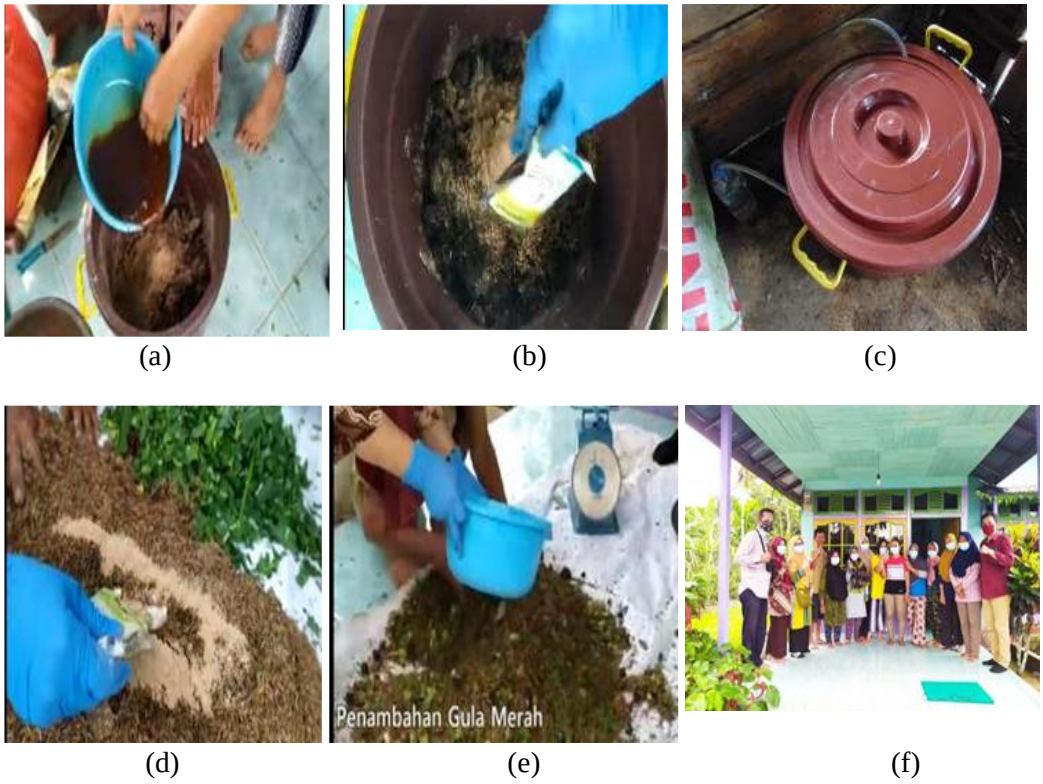
The community's enthusiasm for the presented material was evident from the numerous questions about the methods and materials to expedite the composting process. Likewise, there was great interest in making LOF from agricultural waste used as plant fertilizer. Additionally, the community's enthusiasm was demonstrated by the many people who wanted to participate in the demonstrations and training sessions.

(a) (b)

Figure 1 (a) Socialization and counseling activities and (b) Making LOF, chopping organic materials, and adding decomposer

The dissemination activities (training and assistance in processing agricultural waste into LOF and bokashi) were attended by 10 participants. The PKM team demonstrated and trained the participants in effectively and efficiently processing green waste from agricultural waste into LOF and bokashi. On this occasion, the PKM team also guided the participants in practising how to process agricultural waste so that it was ready to be used as a material for making LOF and bokashi. The team provided recipes for the composition of materials for making LOF and bokashi, along with additional materials such as Trichoderma, which acts as a decomposer and guided the participants in measuring each composition according to the specified amounts to prepare the LOF mixture. The activities used materials and tools provided by the PkM team. Complete documentation of the implementation of activities is shown in Figure 2.

Given the existing conditions in the local community, where housewives are not economically productive, and agricultural waste is abundant at certain times, this PKM activity is one of the programs that encourage housewives to be productive. Besides being utilized as fertilizer for agriculture, if pursued, it can also contribute to the family's economy by selling organic fertilizer. Microorganisms that can play a role as auxiliary agents in increasing and accelerating decomposition so that soil fertility is maintained such as Trichoderma sp. (Setyadi et al., 2017).



(a) (b) (c)

(d) (e) (f)

Figure 2 (a) Combining the sugar, (b) The mixture with decomposer tricoderma, (c) Incubation, LOF is ready to use after 1 month of incubation, (d) Application of chicken manure to chopped organic material, (e) Application of brown sugar solution followed by incubation, and (f) Group Photo with Training Participants from Dipa Untan in Rasau Jaya Village

Trichoderma sp is an antagonistic fungus that has the potential as a biofunction. Stuffy Lycian on plants before and during plant growth can prevent from pest and disease attacks. (Rachmawatie et al., 2022a).

Using Trichoderma as the initial decomposer in organic fertilizer production, both liquid and solid, can shorten the decomposition process, allowing composting to occur more rapidly. Trichoderma sp., besides being a decomposing organism, can also function as a biological agent and a plant growth stimulator. Regular periodic use of biological fertilizers and bio fungicides containing Trichoderma sp. will provide better benefits than chemical fertilizers and fungicides (Syamsuri et al., 2022; Rachmawatie et al., 2022b).

The various benefits of Trichoderma include playing a role in controlling the attack of several pathogens that cause plant diseases (Sharma et al., 2016), degrading heavy metal compounds or pesticides, playing a role in spurring plant growth, and as a biodecomposer (Fauriah et al, 2023; Hussain & Mutlag, 2021; Rao et al., 2020; Sharma et al., 2016). Various species of Trichoderma can be biofungicides and biofertilizers to increase plant growth (Gusnawaty et al., 2020).

The overall program evaluation was conducted through questionnaire surveys. This was done to assess the

program's success among the directly involved community members (farmer groups), with 10 respondents. The evaluation was conducted by assessing the participants' abilities before and after the counselling and training sessions conducted by the PKM team. The evaluation criteria used were:

1) The participants' response to receiving new information and knowledge was observed through the enthusiasm of the community in participating in this activity.
2) Farmers' ability to understand the production of LOF and Bokashi.
3) Participants' understanding of agricultural input technology types.
4) Whether the community is willing to continue implementing this training.

The results of the program evaluation using questionnaires are presented in Table 1.

Table 1 Results of the questionnaire for participants

No	Respondent's Statement	Responds (%)			
		Strongly Agree	Agree	Disagree	Strongly disagree
1	The program that has been implemented is very beneficial for participants	80	20	-	-
2	The program that has been implemented is in accordance with the problems in the Poktan, especially in the agricultural sector where peatlands are not fertile	70	20	10	-
3	After this program is completed, I will continue to cultivate agriculture in the village	50	50	-	-
4	I understand how to make POC and Bokashi	30	70	-	-
5	I know the benefits of POC and Bokashi	50	50	-	-
6	After this program, I will still use POC and Bokashi	70	30	-	-

Table 1 shows that most Poktan members can feel the benefits of this program. Most farmers also agree that the program aligns with the agricultural issues in the village, where the peatland is infertile. Most of the community will continue farming after this program ends. Additionally, most people understand how to make LOF and Bokashi from local biomass waste and know the benefits of these amendments. Farmers will continue to use amendments as appropriate technology in agricultural cultivation management after this program ends.

CONCLUSION

From the PKM activities conducted with housewives in Rasau Jaya 2 Village and its surroundings, several conclusions can be drawn (1) Housewives/farmers who were trained are now able to adopt techniques for processing agricultural waste into LOF and bokashi, and (2) Housewives and farmers in Rasau Jaya 2 Village have great potential for skill enhancement training, given their ample free time and the abundance of agricultural waste, which is a local commodity.

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