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Development of Environmentally Friendly Schools to Optimize the Business of Farmer in Processing Livestock Waste

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Abstract: This environmentally friendly school development activity is a collaboration between PUI PT Sifas (Sustainable Integrated Farming System) Universitas Jambi, with PetroChina International Jabung Ltd, and related East Tanjung Jabung Regency agencies. This activity aims to optimize the processing of livestock waste to support environmentally friendly agriculture with a zero-waste concept. However, the obstacles faced in waste processing are that the biogas installation needs to be fixed, there are no results of compost and biourine nutrient analysis yet, the compost does not have a registered trademark. It is hoped that the group will become a training and demonstration center for environmentally friendly agriculture. This community service activities used the PAR (Participatory Action Research) approach, namely service activities that involve active community participation, starting with coordination, training, creating environmentally friendly schools, product improvement and implementation. This activity included counselling, training and building environmentally friendly schools. All activities included optimizing compost, biogas and biourine processing equipment, carrying out nutrient analysis of compost and biourine, and applying compost and biourine to plants. The extension was attended by 40 participants consisting of 35 members of farmer groups, 5 extension workers and representatives from the Department of Agriculture. Activities to improve biourine installations, compost processing, application of compost and biourine to plants. Applying compost and biourin can increase kale production by 26%, ginger by 16%, long beans by 12%, and eggplant by 14%. Local resources and adequate human resources support the development of an environmentally friendly school in Kota Baru village. Conclusion: SRL activities can have a social impact by growing participants' interest in applying compost and biourine to agricultural businesses, increasing production, reducing environmental impacts.

Keywords: biourine; compost; environmentally friendly; waste

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INTRODUCTION

The development of this environmentally friendly school (*Sekolah Ramah Lingkungan*, henceforth SRL) is a collaboration between PUI PT Sifas (Sustainable Integrated Farming System) University of Jambi as the technical implementer, PetroChina International Jabung Ltd as the funding provider, the Suka Maju farmer group as the target partner. This activity develops field learning, practice, demonstrations, and internships for surrounding farmers to enhance their understanding, awareness, and integration of environmental, conservation, and environmentally friendly cultures into all agricultural activities. The community has widely implemented SRL activities in agriculture and animal husbandry through integrated agricultural and livestock waste processing (Firman et al., 2005; Afriani et al., 2023; Wulandari et al., 2024). This activity produces beneficial, complementary, and mutually beneficial (symbiotic mutualism) products such as compost processing (Asep et al., 2013; Adriani et al., 2020), biogas (Heryanti et al., 2022), silage feed processing (Bahrun et al., 2020; Adriani and Afdal, 2020), and biourin (Nuraini et al., 2023), which are integrated. These products can then be applied in developing environmentally friendly agriculture with a zero-waste principle (Wihardjaka, 2021; Heryanti et al., 2023). One of the groups that has implemented environmentally friendly school activities is the Suka Maju farmer group.

The Suka Maju farmer group is located in Kota Baru Village, Geragai Subdistrict, Tanjung Jabung Timur Regency. Their main activities include oil palm plantation, cattle farming, and waste processing (converting oil palm fronds, feces, and urine into compost, biourin, and biogas) (Adriani & Yurleni, 2019). These activities have been integrated, especially the production of compost and biourin. The group's average monthly production is 10 tons of compost and 75-120 liters of biourin. However, the biogas installation needs to be fixed, there has been no nutrient analysis of the compost and biourin, and the compost still needs to have a registered trademark. To develop the farmer group into an Environmentally Friendly School, optimizing waste processing and establishing demonstration plots for applying compost, biourin, and feed processing is necessary.

To support all these activities and in line with the facilities and conditions of the Suka Maju farmer group, a training room, discussion space, and adequate internship facilities for the group and the community are needed as part of the SRL center. The SRL development also includes an outlet for product marketing. In addition, the environmentally friendly school is equipped with demonstration plots for waste processing, biourin and biogas, and their application to crops. Based on these considerations, community service for developing an SRL at the Suka Maju farmer group in Kota Baru Village, Geragai Subdistrict, Tanjung Jabung Timur Regency, has been made.

METHOD

This activity was conducted over 4 months with the Suka Maju farmer group in Kota Baru Village, Geragai Subdistrict, Tanjung Jabung Timur Regency. The activities were divided into 0.5 months for coordination and action planning, 2 months for constructing the environmentally friendly school, and 1.5 months for counselling activities, demonstration plot support, monitoring, and evaluation. The farmer group is involved in cattle farming, oil palm plantation, and waste processing into fertilizer, biourin, and biogas.

The steps taken to optimize the Suka Maju farmer group's development of the SRL include strengthening the group and setting up demonstration plots for applying compost and biourin as examples and learning sites. The activities began with coordination to determine the activity plan (Figure 1).

Figure 1 Coordination of the activities with the farmer group

The discussion resulted in an action plan consisting of counselling and training activities, trademark registration, compost and biourin quality analysis, demonstration plots for applying compost and biourin, and the construction of the SRL as a training, support, and monitoring site.

The approach method used in this community service activity is PAR (Participatory Action Research), which involves active community participation through integrating environmentally friendly knowledge between agriculture (Afandy et al., 2013), animal husbandry, and plantations. This included building an environmentally friendly school, practising, and setting up demonstration plots. The activities were participatory and collaborative, with the target partners sharing responsibility for implementing and continuing the program. The steps of the activity included field assessment, counselling and training activities, SRL construction, packaging design development, compost trademark registration, and environmentally friendly agriculture demonstration plots.

Forty participants attended the counseling activity, including 35 members of the farmer group, 5 PPL (Agricultural Extension Workers), and technical staff from the Department of Food Crops and Horticulture and the Department of Plantations and Livestock of Tanjung Jabung Timur Regency.

At the end of the activity, monitoring was conducted. Monitoring focused on the processes carried out after the activity and its impact on increasing knowledge, economics, social aspects, and the environment. Monitoring was conducted by providing a questionnaire to all participants, consisting of 15 questions with responses ranging from the lowest score (1) to the highest score (5). The lowest score represents the lowest perception of the activity, while the highest score represents a very good perception of the activity conducted. All participant responses were collected, tabulated, and presented in graph form. Evaluation was done through comprehensive observation of the implementation and challenges faced by the activity partners.

RESULTS AND DISCUSSION

Activity Coordination

Coordination for the SRL development activities was carried out through discussions with the Suka Maju farmer group, PetroChina International Jabung Ltd, the PUI PT Sifas (Sustainable Integrated Farming System) team from the University of Jambi, and the head of Kota Baru village. The discussions resulted in an agreement that the activities would be centered on the Suka Maju Farmer Group, involving all its members and several other farmer groups. The counselling and training activities emphasized product optimization, trademark registration, nutrient analysis of compost and burn, and demonstration plots for horticultural crop farming.

The SRL was agreed to be built next to the farmer group's leader's house. The location was chosen because it is on the main road of Jambi Muaro Sabak. It would also function as an office and outlet for the farmer group's and the surrounding community's products. The Suka Maju farmer group carried out the SRL construction, while the activity funded all the building material needs. Demonstration plots for applying compost and biourin to horticultural crops were created around the environmentally friendly school building as examples.

Environmentally Friendly School Construction

The preparation for SRL construction began with creating a simple building plan as a reference for the group during construction. The farmer group members carried out the SRL construction collectively, starting from the foundation, filling, and complete construction. The group, along with the implementation team and PetroChina International Jabung Ltd, agreed that the SRL would be built next to the house of the Suka Maju farmer group leader, with the SRL building measuring 6 x 17 meters.

The land used for the environmentally friendly school construction was flat, with topographical conditions very suitable for demonstration and SRL application. Based on its geographical location, the SRL site is ideal as a training center, demonstration site, and product outlet for the group. This good accessibility is a key supporting factor in enhancing competitiveness in terms of market efficiency and the effectiveness of SRL development and public services.

The SRL building is divided into three main sections: the first section is a meeting/training room measuring 6 x 11 meters, the second is an office space of 6 x 4 meters, and the third section contains a bathroom and production area of 6 x 2 meters. A sliding door separates the training room from the office, allowing the space to be expanded for larger activities. The bathroom and production area are located at the back. The SRL was constructed using specific materials, including a steel frame, zinc roofing, and semi-open wall structures. The open system allows the group to display products and create an outlet for product marketing (Figure 2).

Figure 2 Environmentally friendly school construction

Counseling and Training

Counselling and training sessions were conducted at the newly constructed SRL. The training focused on strengthening waste processing and its application to crops. 40 participants attended the training and was also attended by the Head of the Research and Community Service Institute of the University of Jambi, representatives from PetroChina International Jabung Ltd, the Head of the Plantation and Livestock Department of Tanjung Jabung Timur Regency, the Head of the Food Crops and Horticulture Department of Tanjung Jabung Timur Regency, the Geragai Subdistrict Head, and the Head of Kota Baru Village (Figure 3).

Figure 3 Counseling activity

During the counselling and training sessions, materials were provided on the importance of environmentally friendly schools and local government policies, especially from the Food Crops and Horticulture Department and the Plantation and Livestock Department, regarding environmentally friendly schools in Tanjung Jabung Timur Regency. Meanwhile, the technical team from PUI PT Sifas focused more on the technical aspects of applying compost and biourin to agriculture.

Application of Compost and Biourin

The SRL's demonstration of compost and biourin application supports environmentally friendly agriculture. It serves as a center for training, learning, practice, and demonstration. This allows other community members interested in learning about SRL to visit, engage in discussions, observe the products produced, and see their applications in action (Figure 4).

Figure 4 Application of biourin and compost on plants

The combination of compost and biourin applied by group members has been shown to increase the production of horticultural crops. Applying 10% compost and 10% biourin on plants increased the production of water spinach by 26%, ginger by 16%, long beans by 12%, and eggplant by 14%. This is likely because water spinach requires a lot of water, and the nutrients it needs can be supplied by compost and biourin. Similar results were found by Murti et al., (2016), where applying compost and biourin increased the size of pak choy vegetable heads.

The optimal soil pH for plant growth ranges between 5.5 and 7.5, depending on the cultivated crop type. Plant growth can be disrupted in very acidic or basic soil conditions, and drastic changes can lead to plant death.

The supporting equipment for SRL is intended to complement the training facilities for the Suka Maju farmer group. To support SRL activities as a learning, practice, training, and demonstration center, the SRL building is equipped with furniture, including two tables, five chairs, one product outlet cabinet, a whiteboard, and product information displayed on banners on both the left and right sides of the environmentally friendly school. The supporting equipment for SRL activities is shown in Figure 5.

Figure 5 Supporting equipment for SRL activities

Product Optimization for the Farmer Group

The optimization of the products produced by the farmer group is carried

out to support SRL activities, including improvements to the biogas installation, registration of the compost trademark, and the compost itself. To facilitate the marketing of compost and the group's brand, the compost produced by the farmer group is branded as "Bintang Compost" with a logo, as shown in Figure 6.

Figure 6 Compost trademark

The "Bintang Compost" trademark has been registered with the Directorate General of Intellectual Property (DGIP) of the Ministry of Law and Human Rights of the Republic of Indonesia under registration number IPT2021154739. The Suka Maju farmer group's compost trademark features four colours: yellow, black, brown, and green. The logo consists of a five-pointed star, with a ribbon across the middle bearing the words "Bintang Compost." In the centre, there is an image of three trees.

To support SRL and the existing group products, namely compost and biourin, laboratory analysis was conducted on their nutrient composition. The nutrient composition of compost and biourin can be seen in Table 1.

Table 1 Nutrient content of compost and biourin

No	Nutrient Element	Product	
		Compost	Biourin
1.	Organic C (%)	29.19	0.10
2	N -total (%)	1.74	0.06
3.	P2O3 (%)	0.67	0.01
4.	K2O (%)	9.54	3.05
5.	pH	7.71	9.16
6.	Zn (ppm)	538	1.00
7.	Pb (ppm)	Td *	1.00
8.	Cd (ppm)	2.00	0.40
9.	Fe (ppm)	4.10	14.00
10.	Cu (ppm)	328.00	0.5
11.	CaO (%)	9.85	0.01
12.	MgO (%)	10.80	0.11

Information: Nd= not detected

Observations on the physical characteristics of the compost produced by the Suka Maju farmer group show that it meets the SNI standards, with a dark brown color, crumbly texture, and earthy smell. According to Suhessy et al., (2016), good compost should have a dark color, crumbly texture, and earthy smell. The nutrient content analysis aligns with SNI compost standards, with a C/N ratio 16.77. This range falls within the SNI standard for compost, which is between 10-20. This C/N ratio range is ideal for nutrient absorption by plant roots. The macro-nutrient content of the compost, such as nitrogen (N), carbon (C), phosphorus (P), and potassium (K), exceeds the SNI standards, indicating that the compost meets the required standards.

Most of the micro-nutrient content in the compost also meets SNI standards, including cadmium (Cd), copper (Cu), calcium (Ca), magnesium (Mg), and iron (Fe), while lead (Pb) was not detected. However, the zinc (Zn) content slightly exceeds the maximum compost limit, and the manganese (Mn) content is higher

than the maximum limit. Overall, the macro and micro-nutrient content of the compost meets SNI standards. Attention should be given to nutrient content that exceeds the set standards. According to Hartatik and Widowati (2015), organic fertilizers can increase plant productivity.

Biourin is a liquid fertilizer made from livestock urine, which contains a complete range of nutrients such as potassium, nitrogen, phosphorus, and micro-nutrients beneficial for plant growth (Sudana et al., 2014). Using cow urine as an organic fertilizer offers several advantages, including being relatively inexpensive, readily available, easy to apply, and containing nutrients essential for plants (Mateus & Djailani, 2021). Urine can be processed into biourin by incubating it before use. The decomposition process of cow urine can be enhanced by adding spices such as galangal, ginger, greater galangal, turmeric, and kencur that have been ground. The pungent odor of cow urine is expected to be neutralized by the essential oils in these spices. These essential oils, composed of eugenol, function as antimicrobials and can reduce anaerobic microbes, thereby reducing the odor of biourin. Many farmers are reluctant to use biourin due to its strong smell.

Biourin can be applied to various types of plants. It is usually diluted with water at a ratio of 1 liter of biourin to 10-15 liters of water. Biourin can be sprayed on leaves or watered onto plants. The recommended dosage for seasonal crops is 100 liters per hectare, and 250 ml per plant for perennial plants.

To optimize the function of the environmentally friendly school as a demonstration and learning center, the biogas installation, which was not functioning, was repaired. The biogas installation had issues due to a leak in the digester, preventing gas production. The biogas installation repair process is shown in Figure 7.

Figure 7 Biogas installation repair

The biogas installation is now functioning well, with many gas reserves available. The gas produced is already being used for cooking by Women's Farming Group (KWT) members, who participated in the training event.

An evaluation was conducted by distributing questionnaires to the participants to assess their perceptions of the activities that had taken place. The questionnaire consisted of 15 questions, with answers ranging from the lowest score (1) to the highest score (5). The lowest score represents the lowest perception of the activities, and the highest score represents a very positive perception of the activities conducted.

Perception is important as it represents how individuals receive stimuli through their senses, also known as the sensory process, which leads to successful communication. This involves organizing, recognizing, and interpreting sensory information to provide an understanding of what has been received (Zulfikar et al., 2018).

The questionnaire contained 15 questions, including: 1) The material is appropriate for the training activities. 2) The material is systematically arranged and easy to understand. 3) There are examples for the material presented. 4) The training material is easy to comprehend. 5) The material can be applied in their locations. 6) The practical exercises are easy to understand. 7) The instructor's ability to answer questions. 8) The clarity of the material presentation. 9) The raw materials used for practice are available in their environments. 10) The

potential for application. 11) The material supports community needs. 12) The material can be implemented in their locations. 13) The business potential of the products produced. 14) The activities align with the group development plans. 15) There is a plan for future application. The average responses from the training participants can be seen in Figure 8.

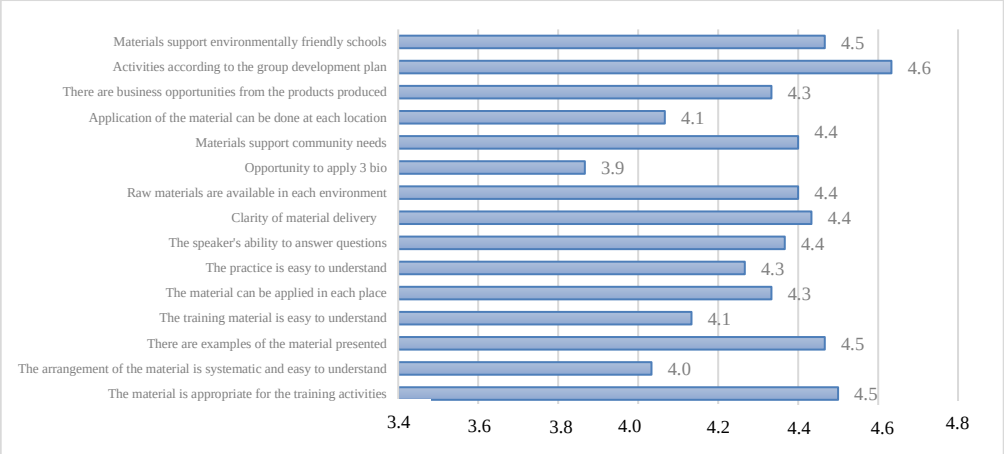

Figure 8 The average responses from the training participants

The evaluation of the socialization and training activities revealed that the highest perception score was obtained for the question, "The activities align with group development," with a score of 4.6. This indicates that participants strongly understand and agree with the establishment of the environmentally friendly school and the products it generates. The second-highest scores were obtained from three questions: "There are examples for the material presented," "The material is appropriate for the training activities," and "The material supports the environmentally friendly school."

The average response score was 4.5, indicating that the training activities were well-delivered, including examples and practice in creating 3-bio. The material aligns with the participants' perceptions, with acceptance scores above 4 (appropriate), leaning towards "very appropriate." Responses to four questions scored 4.4, while the lowest score, 3.9, was for the "The potential for application," indicating that participants believe it can be applied in their farming practices.

CONCLUSION

This activity concludes that developing an environmentally friendly school (SRL) has a social impact. It increases participants' interest in using compost and burn in their agricultural endeavors, enhances production, and reduces environmental impacts.

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