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Utilisation of Palm Oil Empty Bunches into Organic Fertiliser to Support Net Zero Emission Policy

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ABSTRACT

Strengthening the values of Pancasila for elementary school students is an important aspect of shaping the character and identity of students. The purpose of this dedication is to socialize the strengthening of the values of Pancasila to the students of primary school and any obstacles to strengthening the value of the Pancasilla. The method of dedication used in the socialization of strengthening Pancasilas values is the method of lectures and discussions. Based on the results of the socialization showed that the students enthusiastically welcomed the strengthening of Pancasila's values by following the activities until completion, answering questions from the practitioners, and strengthening the material by providing skills development by giving examples of the election of the class leader with discourses, waving red and white flags, and clean Fridays, and others. Strengthening the values of Pancasila in elementary school for students requires the support of teachers so that these values are embedded in students as character and attitude.

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INTRODUCTION

Indonesia, a prominent palm oil producer, generates significant oil palm empty fruit bunch (EFB) trash. Unfortunately, this residue, a byproduct of the palm oil business, is often ineffective, leading to environmental harm. Hence, properly handling PKS waste as organic fertilizer is crucial for promoting sustainable agriculture. Indonesia, the foremost palm oil producer globally, naturally generates a substantial quantity of garbage. Empty Palm Bunches (EFB) account for 21% of the total weight of 1 tonne of Fresh Fruit Bunches (FFB). Unused oil palm bunches collect and remain unused (Praevia & Widayat, 2022). The three provinces with the most extensive oil palm plantations in Indonesia are Riau Province, which boasts the most significant oil palm plantation. In 2023, it encompasses 3.49 million hectares, which accounts for approximately 20.75% of the overall oil palm plantation area in the country. Central Kalimantan ranks second with a total area of 2.03 million hectares dedicated to oil palm plantations. North Sumatra is ranked second in land area, covering around 2.01 million hectares (Annur, 2023). Langkat Regency is one of the districts that contain oil palm farms.

Simpang Tiga Village is situated in the downstream Langkat region and is one of the six villages and one sub-district in the Sawit Seberang District of Langkat Regency. The Simpang Tiga Village can be described as follows: Simpang Tiga Village is situated in the Sawit Seberang Langkat district, namely at coordinates 3°49'17.2 "N98°15'44.9 "E. It is located above sea level and covers an area of 3,931.00 KM². The village of Simpang Tiga is adjacent to the North, while the village of Sawit Hulu / Telaga Said borders it. The location is Sawit Seberang Village in the southern region. The location is Mekar Sawit Village in the western part. The location is Alur Gadung Village in the eastern part. The distance from the village office to the sub-district office is around 3.70 kilometers, while the distance from the village office to the regent's office is approximately 31.00 kilometers.

The settlement is governed by a community organization that oversees the cultivation of oil palm plantations. The majority of the Simpang Tiga village area consists of oil palm plantation land that extends down the river. In addition to working on the plantation, several villagers also engage in agricultural and vegetable companies as secondary sources of income. Hence, expediting the processing of the remaining TKKS will yield advantageous outcomes that can enhance the optimization of agricultural land management while simultaneously facilitating the achievement of the Net Zero Emission policy. Net-zero emission (NZE) or zero carbon emission refers to a condition in which the quantity of carbon dioxide released into the atmosphere is equal to or less than the amount the Earth absorbs. To do this, shifting from the existing energy system to a more environmentally friendly one is necessary to establish a harmonious equilibrium between human activities and the natural balance (Zahira & Fadillah, 2022).

Each processing of 1 tonne of FFB (Fresh Fruit Bunches) yields 22-23% TKKS (Empty Palm

Oil Bunches), equivalent to 220-230 kg of TKKS. Most palm oil mills (PKS) and communities in Indonesia have yet to utilize this waste effectively. The processing and utilization of TKKS by PKS are currently highly restricted. Despite being prohibited by the government (Salmina, 2016), most palm oil mills in Indonesia continue to incinerate the TKKS. Hence, adopting a more inclusive strategy concerning community awareness in Simapang Tiga Village, Langkat Regency, is imperative for effectively managing TKKS to bolster the Net Zero Emission policy.

As per Regulation of the Minister of Agriculture, No.70/Permentan/SR.140/10/2011, organic fertilizer is made from deceased plants, animal excrement, and other organic waste that has undergone an engineering process. It can be in solid or liquid form and may be enhanced with mineral and microbial substances. The purpose of organic fertilizer is to enhance nutrient content, soil organic matter, and the soil's overall physical, chemical, and biological properties. The appropriate decision for counseling and training the Simpang Tiga Village, Langkat Regency community is to convert unused TKKS into organic fertilizer.

METHODOLOGY

The execution of observations, interviews, and counseling implements the service method. The steps above have previously been executed to map conditions in the field. Based on the observations conducted, community workers assessed the field conditions, including the tools and equipment used in the processing, the flow of the process, and the established standards that serve as a reference for managing TKKS by the community in Simpang Tiga Village, Langkat Regency, in order to achieve the Net Zero Emission policy.

RESULTS & DISCUSSION

The unutilized solid waste with the most significant volume currently is empty oil palm bunches. Palm oil mills have yet to significantly use empty oil palm bunches even though the fruit shells are used as fuel for boilers. Palm bunches devoid of contents are solely utilized to accumulate and store soil. The residual unutilized oil palm bunches amass. With the annual growth in palm oil output, there will be a corresponding rise in trash produced. Typically, solid waste generated by the palm oil sector contains a significant amount of organic matter, which has the potential to create pollution if not managed correctly. Ongoing efforts are to transform the solid waste from palm oil into a more profitable form. Palm oil waste refers to the residual products of palm oil production that are not part of the primary product or are by-products of the process (Haryanti et al., 2014).

Academics and community groups from Simpang Tiga Village are collaborating to achieve Net Zero Emissions using sustainable management practices for TKKS. Academics who serve as implementers of community service carry out multiple stages to offer counseling and impart additional knowledge on effectively managing TKKS. This aims to enhance productivity and optimize the side businesses run by community groups in charge of plantations in Simpang Tiga Village, Langkat Regency.

Step I: Assemble participants for counseling and provide training on ecologically sustainable, sophisticated items from TKKS. Offering further information in the form of material that encompasses:

1. TKKS waste has significant nutrients, making it a viable candidate for use as raw material in producing organic fertilizers (compost). The composted palm biomass waste is derived only from empty bunches (Siddiquee et al., 2017).
2. The main challenge in composting PKS waste is the high C/N ratio caused by the high wood component in PKS. Thus, to decrease the C/N ratio in materials with elevated values, it is necessary to apply specific treatments using animal dung (Isroi, 2009).
3. Composting is the regulated process of microbes' decomposition and stabilization of organic matter. During the process of composting, carbohydrates, cellulose, hemicellulose, lipids, and waxes undergo conversion into carbon dioxide (CO2) and water. Proteins undergo conversion into ammonia, carbon dioxide, and water. Indriani (2004) states that organic molecules convert into chemicals capable of being assimilated by plant roots.
4. TKKS waste undergoes natural decomposition. Nevertheless, lignocellulose in TKKS results in a prolonged duration for converting trash into organic fertilizer compared to the natural decomposition process. In order to expedite the process, fungal microbes might be employed to facilitate the decomposition of the lignin and cellulose present in empty palm bunches (EFB). Hence, it is imperative to handle vacant palm bunches while considering environmental sustainability (Adiguna & Aryantha, 2020).
5. Indonesia is part of the network of the International Energy Agency. Thus, Indonesia contributes to the enhancement of NZE commitments. Countries worldwide have different formats for implementing the Sustainable Development Goals (SDGs) or Sustainable Development. One of these elements is the Green Economy, an environmentally sustainable economic system that creates a global economic cycle favorable to the environment and safeguards the earth from harm.

Step II:

1. Collection of TKKS by the service team and community groups managing oil palm plantations in Simpang Tiga Village, at the service location many TKKS were found abandoned and piled up at the plantation site.

Figure 1. Oil Palm Empty Bunch Collection

2. Some of the technologies currently being developed to improve the quality of oil palm empty fruit bunch waste are biopellets, hydrothermal treatment, and torrefaction. Hydrothermal treatment (HT) is the most frequently studied method to improve biomass quality both physically and chemically.

Figure 2. Example of Hydrothermal Material

3. By using microorganisms, the decomposition process of TKKS can be accelerated, which produces organic fertilizer faster. Although TKKS also undergoes natural decomposition, this process takes a longer time. Tankos compost has many significant advantages for use.

Figure 3. Decomposition (decay) of Empty Palm Oil Bunches

DISCUSSION

Tank compost enhances the solubility of essential elements required by plants. Another benefit of Tankos compost is its uniform consistency, which facilitates its application to the soil. Furthermore, utilizing it as a medium for transporting plant pests decreases potential hazards, enhancing agriculture's

overall caliber. Using fertilizer derived from empty oil palm bunches (EFB) in the district has a beneficial effect in mitigating the excessive buildup of EFB waste, and utilizing TKKS as a fertilizer yields substantial environmental advantages by mitigating the pollution caused by industrial waste, encompassing soil, water, and air pollutants. Utilizing TKKS as fertilizer can effectively reduce the adverse environmental effects, making it a viable solution to achieve the Net Zero Emission policy. The Mixed Composting Scheme of Palm Oil Empty Fruit Bunch (EFB) is outlined in the study conducted by Hau et al. (2020) The scheme includes the following:

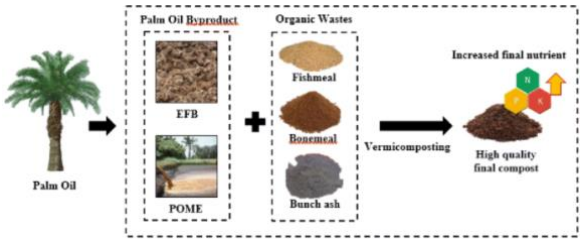

Figure 4. Production Process of Organic Fertilizer Based on Empty Palm Oil Bunches (TKKS)

Utilizing organic fertilizer made from empty oil palm bunches (EFB) can effectively address the issue of EFB accumulation, which hinders the attainment of Net Zero emissions. The TKKS organic fertilizer comprises vital ingredients that promote plant growth, decreasing the need for chemical fertilizers, and utilizing TKKS as a fertilizer yields substantial environmental advantages by mitigating the extent of pollution generated by industrial waste, encompassing air, water, and soil pollution. By commercially selling the TKKS organic fertilizer, companies can save money on monthly fertilizer purchases and potentially generate profits. This can significantly enhance the income of the community organizations in Simpang Tiga Village. Furthermore, it can generate employment opportunities for the neighboring community and enhance the rapport between the enterprise and the local population (Hidayat et al., 2022).

Various activities in oil palm plantations, including fertilization, maintenance, fruit transport, palm oil processing, and harvesting, can cause greenhouse gas (GHG) emissions. This does not align with the Net Zero Emission (NZE) policy. Hence, the management of empty palm oil bunches (EFB) is a better option because it can optimize the economy of oil palm plantation managers. TKKS, which has decomposed, can be used as an organic fertilizer. During this process, it releases nutrients such as nitrogen (N), magnesium (Mg), potassium (K), and phosphorus (P), making it a source of organic fertilizer that provides necessary nutrients to plants.

The use of 0.7 kg per polybag of organic fertilizer of TKKS in tomato plants has been shown to increase soil pH. Research shows that using lignocellulose from TKKS can increase seedling growth,

wet weight of root stems, and dry weight of stems in oil palm and corn plants. To accelerate the decomposition process of TKKS into environmentally friendly organic fertiliser, microorganisms are used. These microorganisms accelerate the decomposition process of TKKS, producing organic fertilizer faster than the natural decomposition process, which takes longer.

The use of compost from TKKS has many benefits. Firstly, it can improve the soil structure, making it looser and better for plant growth. In addition, TKKS compost also increases the solubility of nutrients needed by plants. It reduces the risk of being a carrier of plant pests, contributing to improving agricultural quality. Compost from TKKS can also improve soil durability by adding humus, which helps improve soil structure and reduce erosion. The decomposition process in composting produces more stable compounds and reduces greenhouse gas emissions such as methane and carbon dioxide. TKKS compost also improves soil quality by adding essential nutrients such as nitrogen, phosphorus, and potassium.

In addition, using TKKS compost as an organic fertilizer can reduce the use of synthetic chemicals that negatively impact the environment. TKKS compost can increase crop production by providing necessary nutrients and improving soil structure, which helps plant roots grow better. Through this training, partners were very interested in making organic fertilizer from TKKS and succeeded in making it. This training provides knowledge and skills to partners, so they are expected to be able to process the potential in their environment to make organic fertilizer that is environmentally friendly and cheap.

CONCLUSIONS

Managing oil palm empty fruit bunches (EFB) waste in Simpang Tiga Village, Langkat District, has proven an effective solution to support the Net Zero Emission (NZE) policy and improve community welfare. Through observation, interviews, and counseling, the local community has acquired the knowledge and skills to process TKKS into valuable organic fertilizer. The use of TKKS organic fertilizer can improve soil and plant quality and reduce the use of chemical fertilizers that damage the environment. In addition, this initiative contributes to reducing greenhouse gas emissions, supports the green economy, and creates new economic opportunities for the community. Therefore, sustainable management of PKS helps address waste issues and potentially improves agricultural productivity and the economic welfare of the Simpang Tiga Village community. This initiative can serve as a model for other areas with palm oil industries to implement to achieve Indonesia's sustainable development goals and NZE policies.

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