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Application of Appropriate Technology for Making Organic NPK Fertilizer by Utilizing Palm Oil Mill Waste in Bekiung Village

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ABSTRACT

Bekiung is one of the villages in Langkat Regency. Farmers in this village generally cultivate a lot of oil palm plants. The waste is quite large and causes environmental pollution problems. On the other hand, experience problems in the form of scarcity and expensive synthetic fertilizers, subsidized fertilizers that are no longer available, and less fertile soil. This is due to the lack of knowledge and skills of farmers, limited advice and infrastructure in waste processing. The aim of this activity is to increase farmers' knowledge and skills in processing palm oil waste into organic NPK fertilizer, open farmers' insight into the importance of organic fertilizer as a diversification of synthetic fertilizer which is beneficial for soil properties and increase the independence of partners in waste processing. The solution offered to overcome this problem is the introduction of appropriate technology and processing palm oil factory waste into organic NPK fertilizer. The methods used in this activity are socialization and direct practice in the field. The results obtained were the introduction and delivery of technology transfer equipment in the form of a hummer mill, conveyor and simple filter, training and assistance in making organic NPK fertilizer up to packaging. The conclusion of this activity is that it is a beneficial activity for partners because it increases the understanding and independence of partners in processing palm oil mill waste into organic NPK fertilizer which can overcome the problem of the availability of scarce and expensive fertilizer.
Keyword: empty bunch, fertilizer, organic, synthetic waste

ABSTRAK

Bekiung merupakan salah satu desa di Kabupaten Langkat. Petani di desa ini pada umumnya banyak membudidayakan tanaman kelapa sawit. Limbah yang cukup banyak dan menimbulkan masalah pencemaran lingkungan. Di sisi lain petani mengalami masalah berupa kelangkaan dan mahalnya pupuk sintetis, pupuk subsidi yang sudah tidak tersedia, tanah yang kurang subur. Hal ini dikarenakan karena kurangnya pengetahuan dan keterampilan petani, terbatasnya sarana dan prasarana dalam pengolahan limbah. Tujuan kegiatan ini adalah untuk menambah pengetahuan dan keterampilan petani dalam mengola limbah kelapa sawit menjadi pupuk NPK organic, membuka wawasan petani akan pentingnya pupuk organik sebagai diversifikasi pupuk sintetis yang bermanfaat pada sifat tanah dan meningkatkan kemandirian mitra dalam pengolahan limbah. Solusi yang ditawarkan dalam mengatasi permasalah tersebut adalah pengenalan teknologi tepat guna dan pengolahan limbah pabrik kelapa sawit menjadi pupuk NPK organic. Metode yang digunakan pada kegiatan ini yaitu sosialisasi dan praktek langsung dilapangan. Hasil yang diperoleh yaitu pengenalan dan penyerahan alat alih teknologi berupa hummer mill, conveyor dan saringan sederhana, pelatihan dan pendampingan pembuatan pupuk NPK organic dan sampai packaging. Kesimpulan dari kegiatan ini adalah kegiatan yang bermanfaat bagi mitra pada karena menambah pemahaman dan kemampuan kemandirian mitra dalam mengolah limbah pabrik kepala sawit menjadi pupuk NPK organic yang dapat mengatasi permasalahan ketersiadaan pupuk yang langka dan mahal.
Keyword: limbah, organik, pupuk, sintetis, tandan kosong,

1. Introduction

Bekiung Village is located in Kuala sub-district, Langkat Regency, North Sumatra province, Indonesia. It is situated about 22 km northwest of Medan and approximately 11 km north BinjaiThe majority of the resident in Bekiung Village, are engaged in agriculture and animal husbandry. The main livestock raised by farmers are cows and goats, while the agricultural sector is predominantly focused on plantation crops, particularly oil palm. The target partners for this service activity are BUMDes Bangun Mandiri.

The area of oil palm plantations in Bekiung village reaches approximately 500 hectares which is thought to produce solid waste of around 30%-40% of the total Fresh Fruit Bunches (FFB) so that there is a problem of accumulation of oil palm plant waste in Bekiung village such as the large amount of accumulation of palm oil waste both from harvest residue, fall and death as well as oil palm plant maintenance waste as well as factory waste that has not been utilized. Some farmers even burn the remains of the oil palm harvest around their cultivated plants, which can have a negative impact on the surrounding cultivated plants. Farmers in this village still apply conventional crop cultivation systems, namely by continuously using synthetic chemical fertilizers. As a result, it has an impact on health and damages the physical, chemical and biological properties of the soil. One effort to fulfill the energy needs for agricultural crops is a breakthrough that needs to be carried out by carrying out appropriate technology training by utilizing palm oil and livestock waste into organic NPK fertilize is crucial step toward meeting the energy needs of agricultural crops.

The oil palm and livestock farming business in Bekiung village is quite developed, but the utilization of the waste so far has not been optimal, even though it has great potential to be used as a raw material to produce renewable energy in the form of organic NPK fertilizer. Based on the results of research on the combination of palm oil and livestock waste, both solid and liquid waste contains a lot of macro and micro nutrients when processed into organic fertilizer. Oil palm waste consists of empty bunches, fronds, leaves, fruit fiber, shells, liquid and gas waste. Various studies have been conducted showing that palm oil waste can be used for various needs. Empty oil palm bunches can be used as a source of organic fertilizer which contains nutrients needed by soil and plants. Empty palm fruit bunches account for 23% of the total utilization of palm oil waste as an alternative to organic fertilizer will also provide other benefits from an economic standpoint and from other parts of the oil palm plant. However, due to the lack of knowledge and awareness of farmers about the benefits and processing of palm oil waste, this is an important problem that must be resolved immediately. The solution is to apply appropriate technology to process palm oil waste into organic NPK fertilizer.

Organic fertilizers are fertilizers derived from plant, animal and human remains such as green manure, manure and compost which are necessary for the life of microorganisms in the soil. The role of organic fertilizers in the soil besides adding nutrients can also increase soil fertility, increase soil porosity so that it can improve soil aerase and drainage and increase the activity of soil microorganisms [1]. The chemical components contained in palm oil waste such as nitrogen in plants are the most abundant compared to other mineral nutrients, which is as much as 2-4% of the plant's dry weight [2].

Nitrogen plays an important role as a constituent of chlorophyll, which makes leaves green. This leaf color is a good indication of the nitrogen level of a plant. High nitrogen content makes leaves greener and lasts a long time, so for a number of plants this delay reaches a level that is unfavorable for plants, which can cause crop failure [3]. Phosphorus is the most important nutrient for plants after nitrogen. This element is an important part of the nucleoprotein of the cell nucleus which controls cell division and growth, as well as for DNA which carries the hereditary characteristics of living organisms. Phosphorus compounds also have a role in cell division, stimulating early growth in roots, fruit ripening, energy transport in cells, fruit formation and seed production, testing for phosphorus using the spectrophotometer method. Phosphorus is also an essential plant nutrient. Potassium (K) plays a role in the formation of proteins and carbohydrates, hardening of the woody parts of plants, improving the quality of seeds and fruit and increasing plant resistance to pests and diseases. Plants that are deficient in element K will experience symptoms of dryness on the tips of the leaves, especially old leaves. The dry tip will spread to the base of the leaf [4].

This activity aims to increase farmers' knowledge in terms of processing palm oil waste into organic NPK fertilizer, broaden farmers' insight into the importance of organic fertilizer as a diversification of synthetic fertilizers that are beneficial to soil properties, train farmers to make organic NPK fertilizer from agricultural waste around them and to improve farmers' income.

2. Methods

Community service was conducted for six months, from May to October 2023. The method of implementing the activities used to implement the solutions offered for livestock groups and farmers is the training method. The planned service implementation procedure can be described through several stages of activity. The preparatory phase begins with a survey to see field conditions. At this stage, explore the problems faced by the community and farmers, especially the condition of agricultural waste and palm oil mill waste. Furthermore, how far have they handled the condition of the factory waste. Based on the results of the survey and the problems obtained, this activity must have a follow-up. The implementation of this service activity is packaged using a direct approach. The steps in carrying out this service activity are as follows, giving material to the community and farmers, discussing material that has been given to clarify things that are still not understood, direct participants in the field, see and are directly involved in how to make organic fertilizer, introduction technology transfer and delivery of goods to partners. Materials and tools that must be prepared, namely, shovels, hoes, activators, tarpaulin (plastic), gunny sacks.

The next stage, namely training in making organic NPK fertilizer directly includes, the first process is waste counting which aims to reduce the size of palm oil waste and expand the surface area of palm oil waste. This enumeration was carried out using a chopping machine. The second process is inoculation with a decomposer. The third process is packaging by putting fertilizer that has been stirred by a machine into a sack covered with plastic inside which is intended for the incubation process at the same time. Next, the sack is sewn using a sack sewing machine. The fourth process is data maintenance and retrieval. Evaluation is carried out by distributing questionnaires. The questionnaire consists of 2 entries, namely before and after the implementation of community service, to see the results or success achievements of the activities.

3. Results and Discussion

The participants were very enthusiastic about participating in a series of activities and discussions related to the manufacture of organic NPK fertilizer. Implementation of activities is carried out by providing material, discussions, direct practice (training) as well as mentoring and monitoring.

Figure 1 Community service activities with farmers in Bekiung Village.

One of the factors influencing the success of organic fertilizers is the fermentation time. which typically 21 to35 days for organic NPK fertilizer. The duration of fermentation is linked to the growth phases of microorganisms including the adaptation exponential, stationary, and death phase, whichin turn affect the

composition of the final product [6]. Mature fertilizer is characterized by a dark brown to black color, crumblytexture, room temperature, andlack of odor. If the fermentation process is fully completed, the solid organic NPK fertilizer will habe an earthy smell. Based on the results of the evaluation and filling out the questionnaire, the level of achievement or success of the activities that have been carried out can be determined. Farmers' responses can be seen from the expected targets. The results achieved are described as follows:

3.1. Community service materials according to the needs of partners/participants

The training material provided is the manufacture of organic NPK fertilizer with a focus on utilizing palm oil factory waste in the form of empty bunch ash and liquid factory waste which is abundant around the service location. The availability of organic NPK fertilizer raw materials can be abundant because there are 3 palm oil processing factories around the service location. Organic NPK fertilizer was chosen as an option for utilizing this waste because the majority of Bekiung Village residents work as farmers. The continuous need for fertilizer to ensure the productivity of their crops and the difficulty and high cost of obtaining synthetic chemical NPK fertilizer encourage people to utilize palm oil factory waste. This is also reinforced by the results of the questionnaire regarding the suitability of service material to the problems of the Bekiung Village community in Figure 2. Based on the results obtained from 40 training participants, as many as 87% stated that the material provided was in accordance with the solution for their current needs.

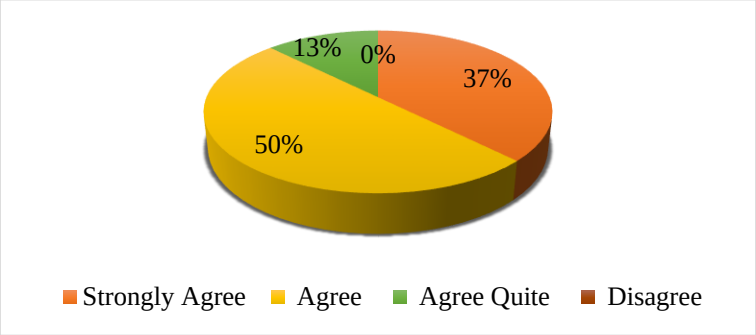

Figure 2 Community service materials according to the needs of partners/participants.

3.2. Partners get direct benefits from the community service activities carried out

This service activity is not only carried out in the form of material presentation but also training and trials in making and providing equipment for making organic NPK fertilizer from palm oil processing factory waste. This is very important to do to provide understanding and practical skills in the process of making organic NPK fertilizer. This understanding and practical skills will foster enthusiasm to independently process empty fruit bunch ash and liquid waste from palm oil processing factories into organic NPK fertilizer. To assess the results of the achievement of understanding and skills of the Bekiung Village community in processing organic NPK fertilizer, a questionnaire was carried out independently with the theme of direct benefits from service activities. The results of the questionnaire showed that the majority of training participants (92%) felt direct benefits from service activities in the form of increasing knowledge and skills in making organic NPK fertilizer.

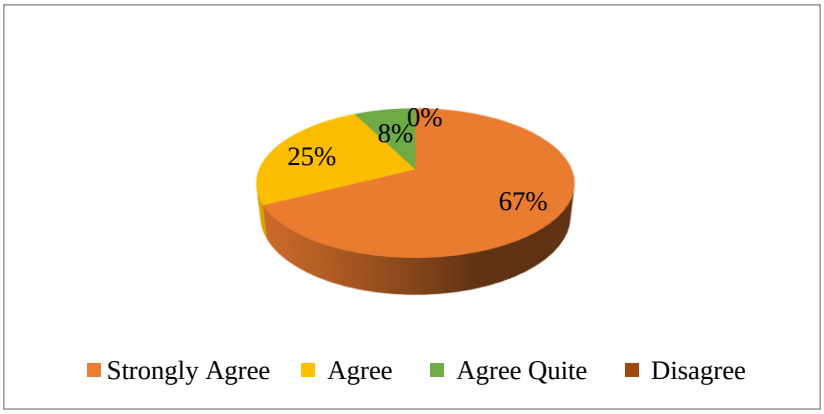

Figure 3 Partners get direct benefits from the community service activities carried out.

3.3. Changes in community knowledge

Indicators of knowledge and skills in processing palm oil processing factory waste into organic NPK fertilizer are divided into 4 parts, namely the use of a hummer mill machine, main ingredients, manufacturing process and application of organic fertilizer. Even though almost all participants showed their understanding regarding these 4 parts, due to limited training time, not all participants had the opportunity to practice using a hammer mill machine. As a result, in this skill there are still 7 people who do not understand the procedures for using this machine. This is shown in Figure 4.

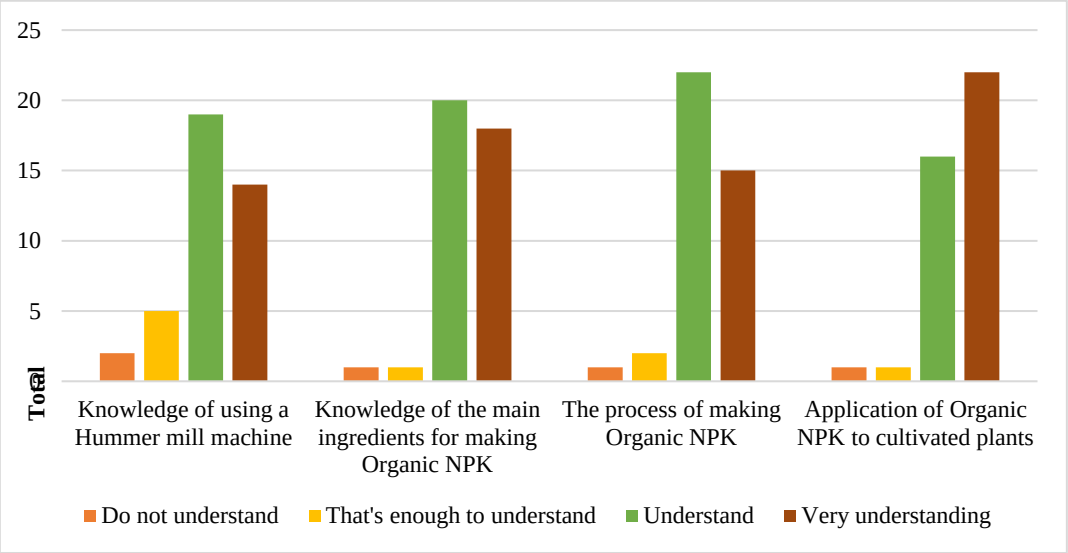

Figure 4 Changes in community knowledge.

4. Conclusions

Community service activities in Bekiung Village in collaboration with BUMDes Mandiri partners, include providing materials and technology, discussions, hands-on practical trining in fertilizer production, mentoring, monitoring, and handing over technological tools. These activities can help address the problems faced by the partners. The benefits gained by the partners from this activity include improved understanding and the ability to independently convert palm oil mill waste into organic NPK fertilizer, addressing the issue of scarce and expensive fertilizer availability.

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