The Use Of Vermicompost Technology In Supporting Sustainable Agricultural Systems In Taman Bali Village, Bangli District, Bangli Regency, Bali Province

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ABSTRACT

The implementation of an integrated farming system aims to maximize the results of all components of the farming business to increase income stably, rejuvenate or improve the productivity of the farming system and achieve agro-ecological balance, avoid the buildup of pests, diseases and weeds through the management of natural planting systems and maintaining low levels of intensity, and reduce the use of chemicals to provide healthy agricultural products, free of chemicals and not damaging the environment. Vermicompost is a compost produced from the decomposition of organic materials carried out by earthworms. Vermicompost consists of the word Vermi which means Worms in Latin and Kompos which means the results of the decomposition of organic materials, so that literally Vermicompost can be interpreted as the decomposition of organic materials carried out by earthworms. Vermicompost Technology Extension is an educational activity for the community, farmers and partner groups of Krama Subak Umajero, Taman Bali Village, Bangli District, Bangli Regency on how to process organic waste using earthworms to produce high-quality compost fertilizer known as Vermicompos. The earthworms used in this vermicompost activity are Eudrilus eugeniae worms or known as African Worms or African Night Crawlers. As a vermicompost medium, cow dung, oyster mushroom baglog waste, banana stem waste and rice straw are used.

1. Introduction

As the population grows and prosperity improves, the demand for fresh food and vegetables also continues to rise. Increasing food production requires fertile soil. Fertilization is a crucial component in improving soil fertility. Farmers in Subak Uma Jero, one of the Subaks developing rice cultivation in Bangli Regency (1). Farmers typically fertilize using chemical fertilizers such as urea, SP36, KCl, and others. In addition to chemical fertilizers, farmers also frequently use organic fertilizers, which have high potential to improve soil fertility. One such organic fertilizer is vermicompost. This fertilization aims to replenish soil nutrients that are gradually depleted due to the plants' absorption to meet their needs (2).

If this deficiency persists, it will lead to soil fertility degradation, which will disrupt plant growth and productivity. Fertilizer use has recently increased, even becoming absolutely necessary. Artificial or chemical fertilizers are often used on agricultural land. The continuous use of chemical fertilizers over a long period of time can cause environmental damage and decrease soil productivity. The use of vermicompost is intended to reduce the use of chemical fertilizers, which tend to be expensive, which can be troublesome for farmers, as most farmers have limited capital. To save costs and prevent further land damage, the use of organic fertilizers is necessary as an alternative or partial substitute for chemical fertilizers (2). Vermicompost is a type of organic fertilizer produced through the digestive system found in the stomachs of earthworms (3). This vermicompost is made by utilizing the role of earthworms as decomposers or decomposers of animal waste. Thus, the resulting product not only contains nutrients sourced from animal waste but also contains nutrients from worm waste. Therefore, organic fertilizer produced through the vermicomposting process has a higher nutrient content than conventional organic fertilizer production (4).

The limited knowledge of the Umajero Subak community regarding sustainable agricultural management systems has led to the need for knowledge on sustainable agricultural management through the use of vermicompost in Tamanbali Village, Bangli District. To improve this knowledge, it is necessary to provide knowledge on waste management and practices in vermicompost production. This activity involves providing extension services and training on vermicompost production. The objectives of this activity are to: 1) increase knowledge gained through extension services and 2) improve skills in sustainable agricultural systems through training in vermicompost production.

2. Method

To address the problems faced by farmers in the Umajero Subak, Tamanbali Village, Bangli, the community service program implementers can provide solutions to these problems, which are expected to benefit the Umajero Subak community (5). The methods used in implementing this activity include:

2.1 Observation and Interview Stage

During the observation stage, the community service team conducted direct field observations to obtain a clear picture of the conditions, potential, and problems faced by the Subak Umajero community in Tamanbali Village, Bangli. These observations covered environmental aspects, the availability of infrastructure, and daily community activities relevant to the focus of the activity. Following this, interviews were conducted with community leaders, village heads, members of Subak Umajero, and other relevant parties to gather more detailed information regarding their needs, obstacles, and expectations. The findings from these observations and interviews served as the primary reference in developing the community service program, ensuring it was more targeted and tailored to the local community.

2.2 Preparation and Activity Planning Stage

The preparation stage began with designing an activity plan, preparing outreach materials, and demonstrations. Next, coordination was conducted with the Tamanbali Village Head, Village Head, and the Umajero Subak community in Tamanbali Village.

2.3 Implementation Stage

The activity began with a presentation on "The Use of Vermicompost Technology to Support Sustainable Agricultural Systems in the Umajero Subak Community of Tamanbali Village, Bangli." The presentation on the application of Vermicompost Technology in Sustainable Agricultural Systems was presented to provide participants with an understanding of the importance of using Vermicompost in increasing crop production. The activity continued with a demonstration of vermicompost production with farmers. In this activity, participants were given the opportunity to directly practice using vermicompost for faster, more efficient, and more equitable distribution.

2.4 Evaluation Stage

The evaluation stage of the community service activity was carried out using pre- and post-tests. Evaluations were conducted prior to the training (1) to analyze the group's knowledge of the topic to be covered. The evaluation stage after the implementation of community service consists of counseling, training and mentoring, namely to determine changes in the group's knowledge and skills before and after the training.

3. Results and Discussion

In this outreach activity, the team presented material on the Use of Vermicompost in the Krama Subak Umajero in Tamanbali Village, Bangli. Vermicompost is a fertilizer produced through the decomposition of organic materials with the help of earthworms (Eudrilus eugeniae) and microorganisms. Vermicompost is formed from a mixture of earthworm waste and organic matter residues produced during the fermentation process 4).

Fig.1. Implementation of Vermicompost Application

The use of earthworms in the composting process is 3 to 5 times faster than composting by microbes. Eudrilus eugeniae is considered the most efficient compost processor in tropical regions, as they grow rapidly and have a higher appetite than red worms (1). These worms will die below 9°C and above 30°C, with the ideal temperature for their growth being 25°C (4). The decomposition of organic matter produced by worms contains a number of essential nutrients and plant growth regulators. The nutrients in question are N 1.58%, C 20.20%, K 21.8 mg/100g, C/N 3, P 70.3 mg/100g, Mg 21.43 mg/100g, Ca 34.99 mg/100g, S 153.7 mg/kg, Zn 33.55 mg/kg, Bo 34.37 mg/kg and pH 6.6-7.5 (Mayani et al., 2021). The growth regulators contained in vermicompost are auxin hormones of 3.80 µgeq/g DM, Gibberellin 2.75 µgeq/g DM and Cytokinin 1.05 µgeq/g DM where these three hormones play an important role in stimulating plant height. The advantages of vermicompost include its role as a nutrient source for soil microbes. Soil microbes play a role in breaking down organic matter into nutrients that are readily available for plant use. Furthermore, the use of vermicompost will increase the soil's cation exchange capacity, improve soil structure and water retention capacity, and enhance plant productivity and quality (4). Compared to other types of compost, vermicompost is also more stable, has a more complex nutrient content with a simpler structure, and is more easily absorbed by plants (5).

Vermicompost is an organic fertilizer produced by the breakdown of organic matter with the help of microorganisms and earthworms. The decomposition of compost by earthworms results in the production of various nutrients and is rich in plant growth regulators that support plant growth. Vermicompost contains plant growth regulators such as gibberellins, cytokinins, and auxins, as well as the nutrients N, P, K, Mg, and Ca, and Azotobacter sp., a non-symbiotic N-fixing bacteria that helps enrich the N needed by plants. Vermicompost also contains various micronutrients needed by plants, such as Fe, Mn, Cu, Zn, Bo, and Mo (3).

Research results from Setiawan et al., (2015) (1) showed that plant height at 10% vermicompost resulted in the highest bok choy plant height compared to other vermicompost treatments. The growth of bok choy plants in vermicompost-fertilized soil increased from 7 days after planting (DAP) to harvest. This finding echoes the findings of Atiyeh et al., 2000, who stated that vermicompost applied to greenhouse soil can increase plant growth and yield. Observations of bok choy plant height at 7, 14, 21, and 28 days after planting (DAP) showed that bok choy plants treated with vermicompost grew taller than those not treated with vermicompost.

These results align with the research of Mamta et al. (2012) (4) on Solanum melongena, plants given vermicompost grew taller, had more leaves and bigger fruit. Vermicompost is rich in nutrients and can stimulate plant growth and yield without damaging the soil. Vermicompost application has been shown to increase the growth and yield of broccoli plants. Furthermore, it improves the quality of Pak-choi and cabbage crops. Vermicompost with biopesticide additives has the dual function of increasing soil fertility, plant nutrient uptake, and controlling pests and plant diseases. Vermicomposting green lettuce plants can increase the nutrient, mineral, and antioxidant content compared to green lettuce plants grown using organic vermicompost fertilizer (2). Evaluation of extension activities is important to measure the success of the program. Evaluation is conducted using pre-test and post-test questionnaires to assess participants' understanding of the outreach material (5). The evaluation results showed that more than 70% of participants experienced increased knowledge based on pre- and post-test results, and were able to re-explain the basic principles of sustainable crop cultivation. The conclusion of this community service activity, based on the evaluation results, showed that more than 70% of participants experienced increased knowledge based on pre- and post-test results, and were able to re-explain the basic principles of sustainable crop cultivation. The community was able to adopt the use of vermicompost to support sustainable crop cultivation.

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