

Community Empowerment through Sustainable Straw Mushroom Cultivation Using Oil Palm Waste

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ABSTRAK

Program pengabdian masyarakat ini dilaksanakan untuk memberdayakan kelompok produsen jamur jerami di Desa Kalisari, Kecamatan Kalirejo, Lampung Tengah, melalui pemanfaatan tandan buah kelapa sawit kosong (tanko) sebagai media tanam berkelanjutan. Program ini berfokus pada penerapan Paten Sederhana No. IDS000005809 untuk meningkatkan produktivitas jamur jerami menggunakan tanko dan mengubah limbah pasca panen jamur menjadi kompos organik bernilai tambah. Strategi pelaksanaannya menggabungkan sosialisasi teknologi, pelatihan praktik langsung, demonstrasi lapangan, dan bantuan teknis berkelanjutan sepanjang siklus produksi. Hasilnya menunjukkan peningkatan yang signifikan dalam kapasitas teknis anggota kelompok, dengan 100% peserta berhasil menguasai penerapan teknologi budidaya yang dipatenkan. Produktivitas jamur jerami meningkat secara signifikan, dengan efisiensi biologis meningkat dari 4,11% menjadi 7,71%, yang mewakili peningkatan sebesar 3,60 poin persentase dibandingkan dengan kondisi sebelum intervensi. Selain itu, 78% peserta mampu mengolah media tanam jamur bekas secara mandiri menjadi kompos organik. Secara keseluruhan, program ini menghasilkan dampak ekonomi, sosial, dan lingkungan yang positif, berkontribusi pada peningkatan pendapatan petani, pengelolaan limbah yang lebih baik, dan promosi praktik agribisnis berkelanjutan dan sirkular di dalam komunitas lokal.

ABSTRACT

This community service program was implemented to empower straw mushroom producer groups in Kalisari Village, Kalirejo District, Central Lampung, through the utilization of empty oil palm fruit bunches (tankos) as a sustainable growing medium. The program focused on the application of Simple Patent No. IDS000005809 to improve straw mushroom productivity using tankos and to convert post-harvest mushroom waste into value-added organic compost. The implementation strategy combined technology socialization, hands-on training, field demonstrations, and continuous technical assistance throughout the production cycle. The results demonstrated a substantial improvement in the technical capacity of group members, with 100% of participants successfully mastering the application of the patented cultivation technology. Straw mushroom productivity increased significantly, with biological efficiency rising from 4.11% to 7.71%, representing an improvement of 3.60 percentage points compared to pre-intervention conditions. In addition, 78% of participants were able to independently process spent mushroom growing media into organic compost. Overall, the program generated positive economic, social, and environmental impacts, contributing to increased farmer income, improved waste management, and the promotion of sustainable and circular agribusiness practices within the local community.

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1. INTRODUCTION

Straw mushroom cultivation represents a promising agribusiness opportunity in rural areas surrounding palm oil mills due to its relatively high market demand. Traditionally, rice straw has been widely used as the primary growing medium; however, its availability has become increasingly limited and its price is subject to seasonal fluctuations. In contrast, empty oil palm fruit bunches (tankos) are abundantly generated as industrial waste from palm oil mills and possess strong potential as an alternative growing medium for straw mushroom cultivation (Siregar et al., 2020).

The Oil Palm Straw Mushroom Farmers Group in Kalisari Village, Kalirejo District, Central Lampung utilizes tankos as a growing medium for straw mushroom production. Despite the availability of this alternative

medium, the group faces significant challenges related to low productivity, recorded at only 4.1%. This condition is primarily attributed to limited technical knowledge of cultivation practices and suboptimal utilization of the growing media (Widodo & Rahayu, 2019). Additionally, post-harvest waste from straw mushroom cultivation is often discarded without proper management, leading to environmental problems such as unpleasant odors, waste accumulation, and the potential spread of pests and diseases (Setiawan et al., 2021). This issue persists despite evidence that spent mushroom substrate has substantial potential as a raw material for organic compost production (Sarono et al., 2024).

Previous studies have demonstrated that straw mushroom productivity using tankos as a growing medium can be significantly enhanced through the implementation of a three-stage fermentation process. This approach is formalized in Simple Patent No. IDS000005809, entitled “Method for Making Straw Mushrooms Using Empty Oil Palm Fruit Bunches as Planting Media through the Implementation of Three Stages of Fermentation Process.” The application of this patented technology has been shown to increase production yields from 4.35% to 6.71%, representing a productivity improvement of 54.23%.

Unlike conventional training programs that primarily focus on short-term knowledge transfer, this community service program is designed as an integrated empowerment initiative that emphasizes direct technology adoption, continuous mentoring, and sustainable resource management. The program not only facilitates the application of a proven fermentation-based cultivation technology to improve productivity but also integrates environmental management by transforming post-harvest growing media waste into organic compost with economic value. By combining technological innovation, environmental sustainability, and income generation, this PKM activity offers a comprehensive empowerment model that enhances farmers’ technical capacity, improves production efficiency, and promotes circular economy practices within rural agribusiness communities.

Objectives of the Activity

This community service program aims to empower straw mushroom farmer groups through the application of appropriate technology and sustainable waste management. Specifically, the objectives of the activity are:

1. To increase the productivity or biological efficiency of straw mushroom cultivation by applying Simple Patent No. IDS000005809, which utilizes empty oil palm fruit bunches (tankos) as an alternative growing medium through a three-stage fermentation process.
2. To utilize spent straw mushroom growing media derived from tankos as raw material for organic compost, thereby reducing environmental pollution while creating additional economic value for farmer groups.

2. METHOD

Activity Implementation Method

The implementation of the community service program was conducted through several integrated stages designed to ensure effective technology adoption and sustainability.

a. Technology Socialization

Technology socialization was carried out directly with the leaders and members of the target group, consisting of 10 straw mushroom farmers. This initial stage aimed to introduce and explain the advantages of the patented technology, particularly its potential to increase production efficiency and reduce raw material usage. The socialization process also served to build farmers’ confidence in adopting the technology within their existing production systems.

b. Technology Application Training

The training phase employed an adult education approach (learning by doing) and was conducted at one of the target group’s mushroom houses. Practical hands-on training was implemented using a pilot-scale production unit with a capacity of 5,000 kg of tankos (equivalent to one cold diesel unit). Participants were directly involved in all stages of the cultivation process, allowing them to gain practical skills in media preparation, fermentation, and mushroom house management.

c. Mentoring and Evaluation

Continuous mentoring and evaluation were conducted throughout the entire production cycle of straw mushrooms using tankos. Farmers were able to observe and participate in daily production activities, enabling real-time learning and problem-solving. The mentoring covered the following stages:

1. Preparation and renovation of the mushroom house to meet ideal environmental conditions for straw mushroom production, including temperature and humidity control.

2. Preparation of tankos growing media, including air-drying for 15–20 days, soaking for 10–12 hours, followed by the first composting stage (36–48 hours) with the addition of agricultural lime, and a second composting stage (36–48 hours) with the addition of bran.
3. First fermentation cycle, beginning with sterilization of tankos at 60–80°C for 10–12 hours, cooling to 30°C, inoculation with mushroom spawn, and fermentation at 35–42°C. This stage produced the first mushroom harvest and the first residual tankos. The fermentation period lasted 15–17 days.
4. Second fermentation cycle, using residual tankos from the first cycle as the growing medium. The process followed the same stages of sterilization, cooling, inoculation, and fermentation, resulting in the second mushroom harvest and second residual tankos over 15–17 days.
5. Third fermentation cycle, utilizing residual tankos from the second cycle, following identical procedures. This final cycle produced the third mushroom harvest and residual substrate suitable for compost production.

d. Program Sustainability

Program sustainability is supported by the fact that all technology implementation activities were conducted directly at the farmers' production sites. This approach minimizes technical barriers, strengthens farmers' independence, and facilitates continuous communication and follow-up, thereby ensuring the long-term adoption of the technology.

3. RESULTS AND DISCUSSION

Technology Socialization Outcomes

The socialization activities demonstrated a high level of farmer interest and acceptance. All participants (100%) expressed willingness to implement the patented technology (Simple Patent No. IDS000005809). This strong response was driven by the relatively low initial biological efficiency of straw mushroom production, which averaged only 4.11%, as well as the potential for reduced tankos usage and improved production efficiency offered by the technology.

Technology Implementation Training

Training and mentoring activities significantly improved farmers' understanding and technical skills in straw mushroom cultivation using tankos. Prior to the program, most farmers utilized tankos only once before discarding it, resulting in inefficient resource use and environmental issues. Following the implementation of the patented technology, farmers were able to properly process the growing media through chopping, composting, sterilization, and controlled humidity management within the mushroom house. The reuse of tankos across multiple fermentation cycles enabled farmers to conduct up to three harvests, leading to a substantial improvement in biological efficiency, with an average productivity increase of 3.60 percentage points.

Improvement in Straw Mushroom Productivity

The mentoring results indicate that the application of Simple Patent No. IDS000005809 significantly enhanced straw mushroom productivity. The use of a three-stage fermentation process increased productivity by 60.97% compared to conventional cultivation methods. Average biological efficiency rose from 4.11% to 7.71% following technology implementation. These findings are consistent with previous research by Siregar et al. (2020), which highlights the role of lignocellulosic content in tankos in supporting mycelial growth. The practical application of the technology within the community service program is illustrated in Figure 1.



Figure 1. Technology Implementation

Processing of Spent Growing Media Waste

Prior to the implementation of the program, spent straw mushroom growing media was typically discarded and piled around the mushroom houses, resulting in unpleasant odors and contributing to environmental pollution. Through targeted training and hands-on mentoring, this waste was successfully transformed into organic compost with economic and environmental value. The composting process was conducted by mixing spent mushroom substrate with livestock (goat) manure at a ratio of 50:50, followed by the addition of an EM4 microbial activator to accelerate decomposition.

The composting process was carried out using a closed fermentation system over a period of 60 days, with periodic turning and watering conducted every 15 days to ensure adequate aeration and moisture control. This systematic approach resulted in stable and mature compost suitable for agricultural use. A simple laboratory analysis indicated that the resulting compost had a C/N ratio of approximately 26, which complies with the Indonesian National Standard for compost quality (SNI 19-7030-2004). These findings are consistent with the results reported by Setiawan et al. (2021), which highlight the potential of mushroom cultivation waste as an environmentally friendly organic fertilizer.

Overall, the utilization of spent tankos-based mushroom media as compost not only mitigated environmental pollution but also supported circular economy practices by converting agricultural waste into a value-added input for crop production. The composting process of oil palm empty fruit bunch waste is illustrated in Figure 2.



Figure 2. Fermentation Process for Making Compost from Tankos

Economic, Environmental, and Social Impacts

The implementation of compost production from spent tankos-based mushroom growing media generated significant economic, environmental, and social benefits for the partner farmer groups.

From an economic perspective, farmers obtained additional income through the sale of organic compost. The compost produced has a market value of approximately IDR 1,000–1,500 per kg. With an average waste generation of 500–600 kg per production cycle, the potential additional income reached IDR 600,000–900,000 per cycle, thereby contributing to improved household income and business sustainability.

From an environmental perspective, the utilization of spent growing media significantly reduced waste accumulation around mushroom houses, minimized unpleasant odors, and lowered the risk of pest and disease proliferation. Furthermore, the availability of organic compost created opportunities for its application in local horticultural farming, supporting soil health and environmentally friendly agricultural practices.

From a social perspective, the program strengthened group cohesion by fostering a spirit of mutual cooperation among members. Participation in shared production and waste management activities increased farmers' confidence and capacity to develop sustainable, agriculture-based enterprises. These outcomes indicate that the program not only improved technical and economic performance but also enhanced social capital within the farming community.

4. CONCLUSION

This community service program successfully empowered straw mushroom producer groups through an integrated approach that combined technological innovation, environmental management, and economic strengthening. First, the enhancement of farmers' technical skills in straw mushroom cultivation using tankos-based growing media led to a 20–30% increase in productivity, demonstrating the effectiveness of the applied technology. Second, the conversion of spent mushroom growing media into organic compost provided an environmentally friendly solution to cultivation waste while generating products with tangible economic value. Third, these improvements contributed to increased partner income and a measurable reduction in environmental problems, particularly waste accumulation and odor around cultivation sites.

Overall, the program not only addressed the issue of low straw mushroom productivity but also offered a sustainable solution to post-harvest waste management. To further amplify its long-term impact, continued support

is recommended in the form of improved access to capital, strengthened farmer group institutions, and the expansion of market networks for compost products. Such follow-up efforts are essential to ensure the sustainability and scalability of this community-based agribusiness empowerment model.

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