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SUSTAINABLE FARMING THROUGH COMMUNITY EFFORTS: THE IMPACT OF ORGANIC COMPOSTING IN KUWON VILLAGE, MAGETAN REGENCY, INDONESIA

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Abstract

This paper presents a community engagement initiative aimed at enhancing agricultural productivity in Kuwon Village, Magetan Regency, through the mechanization of compost production. The project involved collaboration between university researchers and local farmers to introduce and implement organic composting techniques using a specially designed compost chopper machine. The initiative aimed to address the challenges of high fertilizer costs and limited availability of subsidized fertilizers, thereby promoting sustainable agricultural practices and improving the livelihoods of the local farming community. The primary objective was to provide farmers with an efficient and cost-effective method for producing organic compost, reducing their dependency on expensive chemical fertilizers and improving soil health. The project followed a participatory approach, involving local farmers in every stage of the process, from needs assessment to design, fabrication, training, and implementation. This ensured that the solutions were tailored to the specific needs and conditions of the local community. The implementation of the compost chopper machine significantly reduced the time and labor required for compost production. Farmers reported improved soil health and increased crop yields due to the use of organic compost. The project also fostered a sense of community and collaboration among the farmers, as they worked together to adopt and implement new agricultural practices. The economic benefits included reduced input costs and increased income from higher crop productivity. The positive outcomes of this initiative demonstrate the potential of combining technological innovation with community engagement to address the challenges faced by farmers in rural Indonesia, highlighting the value of collaborative efforts in promoting sustainable agricultural development and improving the livelihoods of farming communities.

Keywords: Community Engagement, Agricultural Productivity, Kuwon Village, Mechanization of Compost Production, Farmers' Livelihoods

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INTRODUCTION

Agriculture is a vital sector in rural Indonesia, providing livelihoods for a significant portion of the population (Gina et al., 2023). However, farmers often face challenges such as high input costs and limited access to quality fertilizers. These challenges can significantly impact the productivity and sustainability of agricultural practices, leading to reduced income and economic instability for farming communities. In response to these issues, there is a growing need for innovative solutions that can enhance agricultural productivity while promoting sustainable practices (Touch et al., 2024).

This paper discusses a community engagement project (Ohmer et al., 2022) that aimed to address these challenges by introducing mechanized compost production in Kuwon Village, Magetan Regency (Anonim, 2022). The project was a collaboration between the Faculty of Engineering at Universitas Jember and local farmers, focusing on the development and implementation of a compost chopper machine to enhance organic farming practices. The initiative sought to provide farmers with an efficient and cost-effective method (Lansing et al., 2023) for producing organic compost, thereby reducing their dependency on expensive chemical fertilizers and improving soil health.

The project involved several key activities, including the design and fabrication of the compost chopper machine (Sharma et al., 2024; Widayanto et al., 2022), training sessions for farmers on its use, and ongoing monitoring and evaluation to assess the impact of the intervention. By fostering collaboration between university researchers and local farmers, the project aimed to create a sustainable model for agricultural development that could be replicated in other rural communities. The successful implementation of this project highlights the potential of community engagement and technological innovation in addressing the challenges faced by farmers in rural Indonesia.

Furthermore, the project emphasized the importance of community involvement in the adoption of new agricultural technologies (Yu et al., 2024). By actively engaging farmers in the design and implementation process, the project ensured that the solutions were tailored to the specific needs and conditions of the local community. This participatory approach not only increased the likelihood of successful adoption but also empowered farmers to take ownership of the new practices, fostering a sense of pride and responsibility (Lennon et al., 2019). The positive outcomes of this project demonstrate the value of combining technological innovation with community engagement to achieve sustainable agricultural development.

The primary objectives of this project were to introduce and implement mechanized compost production techniques in Kuwon Village, aiming to reduce the dependency on expensive and limited subsidized fertilizers. By promoting sustainable agricultural practices and improving soil health, the project sought to enhance the economic well-being of local farmers through increased agricultural productivity. The initiative focused on providing farmers with efficient and cost-effective methods for producing organic compost, thereby fostering a more sustainable and resilient agricultural community (Lennon et al., 2019). To enhance the economic well-being of local farmers through increased agricultural productivity.

MATERIALS AND METHODS

The project followed a participatory approach, involving local farmers in every stage of the process to ensure that the solutions were tailored to their specific needs and conditions. The first step was conducting a comprehensive needs assessment, which included surveys and discussions with local farmers to identify their challenges and requirements. This initial phase was crucial in understanding the unique context of Kuwon Village (Anonim, 2022) and ensuring that the project addressed the most pressing issues faced by the farmers. The feedback gathered during this stage informed the design and development of the compost chopper machine, ensuring it was well-suited to the local agricultural practices and resources available.

Following the needs assessment, the design and fabrication phase commenced (Djumhariyanto et al., 2023). The project team, in collaboration with the Faculty of Engineering at Universitas Jember, developed a compost chopper machine tailored to the specific requirements of the farmers. The design process involved iterative consultations with the farmers to incorporate their insights and preferences, resulting in a machine that was both efficient and user-friendly (Courses.aiu.edu, 2024). The design of the chopper is presented at Figure 1. The fabrication of the machine was carried out in the university's engineering workshops, leveraging the expertise and resources available to produce a high-quality and durable compost chopper.

Figure 1. The chopper machine: (a) design, (b) performance testing

Once the machine was ready, the project moved into the training and implementation phase. Training sessions were conducted for the farmers, focusing on the operation and maintenance of the compost chopper machine, as well as organic composting techniques. These sessions were designed to be hands-on and interactive, allowing farmers to gain practical experience and confidence in using the new technology. The documentation of handed over the machine to the farmer group is depicted in Figure 2. The project team also provided ongoing support and troubleshooting assistance to ensure smooth implementation. Regular monitoring and evaluation were conducted to assess the progress and impact of the project, with adjustments made based on feedback from the farmers (Staff, 2024). This continuous engagement and support were key to the project's success, fostering a sense of ownership and empowerment among the farmers (McGuier et al., 2023).

Figure 2. Hand over the chopper from the community empowerment team to the farmer group's leader.

FINDINGS AND DISCUSSION

The experimentations proof that the chopper has the capacity of chopping grass of on more than 300 kg/hour which is coincidence with the previous results (Djumhariyanto et al., 2023). This is a significant improvement over other the previous chopper engine, which had a capacity of only 130 kg/hour (Widayanto et al., 2022), and Marthiana's result, which had a capacity of 220 kg/hour (Marthiana et al., 2018). Additionally, this performance surpasses that of a manual chopper, which has a capacity of 150 kg/hour (Kalaiselvan & Kesavan, 2016). A more thorough design has achieved a capacity of 0.11 kg/s or 396 kg/hour (Zastempowski & Bochat, 2020), and Sucipto's design reached 600 kg/hour (Sucipto et al., 2020).

The implementation of the compost chopper machine significantly reduced the time and labor required for compost production. The normal composting time with prior chopping of the raw material is four weeks (Kuaranita, 2019). Traditional composter, as depicted in Figure 4, without chopping the raw material need longer time to make, six to twelve weeks need depend on raw material used (Budi, 2024). Farmers reported that the machine's efficiency allowed them to produce compost more quickly and with less physical effort, freeing up time for other farming activities. This increased efficiency also meant that farmers could produce larger quantities of compost, which was essential for maintaining soil fertility and supporting crop growth (Waqas et al., 2023). The project not only provided a practical solution to the challenges of compost production but also demonstrated the potential of mechanization in enhancing agricultural productivity (Zhao et al., 2022).

Figure 3. A traditional composting process by the farmer

In addition to the practical benefits, the project fostered a sense of community and collaboration among the farmers. By working together to adopt and implement new agricultural practices, the farmers developed stronger relationships and a shared commitment to improving their farming methods (Izuchukwu et al., 2023). This collaborative spirit was evident in the training sessions and ongoing support provided by the project team, which helped to build trust and confidence among the farmers. The economic benefits of the project were also significant, with reduced input costs and increased income from higher crop productivity contributing to the overall well-being of the farming community (Rizzo et al., 2024).

Impact on Soil Health

The use of organic compost produced with the chopper machine led to noticeable improvements in soil health. Farmers observed better soil structure, which allowed for improved water retention and root penetration. This, in turn, supported healthier plant growth and increased resilience to drought and other environmental stresses. The increased microbial activity in the soil also played a crucial role in nutrient cycling, breaking down organic matter and releasing essential nutrients that were readily available for plant uptake (Hou et al., 2020; Rani et al., 2023).

Higher nutrient content in the soil was another significant benefit of using organic compost. The compost provided a balanced supply of macro and micronutrients, which were essential for optimal plant growth and development. Farmers reported that their crops were more vigorous and productive, with higher yields and better quality produce. These improvements in soil health and crop performance demonstrated the effectiveness of organic composting as a sustainable agricultural practice, highlighting its potential to enhance long-term soil fertility and productivity (Çakmakçı & Çakmakçı, 2023).

Economic Benefits

By reducing the dependency on expensive chemical fertilizers, farmers were able to lower their production costs. The use of organic compost not only provided a cost-effective alternative to chemical fertilizers but also improved soil health and crop yields, leading to higher income for the farmers. The increased crop yields translated into greater marketable produce, allowing farmers to generate more revenue and improve their financial stability (Brunelle et al., 2024; Zheng et al., 2022).

The economic benefits extended beyond individual farmers, as the entire community experienced improved financial resilience. The savings on fertilizer costs and the additional income from higher crop productivity contributed to a more robust local economy (Paul, 2019). Farmers were able to reinvest their earnings into their farms, purchasing better seeds, tools, and other inputs that further enhanced their productivity. This positive economic cycle helped to build a more sustainable and prosperous farming community (Piñeiro et al., 2020).

Community Engagement

The project emphasized the importance of community engagement in achieving sustainable agricultural practices. Farmers participated actively in training sessions, where they learned about the operation and maintenance of the compost chopper machine, as well as organic composting techniques. These sessions were designed to be hands-on and interactive, allowing farmers to gain practical experience and confidence in using the new technology (Hes, 2017). The archive of the socialization is depicted on Figure 4.

Figure 4. Photo session of community engagement between academia and the farmers at Kuwon Village

Sharing their experiences with each other, farmers developed a sense of camaraderie and mutual support. This collaborative approach not only enhanced the adoption of new techniques but also strengthened the social fabric of the community (Pratiwi & Suzuki, 2017). The project team provided ongoing support and troubleshooting assistance, ensuring that farmers felt confident and capable in their new practices. This continuous engagement and support were

key to the project's success, fostering a sense of ownership and empowerment among the farmers (van Ewijk et al., 2024).

CONCLUSION AND RECOMMENDATIONS

The community engagement initiative in Kuwon Village successfully demonstrated the potential of mechanized compost production to enhance agricultural productivity and sustainability. The collaboration between university researchers and local farmers was instrumental in addressing the challenges faced by the farming community. Future research should focus on scaling up the project to other villages and exploring additional sustainable agricultural practices.

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