

Sustainable Agriculture Education through Processing Tobacco Stem into Liquid Organic Fertilizer

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Abstract

Processing agricultural waste into value-added products is an important step in supporting sustainable agriculture. One of the wastes that has great potential to be processed is tobacco stem waste, which is often considered as waste without value. This educational activity aims to provide knowledge and skills to farmers in processing tobacco stem waste into liquid organic fertilizer. This education is carried out through a participatory approach, involving counseling, technical demonstrations, and direct practice. The results of the activity showed that participants were able to understand the importance of waste management in supporting agricultural sustainability. Participants also succeeded in practicing the process of processing tobacco stem waste into liquid organic fertilizer, which includes shredding, fermentation using local microorganisms, and packaging the final product. The positive impacts of this activity include increasing farmer awareness of waste management, reducing dependence on chemical fertilizers, and cost efficiency in their farming systems. In addition, the application of liquid organic fertilizer from tobacco stems can also increase soil fertility naturally and support environmental conservation efforts. However, there are several challenges in implementing this activity, such as the lack of supporting facilities and the need for further assistance to ensure the sustainability of technology adoption by farmers. Overall, this educational activity has a positive impact on improving farmer skills and innovative waste management, while supporting more environmentally friendly and sustainable agriculture.

Keywords: *tobacco waste, liquid organic fertilizer, sustainable agriculture*

1. INTRODUCTION

Sustainable agriculture is becoming an important issue and focus in agricultural development, it is one of the solutions in answering challenges related to environmental issues and the need to provide healthier food ([Saran & Sharma, 2020](#)). Sustainable agricultural systems prioritize the use of natural materials and prevent contamination with chemicals such as pesticides, fertilizers and other inorganic materials. The majority of sustainable farming systems are packaged with organic farming activities ([Gamage et al., 2023](#)). Organic farming is a system run by farmers using natural and environmentally friendly ingredients ([Durham & Mizik, 2021](#)). The goal of organic farming is not only to provide healthy food for consumers, but also to maintain the balance of the ecosystem and soil fertility in the long run ([Zhou et al., 2025](#)).

The application of organic farming as an effort to carry out sustainable agriculture can be started through optimizing the utilization of surrounding resources, such as waste or residual agricultural products, animal manure, and other biological components produced in the farming system ([Xu et al., 2023](#)). One of the leading commodities that is not well managed from the rest of the results of farming is tobacco. The tobacco commodity is one of the commodities that makes a significant contribution to the Indonesian economy ([Rachmat & Aldillah, 2010](#)). In addition, the Indonesian government's regulation in encouraging the welfare of tobacco farmers is shown through DBHJT (Tobacco Excise Revenue Sharing Fund) in the Regulation of the Minister of Finance of the Republic of Indonesia No. 6 of 2024. Based on the results of research ([Setyowati et al., 2024](#)) stated that the existence of DBHJT assistance can help alleviate the production costs of tobacco farmers. This encourages farmers' motivation to continue tobacco farming in the future.

On the other side of the government's support for the sustainability of tobacco farmers, there are problems related to waste from tobacco stems that are only discarded and not utilized. In fact, this waste has the potential to be used as raw material for organic fertilizers or pesticides,

which can reduce farmers' dependence on chemical products that are not environmentally friendly. With the right understanding, this waste can be a solution for farmers to reduce production costs while supporting environmental sustainability.

Tobacco stem waste contains important compounds if processed into liquid organic fertilizer such as nitrogen, potassium, and phosphorus which can support plant growth (Shen et al., 2024). In addition, the benefits of tobacco stem waste can be an alternative fertilizer that is environmentally friendly and sustainable. Liquid organic fertilizer from tobacco stems is proven to be able to improve soil fertility and structure and encourage plant growth with equivalent or even better results than chemical fertilizers. Farmers' lack of knowledge in managing tobacco stem waste is the main obstacle to the low utilization of tobacco stem potential. This challenge requires serious attention to encourage wider dissemination and adoption of processing tobacco stem waste into liquid organic fertilizer. Support in the form of education, training, and promotion from the government and related institutions is needed to increase farmers' understanding of the potential of liquid organic fertilizer.

Seeing these problems, extension efforts are needed to farmers regarding the technique of utilizing tobacco stem waste into liquid organic fertilizer in an effort to carry out sustainable agricultural practices. Therefore, this activity aims to provide education and skills to farmers on how to process tobacco stem waste into liquid organic fertilizer. By doing so, it is hoped that farmers can increase their productivity efficiently and economically, while having a positive impact on the environment.

2. METHOD

This agricultural extension activity will be held in Beji Village, Pedan District, Klaten Regency. The series of activities consists of two stages, namely socialization and followed by practical sessions. The activity will begin by providing training to farmers on environmentally friendly agricultural practices, the benefits of organic fertilizers, and the dangers of chemical residues in soil. This can increase farmers' awareness and skills in maintaining soil fertility. POC (liquid organic fertilizer) is made from stem residue or tobacco waste without any added synthetic chemicals, making it environmentally friendly and safe for health. It supports sustainable agriculture by improving soil fertility, increasing organic matter, and stimulating microorganisms.

Materials and tools used in making POC from tobacco stems are: tobacco, water, chopper, container, stove, and filter. The implementation method used in this agricultural extension is the lecture method with material made into power points. After the delivery of the material, it will be continued with direct practice so that the extension participants will understand better and can implement it individually. The success of this extension activity is expected that the participants can understand the manufacture of liquid organic fertilizer thoroughly.

3. RESULT AND DISCUSSION

Processing Tobacco Stem into POC

This extension activity promotes innovations related to the manufacture of liquid organic fertilizer (POC) made from tobacco stem waste. This technology utilizes the organic matter content in tobacco stems to improve nutrients in the soil, soil structure and is environmentally friendly. The manufacturing process is quite simple, starting with chopping tobacco stems, followed by mixing using molasses and EM4 and then fermenting, then filtering the results and mixing them with water to be applied to the soil.

This product provides key benefits in the form of reduced dependence on chemical fertilizers, reduced production costs, and increased use value of agricultural waste. In terms of

the environment, this technology helps reduce pollution while supporting the implementation of more environmentally friendly agricultural practices.



Figure 1. Processing tobacco stem into POC

Results of Tobacco Waste Processing Counseling Activities

Agricultural extension activities were carried out in Beji Village, Pedan Subdistrict, Klaten Regency by involving local farmer groups attended by 30 farmers. The extension focused on two main issues, namely the handling of tobacco stem waste that has not been utilized and efforts to improve soil fertility in a sustainable manner. The activity began with in-depth socialization on the potential of making liquid organic fertilizer (POC) based on tobacco stem waste as an alternative to conventional chemical fertilizers that can damage soil structure and fertility in the long run.

The activity began with an explanation of the benefits of tobacco stems, which contain natural compounds such as nicotine and phenolics. Participants were educated regarding the benefits of tobacco stem waste, which has been discarded or burned, can actually be used to become liquid organic fertilizer (POC). Furthermore, farmers learned first-hand how to make POC, starting from preparing tools and materials, soaking, fermentation, to how to use the fertilizer to fertilize the soil and increase crop yields.

The training was conducted interactively by combining explanation, discussion, and hands-on practice. The materials were made simple to facilitate understanding by farmers. In the practical session, participants directly tried to make POC, by mixing the ingredients, to understand how to apply it in the field. This activity not only provides insight, but also new skills that can be directly applied in the field.

Participants were enthusiastic during the training. Many of the farmers were interested in how POC works, its benefits and uses, and how to apply it in the field. This training opened the minds of the farmers that tobacco waste can be used to make environmentally friendly fertilizer. In addition, they also realized that using POC can help save production costs while supporting more sustainable agricultural practices.

Evaluation of Tobacco Stem Processing Activity

From the results of the implementation of the activity, several evaluations were obtained including:

1. Knowledge Improvement: Based on the survey results and interviews, the majority of participants reported a significant increase in their knowledge regarding the utilization of tobacco stem waste. Before the counseling, many farmers were unaware of the potential of tobacco stems other than as waste, but after attending the counseling, they understand that tobacco stems can be processed into products that are beneficial to farmers.

2. Skills Improvement: Most participants were able to practice making organic fertilizer from tobacco stems, and some farmers started to try making POC. However, not all participants felt confident in implementing these new techniques without further assistance.
3. Extension materials are highly relevant to farmers' needs. Farmers who are members of farmer groups felt an increased awareness of the importance of waste management and its utilization to reduce dependence on chemicals. Most participants stated that the materials provided were very useful for participating in sustainable agriculture activities.



Figure 2. Implementation of Activities

4. CONCLUSION

The extension activity on the utilization of tobacco stem waste in Beji Village, Pedan District has succeeded in increasing the knowledge and skills of participants in processing agricultural waste into useful products. Nevertheless, there are some challenges that need to be overcome, one of which is related to the assistance of further product use. Overall, this extension program has had a positive impact on tobacco waste management, and has resulted in a decrease in future production costs, as well as increased awareness of the importance of sustainable agriculture.

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