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https://doi.org/10.19184/geosi.v8i1.34508 **Research Article**

Farmers Participation in Applying Silvopasture Technology for Organic Fertilizer Production as A Sustainable Agriculture

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ABSTRACT

Medowo Village is a potential location for plantings due to its location on the slopes of Mount Anjasmoro in Kandangan District, Kediri Regency. Moreover, Medowo Village is renowned for its dairy for cows and goats. This research aimed to determine the type and level of participation in the production of organic fertilizers to support in sustainable agriculture. This research used a qualitative approach and descriptive method. The data was collected through in-depth interviews, participatory observation, and documenting. The identification of key informant was using the purposeful snowball throwing technique. Data analysis used reduction, display, and verification, as well as data validation through Focus Group Discussion (FGD). The discussion was conducted with 20 farmers, with the main topics related to: a) the problem of fertilizer needs in Medowo Village, and b) producing fertilizer for sustainable farming using the Shivansh fertilizer method. According to the results, there were four stages of farmer participation: 1) planning, 2) implementation, 3) utilization of results, and 4) evaluation. The findings indicated that the level of farmer participation is classified as "good" for all stages. Participation is demonstrated specifically by attendance, participation, and enthusiasm. High participation is found mostly in stages that include activities in producing the . Therefore, inviting farmers at the planning stage is essential to increase participation in program.

Keywords: Agriculture; Organic fertilizer; Participation; Sustainable

INTRODUCTION

The Medowo Village is located in Kandangan District, Kediri Province. The location of Medowo Village on the slopes of Mount Anjasmoro makes it an ideal location for livestock and farms. Medowo Village is one of the most productive agricultural communities in the Kediri Regency (BPS, 2020; 2021). Some farmers have also implemented the silvopasture method. This is due to the accessibility of certain locations to the forest. The primary plantation products are coffee, durian, avocado, and cloves. In addition, the community farms are the largest coffee producer in Kediri Regency (BPS, 2020; Putra & Suprianto, 2020). Moreover, dairy cows and goats are produced in Medowo Village. Farmers who also own animals, such as goats and cows, use forest land as grazing areas for their livestock.

This village is one of the largest milk producers in Kediri Regency. According to observations and interviews with village officials and the administrators of KUD (*Koperasi Unit*

Desa/Village Cooperative Unit) Kerta Jaya, existing farmers in Medowo Village can produce around 20,000 liters of milk per day. This demonstrates that many villagers raise dairy cows. Additionally, there are villagers who raise goats, but in smaller numbers than those who raise dairy cows.

There are 1168 farmers and 784 breeders in Medowo village (Medowo, 2020). Furthermore, research findings by Putra & Suprianto (2020) revealed that the level of ownership of the main assets that support the livelihoods of coffee farmers in Medowo Village is still very low, particularly in terms of human resources, funding, physical, and social factors. Because this area has the potential to be used for farms, the farmers in Medowo Village should already be familiar with eco-friendly or sustainable agriculture. This is due to the fact that Medowo Village already has a farmer group. However, based on observations and interviews, farmer groups still concentrate on agricultural cultivation; they do not understand the importance of sustainable agriculture. This is supported by research from Putra & Suprianto (2020), which found that farmers in Medowo Village have limited human resources.

Based on an interview with the manager of the farmer group "Tani Makmur," farmers in Medowo Village have relied heavily on subsidized and non-subsidized chemical fertilizers for agricultural production. Furthermore, the farmer group explained that the availability of subsidized chemical fertilizers in Medowo Village is less than the number of farmers and the size of agricultural land. This is further supported by a statement in (Kementerian Pertanian, 2021) that the supply of subsidized fertilizers in Indonesia does not exceed 50 percent of the total amount of fertilizer required. In general, farmers in the Kediri Regency have a deficit of subsidized fertilizers (KompasTV Kediri, 2021). Moreover, non-subsidized chemical fertilizers are extremely expensive, costing up to three times as much as the subsidized fertilizers (Citra, 2021). The excessive and continuous use of chemical fertilizers will decrease the carrying capacity of the environment, particularly the soil fertility (Patti et al., 2018). In addition, continuous and excessive usage of chemical fertilizers will increase operational expenses and decrease farmer income (Medah, 2018).

The community in Medowo Village has not yet optimally utilized agricultural waste. Farmers let agricultural waste such as litter, plant branches, rice straw, and bean straw to decompose naturally in the field (Karyaningsih et al., 2008). This is acceptable for soil fertility, but it takes a long time to degrade so that plants can absorb it (Rohmawati, 2016). Agricultural waste will be optimally managed if it is first processed. Besides being efficiently absorbed by plants, it is also beneficial for the soil and the environment. Agricultural waste can be converted into organic fertilizer to boost the soil's ability to retain water, raise the resilience to erosion, improve biodiversity and soil health, and decrease the usage of inorganic fertilizers. Moreover, organic fertilizers leave no residues on crop yields, making it safe for the environment and human health (Musnamar, 2003; Nurhayati et al., 2011).

The Medowo village is also known for its dairy production. This is demonstrated by the production of dairy cows collected in KUD Kerta Jaya, which exceeds 20,000 liters per day. Every hamlet in Medowo village has a milk colling or temporary milk storage facility. This number represents the number of dairy farmers in Medowo Village. The dairy industry in Medowo Village is in good category. According to research by Hendrawan et al. (2020), the dairy cow breeders of KUD Kerta Jaya members showed good performance, as measured by a conception rate of 65 percent and the absence of reproductive abnormalities in general. However, the management of cow waste is still rather poor, particularly regarding cage hygiene. According to research by Fawaid (2020), 69% of animals are still categorized as having poor sanitation. Moreover, based on observations, the majority of farms dispose of dairy cow waste directly into the river without processing. This scenario also pollutes the environment, particularly the river that flows through the village.

Medowo Village has the potential to be used for livestock and farms; however, the waste from these two sectors has not been appropriately utilized and managed. In fact, if the waste is processed appropriately and effectively, the residents of Medowo Village will achieve higher economic and ecological benefits. The processed waste can be used as an organic fertilizer that is

eco-friendly and supports sustainable agriculture. Sustainable agricultural development (including regional development) is an important strategic issue that has recently drawn the interest and discussion in many countries (Rivai & Anugrah, 2011; Sudalmi, 2010). Sustainable agricultural development is both an objective and a model for agricultural development.

Based on the above explanation, unprocessed plantation and animal wastes in Medowo Village requires proper management. The Shivansh fertilizer method is one of the plantation and animal waste management methods that promote sustainable agriculture. This strategy was first implemented in India and has since spread to other developing countries. Aside from being environmentally friendly, this strategy is also cost effective and simple for farmers to implement (Munandar TV, 2021). In addition, waste processed with this technology is highly helpful for plant nutrition and soil fertility, making it ideal for eco-friendly and sustainable agriculture (Farming, 2021). Therefore, this research aimed to determine the type and level of participation in the production of organic fertilizers to support in sustainable agriculture.

Several studies have demonstrated the importance of farmer engagement in implementing organic fertilizers for promoting sustainable agriculture. The benefits of organic fertilizers to the environment and the improvement of farmer groups need to be acknowledged (Wuri & Wibowo, 2021). Using organic fertilizers by small farmers also improves sustainable agriculture (Adenle et al., 2019; World Bank, 2008) and food security (Crowley & Carter, 2000; Gowing & Palmer, 2008). Furthermore, the application of silvopasture method is a beneficial technique for some farmers to increase farm incomes, raise animal production and welfare, and improve ecosystem resilience (Smith et al., 2022). Meanwhile, the research on farmer participation in applying organic fertilizers is still limited. Therefore, the objective of this study is to evaluate the type and level of participation in producing organic fertilizers to support sustainable agriculture.

METHODS

The research was carried out in Medowo Village, Kandangan District, Kediri Regency (Figure 1). The research began with training in the production of organic fertilizers and then progressed to the production of organic fertilizers. The next step is to observe the participation of farmers in supporting sustainable agriculture implementation. This research used a qualitative approach with a descriptive method. Qualitative studies are a type of naturalistic study or research conducted under natural conditions (Sugiyono, 2016). Qualitative research is conducted to discover and comprehend the phenomena of what study subjects experience and do holistically through descriptions of word forms and language in real contexts (Moleong, 2021). Key informants are selected through the *purposive snowball throwing* technique by identifying the initial key informants, namely the head of Medowo Village, the chairman of the KUD Kerta Jaya, and the head of the farmer group, and then developing them until the data in the field was saturated. Data was collected through in-depth open interviews, participatory observation, and documentation. Data analysis was applied the method of Miles & Huberman (2000), including data reduction, data display, and generating conclusions. This method is an interrelated activity before, during and after collecting data in a sequence to generate general insight which is called analysis.

Data validation is used Focus Group Discussion (FGD) technique. This technique is used to ensure the reliability of the collected data and to gain a more detailed understanding of the fundamental issues by discussing ideas and perspectives from the participants (Wuri & Wibowo, 2021). The discussion was conducted with 20 farmers of Medowo Village. The main topics discussed is related to: a) the problem of fertilizer needs in Medowo Village, and b) producing fertilizer for sustainable farming using the Shivansh fertilizer method.

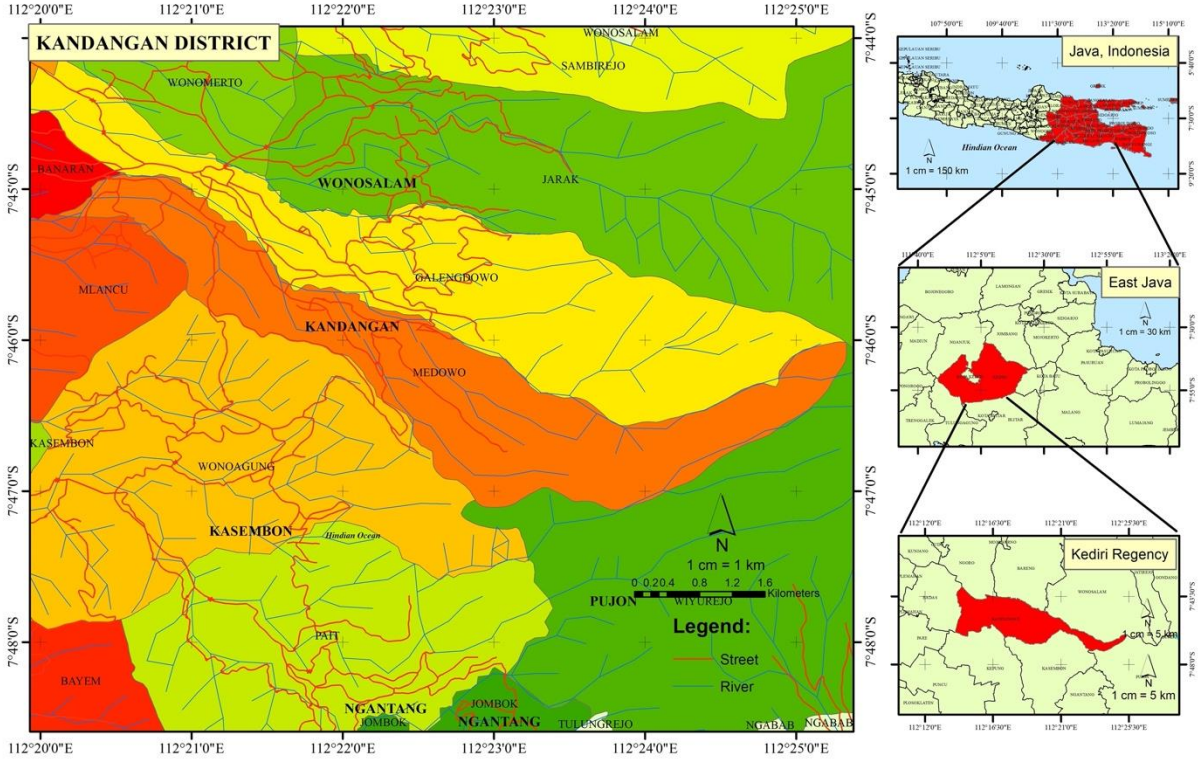

Figure 1. Study Area

RESULTS AND DISCUSSION

Socialization for the Production of Organic Fertilizer

The socialization for the production of organic fertilizer took place at the residence of the chairman of the 'Tani Makmur' group in Medowo Village, Kandangan District, Kediri Regency. This socialization activity was attended by 15 people, including the chairman and members of the 'Tani Makmur' group. The activity began with a guideline from the researcher's coordinator addressing the significance of sustainable agriculture and the disadvantages of agriculture that is not managed in accordance with sustainable agriculture. Moreover, the efforts that can be made to ensure the sustainable agriculture managed by the 'Tani Makmur' group are described.

Figure 2. Socialization for the production of organic fertilizer

After being briefed, the participants watched a movie on how the Indian community created organic fertilizers to promote sustainable agriculture and how to prepare it. Following the film presentation, the farmers participated in a question-and-answer session to better understand the information presented. This activity aimed to provide farmers with understanding and awareness before using organic fertilizers. Moreover, it is necessary for farmers to have a fundamental understanding of organic fertilizer (Lesmana & Margareta, 2017; Sutopo, 2017).

Implementation for The Production of Organic Fertilizer

The implementation of producing organic fertilizer begins with collecting fresh dairy cow waste, because dairy cows are the most widely bred animal by Medowo village at this time. Furthermore, collect animal feed scraps and additional grasses. The community performs community service every Friday to clean village roads or roads leading to their fields. In addition to being the raw material for the production of organic fertilizers, the grass that is removed during the cleaning process is also used as an element in the production of organic fertilizers (Basmal, 2009). Grass is divided into two types as a fertilizer material: semi-dry grass and wet grass that has been roughly chopped, which will be stacked alternately when making fertilizer.

Figure 3. Components of organic fertilizer from dairy cow manure and grass found in agricultural areas

The following production activity is to construct a location for fertilizer fermentation using plugged-in wood poles. Fermentation is produced to increase the effectiveness of good bacteria in decomposing organic fertilizer materials (Anwar et al., 2008). Furthermore, wire nets are installed in a circle around the wooden poles. In addition, nine doses of dry grass are added to the poles, followed by six doses of wet grass and then six doses of dairy cow manure. These steps are repeated until the fermentation space for the organic fertilizer is full. The fermentation poles are then sealed with a tarp until it is tightly sealed. After five days, the fertilizer cover was opened, the ingredients were mixed, and the cover was re-secured. The demolition was completed on the eighth day, and the process was closed again on the 12th day. In approximately 18 days, the fertilizer is finished. The fermentation period affects whether the produced fertilizer provides good results or not (Soraya , 2012; Widari et al., 2020).

Figure 4. The process for producing organic fertilizer

Participation of Farmers in The production of Organic Fertilizers to Promote Sustainable Agriculture

Participation is the voluntary involvement of individuals in societal activities, resulting from an awareness of social interaction. According to Cohen & Uphoff (1977), participation is divided into four stages: planning, implementation, utilization of results, and evaluation. The following are the results of the study regarding farmer participation.

First, the planning stage. The planning activity is a process that systematically prepares everything that will become a guide for the implementation of activities. At this stage, the importance of sustainable agriculture can be implied from the farmers' participation in the socialization of organic fertilizer production. However, farmer participation is still relatively passive at this stage. In this instance, farmers generally accept the socialization that is provided to them. According to research by Wulz (1986), architectural participation is categorized as active when the ideas and concepts originate from the participant, whereas passive participants tend to accept the concepts/activities provided. Hence, the form of farmer participation at the planning stage is categorized as passive because farmers do not provide ideas/concepts of the form of activities to be carried out/followed during socialization.

Second, the implementation stage. Implementation is a process for achieving the objectives of planning, so at the implementation stage it has an important role in determining the success or failure of a program or project. At the implementation stage of development, there are several types of activities that allow the community to be involved and participate, particularly in regards to the implementation of work, as the community has the opportunity to provide support, motivation, and enthusiasm through the dedication of time, energy, and resources. At this stage, the participation of farmers is quite active. This is evident from the farmers' participation and activity in the production of organic fertilizers. This is due to the fact that farmers have been educated on the production of organic fertilizers and the importance of sustainable agriculture. In following with research by Agidew & Singh (2018), it is necessary to expand information on programs or activities to be implemented in order to increase participation awareness. Based on in-depth interviews with key informants, it is demonstrated that the activities carried out are in line with the current work and needs of farmers (Citra, 2021; Kementerian Pertanian, 2021; KompasTV Kediri, 2021). In addition, at this stage of implementation, the form of farmer participation is categorized as active, which is related to factors that affect participation, namely the work and income for farmers (Firmansyah, 2009) and the driving factor for participation, which is following with the needs and interests of the community (Mulyadi, 2009).

Third, the utilization of the results stage. Community participation in the utilization of the results stage consists of implementing, maintaining, caring for, and establishing each development result, as the community is a subject directly involved in the utilization and maintenance of development results. At this stage, farmer participation is considered active because farmers apply organic fertilizers to their farms voluntarily (Figure 4). Based on in-depth interviews, it is shown that organic fertilizers are beneficial to farmers when chemical fertilizers are expensive and subsidized fertilizers are limited (Citra, 2021; Kementerian Pertanian, 2021; KompasTV Kediri, 2021), so that farmers are actively involved at this stage. Farmers' participation in participatory activities is highly correlated with the benefits of the program/activities undertaken (Defrancesco et al., 2008; Pannell et al., 2006; Pedersen et al., 2012). Furthermore, various literatures have explained why farmers choose to voluntarily participate in the agricultural environment in terms of the benefits derived from the programs that farmers follow or take part in (Cullen et al., 2020).

Figure 5. Utilization of Organic Fertilizer to Fertilize Plants

Fourth, the evaluation stage. Evaluation is a participation in monitoring and evaluating the implementation of the results of planning. The community is able to offer suggestions and concerns regarding the implementation of activities by 'Tani Makmur' group so that they are carried out in accordance with the plan and achieve the intended results. The farmer participation is classified as active during the evaluation stage. This is evident from the farmers' enthusiasm to provide input and suggestions when evaluating the manufacture of fertilizers and the application of organic fertilizers. Based on interviews, it has been determined that the production of organic fertilizers provides financial/economic benefits to farmers as well as future agricultural sustainability. It is essential that farmers understand the relationship between self-identity, attitudes toward strategies, and farmer decisions in order to design future programs that will appeal to a larger number of farmers and simultaneously meet environmental policy goals (Cullen et al., 2020). In addition, innovative farmers who intend to continue practicing sustainable agriculture in the future have a positive relationship with farmer participation (Barreiro-Hurlé et al., 2010; Willock et al., 1999).

The results indicated that farmer participation in the production of organic fertilizers and their use to support sustainable agriculture was high. This is evident from the forms of farmer participation discussed previously. Participation by farmers consists of four stages: planning, implementation, utilization of results, and evaluation. Several research studies demonstrate that not all individual/community participation in an activity involves all four stages sequentially. Furthermore, the factors that influence farmer participation in the research location are determined, namely age, occupation, and income, as well as the length of working period in the environment (Firmansyah, 2009). This is similar to the results of Agidew & Singh (2018) study, which found that gender, land ownership, and length of residence are significant variables that influence farmers' participation decisions. Furthermore, the level of farmer participation is classified as good; it is also determined by the factors driving participation, namely the community's needs for fertilizers, the community's interests, and the conditional nature of each member (Mulyadi, 2009). In accordance with the community's requirements, the high cost of chemical fertilizers and the lack of supply of subsidized fertilizers (Citra, 2021; Kementerian Pertanian, 2021; KompasTV Kediri, 2021) make the production and application of organic fertilizers highly appropriate. Farmers are satisfied because they can make their own high-quality fertilizer in a short amount of time, despite the fact that fertilizer is expensive and often difficult to obtain due to its lack of supply. Moreover, the community's interest in the organic fertilizer manufacturing program is closely related to the livelihoods of the research subjects. Since farmers have been accommodated in the 'Tani Makmur' Group, each member is required to commit to the agreement reached between the Chair and the members of the 'Tani Makmur' Group regarding the production and use of organic fertilizers for sustainable agriculture. Using the *Theory of Planned Behavior* as a framework, a number of studies have found a correlation between farmer environmental behavior and social norms (Daxini et al., 2018; Price & Leviston, 2014). Additionally, it may be due to the fact that farmers try to avoid judgment or criticism from their peers for failing to meet the expectations of their neighbors (Burton & Paragahawewa, 2011; Emery & Franks, 2012).

CONCLUSION

Participation is the voluntary involvement of individuals or groups in a social activity that results from self-awareness of a social interaction. There are four types of farmer participation in the production and use of organic fertilizers to support sustainable agriculture. The first stage is planning, which is classified as passive participation. The second stage is implementation, which is classified as active participation. The third stage is the utilization of the results, which is classified as active participation. The fourth stage, evaluation, is classified as active participation. The farmer participation rate is quite high. This is evidenced by participation or attendance in activities, activity or involvement in activities and enthusiasm for activities. The government and the agriculture office have been advised to invite farmers directly during the planning stage so that they can participate in designing the program. Furthermore, the government and organizations must add and distribute additional information regarding organic fertilizers and sustainable agriculture.

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DECLARATIONS

Conflict of Interest

The authors declare that in the research and preparation of this article, there are no conflict of interests related to certain organizations, institutions, and individuals or groups.

Ethical Approval

The research has been approved by the Research Committee of Universitas Negeri Malang. All research was carried out in accordance with Universitas Negeri Malang research ethics guidelines applicable when human participants are involved.

Informed Consent

On behalf of all authors, the corresponding author states that all participants have been given informed consent and agreed to take part in this study.

DATA AVAILABILITY

Data used to support the findings of this study are available from the corresponding author upon request.

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