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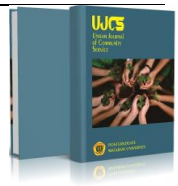

Towards Environmentally Friendly Agriculture: Assisting Farmers in the Use of Organic and Biological Fertilizers

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Abstract: Environmentally friendly agriculture is an urgent necessity amid increasing soil degradation and farmers' dependence on chemical fertilizers, which incur high costs and reduce land quality. This condition also occurs in the Hikmah Farmer Group in Majalengka, where the majority of farmers still rely entirely on chemical fertilizers, while knowledge and skills regarding organic and biological fertilizers are still very limited. This Community Service Program (PKM) aims to increase farmers' capacity to produce and utilize organic and biological fertilizers, thereby reducing their dependence on chemical fertilizers and supporting the realization of sustainable agriculture. The implementation methods included counseling on the concept of environmentally friendly agriculture, training in the production of solid and liquid organic fertilizers, as well as biological fertilizers based on local microorganisms, and direct assistance in their application on agricultural land. The results of the activities showed a significant increase in farmers' knowledge and skills, with more than 70% of group members able to produce organic fertilizers independently, and more than 60% successfully applying biological fertilizers on their land. In addition, the use of chemical fertilizers can be reduced by 20-30% without reducing crop yields, while improving soil fertility and increasing soil biota activity. Thus, this program not only has a positive impact on farmers' economic efficiency, but also contributes ecologically to the sustainability of environmentally friendly agriculture. Future recommendations include strengthening institutional support and replicating the program among other farmer groups in Majalengka to ensure its benefits can be sustained and expanded.

Keywords: Environmentally Friendly Agriculture, Organic Fertilizers, Biofertilizers, Farmer Assistance.

Introduction

Environmentally friendly agriculture is one of the important approaches in realizing the sustainability of the agricultural system in Indonesia. With increasing global awareness of climate change, environmental degradation, and the need for healthy food, agricultural practices that prioritize ecological balance are gaining attention (Widiyanti et al., 2024; Vaulina et al., 2025). Environmentally friendly agriculture is not only oriented towards production, but also maintains soil, water, and biodiversity quality so that food production sustainability can be guaranteed for future generations. This approach is becoming increasingly relevant in the context of sustainable development (SDGs), particularly in achieving goal 2 (Zero Hunger), goal 12 (Responsible Consumption and Production), and goal 15 (Life on Land).

However, the reality on the ground shows that the use of chemical fertilizers still dominates agricultural

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practices, especially among smallholder farmers. Chemical fertilizers can indeed increase productivity in the short term, but excessive dependence on them has caused a number of serious problems. First, the relatively high price of chemical fertilizers increases production costs, thereby reducing farmers' profits (Marina & Nur'aeni, 2025). Second, uncontrolled use has an impact on soil fertility degradation, reducing organic content and disrupting the balance of soil microorganisms. Third, chemical fertilizer residues have the potential to pollute groundwater and the surrounding environment, which ultimately endangers ecosystems and human health. Therefore, concrete efforts are needed to encourage farmers to reduce their dependence on chemical fertilizers and switch to the use of organic and biological fertilizers (Lusiana et al., 2025).

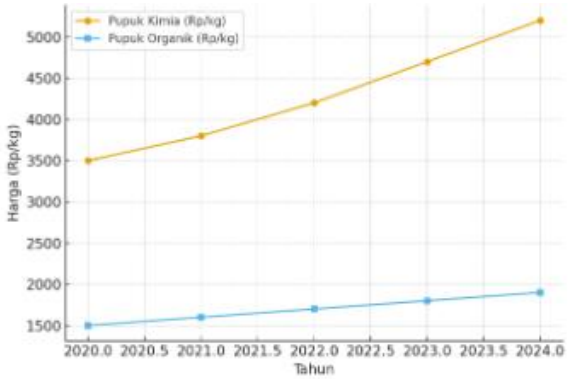

Figure 1. Comparison of Chemical Fertilizer vs Organic Fertilizer Price Trends (2020-2024)

Fertilizer prices over the past five years show a sharp difference between chemical and organic fertilizers, with chemical fertilizer prices continuing to increase significantly from IDR 3,500 per kilogram in 2020 to more than IDR 5,200 per kilogram in 2024, while organic fertilizer prices have remained relatively stable at only IDR 1,500–IDR 1,900 per kilogram. Excessive use of chemical fertilizers causes various problems, ranging from high production costs to soil degradation and environmental pollution (Liao et al., 2025). The increase in chemical fertilizer prices over the past five years has further exacerbated the burden on farmers (Suparwata & Jamin, 2024). This condition confirms that farmers' dependence on chemical fertilizers causes high production costs and reduces profit margins, especially when the selling price of crops is not proportional to the increase in input costs. Conversely, organic fertilizers are not only cheaper, but also easy to produce independently from agricultural waste, livestock manure, and household organic waste, thereby reducing dependence on imported chemical fertilizers and subsidies. This price gap also highlights the urgency of shifting to the use of organic and biological fertilizers as a more economical, environmentally friendly, and sustainable alternative because, in addition to reducing costs, their use can improve soil fertility, maintain water quality, and support the sustainability of agricultural ecosystems in the future (Marina et al., 2025).

The Hikmah Farmer Group in Majalengka Regency is one of the farmer groups facing similar problems. This group consists of small farmers who mostly cultivate rice fields and horticulture on a household scale. The obstacles they face include high agricultural input costs, especially chemical fertilizers, and declining land productivity due to the continuous use of inorganic fertilizers. Nevertheless, this group has great potential for development. Its members have a spirit of mutual cooperation, fairly extensive agricultural land, and openness to agricultural technology innovations. This potential is an important asset in the implementation of environmentally friendly agriculture based on the use of organic and biological fertilizers. The conditions of farmers in areas such as Majalengka show a dependence on chemical fertilizers, even though the potential for applying organic and biological fertilizers is quite large. A similar study was also found among soybean farmers in Indramayu, where the level of knowledge related to the use of biological fertilizers still needs to be improved (Sukmasari et al., 2022).

Assistance in the use of organic and biological fertilizers in the Hikmah Farmer Group is very high, given the increasingly difficult agricultural conditions due to high production costs and declining land quality (Gunawan et al., 2025). Organic and biological fertilizers can be a strategic solution to improve soil fertility, reduce production costs, and produce healthier and safer agricultural products. They have also been proven to improve soil fertility and increase crop productivity, as in the cultivation of soybeans using Azolla microphylla liquid organic fertilizer (Yaqiin et al., 2022). Additionally, the adoption of fertilizer technology based on plantation waste also shows potential for success in reducing production costs (Utomo et al., 2020). Therefore, assistance to farmers is important so that they can switch to a more sustainable agricultural system (Suparwata & Jamin, 2024; Vaulina et al., 2025). Through assistance, farmers are not only provided with technical knowledge about the manufacture and use of organic and biological fertilizers, but also motivation and skills to be independent in producing them. Thus, the sustainability of this technology's implementation can be better ensured (Syamsiah et al., 2025).

Method

This PKM activity was carried out in the Hikmah Farmer Group, Cijati Village, Majalengka Regency, using a participatory approach that involved active collaboration between the service team and farmers. The activity began with identifying problems and farmers' needs through observation, interviews, and questionnaires to map the level of dependence on chemical fertilizers and the need for organic and biological fertilizers. Next, socialization and education were carried out on the concept of environmentally friendly agriculture, the negative impacts of chemical fertilizer use, and the benefits of organic and bio fertilizers for soil fertility and crop productivity. The activities continued with training on the production of solid organic fertilizers, liquid organic fertilizers, and biofertilizers using agricultural waste and local microorganisms, in which farmers were directly involved in the production process. After that, assistance was provided in the application of organic and biofertilizers on farmers' land, including technical guidance on dosage and application methods. The final stage is monitoring and evaluation through observation of plant growth, reduction in chemical fertilizer use, and evaluative discussions with farmers to find solutions to the challenges they face. The participatory approach used in each stage aims to foster farmers' awareness, skills, and independence in implementing sustainable environmentally friendly agriculture.

Result and Discussion

Initial conditions of farmers before the PKM Program was implemented

Farmers in the Hikmah Farmer Group, Cijati Village, Majalengka, are still very dependent on chemical fertilizers. Initial survey results from 22 respondents show that all farmers (100%) use chemical fertilizers as their main input. This dependence has the potential to reduce soil quality, increase production costs, and cause vulnerability to fertilizer prices. The use of environmentally friendly fertilizers is still low. Only 9 people (40.9%) have ever used organic fertilizers, both solid and liquid, and 8 people (36.4%) have used biofertilizers. Their knowledge is also limited, as only 7 people (31.8%) have ever participated in training related to organic and biofertilizers.

This situation shows that the majority of farmers still have a limited understanding of sustainable agriculture. Many consider organic fertilizers to be merely compost, without understanding the benefits of biological microorganisms. Therefore, education, training, and assistance are urgently needed to reduce dependence on chemical fertilizers and encourage environmentally friendly agricultural practices (Sukmawati et al., 2025).

Figure 2. Introduction of the program to farmers

Training Process and Farmers' Enthusiasm

The PKM program began with an information session on the benefits of organic and biological fertilizers. The aim was to help farmers understand the long-term negative impacts of chemical fertilizers and learn about more sustainable, environmentally friendly alternatives. The session included presentations, video screenings, and discussions, allowing farmers to actively ask questions and share their experiences.

After that, training was conducted on the production of solid, liquid, and biological organic fertilizers based on local microorganisms (MOL). The training took the form of hands-on practice with easily obtainable materials, such as straw, livestock manure, kitchen waste, rotten fruit, bamboo shoots, and banana stems. With this method, farmers can learn directly, not just hear theory. The farmers were very enthusiastic, as evidenced by the attendance of more than 80% of the group members. They also actively participated in the practical sessions, discussions, and sharing of experiences, especially regarding the high cost of chemical fertilizers and declining soil fertility. Many were interested in trying organic fertilizers on their land because they are cheaper, simpler, and the raw materials are easy to find (Roswinna et al., 2024). There was even an idea to form a joint organic fertilizer production group.

This training not only added to the farmers' technical skills, but also boosted their confidence in utilizing local resources. Socialization and training proved to be a means of empowerment that encouraged farmers to actively seek solutions, reduce their dependence on chemical fertilizers, and support sustainable agriculture in Cijati Village.

Figure 3. Process of Introduction and Training in the Use of Organic and Biological Fertilizers

Mentoring Results

Mentoring the Hikmah Farmer Group has shown quite good results. Before the program, most farmers had never made organic or biological fertilizers and still relied on chemical fertilizers. After participating in training and technical guidance, their knowledge and skills improved.

A total of 16 people (72.7%) out of 22 respondents are now able to make organic fertilizer independently. Fourteen people (63.6%) are also able to apply biofertilizer on their farmland. The application of this fertilizer has begun to have an impact, such as looser soil, increased soil biota activity, and healthier plant growth. The level of participation in training has also increased. Initially, only 7 people (31.8%) had participated in similar training, but now 20 people (90.9%) actively participate in training on the production and use of organic and biological fertilizers.

Overall, this assistance has succeeded in improving skills, encouraging environmentally friendly agricultural practices, and reducing farmers' dependence on chemical fertilizers. This program is an important first step towards sustainable agriculture.

Initial Impact on Land and Crops

Assistance provided to the Hikmah Farmer Group has shown positive results from the outset. Before the program, the land in Cijati Village was hard and poor in organic matter due to the continuous use of chemical fertilizers. After farmers began using organic and biological fertilizers, the soil became looser, easier to cultivate, and better at absorbing water. This supports root growth and healthier crop conditions.

In addition, soil biota activity, such as worms and microorganisms, began to increase, indicating that the soil ecosystem was beginning to recover. Soil nutrient content also slowly improved, although chemical changes were still limited in the early stages (Marina et al., 2024).

Economically, farmers were able to reduce their use of chemical fertilizers by 20-30% without reducing their yields. Production costs become more efficient, especially since some fertilizers can be made from inexpensive local materials, such as agricultural waste and livestock manure. Plants fertilized with organic and biological fertilizers also grow better: their leaves are greener, their stems are stronger, and their roots are stronger. This means that these fertilizers not only add nutrients, but also improve soil quality.

Overall, this program demonstrates that the use of organic and bio-fertilizers can provide ecological (healthier soil) and economic (lower costs) benefits. If implemented continuously, farmers have the potential to become self-sufficient in fertilizer production while maintaining sustainable land productivity.

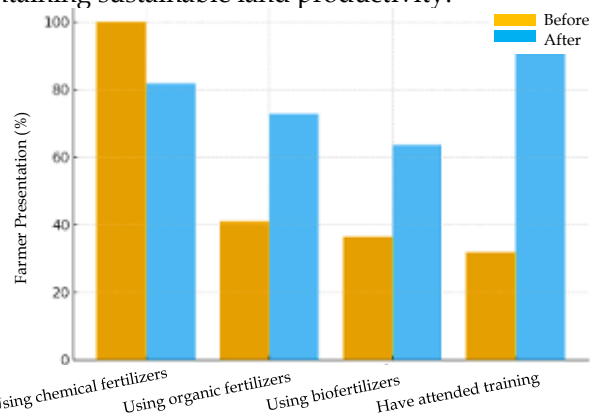

Figure 4. Graph Comparing Farmers' Conditions Before and After the Program

Program Contribution to Sustainable Agriculture

The PKM program "Towards Environmentally Friendly Agriculture: Assisting Farmers in the Application of Organic and Biological Fertilizers" has successfully changed the habits of farmers in the Hikmah Farmer Group, who were initially 100% dependent on chemical fertilizers, to become more open to using organic and biological fertilizers. Through socialization, training, and assistance, farmers are now able to make their own fertilizers and start applying them to their land.

The impact of this program can be seen in three main aspects:

1. Economy: production costs have decreased due to a 20-30% reduction in the use of chemical fertilizers, thereby increasing farming profits.
2. Ecology: the soil has become looser, soil microbes are more active, and land fertility has improved.

3. Social: there is a growing collective awareness to protect the environment and share knowledge among farmers.

With these results, the program supports the principles of sustainable agriculture that balance economic, ecological, and social aspects. In addition, the methods used can serve as a model for other farmer groups. This program also contributes to the achievement of the SDGs, particularly Goal 2 (Zero Hunger), Goal 12 (Responsible Consumption and Production), and Goal 15 (Life on Land).

Figure 5. Program Discussion on Sustainable Agriculture

Conclusion

The Hikmah Farmers Group in Majalengka has demonstrated a significant increase in farmers' knowledge, skills, and independence in producing and applying organic and biological fertilizers. This program has succeeded in reducing farmers' dependence on chemical fertilizers by 20-30%, lowering production costs, improving soil fertility, and raising collective awareness of the importance of environmentally friendly agriculture. The positive impact is not only felt in economic terms through cost efficiency, but also in ecological terms through improved soil quality and increased soil biota activity. In addition, this program fostered a spirit of mutual cooperation and encouraged the formation of independent fertilizer production initiatives, thereby contributing directly to the sustainability of agriculture in Majalengka. To maintain the sustainability of the results, institutional support for agriculture, continued assistance, and replication of this program model to other farmer groups are needed as efforts to expand the application of environmentally friendly agriculture in a sustainable manner.

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