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Increasing Farmers' Knowledge on Sustainable Horticultural Crop Cultivation

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Abstract - *This community service activity aimed to improve farmers' knowledge and skills in implementing sustainable horticultural cultivation practices. The program was conducted through problem identification, preparation of learning materials, educational counseling, interactive discussions, and activity evaluation. The topics covered included soil fertility management, the use of organic fertilizers, integrated pest management, crop rotation, and efficient water utilization as essential components of sustainable agriculture. The results indicated an improvement in farmers' cultivation skills, demonstrated by the adoption of new environmentally friendly cultivation techniques. Participants showed high enthusiasm throughout the activity, actively engaging in both the educational sessions and discussions. The implementation of improved cultivation practices is expected to enhance horticultural productivity while preserving environmental quality and ensuring the sustainability of agricultural resources. Furthermore, this community service activity strengthened the role of higher education institutions in supporting community capacity building through the transfer of practical agricultural knowledge. Overall, the program contributed positively to improving farmers' capabilities in managing horticultural farming more effectively, efficiently, and sustainably.*

Keywords: *horticultural cultivation; farmers; sustainable agriculture; community service; agricultural extension.*

1. INTRODUCTION

The agricultural sector is one of the strategic sectors that has an important role in supporting food security, improving community welfare, and encouraging national economic growth. In Indonesia, agriculture is still the main source of livelihood for most rural communities, including the horticulture sub-sector which includes the cultivation of vegetables, fruits, ornamental plants, and medicinal plants (Pertiwi et al., 2022). Horticultural commodities have relatively high economic value due to increasing market demand along with the increasing population, increasing public awareness of healthy food consumption patterns, and the development of the agricultural product processing industry (Simarmata & Simanjuntak, 2026). Therefore, the development of horticultural crop cultivation needs to be carried out in a sustainable manner in order to meet market needs while preserving natural resources. The concept of sustainable agriculture has become one of the important approaches in the development of the agricultural sector in various countries, including Indonesia (Hasanudin, 2026). Sustainable horticultural cultivation is not only oriented towards increasing production yields, but also pays attention to environmental, social, and economic aspects. Cultivation practices that pay attention to ecosystem balance are able to maintain soil fertility, reduce environmental pollution due to excessive use of chemicals, and improve the efficiency of using resources such as water and fertilizer. Thus, the application of sustainable cultivation principles can provide long-term benefits for farmers and the community at large (Tjilen et al., 2024).

However, in practice, there are still many farmers who apply conventional cultivation systems with a high dependence on chemical fertilizers and pesticides. The excessive use of agricultural inputs is often carried out with the aim of obtaining high yields in a short time. However, these conditions can cause various negative impacts, such as declining soil quality, reduced populations of beneficial organisms, increasing production costs, and the emergence of plant pest and disease resistance (P. Lestari et al., 2026). In addition, chemical residues left behind in crops can also affect the quality of horticultural products and consumer health. These problems show that increasing agricultural productivity needs to be balanced with the application of more environmentally friendly cultivation techniques. One of the factors that affects the success of the implementation of sustainable horticultural cultivation is the level of knowledge of farmers. Knowledge is the basis for the decision-making process regarding seed selection, land tillage, fertilization, control of plant pest organisms, water management, and post-harvest handling (Febriantoko et al., 2023). Farmers who have a good understanding of sustainable cultivation techniques

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tend to be better able to manage their farming business effectively, efficiently, and are sustainability-oriented. On the other hand, limited knowledge can make it difficult for farmers to adopt agricultural innovations so that productivity and crop quality are not optimal (Refa Firgiyanto et al., 2025).

Increasing farmers' knowledge is one of the strategic steps in supporting the transformation towards a more sustainable agricultural system. Counseling, training, mentoring, and experience sharing activities between farmers are forms of capacity building that can increase understanding of good horticultural cultivation techniques. Through these activities, farmers obtain information about soil fertility management, the use of organic fertilizers, the application of crop rotation, integrated pest control, water conservation, and other cultivation practices that support environmental sustainability (Ahmad, 2024). In addition to improving the aspect of knowledge, these activities can also build positive attitudes and encourage changes in farmers' behavior in implementing more environmentally friendly cultivation practices (Tamara et al., 2026). In the context of community service, universities have an important role as agents of change through the implementation of educational activities for farmer groups. The transfer of knowledge from academics to the community is a form of implementation of the tridharma of higher education which aims to increase the capacity of human resources in the agricultural sector (Tuti Supatminingsih, 2022). Through community service activities, farmers can obtain the latest information on horticultural cultivation techniques that are in accordance with environmental conditions, scientific developments, and market needs. Assistance that is carried out in a sustainable manner is also able to strengthen the relationship between universities and the community in an effort to improve the welfare of farmers (Iqbal et al., 2023).

In addition to providing benefits for improving individual farmer capabilities, increasing knowledge about sustainable horticultural cultivation also has the potential to have a wider impact on agricultural development at the local level. Farmers who have understood good cultivation techniques can be an example for other farmers so that the process of spreading innovation naturally occurs within the farmer group (P. D. Lestari et al., 2024). This condition will accelerate the adoption of technology and more efficient cultivation practices and encourage the creation of a more productive, competitive, and sustainable agricultural system. The success of the implementation of sustainable horticultural cultivation is not only determined by the availability of agricultural technology, but also influenced by the readiness of human resources in understanding and implementing this technology (Wardatun Nikmah et al., 2023). Therefore, increasing the capacity of farmers through educational activities is one of the relevant approaches in answering various challenges of modern agriculture, such as climate change, land degradation, increasing food needs, and demands for horticultural products that are safe to consume and have high quality. With adequate knowledge, farmers are expected to be able to make appropriate cultivation decisions based on land conditions and plant needs so that productivity can increase without neglecting environmental sustainability aspects (Saimah & Sarjan, 2024).

Based on these conditions, this community service activity is focused on efforts to increase farmers' knowledge about sustainable horticultural crop cultivation through counseling and education activities. This activity is expected to provide a better understanding of the principles of environmentally friendly cultivation, increase farmers' awareness of the importance of maintaining the sustainability of agricultural resources, and encourage the implementation of more effective and efficient cultivation practices (Irawan et al., 2024). With the increase in farmers' knowledge, it is hoped that there will be a change in behavior in the management of farming so that productivity, crop quality, and sustainability of the horticultural sector can continue to be improved as part of efforts to realize sustainable agricultural development.

2. IMPLEMENTATION METHOD

The method explains the design of the activity, how to choose the respondents/target audience, the materials and tools used, the design of the tool and its performance and productivity, data collection techniques, and data analysis techniques.

Describe the stages of the activity systematically. Commonly used stages include Preparation, Coordination, with partners, Preparation of materials, Implementation of training/counseling, Mentoring, Monitoring and Evaluation. And you should make a flow diagram and give the title of the image as well as an explanation of the flow after the image, example of figure 1**:**

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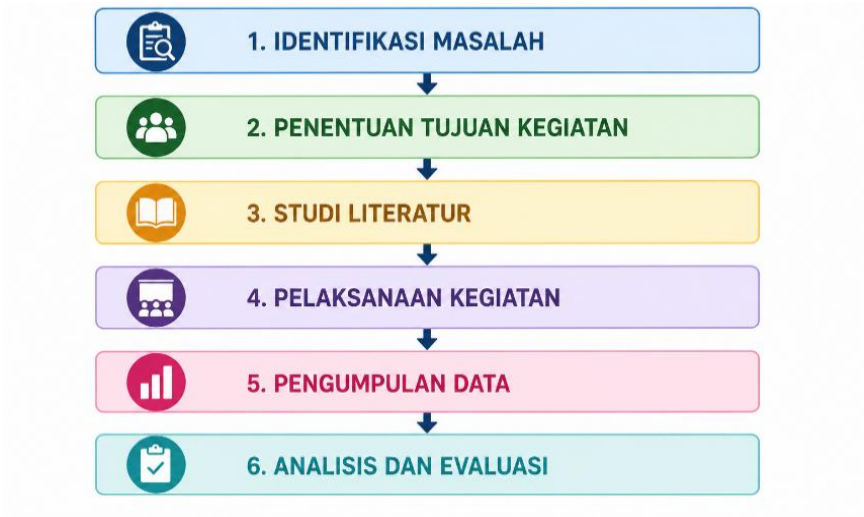


Figure 1. Implementation Method

2.1 Problem Identification

The initial stage in community service activities is to identify problems faced by farmers in the cultivation of horticultural crops. Identification is carried out through field observation and discussions with farmers to find out the actual conditions related to the cultivation techniques applied, the level of knowledge about sustainable agriculture, and various obstacles faced during the cultivation process. The results of the identification show that some farmers still apply conventional cultivation patterns with relatively high use of chemical fertilizers and pesticides, while the understanding of environmentally friendly cultivation practices is still limited. This information is the basis for the preparation of materials and the implementation of service activities.

2.2 Determination of Activity Objectives

Based on the results of problem identification, the purpose of the service activity is then determined. The main purpose of this activity is to increase farmers' knowledge about sustainable horticultural crop cultivation so that they are able to understand the principles of environmentally friendly agriculture and can apply them in daily cultivation activities. In addition, this activity also aims to increase farmers' awareness of the importance of preserving the environment without reducing the productivity of agricultural products.

2.3 Studi Literatur

The literature study stage is carried out to obtain references related to the cultivation of sustainable horticultural crops. Literature is obtained from books, scientific articles, journals, government regulations, and various other relevant scientific sources. The results of the literature study are used as a basis in compiling extension materials so that the information conveyed to farmers is in accordance with the development of science and sustainable agricultural practices that have been proven effective.

2.4 Implementation of Activities

The implementation of the activity was carried out through counseling and interactive discussions with farmers. The material presented included the concept of sustainable horticultural cultivation, soil fertility management, the use of organic fertilizers, integrated pest control, water management, and the importance of maintaining environmental balance in agricultural activities. During the activity, participants were given the opportunity to ask questions and discuss the problems they faced so that the learning process became more active and in accordance with the needs of farmers.

2.5 Data Collection

Data collection was carried out during the activity to determine the level of participants' understanding of the material that had been provided. Data was obtained through observation of participant participation, activity documentation, and the distribution of questionnaires before and after counseling. The data was used to determine changes in the level of knowledge of farmers after participating in service activities.

2.6 Analysis and Evaluation

The last stage is to analyze and evaluate the results of the activity. The data that has been obtained is analyzed descriptively to describe changes in the level of knowledge of participants before and after the activity. Evaluation is also carried out on the process of implementing the activity, the level of participant participation, and the

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achievement of the goals that have been set. The results of the evaluation are considered in compiling recommendations for the implementation of the next service activities to be more effective and provide greater benefits for farmers.

3. RESULTS AND DISCUSSION

3.1 Implementation of Service Activities

The community service activity with the title "Increasing Farmers' Knowledge about Sustainable Horticultural Crop Cultivation" was carried out as an effort to increase the capacity of farmers in implementing cultivation practices that are more environmentally friendly, efficient, and sustainability-oriented. The target of the activity is a group of horticultural farmers who have been still implementing conventional cultivation with a fairly high use of chemical fertilizers and pesticides. This condition shows the need to increase knowledge and skills so that farmers are able to apply better cultivation techniques without reducing the productivity of agricultural products. The implementation of the activity began with participant registration, opening, and submission of the objectives of the activity, then continued with counseling on the concept of sustainable agriculture. The material presented included soil fertility management, the use of organic fertilizers, the use of local organic matter, integrated pest control (PHT), crop rotation, water use efficiency, and horticultural plant maintenance techniques in accordance with the principles of sustainability.

During the activity, participants showed high enthusiasm. This can be seen from the many questions asked about problems that are often faced during the cultivation process. Most of the participants said that they still experienced obstacles in controlling pest attacks, determining the right fertilization dose, and maintaining plant productivity when the use of chemical pesticides was reduced. The interactive discussion provided an opportunity for participants to obtain solutions based on field experience and materials provided by the service team. In addition to the presentation of materials, participants were also given examples of the application of sustainable horticultural cultivation techniques that can be applied according to their respective land conditions. This approach aims to ensure that the material is not only understood theoretically, but can also be implemented in daily cultivation activities.

3.2 Characteristics of Activity Participants

The success of the service activity is greatly influenced by the participation of the participants. All participants participate in the activity from the beginning to the end so that the process of delivering the material can take place optimally.

Table 1. Characteristics of Service Activity Participants

No	Features	Number of Participants
1	Horticultural farmer	20 Participants
2	Participate in the activity until it is completed	20 Participants
3	Active in discussion sessions	17 Participants
4	Following simple practices	20 Participants

Table 1 Description. The table shows the level of participant participation during the service activity. All participants participated in the activity until the end, while most actively participated in the discussion session. Based on Table 1, it can be seen that the participation rate reached 100%. The high attendance showed that the material presented was in accordance with the needs of farmers. The activeness of the participants in the discussion session also illustrates the desire to gain new knowledge about better horticultural cultivation techniques. The interaction that occurred during the activity is one of the indicators that the extension method used is able to create a communicative learning atmosphere and encourage the exchange of experiences between farmers.

3.3 Peningkatan Keterampilan Budidaya Petani

The main result of this service activity is the improvement of horticultural crop cultivation skills through the application of better cultivation techniques. After participating in the counseling, farmers begin to understand the importance of maintaining soil fertility, reducing dependence on chemical fertilizers, and implementing more environmentally friendly pest control techniques.

The most visible change is the increasing willingness of farmers to try new cultivation techniques that have not been applied before. This condition shows that extension activities not only increase knowledge, but are also able to encourage behavioral changes in cultivation practices.

Table 2. Results of Implementation of Cultivation Techniques After Activities

No	Cultivation Techniques	Conditions After the Activity
1	Use of organic fertilizers	Get implemented

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No	Cultivation Techniques	Conditions After the Activity
2	Integrated pest control	Start to be understood and tried
3	Land management	More planned
4	Water use efficiency	Get implemented
5	Crop rotation	It is understood as an effort to maintain soil fertility

Table 2 Description. The table shows the changes in cultivation practices that participants began to implement after obtaining the extension materials. The data in Table 2 shows that most of the participants began to implement more sustainable cultivation techniques. Although the implementation is still in its early stages, these changes are a positive indicator that the service activities have succeeded in improving farmers' skills. The application of organic fertilizers, for example, has begun to be carried out as an effort to improve soil structure while reducing the use of chemical fertilizers. Similarly, integrated pest control is beginning to be understood as an alternative to pest control without relying entirely on synthetic pesticides.

3.4 Discussion

The results of the activity showed that counseling is one of the effective approaches in improving farmers' skills. The learning process that takes place through lectures, discussions, and questions and answers provides opportunities for participants to understand the material more deeply. The delivery of material that is tailored to field conditions makes it easier for participants to connect theory with the practice they do every day. Improvement in cultivation skills does not occur instantly, but through a process of changing knowledge, attitudes, and actions. Before the activity took place, most participants still considered that the use of large amounts of chemical fertilizers and pesticides was the best way to increase crop yields. After obtaining an explanation about the impact of excessive use of chemicals on soil quality, the environment, and human health, participants began to understand the importance of implementing more environmentally friendly cultivation techniques.

This activity also showed that the transfer of knowledge from universities to the community can run effectively if it is delivered in easy-to-understand language and accompanied by examples of application in the field. The participatory approach allows participants to convey their experiences so that the discussion becomes more contextual. This condition helps participants compare the cultivation practices that have been carried out with the sustainable cultivation techniques introduced in the service activities. One of the changes that is quite prominent is the increasing awareness of farmers about the importance of maintaining soil quality. Previously, most farmers focused more on increasing crop yields without paying attention to the condition of the soil in the long term. After the activity took place, participants understood that soil fertility is the main factor that determines the sustainability of horticultural production. Therefore, the use of organic fertilizers, the addition of organic matter, and crop rotation began to be seen as an important part of the cultivation system.

In addition, participants also gained an understanding of the concept of integrated pest control. This approach is considered more effective in maintaining the balance of the ecosystem because it does not only rely on chemical pesticides, but also utilizes cultivation techniques, routine observations, land sanitation, and mechanical and biological control. Although not all participants have applied the method comprehensively, the increased understanding is an important capital for behavior change in the future. The enthusiasm of the participants during the activity is a supporting factor for the success of the service. Many participants conveyed their experiences regarding the decrease in productivity due to pest attacks and increased production costs. These problems became very useful discussion material because the solutions provided were adjusted to the real conditions faced by farmers. Thus, the material presented was not general, but relevant to the needs of the participants.

The service activity also showed that changes in farmers' behavior were greatly influenced by examples of practices that were easy to apply. When participants saw that certain cultivation techniques could be carried out by utilizing the resources available in the surrounding environment, they became more confident to try them. This shows that the success of extension is not only determined by the quality of the material, but also by the applicable delivery method. Although the results of the activities show positive developments, there are still some challenges that need to be considered. Some participants stated that changes towards sustainable cultivation require time, cost, and continuous assistance. Changes in habits that have been carried out over the years cannot occur through just one extension activity. Therefore, a follow-up program in the form of mentoring, monitoring, and periodic evaluation is needed so that the application of sustainable cultivation techniques can take place consistently.

The success of this activity shows that improving farmers' skills can be the first step in supporting sustainable agricultural development. Farmers who have better skills will be able to make appropriate cultivation decisions, reduce waste in the use of production facilities, maintain environmental sustainability, and improve the quality of crop yields. In the long term, these conditions are expected to increase the competitiveness of horticultural products while supporting regional food security. In terms of community service, this activity proves that synergy between universities and the community has a very important role in disseminating agricultural innovation. Universities not only function as a center for science development, but also as community partners in solving various problems

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in the field. Through continuous extension activities, farmers can continue to obtain the latest information about cultivation techniques in accordance with the development of science and the needs of modern agriculture.

Overall, the results of the activity show that the goals of service have been achieved. Improving cultivation skills through the application of new techniques is the main indicator of the success of the activity. These changes are supported by the high participation of participants, increased understanding of sustainable horticultural cultivation, and the emergence of farmers' willingness to start implementing more environmentally friendly cultivation techniques. With these skills increased, it is hoped that farmers will be able to develop their farming business in a more productive, efficient, and sustainable manner so as to provide economic benefits while maintaining the preservation of natural resources.

4. CONCLUSION

Community service activities regarding increasing farmers' knowledge about sustainable horticultural crop cultivation have yielded positive results in improving participants' skills. Through counseling, interactive discussions, and the delivery of materials tailored to conditions in the field, farmers gained a better understanding of the importance of implementing environmentally friendly and sustainability-oriented cultivation techniques. The results of the activity showed that participants began to implement various new cultivation techniques, such as the use of organic fertilizers, more planned land management, water use efficiency, the implementation of crop rotation, and integrated pest control as an alternative to reduce dependence on chemical pesticides. The high participation of participants during the activity also showed that the materials provided were in accordance with the needs of farmers and were able to increase their motivation to develop better cultivation practices. These changes are an indicator that the service activities not only increase knowledge, but also encourage skill changes in the management of horticultural farming businesses. However, the implementation of sustainable cultivation requires a continuous process through mentoring, monitoring, and evaluation so that the techniques that have been introduced can be applied consistently in daily cultivation activities. Therefore, collaboration between universities, agricultural extension workers, local governments, and farmer groups needs to be strengthened to support the development of a productive, competitive, and sustainable horticultural sector so that it can improve the welfare of farmers while preserving the environment.

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