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Education and assistance in hydroponic plant cultivation for strengthening the self-reliant economy

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ABSTRACT

Assistance with a hydroponic cultivation theme towards strengthening the self-reliant economy of Sukoreno Village is a manifestation of awareness in contributing to the development of a more modern agricultural system and Micro, Small, and Medium Enterprises (MSMEs) within the community. The partners for this activity are 10 members of the Sukoreno Village Youth Organization ("karang taruna"). The implementation method consists of three stages: planning, implementation, and evaluation. During the planning stage, the situation and potential of the Sukoreno Village community are analyzed. In the implementation phase, seminars are conducted to provide information and invite the local youth organization and village government officials to practice farming using hydroponic systems, which are more space-saving, environmentally friendly, and practical to maintain. This aims to raise awareness among the community that farmers do not always have to rely on large plots of land. Evaluation involves regular checks on the hydroponic growing media in the village's greenhouse. Based on the monitoring and assistance activities conducted by our group members, the cultivated plants have thrived and become assets for the village's youth organization. Furthermore, some residents have shown interest in practicing hydroponics in their own homes. This activity can be further expanded on a larger scale within the Sukoreno Village area.

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1. INTRODUCTION

The strengthening of self-reliant economy for rural communities plays a crucial role in sustaining their livelihoods. In the village of Sukoreno, the majority of the population is engaged in agriculture, which greatly requires the development of agricultural Science and Technology (S&T) in accordance with the modern era. Agriculture is of utmost importance for the life of the Indonesian nation. As an agrarian country, Indonesia possesses fertile land and is an area blessed with ample sunlight and high rainfall (Prasetyani & Mahendrastiti, 2022). The Sukoreno Village area has vast agricultural land, but it is possible that in the future, this agricultural land may experience narrowing due to the presence of buildings.

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Hydroponics is introduced as an alternative that is more practical and efficient. Hydroponics is agricultural cultivation without using soil media, so hydroponics is an agricultural activity that is carried out using water as a medium to replace soil (Roidah, 2014). Hydroponic systems arise due to limited land in urban areas (Sufiyanto et al., 2021). The potential of residential yards to increase agricultural productivity is significant in Indonesia. Residential yards are not only for creating beauty and tranquility but also for the purpose of improving the economic well-being of each family (Syidiq, 2022). Strengthening self-reliant economy through the development of agricultural S&T in Sukoreno Village can motivate the community to produce agricultural products with significant potential, thus improving the economic well-being of their families.

Sukoreno Village has high potential in hydroponic cultivation. The potential that it has is not only large agricultural land, but also cold temperatures making it very suitable for hydroponic types of plants such as pakcoy vegetables, mustard greens, and so on. Sukoreno Village also has potential in the field of Human Resources (HR) which makes all residents in this village work as farmers and is supported by large Natural Resources (SDA) coupled with beautiful views of Mount Penanggungan.

Sukoreno is one of the westernmost villages in the Prigen sub-district, Pasuruan, East Java, Indonesia. Sukoreno Village has an area of 889.29 Ha accompanied by a view of Mount Penanggungan which is used as the main icon. In terms of community demographics, Sukoreno Village has 48 Neighborhood Units (RT) and 14 Residential Units (RW). Sukoreno Village has 14 hamlets including Konang Hamlet, Kasin Hamlet, Kesamben Hamlet, Pakel Hamlet, Mendalang Hamlet, Karanglo Hamlet, Terongso Hamlet, Kebon Alas Hamlet, Brubuh Hamlet, Candi Hamlet, Kesiman Hamlet, Guci Hamlet, Terong Dowo Hamlet, and Middle Coral Village. Demographically, Sukoreno Village is bordered by several villages, namely Sumbersuko Village in the north, Belik Village in the west, Candi Wates Village in the east, and Lumbangrejo Village in the south.

Hydroponic mentoring and education as a form of community service activities is carried out in Sukoreno Village, which is expected to be continued in the long term. Education and assistance are carried out by planting pakcoy mustard greens with hydroponic media and then cultivating them in the Greenhouse which is located in Brubuh hamlet, Sukoreno village. Hydroponics is a method of cultivating plants without soil using water. Etymologically, hydroponics comes from the Greek words hydro which means water and ponos which means power. Hydroponics is the cultivation of plants without using soil replaced with rockwool media, rice husks, cotton, etc., where in this hydroponic plant the emphasis is on using nutrients dissolved in water (Singgih et al., 2019). The types of hydroponics can be distinguished by the media used to support the upright growth of plants. These media are typically free from the necessary plant nutrients, which are delivered to the media through pipes or manually watered (Waluyo et al., 2021).

The current understanding of the community considers that cultivating vegetables with a hydroponic system is complicated and expensive cultivation. Even though the cultivation of vegetables with a hydroponic system can be done in an easy way and at a very low cost (Hidayat et al., 2018). Hydroponics can be an alternative to independent business that anyone in Sukoreno Village can do because the process is relatively very practical and easy to maintain, but produces quality crops. Hydroponic cultivation is carried out with planting media other than soil, which minimizes pests or diseases that can arise from the soil. With the cultivation of vegetable plants carried out using the hydroponic method, narrow and limited land can be put to good use so as to get income from vegetable cultivation or can be used for daily needs (Wirawati & Arthawati, 2021), so that hydroponics can be a solution in strengthening the independent economy in Sukoreno Village. The education and assistance program for the cultivation of hydroponic plants is able to have an impact on the people of Sukoreno

Village in increasing productivity in the agricultural sector which can be carried out independently by the community members. Cultivating hydroponic plants is also a solution for the farming community of Sukoreno Village, which depends on the availability of increasingly narrowing land due to the construction of buildings every year.

2. METHODS

The design of community service activities is carried out in Sukoreno Village, Kec. Prigen, Pasuruan Regency. The partners involved were 10 members of the Sukoreno village community, namely youth organizations. The initial survey was carried out in coordination with village officials to determine partners and implement activities. Coordination produces youth partners who are chosen because they have enough potential and are carried out on Saturdays and Sundays. This activity was carried out from January to February 2023.

This activity method includes 3 stages, namely planning, implementation, and evaluation, as follows: (1) Planning. At the planning stage, namely analyzing the situation and potential of the village of Sukoreno. This planning stage was carried out to analyze needs, namely an understanding of hydroponic plants and the practice of growing hydroponic plants; (2) Implementation. The implementation phase is conducting hydroponic seminars and mentoring hydroponic plant cultivation. Table 1 is the hydroponic seminar schedule. After the entire series of seminar events was finished, we then moved the planting media to the village's greenhouse in Brubuh hamlet, which at the same time will be held a mentoring stage by our members, to monitor the success of planting the seeds that have been carried out and practiced together; (3) Evaluation. In the evaluation phase, recommendations and follow-up actions are conducted based on the activities that have been implemented. The success of the event is measured by whether it aligns with the predetermined guidelines set by the event committee, including adherence to time and location, resulting in the event running according to plan. The excellent collaboration among the committee members also contributes to the success. The success criteria include the ability to effectively practice the hydroponic planting process and implement the learned materials into practice. The success of the organizers is determined by the facilitator providing guidance from start to finish, accompanied by practical examples. Additionally, the enthusiastic participation of the seminar attendees in the hydroponic planting practice is another indicator of success. The overall success of this activity is determined by the majority of the seminar participants demonstrating a good understanding of hydroponic cultivation techniques.

Table 1. Hydroponic seminar schedule

Activities	Time
Opening by MC and Moderator	9:00-9:30
Recitation of the Holy Qur'an	9.30-9.35
Singing Indonesia Raya	9.35-9.40
Acknowledgment	9.40-9.50
Delivery of Hydroponic Seminar	9.50-10.30
Q&A Session	10:30-10:45
Hydroponic Practice for Villagers	10.45-11.30
Closing	11.30

3. RESULTS AND DISCUSSION

Based on the educational and mentoring activity method, it consists of three stages: planning, implementation, and evaluation. In the planning stage, an analysis is conducted to identify issues such as the decreasing amount of land, the pandemic teaching the importance of food resilience, and efforts to strengthen the self-reliant economy of Sukoreno Village. In the implementation stage, education and mentoring are carried out. The education on hydroponic cultivation is conducted in two stages.

Hydroponic Seminar

Hydroponic seminar activity materials can be seen on the following Google Drive link: https://drive.google.com/drive/folders/1icj91tmzHm9sOhCuNdnjKErYguDTBn9Z. The speaker introduces hydroponics in detail, covering the scope of hydroponics, the steps of cultivation, selecting superior seeds, and analyzing the risks involved in hydroponic farming. This material is based on the analysis of the existing potentials in Sukoreno Village, ranging from the social environment of the community to the geographic and natural resource potentials. The goal of promoting self-reliant economic growth through hydroponic technology transfer is to provide new insights to millennial farmers regarding planting using hydroponic methods. With this training, it is expected that the future will bring an increase in the economic well-being of the Sukoreno Village community through vegetable or fruit cultivation using hydroponic methods.

Figure 1. Presentation session

This activity involves delivering materials related to hydroponics, starting from the etymology of hydroponics, the advantages of the hydroponic method, and the requirements for implementing hydroponics. During the material presentation session, explanations are given on how to cultivate hydroponics, various models of cultivation in limited land spaces, types of growing media, hydroponic plant varieties, and hydroponic systems (Figure 1. The materials presented include both theory and practical aspects. Some of the outcomes obtained from hydroponic cultivation include hydroponic melons, hydroponic ginger, vertical cultivation, pot and polybag cultivation, tabulampot (potted plant), and rack and tiered cultivation. The aim of this is to inform the community that hydroponic planting systems are environmentally friendly and can be used for various fast-growing crops such as chili, pokchoy vegetables, and melons.

Hydroponic Practice

This activity involves field practices to ensure that the knowledge provided can be understood and implemented by the community. The speaker invites the audience to engage in hands-on practice of the

hydroponic planting process, with the hope that this knowledge will spread throughout the community and enhance productivity in Sukoreno Village, as well as contribute to strengthening the local economy. During the field practice stage, participants are specifically trained in planting seedlings using rockwool as the growing medium. Rockwool is commonly used by beginners in hydroponics. It has excellent water absorption and retention properties, and it is neutral in pH and devoid of nutrients found in soil. Assistance in the cultivation of hydroponic plants is carried out in 2 stages, as follows planting seeds and transplanting seedlings in Figure 2.

Figure 2. Hydroponic cultivation practice session

Planting seeds

This activity involves selecting the appropriate seedlings for planting. The selection process not only considers the quality of the seedlings but also aligns with the prepared planting plan. Factors such as food demand and current season conditions are taken into consideration when determining the types of plants to be grown. This stage also focuses on training participants in seed planting, emphasizing the importance of using high-quality seeds with good germination rates and disease resistance. The training also covers the appropriate number of seeds to be sown during the germination process. For example, the practice of planting pak choi seedlings may involve a single planting hole, while spinach seedlings may require multiple planting holes. In this stage, the first step is to select seedlings that are suitable for the prepared planting plan. When choosing seedlings, it is important to consider not only the quality of the seeds but also the food requirements and the suitability of the seedlings for the current season. The training on seed planting also includes checking the quality of the seedlings in terms of germination and disease resistance. Additionally, the number of seedlings to be sown during the germination process should be taken into account. Based on the planting practices, for example, the pak choi seedlings are planted using a single planting hole, while spinach seedlings require multiple planting holes;

Transplanting seedlings

This activity involves theories and materials that have previously been explained in the presentation material sessions and question and answer sessions. In this stage, a series of joint planting practices were carried out guided by the presenter. The presenter gave directions to the participants who attended the practice and gave the steps for planting hydroponic media. The hydroponic planting method is very suitable to be applied in areas that have little water and adds plant nutrients which are very important for maximum plant growth, the nutrients used in this planting come from various sources such as animal manure and chemical fertilizers. Hydroponic planting requires less water than planting in soil in general.

Figure 3. Planting seeds session
Figure 4. Transplanting seedlings

Cultivation

In this stage, a reseeding process is carried out inside the greenhouse to increase the capacity of seedlings that can be planted. This allows the greenhouse to be utilized for observation, research, and hydroponic cultivation. The growth of the seedlings that have been planted is monitored daily to ensure the quality and suitability of the growing environment. The objective of implementing hydroponic cultivation is to enhance the economic situation of the community in Sukoreno Village, where the majority of residents are farmers. By doing so, it aims to develop hydroponic cultivation as a solution to the issues faced by the community, particularly their tendency to be consumptive in purchasing goods.

Monitoring of seedling yields

This process continues until the harvesting stage, aiming to monitor the growth and health of the plants that have been provided with nutrients. It helps to determine whether the plants are growing well or if they are being affected by pests or other issues. Through this process, participants receive guidance on monitoring the progress of their seedlings. The monitoring is typically done once a day, and if the water in the growing medium runs out, it needs to be replenished immediately and provided with the appropriate nutrient dosage as explained by the speaker. The mentoring sessions are conducted in the Brubuh Hamlet of Sukoreno Village.

Figure 5. Cultivating session
Figure 6. Monitoring of seedling yields

The evaluation of the education and mentoring activities for hydroponic cultivation takes place in the greenhouse of Sukoreno Village. Several factors need to be considered in order to prevent the plants from being damaged by pests. Samples of fertilizers or nutrients are provided, which can later be used by the community during independent practice. This activity is expected to provide a solution to agricultural issues in Sukoreno Village, contributing to the strengthening of the local economy.

Discussion

Hydroponics is a farming method using planting media other than soil, such as pumice, gravel, sand, coconut fiber, pieces of wood or foam (Laksono, 2020). The term hydroponics is used to explain how to grow crops without using soil as a planting medium (Maimunah et al., 2021). Examples of vegetables that are usually grown using hydroponics are mustard greens, spinach, lettuce, kale, tomatoes and others (Lissa et al., 2020). The community service program in the form of mentoring for hydroponic cultivation has several objectives, including increasing awareness and sharing information with the community, especially those who work primarily as farmers. Additionally, the program aims to anticipate the potential shrinkage of agricultural land in the future due to infrastructure development, as well as to enhance the productivity of the community as an effort to support economic growth and the well-being of the residents. Hydroponic farming is a greening concept suitable for urban areas and limited land, and it is also emphasized that from an economic perspective, cultivating vegetables using the hydroponic concept is highly beneficial. Hydroponic cultivation does not require high costs and the maintenance is relatively easy, allowing residents to fulfill their need for healthy vegetables without having to purchase them (Ruswaji & Chodariyanti, 2020).

The efforts to improve the skills of the participants in the seminar in Sukoreno Village have successfully achieved the planned targets. The improvement in participants' skills was evident during the session of material presentation by the speakers and the question-and-answer session. They discussed topics such as how to overcome diseases in open-field hydroponic farming, the limitations of available nutrients in stores, and the issue of limited harvests that can only be done once or twice. This was demonstrated through role plays during the seed germination practice. Germination was carried out using special seed germination containers called trays. The sowing process could also be done using medium-sized pots or used cake boxes (Solikhah et al., 2018). This shows that community service to hydroponic planting can achieve the set targets.

The implementation of this hydroponic seminar is supported by several factors, including: (1) Guidance and support from the village authorities to carry out a program that focuses on agriculture; (2) The enthusiasm of the residents in welcoming the hydroponic mentoring program as the audience; (3) The strong interest of the community in farming, which supports the implementation of hydroponic cultivation in their environment; (4) The village providing adequate land facilities in the form of a greenhouse for hydroponic plant cultivation; and (5) The support of the organizing committee and speakers who have made efforts to ensure the smooth running of the event.

During the implementation of the hydroponic seminar for the community, there are several hindering factors that occur during the activity, namely: (1) Due to the seminar being conducted in person, direct guidance from the speaker is necessary. This is based on the fact that the community is newly introduced to environmentally friendly hydroponic cultivation techniques and their care methods; (2) Some individuals are still hesitant to engage in hydroponic cultivation due to the assumption that it is not sustainable in the long run, leading them to prefer traditional soil-based farming techniques; (3) The seminar implementation method, which heavily relies on practical demonstrations, sometimes requires additional guidance for participants to understand the subsequent stages of the process; (4) Limited

time constraints necessitate clear time allocation for the hydroponic seminar, and the lack of facilities for practical demonstrations in the field, such as a greenhouse, requires participants to transfer their practiced results to a designated location. According to Dirgantara et al. (2021), monitoring aquaponic plants aims to determine the occurrence of blockages in waterways, knowing the temperature and humidity around the pond area. According to Yuniwati & Afdah (2021), community empowerment must be carried out comprehensively by involving various elements and carried out in a sustainable manner by implementing various fields.

4. CONCLUSION AND RECOMMENDATIONS

Based on the series of activities in the implementation of education and support for hydroponic plant cultivation, involving various community elements, particularly members of the youth organization (karang taruna) and village officials in Sukoreno village, the event proceeded smoothly and was easily understood by the audience. They were able to comprehend and apply the presented materials. It is expected that this knowledge will be disseminated to the entire Sukoreno Village community, encouraging them to adopt hydroponic cultivation methods and make each individual more productive. After conducting monitoring activities, several villagers have shown interest, and some have started using hydroponic cultivation as an alternative at their homes. It is hoped that this practice will be further developed to contribute to the economic empowerment of the residents of Sukoreno Village.

Considering the limitations in terms of human resources and funding for education and support activities, it is recommended to provide further assistance to participants who have not yet acquired sufficient knowledge and technology in hydroponics. Additionally, additional advanced-level materials should be included. Suggestions for future activities include organizing seminars with more in-depth content and practical models on advanced hydroponics techniques, conducting practical mentoring sessions by visiting industrial-scale hydroponic gardens, providing periodic training sessions for more intensive practice, conducting advanced seminars or mentoring sessions covering topics such as marketing strategies and harvest management, and upgrading materials to include techniques for enhancing the value of the harvested produce. By implementing these recommendations, it is expected that the education and support activities in hydroponics can be further developed and provide greater benefits to the participants, ultimately contributing to the economic growth of the community.

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