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Hydroponic Training as an Effort to Improve Food Security, Community Economy, and Environmental Quality in the City of Surakarta

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A B S T R A C T

Currently, cases of hunger and malnutrition as indicators of food insecurity are common in developing countries. Based on the problems that occurred, a collaborative activity was carried out between the Environmental Engineering Study Program at Surakarta Christian University and PT. Bandungan Hydroponic Agrofarm (PT.HAB), and the Panti Waluyo Hospital Surakarta. The implementation of this Cooperation activity is carried out in 3 stages, namely: the preparation stage which includes selecting a topic, the stage for searching for activity participants and the stage for implementing activities in the form of training. One of the efforts that can be made to support the food security program, as well as improve the community's economy and the quality of the environment, especially the air in Surakarta City and other cities in Indonesia is by implementing a hydroponic farming system.

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INTRODUCTION

Currently, cases of hunger and malnutrition as indicators of food insecurity are common in developing countries. This problem also occurs in food producing countries. Food security is defined as the food adequacy of a community in a certain location, measured per capita or per household, with the availability of food suitable for the family. This allows the family to function properly and have a decent life. Food, which is still the main human need, requires equitable development of food security to achieve optimal food self-sufficiency. Rapid population growth, as well as the impact of climate change, are currently a challenge in efforts to achieve food security (O'Brien et al., 2021) . In addition, it is necessary to pay attention to food safety, quality and nutrition in adequate proportions.

In the Indonesian context, various government-sponsored development programs, including family planning and increasing food crop production, have reduced hunger by 7.9% between 2014 and 2016. Despite progress in reducing hunger, Indonesia is considered to be somewhat slow in reducing shortages nutrition, particularly in young children. 5 years. In 2015, more than 37% of children under the age of five in Indonesia were malnourished, which resulted in stunting or impaired physical development (Muhafidin, 2022) . The effort for food self-sufficiency and food sovereignty in Indonesia was officially proclaimed by the Ministry of Agriculture with the aim of reducing the number of families facing extreme food insecurity. Utilizing local food sources in the community and cultivating them at home is one of the answers to this problem (Degefa et al., 2021) .

Greater awareness of the importance of food security must be linked to local, regional and national development strategies. The availability of nutritious food for Indonesian households is very important. Government steps have been made to strengthen human resources. This is in line with Indonesia's development goals, namely developing the entire population. Therefore, development must be a social transformation that takes place not only at the level of people's lives, but also at the level of the functions of its constituent elements.

Humans are the focal point of development. The central government and local governments have shared commitment and responsibility to empower communities to fight poverty. The use of hydroponic technology is an option or effort to increase community resilience while fighting poverty, especially in urban areas. Hydroponics is a technology for growing plants without using soil, with an emphasis on meeting their nutritional needs (Vinci & Rapa, 2019) . Agriculture with a hydroponic system aims to make plant cultivation easier for humans (Lakhiar et al., 2020) . This technique can produce cultivated plant products that are more free from pests and infectious diseases from the soil, besides that hydroponic plant cultivation can be used as a new livelihood which is a source of income for the community, as well as increasing the nutritional needs of the community, especially within the family sphere. If the hydroponic system is used to cultivate plants on a large scale, exports of high-quality fresh horticultural products will also increase so that they can boost the country's foreign exchange.

Modification of growing media is an alternative for sustainable agricultural production to address the challenges of limited land and reduced available water resources (Sharma et al., 2018) . Hydroponics is the best choice for creating conditions for a healthy and prosperous society in the future, increasing food self-sufficiency, and promoting food security, especially for individuals who do not have access to large areas of land (Atmadja et al., 2022) . Hydroponics also provides social and environmental benefits, as it can be used to teach and train people of all ages in modern agriculture, enhancing the performance of rural agriculture and agribusiness without polluting the atmosphere.

Most people's first impression when they see this hydroponic system is that it is very complicated and difficult, but once they understand how it works, they realize that it is not as complicated as they first believed. There are various types of hydroponic systems, including drip systems, tidal systems, NFT (nutrient film technique), deep water culture, aeroponics, and wick systems. (Phibunwatthanawong & Riddech, 2019) . The six hydroponic systems provide plant nutrients to plant roots differently.

Hydroponic plant cultivation includes horticultural plant types such as annual and seasonal plants, vegetables, fruits, flowers, ornamental plants, medicinal plants, and landscape plants. Regardless of the season, individual communities can build hydroponics for both recreational and economic purposes. Hydroponic vegetables have been widely developed in Indonesia. Hydroponic farming offers a number of advantages, including eliminating the need for large tracts of land, year-round cultivation, increased household income, and promotion of a clean and healthy environment (air) around the home.

In a hydroponic system, the most crucial aspect to pay attention to is fertilization. In hydroponic media, water and fertilizer are given together as a solution. For optimal plant growth and productivity in hydroponic gardening, fertilizers or nutrient solutions as sources of water and minerals are essential. The nutrition provided must include macro and micro components. The pH level can affect the solubility of nutrients that can be absorbed by plant roots. In most hydroponic horticulture, the pH of the solution is maintained between 5.5 and 6.5. The development of hydroponic plants can be up to two times faster than the growth of conventional soil-based plants. This is the result of direct contact between the roots and oxygen, optimal pH, increased nutrient absorption, and balanced nutrition.

Surakarta city is one of the cities in Indonesia which is growing rapidly. The growing population of people causes an increase in the need for land for homes, businesses and offices. In addition, the increase in the population also causes a high demand for clothing, boards and food. In an effort to improve food security, especially in the city of Surakarta, the Department of Agriculture, Food Security and Fisheries of the City of Surakarta has a vision to utilize existing paddy fields and yards as productive agricultural businesses and to provide production facilities for urban agriculture or urban agriculture. In addition, BKPM also intends to foster a business-friendly environment in the fields of agriculture, animal husbandry, fisheries, and marketing facilities for agribusiness

actors, as well as agricultural, livestock and fishery business services. Improving the quality of human resources and farmer institutions is also carried out for the benefit of the community. Efforts to improve the quality of ASUH's animal products (safe, healthy, intact, and halal) and food products of animal origin in order to create diverse, nutrient-dense, balanced, halal, and locally diversified cuisines.

In connection with the above, the Environmental Engineering Study Program, Faculty of Engineering, Surakarta Christian University conducted Community Service in the form of hydroponic training for the community in Surakarta City. This is done to support food security in Surakarta City, improve the community's economy, and improve environmental quality, especially air quality.

IMPLEMENTATION AND METHODS

This community service activity in the form of hydroponic training was organized by lecturers and students of the Environmental Engineering Study Program, Faculty of Engineering, Surakarta Christian University on Saturday, 03 September 2022.

Figure 1. Group photo of the PKM Activity Implementation Team

This hydroponic training activity was attended by 50 participants, namely the general public from various backgrounds in the city of Surakarta. Participants in the activity came from 5 (five) sub-districts in Surakarta City (Banjarsari, Laweyan, Jebres, Pasar Kliwon, Serengan). The resource persons for this activity came from lecturers of the Environmental Engineering Study Program, Faculty of Engineering, Surakarta Christian University, PT. Bandungan Agrofarm Hydroponics, and the Panti Waluyo Hospital, Surakarta. In this activity, the resource person conveyed several main things to the participants , namely: 1) what is a hydroponic system, along with its goals and benefits; 2) how to use the narrow yard around the house to produce vegetables and earn additional income; 3) how to make a simple hydroponic installation using materials that are cheap and available around the house.

Figure 2. The resource person explains how the hydroponic system works and explains the tools and materials for making hydroponic media

In the first session, the resource person explained in detail to the participants what a hydroponic system is, how it works, what are the goals and benefits of implementing the system, and how to use the narrow space at home to implement a hydroponic system. Through this material participants can find out the benefits of implementing the hydroponic farming system both for themselves, and what its contribution is to food security and environmental quality, especially in the city of Surakarta. In addition, in this session the resource person also answered problems and provided solutions to any obstacles faced by participants in implementing this hydroponic system and provided choices of hydroponic media technology that fit the needs and economic capabilities of each participant.

Figure 3. Resource persons inviting participants to practice making hydroponic growing media

In the second session, the resource person also invited participants to practice making simple hydroponic growing media with the aim that all participants could immediately practice it in their respective homes after completing this training. The resource persons chose to use cheap and easy-to-obtain materials with the aim that the participants would not have difficulty

making them at home as well as increasing the participants' motivation to practice them in their respective homes.

Figure 4. Students Distributing Used Mineral Water Bottles to Participants for Practice

In this Community Service activity, students from the Environmental Engineering Study Program, Faculty of Engineering, Surakarta Christian University also play an active role in joining committees or teams along with lecturers. This student involvement starts from the preparation stage, implementation to activity evaluation. Through this collaboration students also contribute directly in helping the difficulties faced by the community, besides that students can also learn from the training activities carried out so that students can gain a more meaningful learning experience.

Figure 5. Participants Look Very Enthusiastic Listening to the Speaker's Explanations

The high curiosity of the participants made them more enthusiastic and active in listening to the material presented by the speakers so that the training atmosphere became more lively and interesting. Every question and difficulty from the participants was immediately answered and helped to find a solution by the resource person. In this session students were also given the opportunity to answer questions from participants and help solve problems faced by participants.

Figure 6. Group photo of all resource persons and training participants

RESULT AND DISCUSSION

The results of this training activity were able to make participants who previously did not know what a hydroponic system was, along with its goals and benefits, how to use the narrow yard around the house to produce vegetables and earn additional income, how to make a simple hydroponic installation using materials those that are cheap and available around the house are more knowledgeable and able than before so that it is hoped that they can be practiced and developed in their respective homes.

This Community Service Activity takes place on September 3, 2022, from 10.00 WIB to 14.00 WIB. at Surakarta Christian University. This activity is a collaboration between the Surakarta Christian University Environmental Engineering Study Program and PT. Bandungan Hydroponic Agrofarm (PT.HAB), and the Panti Waluyo Hospital Surakarta.

Analysis of the problem conditions of partners or participants in this training and the solutions carried out can be seen in table 1 below :

Table 1. Analysis of Partner Problem Conditions and Solutions

Partner Problems	**Solution**
Don't know what a hydroponic system is, its purpose and benefits	Education is carried out through lectures, questions and answers and discussions about what hydroponics is, its purpose and benefits
Still don't know how to use the narrow yard around the house to grow vegetables and earn extra income	Education is carried out through lectures, questions and answers and discussions regarding techniques for using narrow land around the house so that it is more productive through hydroponics and marketing techniques

Still not able to make a simple hydroponic installation using materials that are cheap and available around the house	Practice how to make a simple hydroponic installation using materials that are cheap and available around the house

The method for implementing Community Service activities consists of 3 (three) main stages, namely:

1. **Preparation** , which includes selecting topics and themes for PKM activities, forming teams, coordinating team meetings, determining activity objectives and activity partners, submitting proposals, identifying relevant sources, and developing training materials. The team that carried out this community service consisted of lecturers and students of the Environmental Engineering Study Program , Faculty of Engineering, Surakarta Christian University. There were 6 (six) lecturers and 9 (nine) students participating in this activity.
2. **Search for activity participants** . At this stage the team socialized the hydroponic training to the people of Surakarta during the *Solo Car Free Day activity* , then opened registration for people who were interested in taking part in the training. Furthermore, because the number of participants targeted was limited, namely around 50 people, the PKM implementation team selected applicants. The selection criteria included the distribution of the participant's place of residence, the participant's age, gender, education level and the participant's commitment to learning and following up on the results of the training;
3. **Implementation of activities** . Activities carried out in the form of hydroponic training. Submission of training material is carried out through lectures, questions and answers, and discussions. The resource persons in this activity came from lecturers of the Environmental Engineering Study Program, Faculty of Engineering, Surakarta Christian University, PT. Hydroponic Agrofarm Bandungan (HAB) and Panti Waluyo Hospital, Surakarta;
4. **Evaluation and reporting** . Comparing the conditions of partners or participants before and after the implementation of activities by using *pre-test* and *post-test techniques* for participants, then making activity reports and activity publications.

CONCLUSION AND RECOMENDATION

One of the efforts that can be made to support the food security program, as well as improve the community's economy and the quality of the environment, especially the air in Surakarta City and other cities in Indonesia is by implementing a hydroponic farming system. Apart from not requiring a large area of land, this hydroponic farming system can be applied to the yards of residents' houses or office yards which are relatively narrow so that anyone can practice it, but unfortunately not all people know about what a hydroponic

farming system is and its benefits. Therefore it is necessary to carry out socialization and training from related parties to the community so that people will know the benefits and want to practice it in their respective environments. Support and collaboration from all parties, both the Regional Government through related agencies, universities, Non-Governmental Organizations (NGOs), and community leaders are absolutely necessary so that this system can be implemented in a sustainable manner.

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