Vol. 4 No. 02 (2024)

Andalasian International Journal of Social and Entrepreneurial Development (AIJSED)

ISSN: 2808-6732 (Online)

Available at: http://aijsed.lppm.unand.ac.id/index.php/aijsed

DOI: https://doi.org/10.25077/aijsed.4.02.25-28.2024

Article

Implementation Of Aquaponic-Based Smart Greenhouse For Sustainable Agriculture Development In Nagari Parambahan, Bukit Sundi, Solok

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Article Information

Received : 2024-08-30
Revised : 2024-09-26
Accepted : 2024-10-21
Published: 2024-10-28

Keywords

keyword: smart greenhouse, agricultural technology, aquaponics, nagari parambahan

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Abstract

Nagari Parambahan, located in Bukit Sundi District, Solok Regency, West Sumatra, has tremendous natural and cultural potential, but it still confronts obstacles in employing contemporary technologies for the benefit of the community. Using eco-friendly technologies, the Smart Green House design is suggested as a way to boost agricultural productivity. The urgency of this program is to empower the community with contemporary agricultural technology, which is predicted to boost agricultural production as well as economic and social wellbeing. In addition, the importance of education on sustainable agriculture is also a major focus, intending to preserve the environment. In the implementation of this Smart Green House, the aquaponics system is also introduced as an innovative technology that combines fish and plant farming in one integrated system. Aquaponics not only significantly reduces land and water usage, but also provides higher quality agricultural produce by utilizing fish waste as plant nutrients. By utilizing this technology, farmers can optimize production with higher efficiency, in line with the principles of sustainable agriculture. The program's objectives include increasing the utilization of modern technology in agriculture, empowering communities with agricultural technology knowledge and skills, and increasing agricultural production and economic welfare. The program also focuses on education about sustainable agriculture and forming a better community personality through empowerment. The targeted outputs of this program are the implementation of a functioning and useful Smart Green House, increased community knowledge and skills in modern agricultural technology, and a significant increase in agricultural yields. This program is also expected to be a model that can be applied in other areas. With collaboration and support from various parties, this program has the potential to provide great benefits to the people of Nagari Parambahan and become an example for other regions in utilizing agricultural technology for community welfare.

INTRODUCTION

Nagari Parambahan is a region with abundant natural and cultural potential, situated in the Bukit Sundi District of Solok Regency, West Sumatra. But like many other areas, Nagari

Parambahan too has difficulties using contemporary technologies to raise the standard of living for its citizens. One potential answer is the creation of a Smart Green House, which uses eco-friendly technology to help the community increase agricultural yields. By educating the local population about cutting-edge and effective agricultural technology, this Smart Green House aims to empower them. It is anticipated that the Smart Green House will enable the community to greatly boost agricultural output, thereby enhancing their social and economic well-being. Furthermore, the initiative attempts to educate the community about the necessity of sustainable agriculture in preserving the environment.

Increasing the community's understanding of agricultural technologies is critical. Communities with broad knowledge will be able to manage their natural resources more effectively and sensibly. In addition, this initiative attempts to improve community personality through education and empowerment. With the involvement and support of all partners, this program is projected to deliver significant advantages to the local community and serve as an example for other regions in the use of agricultural technology for community welfare.

This Smart Green House can be implemented using a variety of technologies, including hydroponics and aquaponics. One technique for growing crops without soil is hydroponics. A plant grown hydroponically employs water as its growing medium. (Zega et al., 2023). Instead, plants are cultivated in a nutrient solution rich in critical minerals required for plant growth. Hydroponic systems often use an inert medium, such as perlite, sand, Rockwool, or hydroton, to provide root support. Aquaponics is an agricultural technique that combines aquaculture with plant cultivation, particularly vegetables, without the use of soil medium (hydroponics). Using the aquaponics system will allow for the simultaneous harvesting of fresh crops and fish. (Ritonga, 2023).

Aquaponics also uses natural bacteria to convert feces and fish feed waste into plant nutrients (Hadi et al., 2021). The basic idea behind aquaponics is that since fish farming waste and water contain a variety of nutrients that plants require, they are directed toward plants. Through filtered water in the planting area, the plants in turn provide the fish oxygen. Compared to other farming techniques, aquaponics has numerous advantages. These include water conservation, land usage efficiency, and environmental sustainability. Aquaponics and hydroponics are frequently used interchangeably. The distinction is that aquaponics uses nutrients from organic wastes or other aquatic life to support plants. Hydroponics depends on nutrients that are found in fertilizers, which are made up of various substances. (Handayani, 2018).

Aquaponics is a strategy and innovation that aims to improve the agricultural and fishing sectors. Aquaponics can meet the community's food production and economic needs by combining aquaculture and plant cultivation without soil media (hydroponics). (Ningrum et al., 2023). Unlike aquaponics, which is utilized in this smart greenhouse, irrigation is powered solely by the flow of the river instead of by machinery. Aquaponic system use is anticipated to boost family food security, create extra revenue streams, and improve the productivity of small community-owned property. Economical and ecologically friendly implementation is made possible by simple aquaponic technology that makes use of local resources and recycled materials like Styrofoam and mineral water bottles.

ACTIVITY METHODOLOGY

1. The approach is a case study of the region in question, which comprises an analysis of regional conditions, the use of local natural resources, the survey of agricultural needs, and the selection of key sites for the construction of Smart Green Houses. This project will be constructed at Bukit Sundi's Nagari Parambahan.

2. The implementation takes the shape of educating locals about aquaponic plant cultivation,

upkeep, and utilizing this technique to harvest agricultural products. The local population may later use these agricultural products if they are in need..

ACTIVITY RESULTS

The Smart Green House was implemented at Parambahan, Bukit Sundi, Solok, in 2024, from mid-August until the end of October. The team started the activity by conducting a survey of the region and its natural resources in an effort to identify local needs and possibilities. According to the survey's findings, vegetable crop development is still at a very low level in Parambahan, while the majority of the country's natural resources are being employed for rice production. Vegetables like pakcoy, kale, lettuce, and so forth are deemed favorable for development because the place is in the highlands. The local community's food security is to be supported and the range of agricultural goods increased by this endeavor.

Figure 1. the formal transfer of the Smart Green House to the authorities of Nagari Parambahan.

After the survey of the region and natural resources was completed, the Smart Green House building began. The construction phases include installing the building frame, creating water channels to the pond, creating fish ponds, filling the ponds with fish, and using an aquaponic system to seed and plant plants. Aquaponic systems are advantageous because they minimize the need for artificial fertilizers by allowing plants to obtain nutrients from fish feces. The fish raised in the ponds may also be harvested by the community, so this method provides both fish and plants that are beneficial for everyday sustenance.

Figure 2. Aquaponic System in Smart Green House

During the implementation process, both the team and the community had the opportunity to learn about good planting techniques and how to care for the plants to optimally utilize the harvest. All parties gained an understanding of plant cultivation using the aquaponics method, which is relatively new to both parties. This interaction not only increased technical knowledge but also strengthened the bond between the team and the community, creating a collaborative atmosphere that was beneficial for all parties.

Figure 3. Final Result of Smart Green House Building

The Smart Green House's harvest is designed for the neighboring community, with the goal of providing their daily food needs in a sustainable manner. Even though the Smart Green House's construction is far from ideal, it is anticipated that this project will serve as a springboard for future advancements in the Parambahan region's vegetable farming industry. By diversifying agricultural products and serving as models for other regions looking to implement comparable technologies, the use of this agricultural technology is also anticipated to enhance community welfare.

CONCLUSION

As a result of the construction of the Smart Green House in Parambahan, this project is expected to serve as an example and inspiration for Nagari Parambahan in developing local agricultural potential by implementing environmentally friendly aquaponic methods. With this system, the community can sustainably increase agricultural yields while maintaining ecosystem balance. This initiative also opens opportunities for Nagari Parambahan to become a pioneer in the use of modern agricultural technology that supports food security and the economic well-being of the local community.

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