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Article

Empowerment of Jirak Serumpun Women Farmers Group through the Application of Aquaponic System in Vegetable Cultivation in Limited Land Area

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Abstract

Utilizing limited land for agricultural activities in urban areas is an effective alternative solution in providing healthy food for families, while reducing household costs. Aquaponic systems, which integrate fish and plant farming in a mutually beneficial recirculating ecosystem, utilize natural bacteria to convert fish waste and feed residues into nutrients for plants. Thus, aquaponics allows plants and fish to grow together in one cycle, maximizing the use of a small area of land. This service activity aims to help the Women Farmers Group (KWT) find the right solutions and strategies in overcoming the problem of limited land. One of these efforts is the creation of an innovative device in the form of a simple aquaponics system for the Jirak Serumpun Women Farmers Group, using the Deep Flow Technique (DFT) method. The aquaponics program implemented in Mata Air Village, Padang Selatan Sub-district, Padang City, has had a positive impact on the community. This training not only provides economic and social benefits, but also offers an effective solution in utilizing narrow yards productively and economically.

INTRODUCTION

Jirak Serumpun Women Farmers Group (KWT) is located at Jalan Kolam Indah VI No. 1, Mata Air Village, Padang Selatan Sub-district, Padang City, West Sumatra Province. KWT Jirak Serumpun is one of three KWTs active in Kelurahan Mata Air, which has an area of 0.8 km² and is 17 km from the center of Padang City government and 14 km from Andalas University, with a population of 14,529 people. The group does not have permanent land for agricultural activities. So far, they have utilized empty plots in housing complexes, but when the plots were built, they had to move their agricultural activities to other locations permitted by the plot owners. In addition, there has been no effort to utilize open green land through systems such as aquaponics that can provide more optimal results. In order to carry out the community service program, appropriate solutions and strategies were sought to overcome the land limitations faced by KWT Jirak Serumpun. One of the innovative steps taken was to organize training on making a simple aquaponic system for this group.

According to Fatmawati (2018), aquaponics is an alternative that combines plant cultivation and fish rearing in one integrated system. The process involves the utilization of nutrients from fish waste which, if left in the pond, can be toxic to fish. Plants serve as vegetation filters that decompose these harmful substances, making the water used to raise fish safe and oxygenated (Hariono & Chanifuddin, 2021). This cycle creates a win-win relationship for both plants and fish, and is advantageous for

those who implement it as it does not require a large area of land.

Training in simple aquaponics, involving community participation, provides an opportunity to apply this technique practically at minimal cost. The media used can come from used materials, such as mineral water bottles and Styrofoam from food boxes. This aquaponic technique is an attractive solution for farmers or vegetable cultivators, as with little additional capital for growing media, they can utilize this system and increase their income.

Organic farming is now trending again among the public as it is able to minimize production costs and produce products that are free from harmful substances to health. Along with the times, organic farming is no longer limited to using soil as a growing medium, one of which is through the hydroponic method. Hydroponics is a farming method that uses water as a growing medium and source of nutrients for plants. From this method, an innovation emerged that combines hydroponics with fish farming, which both use water as a medium, known as the aquaponic system. Aquaponics is a combination of aquaculture, which is fish farming, and hydroponics, which is the cultivation of plants without the use of soil. This system is considered very efficient because it allows the use of land that is usually only used for aquaculture, can also be used for hydroponics simultaneously in one place.

Based on this background, the objectives of this service are to produce organic vegetables that are good for consumption, minimize capital for entrepreneurs who want to cultivate vegetables, and provide motivation for other business actors to do similar businesses. It is hoped that through this activity, the community can utilize narrow land to carry out two types of cultivation at once in one place, thus creating business opportunities that have good prospects and can improve welfare.

After discussing with the group, the training program on making a simple aquaponic system was implemented by the Jirak Serumpun Women Farmers Group. After the training, they are expected to practice the aquaponic system in their own yard, not only for gardening but also for raising small fish. In addition, this aquaponic system helps the group start a business selling the plants they cultivate, so that it can improve the economy of the community in Kelurahan Mata Air.

EXPERIMENTAL SECTION

Some of the problems identified in this Community Service activity are as follows:

1. Farmers have not been able to utilize the available land to produce fish and vegetables simultaneously.
2. Cultivation technology is still traditional, coupled with the limitations of container making technology, due to farmers' limited capital.
3. Lack of training from the government and universities, and the unavailability of information and technology that can be used as a reference by aquaponic farmers to develop this system.
4. Limited capital at the farm level, due to the increasing needs of daily life. This has an impact on the shrinking of farmers' savings reserves, resulting in limited funds available for investment, including aquaponic development. Savings tend to be used for short-term investments such as the purchase of fish and vegetable seeds.
5. Aquaponic farmers are unable to produce on a large scale because the amount of production is limited by consumer demand. This production limitation is an obstacle in increasing profits from aquaponic businesses.
6. Lack of effective promotion and sales system for aquaponic products.Adapun target luaran dari kegiatan pengabdian ini adalah pemanfaatan lahan sempit untuk mengintegrasikan dua jenis budidaya dalam satu tempat, serta menciptakan peluang usaha yang memiliki prospek baik dan dapat meningkatkan kesejahteraan masyarakat.

Materials

The implementation stage of this service program uses the Participatory Action Research (PAR) method. The PAR method aims to: (1) build awareness and empower the community through a critical education approach, which involves dialog, public discussion, and adult-based learning; and (2) transform the research approach into a process of active participation from the community. This service was carried out from August to October 2024 in Mata Air Village, Padang Selatan Sub-district, Padang City. This program begins with socialization which aims to introduce the service

activities, namely training in making simple aquaponics to the Jirak Serumpun Women Farmers Group. In addition, this program includes plant cultivation through an aquaponic system, processing agricultural cultivation products into local food products, and digital marketing training to improve the ability to market agricultural products with an aquaponic system.

Instrumentation

Preparation of Materials and Making Aquaponics Containers

The materials used in this service activity include kale vegetables as the plant medium in the aquaponic system, and small fish as supporting organisms. The construction of the aquaponic system begins with the construction of a fish holding pond, which is then followed by setting up pumps, timers, and PVC pipes to place plants using the Deep Flow Technique (DFT) method. In the DFT aquaponic system, the function of the filter is crucial, especially the filter to filter solid waste so as not to interfere with plant growth. In addition, biofilters play a role in decomposing impurities that cannot be absorbed by plants.

The pipe used in this aquaponic system should be 2 inches. Maintenance of the filter is simply done by draining it once a week through the drain. It is important to note that the biofilter will work optimally after several weeks of cycling. Once the water circulation system is functioning properly, the fish seedlings can be put into the pond, and the pre-seeded plants that have become seedlings can be placed on the planting pipes. The fish rearing container must have a water drainage system that is able to suck up fish waste and feed residue, which is then channeled into a filter basin that also functions as a place for planting plants. The filtered water then flows back into the fish pond continuously, so that ammonia in the pond can be filtered up to 85% by the plants.

RESULT AND DISCUSSION

Figure 1: Socialization of Simple Aquaponics Making

Based on the pictures presented, the socialization and training activities for making simple aquaponics went well and orderly. The activity began with a socialization session that introduced the concept of simple aquaponics, including the objectives, benefits, and explanation of the tools and materials used, as well as the stages of making an aquaponic system. After the presentation of the material, the activity continued with the practice of making simple aquaponics which was attended by 15 participants.

Figure 2. Aquaponic circuit with kale plants

Based on Figure 2, the results of this simple aquaponics using the Deep Flow Technique (DFT) method. The process of making this system involves several steps, including soaking the kale vegetable seeds overnight. The pipe used should be 2 inches. The maintenance required is simply to drain the filter once a week through the drain. The biofilter in this system will function optimally after cycling for several weeks.

Once the water circulation is running well, fish seedlings can be placed in the pond, while plants that have been sown and become seedlings can be transferred to the planting pipe. The fish pond plays an important role in this aquaponic system because it serves as a place to accommodate fish and water that will be flowed to the plants. The pond can be adjusted according to the land area and environmental conditions, which also affects the length of PVC pipes or plant containers used in hydroponic cultivation.

Aquaponics has the advantage of producing two products at once, namely vegetables and fish, from one production unit. This system is suitable for dry and land-limited areas, and is sustainable with a combination of plant and fish farming. The main benefit of simple aquaponics is the fish waste used as a source of organic fertilizer that is good for plant growth, producing organic products without the use of chemicals. Plants can also be grown at a high density using a floating system, which can accommodate up to 10 times more plants on the same area of land. This system ensures each plant root gets a supply of nutrient-rich water, is easy to maintain, requires no weeding, is free from soil pests, and requires no watering. With proper care, plants can grow faster and be more productive.

CONCLUSION

The aquaponics training for the Jirak Serumpun Women Farmers Group (KWT) in Mata Air Village, Padang Selatan Sub-district, Padang City has had a positive impact on the local community. The training not only focused on providing materials, but also involved hands-on practice by the group in making a simple aquaponic system. After the training, the community's understanding of gardening techniques using simple aquaponics improved significantly. In addition, the training provided economic and social benefits, as well as a solution for the community in utilizing narrow land or yards to be more productive and of high selling value. KWT Jirak Serumpun responded enthusiastically to this activity, and plans to apply the simple aquaponics method using the Deep Flow Technique (DFT) technique, as the manufacturing process is relatively easy and suitable for small spaces.

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