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Catfish and Water Spinach Cultivation Using Aquaponics as an Effort to Meet Household-Scale Food Needs in Nagori Raya Usang Village

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ABSTRACT

Nagori Raya Usang Village is one of the Nagori villages in the Dolog Masagal sub-district, Simalungun Regency, North Sumatra Province. Based on the situation analysis, most village residents' livelihoods are artisans and farmers. The production of water spinach and catfish in Dolog Masagal District is still not optimal, so it is necessary to transfer science and technology in terms of cultivating fish and vegetables using an aquaponic system so that people can start businesses to meet their food needs starting from the household scale. The community service activity was carried out in September – October 2022. The implementation of this activity consists of 3 stages: field survey, outreach, and direct practice in making aquaponics with the community. The community has increased their knowledge and ability by 80% through socialization and direct practice of making aquaponics. The results of this aquaponics can be used for household-scale food consumption for vegetable and fish, or as an alternative additional income for the community.
Keyword: aquaponics, catfish, enviromentally friendly, water spinach

ABSTRAK

Desa Nagori Raya Usang merupakan salah satu nagori yang ada di kecamatan Dolog Masagal, Kabupaten Simalungun, Provinsi Sumatera Utara. Berdasarkan analisis situasi yang dilakukan bahwa mayoritas mata pencaharian warga desa adalah pengrajin dan petani. Produksi tanaman kangkung dan ikan lele di Kecamatan Dolog Masagal masih belum optimal, sehingga perlu dilakukan transfer IPTEK dalam hal budidaya ikan dan sayur dengan sistem aquaponik agar masyarakat dapat memulai usaha pemenuhan kebutuhan pangan mulai dari skala rumah tangga. Kegiatan pengabdian ini dilakukan pada September – Oktober 2022. Adapun pelaksanaan kegiatan ini terdiri dari 3 tahapan, yaitu: survei lapangan, sosialisasi, dan praktek langsung pembuatan aquaponik bersama masyarakat. Melalui sosialisasi dan praktek langsung pembuatan aquaponik, masyarakat semakin meningkat pengetahuan dan kemampuannya dalam melakukan pembuatan aquaponik sebanyak 85%. Hasil dari kegiatan aquaponik itu yaitu masyarakat dapat memenuhi kebutuhan pangan dalam hal sayur dan ikan dalam skala rumah tangga, atau dapat menjadi alternatif pendapatan bagi masyarakat.
Keyword: aquaponik, ikan lele, kangkung, ramah lingkungan

1. Introduction

Nagori Raya Usang Village is one of the Nagori villages in the Dolog Masagal sub-district, Simalungun Regency, North Sumatra Province. Based on the situation analysis that has been carried out, the majority of village residents' livelihoods are bamboo basket artisans and farmers. Based on BPS Simalungun data [1], agricultural commodities produced in Dolog Masagal sub-district are field rice, ginger, turmeric, corn, curly

chilies, cassava, shallots, beans, cayenne peppers, tomatoes, and several plantation commodities. Based on this data, it is known that vegetable and fish production in Dolog Masagal District still needs to be improved.

The human need for food is also increasing every year due to the increase in the human population, while resources in the form of land are limited [2]. Based on data from the Central Statistics Agency [3], Indonesia's population will continue to grow from 2020 to 2022. In 2022, Indonesia's population will be 275,773,800 people, up from 270,203,900 people in 2020.

As an effort to fulfill human needs for food in the form of vegetables and fish in conditions of limited land, the use of yards can be an option to support agricultural development as an effort to achieve small-scale food security, namely the household scale [4]. Efforts to cultivate plants without soil can be made using the aquaponics technique. Aquaponics is a combination of aquaculture and hydroponic techniques in the same system, aiming to optimize the function of water as a fish-rearing and plant-growing medium [5].

Aquaponics, in principle, aims to reuse nutrients from fish waste for plants. In this case, plants can act as vegetation filters because if fish waste and food remain remain in the water for too long, they will become ammonia, which is not suitable for fish, so the supply of dissolved oxygen in the water used to raise fish becomes normal again [6]; [7]; [8]. This aquaponic cultivation system is also environmentally friendly because efforts can be made to save clean water in these two cultivation systems. Therefore, this aquaponics system can be applied on a household scale to fulfill small-scale food requirements.

Cultivating fish and vegetables using aquaponic techniques can be done with several types of fish or vegetables. Various fish cultivated using this aquaponics system include catfish, tilapia, gourami, pomfret, and goldfish. Types of vegetables that can be grown using this aquaponics system include water spinach, spinach, pakchoy, lettuce, and mustard greens. Generally, the types of vegetables cultivated using aquaponics are used for daily consumption and are a family economic commodity [8].

The aquaponics system has various types of fish and vegetables, such as goldfish, tilapia, gourami, catfish, and pomfret. Two types of vegetables are suitable in an aquaponic system, namely leaf vegetables and fruit vegetables. Leaf vegetables include kale, spinach, lettuce, pakchoy, and mustard greens. The types of vegetables that can be applied in an aquaponics system can be used for daily needs and can become a family economic commodity.

Nagori Raya Usang Village is one of the villages in the Dolog Masagal sub-district, Simalungun Regency, North Sumatra Province. Based on the situation analysis conducted, it is found that the majority of residents' livelihoods villages are traditional craftsmanship and farmers. Based on BPS Simalungun data [8] that the production of vegetable and fish crops in the Dolog Masagal District is still not optimal, so it is necessary to transfer science and technology in terms of cultivating vegetables and fish with an aquaponic system so that people can start businesses and meet their food needs starting from the household scale. Aquaponics is very worthy of being introduced to the community because it is considered to be an alternative for improving family nutrition through fulfilling family nutrition from animal and vegetable protein [9]..

2. Methods

This service activity was carried out in September - October 2022 in Nagori Raya Usang Village, Dolog Masagal Sub-district, Simalungun Regency.

The following materials are needed to carry out catfish and water spinach cultivation activities using the aquaponic system: catfish seeds (Clarias sp.), rockwool, water spinach seeds, catfish feed, EM4 Fisheries, and water. And the tools needed include: a knife, a plastic cup, a nursery container, a large 80 L plastic bucket.

This community service activity was carried out in 3 stages: 1) A field survey was carried out to see the problems and potential in Nagori Raya Usang Village. The survey results were then formulated to determine the program that will be implemented to optimize green villages and empower the people of Nagori Raya Usang Village by conducting outreach on cultivating catfish and water spinach using an aquaponic system. 2) This socialization and discussion activity was attended by the target audience, namely the people of Nagori Raya Usang Village. 3) Direct practice in making aquaponics for catfish and water spinach. Evaluation is also carried out through questionnaires with questions and answers directly to the socialization participants.

Figure 1 The Process of making an aquaponic installation.

The steps for making catfish and water spinach aquaponics are as follows: tools and materials are prepared, and rock wool is cut to cup size with a knife and then placed in a nursery container. The nursery container is filled with sufficient water (3/4 part of the bucket). Make a hole in the rock wool that has been cut, then fill it with sufficient water for water spinach seeds. The water spinach seedling media is placed in a dark place for 3 to 4 days until the plumula of the water spinach plant appears. Making a hole in the lid of the bucket for the kale planting medium. Fill the bucket with ¾ of water and then add the catfish seeds. Transfer the seeds of water spinach into the cup. The bucket is closed with the cultivation of water spinach plants on the lid of the bucket. The seeds of catfish were fed 2 times a day, in the morning and evening. The water was checked for a week so that there was no reduction in water in the bucket due to evaporation or transpiration. If there was a reduction, it was added to the bucket according to the initial height. EM4 Fisheries was given to remove odors from catfish culture water. The ratio of giving is as much as 2-3 bottle caps into a bucket. The water spinach can be harvested at the age of 23 days.

Figure 2 Feeding catfish regularly twice a day.

3. Results and Discussion

Field survey activities and implementation preparations were carried out in September 2022. Socialization activities and direct practice of making aquaponics were carried out on October 1 and 17, 2022. Based on the results of this service implementation activity, it is known that the number of people who attended the socialization and direct practice of making catfish aquaponics and kale as many as 26 people. This activity was carried out twice in two hamlets in Nagori Raya Usang Village, and was accompanied by six tutors. It is known that the people who took part in the event were enthusiastic and participative in both the discussion sessions and direct practice and were willing to cultivate catfish and water spinach using aquaponics in their own homes. Based on the results of a questionnaire conducted by asking questions and answers to the socialization participants, it was discovered that 100% of the public did not know about aquaponics, and 80% of the public had increased their knowledge and skills about aquaponics after the socialization was held.

The activity of learning about aquaponics doesn't end with just socializing and practicing the aquaponics technique. The tutors provide assistance to individuals who are interested in starting their own aquaponics practice at home. In particular, the dedication team provided a design for an aquaponic tool that had been made by tutors at Nagori Raya Usang primary school. Aquaponics can be easily done at home since the necessary tools and materials are readily available.

An innovative aquaponic fish farming method in buckets, also known as "budikdamber," has been introduced to the public. To maintain the circulation system of aquaponics, water is added to the bucket whenever the level decreases. Plant and fish cultivation activities using this system are environmentally friendly and promote water conservation. By cultivating fish and water spinach in the same container, clean water can be saved. This aligns with the view of Asni et al. [10] that aquaponics is a viable solution to reducing water pollution caused by fish farming and minimizing water usage in aquaculture systems. The amount of water saved in this system can be as high as 97% [11]. Shobihah [12] has noted that the use of various construction methods in the aquaponic system has a positive impact on fish survival, with an average rate of above 80%, and the specific growth rate of fish ranges from 0.89% to 3.31%.

The growth of kale plants cultivated using the aquaponics system can grow well and normally. Good water spinach growth in aquaponic cultivation can occur due to the plant's reuse of nutrients from leftover food and fish waste. Water spinach plants in an aquaponic system can reduce ammonia levels in pond water to nitrate and use it for plant growth with the help of Nitrobacter [13]; [14]; [15]. The results of this aquaponics can be used for household-scale food consumption or as an alternative additional income for the community.

4. Conclusions

Aquaponics is considered environmentally friendly because it can save clean water in two cultivation systems, namely catfish and water spinach. The results of the transfer of science and technology in the form of socialization and practice of cultivating vegetables and fish using the aquaponic method can increase community knowledge and skills by 85%, compared to when no community previously knew about aquaponic cultivation. The results of cultivating vegetables and fish using the aquaponics method can help meet the needs for vegetable and fish consumption on a household scale. They can be an alternative income source for the community.

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