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INTEGRATED FISH FARMING AS A PROTEIN SOURCES FOR FAMILIES (A REVIEW)

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ABSTRACT

Directing the community at the household level to independently generate protein by exploiting the backyard at home is one of the efforts that can be made to maintain optimal nutritional intake for families and toddlers. One alternative for obtaining a self-sufficient supply of animal and vegetable protein for the family is to engage in integrated fish farming. Integrated farming with fish cultivation in buckets is a way of growing fish in a container (bucket shaped) while also growing vegetables. This method is not only space-saving, but it also saves electricity and is environmentally good as it does not require additional fertilizer throughout its upkeep.

INTRODUCTION

We have lived a pandemic for almost two years, and suddenly changed the order and habits of people's lives. Some basic behaviors must be changed to comply with health protocols, in order to suppress the spread of the virus. Including in the provision of food for families, there have been fundamental changes due to the pandemic: 1) limited distribution due to regional restrictions, and 2) prices soaring due to decreased supply. This causes the burden of providing healthy food for families to become heavier, especially for housewives. On the other hand, the problem of the availability of aquaculture land, the increasingly limited water for fishery activities can be overcome with the help of technology. The decreasing number of large cultivation locations requires us to be more creative in utilizing narrow locations and in saving cultivation water [1]. In the agricultural sector, in particular, the Covid-19 pandemic has caused a decrease in food production by 6.2%. Focusing on the problem of food sufficiency and agricultural production, there is one solution offered, namely to restore the pattern of subsistence agriculture. An agricultural pattern whose main goal is to meet the family's food needs independently by family members [2].

One of the efforts that can be done to maintain good nutritional intake for families and toddlers is to direct the community at the household level to independently provide protein, by utilizing the yard at home. Integrated fish farming is one of the options to get an independent supply of animal and vegetable protein for the family. This mini aquaponics model integrates fish and vegetable cultivation at the same time on limited land [3]. Integrated farming by means of fish cultivation in buckets, is a method of cultivating fish that is synergized with vegetable crops which is carried out in a container in the form of a bucket. The principle of implementing this method is the same as Aquaponics, which synergizes the cultivation of plants and fish in one container, however this method is carried out in a smaller container (bucket), so that it is efficient when placed in a narrow area. Besides being space efficient, this method also saves electrical energy and is environmentally friendly because it does not require additional fertilizer during its maintenance.

Integrated fish farming in buckets is a potential solution for aquaculture in a narrow area with a more efficient use of water, easy for people to do in their respective homes with relatively small capital and finally able to meet the nutritional needs of the community [1]. This method is suitable for use during this pandemic. The advantages or strengths of this method have is that it does not require large land, large finance capital, it is not difficult to find the tools and materials needed and it is easy to perform locally. In addition, the farmes

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will get some benefit (profits). First, the opportunity to fulfill nutrition and family food security and creating new business opportunities in the midst of the Covid-19 pandemic [4]. The target of this method is that it can become a fish farming system for family food consumption purposes and is very suitable and environmentally friendly for the community, and becomes a business opportunity for the community [5].

Figure 1. Unit of Fish cultivation in a bucket

IMPORTANT FACTORS IN INTEGRATED FARMING

Type, Source and Density of Fish

Not all types of fish are suitable for cultivation in this integrated farming system. Due to the limited space capacity, the fish that are suitable for cultivation in such methode are fish that do not have scales and do not require much oxygen in the water, such as Clarias catfish, Pangasius catfish and Snakehead. Fish with scales and sharp fins have the potential to injure each other in a confined space, increasing their mortality rate. Meanwhile, the use of catfish (such as *Clarias* sp.) is safer because it allows it to be used in high density due to its body is protected by mucus. The mucus will protect the fish's body because it reduces friction with each other so that the fish are free from friction wounds. [6], [7]. In addition to the type, the health of the fish used is also a prerequisite for success in cultivation of this method. Healthy fish can be purchased at a trusted place, such as the local Fish Seed Center, and have characteristics such as: bright shiny color, no white spots, agile movements and perfect body shape. In one bucket with a volume of 78 liters filled with water as high as 50 cm or as much as 60 liters of water, 60 catfish seeds can be filled [1].

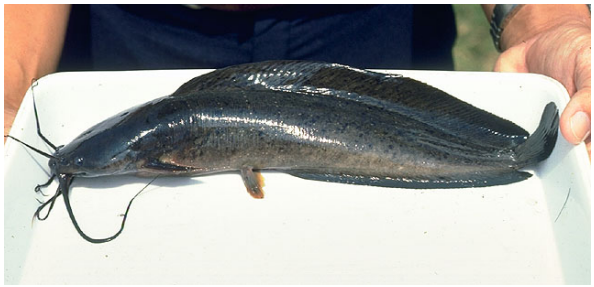

Figure 2. *Clarias batrachus*[1]

Figure 3. *Pangasius hypophthalmus*[2]

[1] https://www.fishbase.de/FieldGuide/FieldGuideSummary.php?genusname=Clarias&speciesname=batrachus&c_code=050
[2] http://bbppkupang.bppsdmp.pertanian.go.id/blog/post/memahami-kebiasaan-makan-ikan-patin

Figure 4. *Channa striata*[3]

Plant Type

Basically all plants can be used in this integrated farming activities, but several studies have shown that vegetable crops such as lettuce, kangkong (water spinach), pakcoy and mustard have good growth when planted in this methods. Apart from being a plant commodity in this method, water spinach can also functions as a biofilter that functions to absorb nitrogen in the form of ammonium so that nitrogen in the water will be reduced. The more and bigger the kale is used, the more effective it is in reducing ammonia [8]. The root structure of these plants is in the form of fine fibers, so that they are able to filter out the nutrients contained in the cultivation media. In turn, this relates to the provision of organic fertilizer derived from fish feces, which helps provide nutrients for plants.

Figure 5. Lettuce[4]

Figure 6. Water spinach[5]

[3] https://www.nytimes.com/2019/10/10/us/snakehead-fish-georgia.html
[4] https://bisnisukm.com/budidaya-selada-hidroponik-sederhana-dan-menguntungkan-buat-dicoba.html
[5] https://www.prosehat.com/artikel/artikelkesehatan/manfaat-dan-bahaya-mengonsumsi-kangkung

Figure 7. Pakcoy[6]

Feeding

The amount of feed in this integrated farming system must be regulated because the remaining feed that is not eaten by fish will rot and cause a decrease in water quality. Adequate feed is given 2-3 times a day with an amount of 3-4% of the total weight of fish in this method. During feeding pay attention to the response of the fish to the feed. If the fish is not responding to the feed, stop feeding. The feed given to fish in this integratef farming system can also utilize household organic waste that has been fermented first.

Figure 8. Fish feeding integrated with water spinach farming[7]

Water Quality

Water quality parameters are important profiles in describing the environmental conditions of a waters, especially the aquaculture environment. The need for good water quality in intensive fish farming requires an environmentally friendly technology based so that the organic matter is low in the maintenance media and the waste is wasted into public waters [1]. The role of water quality in integrated farming system is crucial, because the volume of water used is very limited. Maintenance of water quality can be maintained by changing water by 20-30% periodically so that the water is in good condition for fish. Oxygen plays an important role as an indicator of water quality, because dissolved oxygen plays a role in the oxidation and reduction of organic and inorganic compounds [8]. Temperature fluctuations occur in the cultivation of this methodif the bucket is placed in an open location (outdoor) which would be influenced by environmental temperature, both rain and heat from the sun. An increase in temperature can cause a decrease in oxygen content so that oxygen intake decreases and can cause stress to fish. The right temperature will increase the activity of eating fish so that the fish grow faster. An increase in temperature can also result in an increase in the toxicity of a pollutant to aquatic organisms [1].

Changes in pH are determined by photosynthetic and respiratory activities in the ecosystem. Photosynthesis requires carbon dioxide which by autotroph components will be converted into monosaccharides. The decrease in carbon dioxide in the ecosystem will increase the pH of the waters. On the other hand, the respiration process in the ecosystem will increase the amount of carbon dioxide so that the pH of the water decreases [1]. The use of probiotics is highly recommended, especially to reduce odors, as well as suppress pathogenic microbes that have the potential to cause disease in fish. The recommended dose is 1 ml/liter of water. The recommended water quality for this method is as follows:

Table 1. Recommended water quality for integrated farming system

No.	Parameters	Measurement Results
1.	Temperature	23-32^{o}C
2.	Dissolved oxygen	2-6 ppm
3.	pH	6.68-6.97

[6] https://www.grid.id/read/042576371/9-manfaat-pakcoy-untuk-kesehatan-menyehatkan-kulit-hingga-meningkatkan-kekebalan-tubuh?page=all
[7] https://kabarbanten.pikiran-rakyat.com/seputar-banten/pr-591431733/mengenal-budikdamber-usaha-perikanan-yang-digrandungi-milenial-pandeglang

4.	NH_3/NH_4	0 – 0.5 ppm
5.	NO_2	0 – 0.5 ppm
6.	NO_3	0 – 0.5 ppm

Source: [1]

Conclusion

Based on the results of a literature search, it can be concluded that the integrated farming system has great potential to provide protein sources for families. However, there are several important factors to be considered of, such as water quality, feeds, plant type, fish type, sources and density.

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