Original Research Article

Productivity Analysis of Tilapia Farming in Pond (Case Study in Lengkong Kulon Village Sindangwangi District Majalengka Regency)

ABSTRACT

This research aims to analyze the productivity of tilapia aquaculture in Lengkong Kulon Village. The research was carried out from January 2023 to March 2023 in Lengkong Kulon Village, Sindangwangi District, Majalengka Regency. The method used is the survey method. Sampling using the purposive sampling technique was analyzed with quantitative descriptive. The total sample of farmers was 30 respondents. Tilapia Farming in Lengkong Kulon Village has not been maximal in applying good fish farming methods principles, based on 17 good fish farming methods suitability criteria there are 9 suitable criteria and 8 inappropriate criteria. The average value of productivity in the land area obtained is 7,52 Kg/year/m^2. This value is still low, so it is necessary to increase productivity by improving the quality of seeds and feed according to good fish farming methods principles.

Keywords: Productivity, Aquaculture, Tilapia

1. INTRODUCTION

Tilapia (*Oreochromis niloticus*) is a freshwater fish that is widely farmed in Indonesia. The mono sex culture of tilapia is one of the export commodities. FAO (Food and Agriculture Organization) places tilapia in third place after shrimp and salmon as a successful example of world aquaculture. Tilapia is a freshwater fish that has high economic value, has a high protein content of 43,76%, and has the advantage of growing rapidly [1].

Sindangwangi District is one of the Districts in Majalengka Regency which has the potential in the field of freshwater fish farming, namely tilapia. Based on data In 2021, Majalengka Regency has tilapia production of 4.049,03 tons/year from a total of 27 Districts. Sindangwangi District is the District with the highest tilapia production in Majalengka Regency. Sindangwangi District contributed 598.99 tons/year to the cultivation of 562,25 still water ponds, 17,59 tons/year of paddy fields/mina paddy, 2,70 tons/year, and 16,45 tons/year [2]. From these data, it can be concluded that Sindangwangi District is a potential center for tilapia aquaculture in Majalengka Regency.

Lengkong Kulon Village is one of the villages in Sindangwangi District where the community has a freshwater fish farming business, one of which is tilapia farming. According to 2021, Lengkong Kulon Village has a tilapia production of 60,80 tons/year, with tilapia being the highest production compared to carp as much as 30,00 tons/year, pomfret 19,85 tons/year and catfish 12,75 tons/year [3]. The data shows that Lengkong Kulon Village has the potential for the development of a tilapia farming business.

The community in Lengkong Kulon Village has been doing tilapia farming for a long time, but there has been no research on the productivity of tilapia cultivation in Lengkong Kulon Village. Therefore it is important to research the analysis of the productivity of tilapia aquaculture in Lengkong Kulon Village, Sindangwangi District, Majalengka Regency. This research is expected to be used as a source of insight for the government to increase the amount of tilapia production continuously.

2. METHODS

2.1 Time and Place

This research is located in Lengkong Kulon Village, Sindangwangi District, Majalengka Regency, West Java Province. This research was conducted in January–March 2023.

2.2 Research Methods

The method used in this research is the survey method. The types of data used in this research are primary data and secondary data. Primary data in this study were obtained from interviews with the help of questionnaires. Interviews were conducted with tilapia farmers spread across the study area randomly using a prepared questionnaire. Secondary data came from Lengkong Kulon Village in the form of Lengkong Kulon Village Monographs and data from the Agriculture and Fisheries Service of Majalengka Regency in the form of tilapia production in the sub-district of Majalengka Regency.

2.3 Sampling Technique

The respondent collection technique used in this study was a purposive sampling technique. Purposive sampling is a sampling technique for data sources with certain criteria [4] This criterion can also provide reasons for using a certain number of samples in a study. The sample criteria used in this study are:
1. Tilapia Farmers who live in Lengkong Kulon Village
2. Tilapia Farmers with at least 5 years of business experience
3. Fish farming community who are willing to be interviewed.

2.4 Data Analysis

The data analysis used is quantitative descriptive analysis. Quantitative analysis was used to describe the characteristics of farmers, general conditions, and productivity of tilapia farming in Lengkong Kulon Village, Sindangwangi District, Majalengka Regency. Data obtained from questionnaires and interviews were processed using numbers to facilitate the analysis process. Quantitative data are presented in tabular form and then analyzed descriptively. Productivity analysis is seen from the difference between the amount of expenditure and input expressed in common units [5]. Productivity analysis uses the following formula:

$$\text{Productivity (Kg/year/m}^2\text{)} = \frac{\Sigma Production\,(Kg/year)}{\Sigma Land\,area\,(m^2)}$$

3. RESULTS AND DISCUSSION

3.1 Characteristics of Respondents

The total number of respondents was 30 people, the respondents were dominated by male farmers, namely 97% or as many as 29 people. This is because men have the responsibility to make a living by doing fish farming. Fish farmers in Lengkong Kulon Village still think that the work of caring for and farming fish is classified as hard work so fish farming is only appropriate for men.

Characteristics of fish farmers in Lengkong Kulon Village have ages ranging from 25-92 years. A total of 20 people with a percentage of 67% were aged 15-64 years. This means that most of the respondents are in the productive age. The age level of fish farmers affects their productivity in managing the aquaculture business. Productive age indicates that they have good physical and mental abilities and have great potential in developing cultivation businesses [6].

The education level of most of the respondents had graduated elementary school, namely 14 people with a percentage of 46%. Farmer's education is in a low category, namely education taken ≤6 years. In general, farmers get fish farming skills based on experience. Educational level is one of the most important social aspects for fish farmers because it influences technology adoption if the education level is low it is difficult to accept new technology [7].

The characteristics of fish farmer respondents in Lengong Kulon Village generally have a moderate work experience ranging from 5-10 years, namely 19 people with a percentage of 63%. This indicates that the respondent has been doing this work for a long time so they already have the skills to carry out farming activities. Work experience is very close to the skills they have, the longer they try to study in a business field, the higher the skills they will have [8].

3.2 General Conditions of Tilapia Farming

3.2.1 Land area

The area of land for farming activities owned by the majority of respondents is less than 1000 m^2 with 90% or 27 respondents and there are 3% or one person who has a tilapia farming area of more than 2000 m^2 which is about 2 hectares. The farming area of <1000 m^2 is included in the micro category [6]. The area of cultivation land will affect the production results produced. The detailed land area can be seen in Table 1.

Table 1. Tilapia Farming Land Area in Lengkong Kulon Village

Land Area (m^2)	Frequency	Percentage (%)
<1000	27	90
1000–2000	2	7
>2000	1	3
Total	30	100

3.2.2 Seed Source

Most of the farmers, 80% of 24 respondents, bought seeds from other farmers at a price of around IDR 30.000/kilogram, and 17% of 5 respondents bought seeds from collectors for

IDR 35.000/kilogram with a content of around 100 heads of seed. As much as 3% or one respondent bought from the People's Hatchery Unit in the area, namely the Mina Cikole People's Hatchery Unit at a lower price of IDR 100/head. However, the tilapia seeds at UPR Mina Cikole are of poor quality, so farmers prefer to buy seeds from other places. Poor seed quality affects production yields and the selling price of fish.

3.2.3 Feed source

Farmers usually buy feed in the form of pellets from agents or collectors. Several brands of pellets used are Hi Pro-Vite 781-3, Sidole 88, and Turbo Feed T79-2P. The price of pellets also differs depending on the protein content in them, the higher the protein content, the more expensive the feed will be. Hi Pro-Vite 781 pellets are produced by PT. CV Prima has a protein content of 31–33%, 4–6% fat, 3–5% fiber, and 9–10% water content and costs IDR 385.000/sack containing 30 kilograms. As for farmers who cannot afford to buy feed for a sack, they usually buy retail feed at shops or kiosks, namely feed with the Hi Pro-Vite 781 brand for IDR14.000/kilogram. When unable to buy pelleted feed, farmers only use natural feed from plants or are not given feed.

3.2.4 Total production

Tilapia farming in Lengkong Kulon Village in a cycle lasts for 3-4 months. Most of the farmers, as much as 53% or 16 respondents, get a production of around 200-500 Kg/m^2/cycle, and as many as 4% or 4 respondents get a production of more than 1000 Kg/m^2/cycle, as in one of the respondents with a land area of 2 hectares. production reached 14300 kg or 14.3 tonnes/m2/cycle. The average weight of the fish produced is 300–500 grams/fish. These results indicate that the wider the farmland owned, the greater the production results obtained. The total production of tilapia aquaculture in Lengkong Kulon Village can be seen in Table 2.

Table 2. Tilapia Production in Lengkong Kulon Village

Total Production in a cycle (kg)	Frequency	Percentage (%)
200-500	16	53
600-1000	10	33
>1000	4	13
Total	30	100

3.2.5 Selling Price of Fish

Tilapia fish of consumption size are sold to collectors at prices ranging from IDR18.000 to IDR25.000/kilogram. The farmer will contact the collector if the fish is ready to be harvested. Selling production through collectors is considered more practical even though the price is set by the collectors and the farmers often complain. farmers in Lengong Kulon Village generally do not have workers because they carry out their own fish farming business, workers are needed only for pond repairs.

3.3 Tilapia Farming Techniques

Technical aspects of tilapia farming based on interviews with respondents include pond preparation, enlargement and maintenance, harvesting, and good fish farming methods assessment.

3.3.1 Pond preparation

The pond used for the tilapia culture in this research is a permanent pond with an earthen bottom while the four sides are made of concrete. Pond preparation includes drying, liming, and irrigation. Pond drying is carried out for 7 days until the soil looks cracked. After drying, calcification is carried out using dolomite lime which is spread over the entire bottom of the pond. After the liming process, then fill it with water with a height of about 30-40 cm, and leave it for about 7 days so that natural food can grow.

3.3.2 maintenance

Tilapia enlargement business activities are rearing fish from seeds for several months until they are consumption size or ready for harvest. The tilapia seeds that were spread in rearing ponds ranged from 5–7 cm. The amount of seed stocking in Lengkong Kulon Village for each pond ranged from 50–100 fish/m^2. The sowing of seeds in Lengkong Kulon Village is usually done in the morning or evening.

One of the main factors in fish maintenance is feeding. The frequency of feeding is done 2 times a day in the morning at 07.30 and in the evening at 16.00. The feed given is in the form of Hi Pro-Vite 781 pellets produced by PT. CP Prime. The Food Conversion Ratio for growing tilapia is 1:1,2. This means that for every 1 kg of consumption-size tilapia meat, 1,2 kg of feed (pellets) is required. According to theory, the feed conversion for rearing tilapia ranges from 1,11–1,12 which is good because the feed given can be utilized by the fish for maximum weight growth [9]. The crude protein content of Hi Pro-Vite 781 pellets ranges from 31–33%. The protein content of tilapia feed based on Indonesian National Standard 01-7242-2006 is at least 25%. According to theory, the protein requirement for tilapia for optimal growth ranges from 28–35%[10].

3.3.3 Harvest

Fish are harvested after 3–4 months of maintenance or after tilapia reach consumption size. The average weight of fish can reach 2-3 fish/kilogram or around 250-500 grams/head. The harvesting tools used are scales, scoops, and jerry cans. Harvesting in Lengkong Kulon Village is usually carried out by collectors. The first harvest process is by gradually reducing the pool water first. Fish are caught using a scoop. Fish that have been caught are put into jerry cans. Fish are weighed with wet weight and then transported in jerry cans.

3.3.4 Good Fish Farming Methods

According to the Decree of the Minister of Maritime Affairs and Fisheries of the Republic of Indonesia Number KEP.02/MEN/2007 concerning good fish farming methods, several criteria must be considered in fish farming. These requirements consist of 17 (seventeen) assessment criteria, including location suitability, water sources, layout, equipment, containers, seeds, stocking density, feed, health management, water management, site and facility cleanliness, harvest, waste management, environmental management, workers, training and documentation [11].
The good fish farming methods assessment of tilapia enlargement farming is an attempt to find out the farming pattern in Lengkong Kulon Village by applying good fish farming methods principles. This good fish farming methods assessment is a reference for the

success of tilapia farming in Lengkong Kulon Village. Good fish farming methods suitability assessment of tilapia aquaculture business activities in Lengkong Kulon Village can be seen in Table 3.

Table 3. Good Fish Farming Methods Conformity Assessment of Tilapia Farming in Lengkong Kulon Village

Assessment Aspects	Rating result		Explanation
	Appropriate	Inappropriate	
Location	√		Environmental conditions comply with food safety and are free from contamination
Water sources	√		Water is available all year round and free from pollution
Design and Layout	√		Pond construction is suitable for pond-farming containers
Equipment	√		Equipment does not cause contamination to the fish and is kept in a hygienic condition
Container Preparation	√		Container preparation is managed properly and correctly according to environmental conditions
Seed		√	The seeds are not good fish hatchery method certified
Species Selection and Stocking Density		√	The stocking density did not meet the Indonesian National Standard [12]
Feed	√		Registered, labeled feed and feed free of hazardous materials
Health Management		√	There is no special container for quarantine sick fish and no commercial fish medicine is used
Water Management		√	Water quality parameters are not measured periodically and there is no water filtration
Cleanliness of Location and Facilities	√		Facilities and locations are kept clean and free from contamination

Assessment	Rating result		Explanation
Harvest and Post Harvest	√		Harvesting is carried out in a clean condition and does not cause physical damage
Waste Management		√	Waste is discharged directly into the sewer without going through a sanitation process
Management of the environment		√	Have not carried out environmental management by applicable regulations
Workers	√		workers who handle harvest and post-harvest are in good health
Training		√	Farmers have not received socialization and understand Good Hygiene Practices (GHP)
Documentation		√	Farmers do not document, only based on assumptions

Based on the table above, it is known that the good fish farming methods of fish farmers in Lengkong Kulon Village. Appropriate criteria include location, water sources, design and layout, equipment, container preparation, feed, site and facility cleanliness, harvest and post-harvest, and workers. While several criteria are not suitable, including seeds, species selection and stocking density, health management, water management, waste management, environmental management, training, and documentation.

In the location assessment, Lengkong Kulon Village is a village with great potential for the development of freshwater fish farming. The location which is at the foot of the mountain makes Lengkong Kulon Village rich in mineral resources. Lengkong Kulon Village is a hilly area so its natural elements are still preserved. The location factor also has an effect due to the presence of natural food sources in the form of snails, green plants, earthworms, etc.

Assessment of water sources, irrigation which comes from natural springs from the foot of Mount Ciremai makes the water supply abundant throughout the year. The abundance of water sources and good drainage makes Lengkong Kulon Village a potential area for developing freshwater fish farming. The water supply runs well in the dry season and the rainy season.

Assessment The design and layout of the pond are designed to support the growth of the fish being farmed. Water channels utilize irrigation channels that are arranged in such a way that water use is efficient. The seeds used are not good fish hatchery method certified. The stocking of seeds was not appropriate because the stocking density did not comply with the Indonesian National Standard 6495:2011, but one indicator was fulfilled, namely temperature acclimatization beforehand so that the fish seeds were not stressed and reduced the mortality rate of the seeds.

The preparation of the container is by good fish farming methods because the bottom of the pond is drained first so that the pond is free from pathogenic organisms. Liming is done using dolomite lime according to the procedure. The pond is equipped with inlet water filters to prevent the entry of parasites, pests, or predators. Feed assessment is appropriate because it utilizes pellet feed from factories and natural feed. Artificial feed or pellets are widely available in kiosks and collectors. Natural food as an alternative feed is obtained from the garden area and rice fields around the pond. However, there are still farmers who use feed from household waste. This affects production yields and production costs are not fully known.

Health management is not by good fish farming methods because there is no pond to quarantine sick fish. The use of chemicals, biology, and fish medicine is still underused in the fish farming process in Lengkong Kulon Village. The use of probiotics is only carried out by some farmers according to needs. Water management is not periodically controlled and there is no filtration. Water quality cannot be well-known for fish farming.

The assessment of waste disposal is not by good fish farming methods because the waste is disposed of directly into the sewer without going through a sanitation process. Documentation evaluation is not carried out routinely in a production cycle or on a time scale, so it is difficult to know the amount of profit or total cost. Only a few farmers record the time of purchasing feed and the feeding schedule through notes or a small book. Corrective action is carried out only through the process of subjective observation of the farmer. The amount of repair costs are not included in the calculation, causing an economic anomaly in the event of damage.

3.4 Tilapia Aquaculture Productivity

The purpose of fish farming business activities is to produce products to gain profits for fish farmers. The production result in the tilapia farming business is in the form of the number of tilapia fish that grow successfully in one harvest cycle. Productivity is the ratio between the output produced in a business to the number of inputs used during the production process within a certain period [13]. Data on average production, land area, and productivity in the unit area in Lengkong Kulon Village can be seen in Table 4.

Table 4. Tilapia aquaculture productivity in Lengkong Kulon Village

Description	Value
Average Production of one Maintenance Season (Kg)	1.301,67
Average Total Production in a Year (Kg/th)	3.905,00
Average Land Area (m^2)	1.051,47
Average Productivity in Land Area (Kg/th/m^2)	7,52

Based on Table 4. The average production value of one maintenance season is 1.301,67 Kg. The average total production in a year is 3.905 kg/year. The average land area is 1.051,47 m^2. The average value of productivity in the unit area obtained is 7,52 Kg/year/m^2.

The average value of productivity in the land area obtained is 7,52 Kg/year/m^2. This means that tilapia growers in the pond system in Lengong Kulon Village will get 7.52 kg of total harvest from every 1,00 m^2 of pond area they own. These results are considered low when compared to research on tilapia enlargement productivity in Lake Toba Floating Net

Karamba (KJA), Pangururan District, Samosir Regency, showing a productivity level of tilapia of 17,2 Kg/m^3/year [14]. The high productivity of rearing tilapia in the floating net cage system is due to the high stocking density and effective use of cultivation land.
The low productivity of tilapia aquaculture enlargement in Lengkong Kulon Village is due to the influence of the implementation of good fish farming methods principles which has not been maximized. Seeds that are of poor quality and not certified as well as feeding that is not by the rules can affect the productivity of tilapia cultivation in Lengkong Kulon Village. Increasing productivity can be done by continuously improving the quality of seeds and feed. Improving seed quality can be done by developing new strains of farmed fish. Improving feed quality can be done by increasing the feed conversion ratio to fish weight [15].

4. CONCLUSION

Farmers have not maximized the application of good fish farming methods principles, based on 17 good fish farming methods conformity criteria, there are 9 suitable criteria and 8 inappropriate criteria. The average value of productivity in the land area obtained is 7,52 Kg/year/m^2. This value is still low, so it is necessary to increase productivity by increasing the quality of seeds and feed.

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