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FEASIBILITY STUDY OF THE LOCATION AND CULTIVATION OF TILAPIA AT KADEN FARM, BABAKAN PANJANG VILAGE, SUKABUMI DISTRICT

Studi Kelayakan Lokasi Dan Budidaya Ikan Nila di Kaden Farm, Desa Babakan Panjang, Kecamatan Nagrak, Kabupaten Sukabumi

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ABSTRACT

Selecting an optimal aquacultural site can enhance feed efficiency and diminish production costs. Tilapia cultivated in an optimal environment will more readily digest feed and utilize nutrients. This research was conducted through field observations, including soil sampling, water quality measurements, and production performance assessments. The results of the soil texture analysis performed on the two ponds at Kaden Farm indicated that the proportion of sand ranged between 17–18%, dust 42–43%, and clay 40–42%. The water quality was 'slightly suitable,' with a suitability index of 66.67% for Pond 1 and 71.01% for Pond 2. The production performance of the tilapia, as indicated by the survival rate reached 70%, the relative growth rate was 0.017 g/day, and the specific growth rate reached 14.62%. Cultivating tilapia at Kaden Farm in terms of pond media in the form of soil is feasible for cultivation. The results indicate that water quality is slightly below the expected standards. The tilapia production at Kaden Farm is feasible based on the observed survival, relative growth rate, and specific growth rate.

Keywords: Water Quality Aspects, Pond Media Aspects, Tilapia, Site and Cultivation Feasibility Study

ABSTRAK

Pemilihan lokasi budidaya yang tepat dapat meningkatkan efisiensi pakan dan menekan biaya produksi. Ikan nila yang dibudidayakan di lingkungan yang ideal akan lebih mudah mencerna pakan dan memanfaatkan nutrisi. Penelitian ini dilakukan melalui observasi lapang meliputi pengambilan sampel tanah, pengukuran kualitas air, dan kinerja produksi. Berdasarkan hasil analisis tekstur tanah di kedua kolam Kaden Farm berupa liat berdebu, proporsi pasir berkisar antara 17–18%, debu antara 42–43%, dan liat antara 40–42%. Kualitas air masuk ke dalam kategori "Sedikit Sesuai", dengan indeks kesesuaian sebesar 66,67% untuk Kolam 1 dan 71,01% untuk Kolam 2. Kinerja produksi berupa sintasan pemeliharaan ikan nila mencapai 70%, laju pertumbuhan relatif sebesar 0,017 g/hari dan laju pertumbuhan spesifik mencapai 14,62%. Kelayakan lokasi dan budidaya ikan nila di kaden farm ditinjau dari aspek media kolam berupa tanah sudah layak untuk melakukan budidaya, sedangkan pada aspek kualitas air sedikit sesuai dengan standar baku mutu yang diharapkan, dan pada aspek produksi ikan nila pada Kaden Farm cukup layak yang ditinjau berdasarkan sintasan, laju pertumbuhan relatif, dan laju pertumbuhan spesifik.

Kata Kunci: Aspek Kualitas Air, Aspek Media Kolam, Ikan Nila, Studi Kelayakan Lokasi Dan Budidaya

INTRODUCTION

Babakan Panjang Village is an area located in Nagrak District, Sukabumi Regency, West Java. This village has good fisheries potential with the types of fish cultivated in this village, including tilapia, gold, and catfish with tilapia consumption in Sukabumi Regency quite high, reaching 10 kg per capita per year (BPS Sukabumi Regency, 2020). This shows that there is a great market opportunity for tilapia farmers in Babakan Panjang Village (Supriatna, 2023).

Oreochromis niloticus tilapia is a prima donna in aquaculture because it has many advantages over other types of fish. Its advantage lies in its relatively short harvest time, allowing cultivators to make a profit in a faster time. In addition, tilapia is able to adapt to various environmental conditions and is easy to breed (Gunadi et al., 2016). Choosing the right fish farming location is the main key to achieving the success of this fish farming business.

An important aspect to consider in site selection is water and soil quality. Good water and soil quality will support optimal fish growth and health. Clean and oxygen-rich water, as well as fertile soil with adequate nutrients will help fish develop properly (Boyd, 2014; Lupatsch & Kissil, 2018). Good water quality for tilapia cultivation includes water temperature between 25–30°C, water pH value between 7–8, and DO levels above 5 mg/L (Boyd, 2014; Wijaya, 2022). The ideal soil texture for tilapia cultivation is sandy loam and fertile soil (Suyanto, 2016; Putrianti, 2021). If these location conditions are met, it can increase crop yields and the quality of fishery products (Masser & Bridger, 2019). On the other hand, a sub-ideal environment, such as polluted water or nutrient-deficient soil, can increase the risk of disease in fish. Pathogens and parasites can multiply easily under suboptimal conditions, endangering fish health and resulting in economic losses for farmers (Rakocy & Hargeaves, 2018).

Choosing the right cultivation location can also improve feed efficiency and reduce production costs. Fish farmed in an ideal environment will be easier to digest feed and utilize nutrients, resulting in less feed needs and faster growth. This can save feed costs and increase profits for cultivators. So that a study on the feasibility of the location and technical evaluation of tilapia cultivation in Babakan Panjang Village needs to be carried out for the selection of the right location.

RESEARCH METHODS

Place and Time

This research was conducted in August – November 2023. The address of the research location is at Kaden Farm RT 001/RW 002, Babakan Panjang Village, Nagrak District, Sukabumi Regency.

Tools and Material

The tools used in this study include a fish tank with a size of p x l x t of 6 m x 2 m x 1 m, fish tank (larva), fish tank (seed), sorting bucket, harvest bucket, large basin, 5 kg digital scale, 200 L drum, mining rope and bamboo. The ingredients used are parent feed, fish feed (pellets and powder), herbal feed ingredients, booster antibiotics, natural feed culture materials, dolomite lime 50 kg and krosok salt 50 kg.

Procedure

Soil Test

The soil test began with soil sampling using a biopore soil drill with a depth of 50 cm. The soil samples obtained were then analyzed descriptively based on the millar triangle to find out the physical description of the soil texture shown in Figure 1. (Muliani et al., 2021). The texture of the soil can be grouped based on the percentage of dust, clay, or sand grains obtained from the test results.

Figure 1. Millar triangle (Muliani *et al., 2021*)

Water Quality Test

Water quality test activities are carried out by taking water from 3 parts of the pond that will be used for cultivation, namely the inlet, outlet, and the middle of the pond. Water quality measurements carried out directly (in situ) include temperature, pH, dissolved oxygen (DO), TAN, nitrites, and nitrates. Indirect observations (ex situ) including total dissolved solids (TDS), total suspended solids (TSS), turbidity, iron, chemical oxygen demand (COD), and alkalinity were analyzed at the Sukabumi Freshwater Aquaculture Fisheries Center. Water sampling is carried out in ponds that will be used for fish farming.

Water quality data was analyzed using the scoring method, which gives different weights to each parameter (Hidayah & Marion 2019). Weighting is determined based on the magnitude or smallness of the influence of these parameters on the feasibility of fish farming. The greater the influence, the higher the weight is given. The table of scoring and weighting instruments refers to Nurchayati et al., (2021) which is categorized with numbers 1 (not good), 2 (good), and 3 (very good), the table is shown in Table 1.

Table 1. Scoring and weighting instruments for fish aquaculture water quality parameters

Parameters	S1(3)	S2(2)	S3(1)	Weight
Alkalinity	120–160	100–120, >150–200	<100, >200	1
COD	<20	20–30	>30	2
Suspended Solids (TSS)	<25	25–80	>80	1
Dissolved Residue (TDS)	<100	100–1000	>1000	1
Turbidity	0–10	10–20	>20	1
Iron	<0,2	<0,3	>0,3	3
pH	7–8,5	6–7	<6, >8,5	3
Nitrite	0–0,001	0,001–0,05	>0,05	1
Nitrate	0,4–0,8	0,1–0,4 dan 0,8–5	>5	1
Temperature	28–32	26–28	<26 dan >32	3
TAN	0–0,02	0,02–0,05	>0,5	3
DO	>6	3–6	<3	3

The determination of the level of conformity or feasibility of waters based on water quality parameters can be determined by calculating the percentage of the comparison of the total score of the variables obtained with the maximum total score The table of conformity analysis, criteria, and classes is shown in Table 2 (Hasani *et al.*, 2021).

Table 2. Conformity analysis, criteria, and classes of water quality parameter scoring results

Conformance analysis	Criterion	Class
S1 (very suitable)	85–100%	58,69–69
S2 (quite suitable)	75–84%	51,75–58,65
S3 (slightly fitted)	65–74%	44,85–51,75
N (not suitable)	<65%	<44,85

Water quality analysis and measurement results can then be classified based on the level of suitability for cultivation. The classification includes very suitable (S1) which means that water does not have limiting factors or obstacles for cultivation activities. Quite suitable (S2) which means that water has few limiting factors so that several alternatives such as treatment are needed. A little bit of conformity (S3) that requires special treatment as an effort to improve water quality. Not in accordance with (N) which means that there are obstacles or limiting factors in the water so that the water cannot be used for cultivation activities.

Fish Keeping

The cultivated tilapia is a self-spawning seed of Bangkok red tilapia. The mother used is 4-020126 months old with a weight of 300-2500 g and a body length of about 20-25 cm. The mother to be slaughtered is first checked for gonad maturity by direct observation. The characteristics of mature gonadal broods in male tilapia are that there is a protrusion on the genitals, when stripped it will release sperm, and has a brighter color. Meanwhile, in the female female, the genital hole is rounded and reddish, when stripped, it releases dark yellow eggs, and the abdomen is bulging.

Tilapia are kept in earthen ponds with a length × width x depth of 12.3 × 12.3 x 1.2 m respectively and a second pond measuring 8 × 6.3 m with a depth of 70 cm. The first pond is given hapa to separate the male and female mothers, then the second pond is also given hapa

for the mating place of the mother, the place of larvae, and the place of seeds. Male mothers are kept at a density of 2–3 heads/m2 while female mothers are kept at a density of 1–2 tails/m^2.

Parent feeding during maintenance by the ad satiation method uses All Feed-2 brand pellet feed with 30% protein content mixed with turmeric. This feed is produced by PT. Central Panganpertiwi, one of the feed companies that focuses on the production of animal and fish feed. The provision of turmeric feed aims to stimulate the maturity of tilapia gonads. Feeding with turmeric was carried out by a restricted method with a feeding rate (FR) of 3% of the biomass weight of the fish raised. The frequency of feeding tilapia broodstock is carried out 2 times a day in the morning and evening.

Tilapia larvae that are 7 days old after hatching are taken from the pond and stocked into hapa with a stocking density of 50-100 fish/m2. The fish is kept until 30 days old and given artificial feed in the form of Fengli 0 with a nutritional composition of at least 40% protein, 3% fiber, and water content of 9-10%. Feed is given 3 times a day at 08.00 WIB, 12.00 WIB, and 15.00 WIB. Water quality management is carried out by changing water, measuring quality parameters and providing herbal feeds.

Data Analysis

Water quality data was analyzed by the scoring method to determine the class of suitability of the cultivation location. Data on soil texture, fish growth and survival were analyzed descriptively to see the evaluation of the technical aspects of aquaculture.

RESULT

Cultivation Container

The cultivation container used for maintenance consists of a mother pond (Figure 2a) is a soil pond with dimensions p x l is 12.3 x 12.3 m. The larval rearing pond (Figure 2b) uses an 8 x 6.3 m earthen pond. Each pond is partitioned into several parts using a hapa. The use of hapa in the first pond aims to make it easier to check the maturity of the broodstock gonads when they are to be spawned and in the second pond it is used for larval rearing.

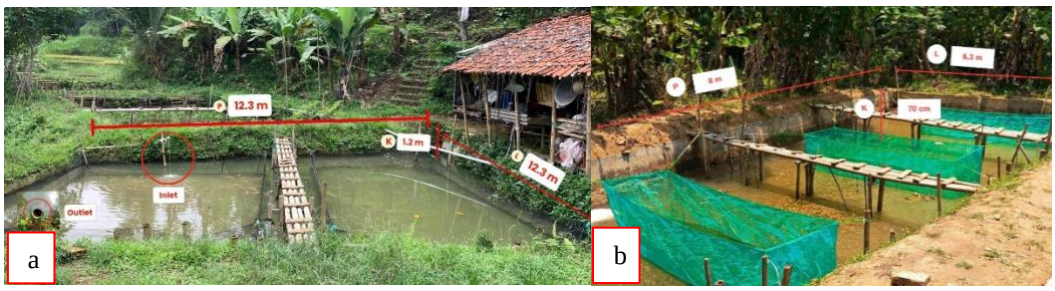

Figure 2. Broodstock and larval rearing ponds. a) Pool one is used to maintain mother. b) The second pond is used to raise larvae.

Soil Texture

The results of the analysis of soil texture types using millar triangles are shown in the following Table 3.

Table 3. Soil texture in Kaden Farm Pond, Babakan Panjang Village, Nagrak District

Information	Percentage (%)			Soil Type
	Sand	Dust	Clay	
Pool 1	17	42	42	Dusty Sight
Pool 2	18	43	40	Dusty Sight

Based on the results of soil texture analysis in Kaden Farm Pond in Babakan Panjang Village, Nagrak District, it can be seen that Pool 1 has a dust content of 42%, clay 42%, and sand of 17%, while Pond 2 has a dust content of 43%, clay 40%, and sand 18%. Both ponds show a high dust content that can affect the structure and texture of the soil, while the clay content is quite significant. Based on calculations, the condition of soil texture at the research site can be categorized as dusty clay.

Water Quality

The results of the water quality analysis at the Kaden Farm Pond in Babakan Panjang Village, Nagrak District, showed significant differences between the two ponds. Pool 1 has high alkalinity and fairly high turbidity, while pool 2 has a higher TDS value and a higher concentration of ammonia, the water quality parameter values are shown in Table 4. Although some parameters are relatively stable, these differences indicate changes in environmental conditions. Therefore, more intensive management actions are needed to maintain the balance of the aquatic ecosystem and prevent negative impacts on the environment.

Table 4. Water quality parameter values in Kaden Farm Pond, Babakan Panjang Village, Nagrak District

Parameters	**Unit**	**Pool 1**	**Pool 2**
Alkalinity	mg/L	65,96	58,2
COD	mg/L	22	13
Suspended Solids (TSS)	mg/L	5	5
Dissolved Residue (TDS)	mg/L	119	127,6
Turbidity	NTU	65,7	15,4
Iron		0,361	0,371
Ph	ppm	7,85	8,3
Nitrite	mg/L	<0,3	<0,3
Nitrate	mg/L	12,5	12,5
Temperature	C	27,8	27,3
Ammonia	mg/L	0	0,25
DO	mg/L	3,5	4,2

Based on the results of the water quality analysis at the Kaden Farm Pond in Babakan Panjang Village, Nagrak District, several critical parameters have been measured to evaluate the condition of the water ecosystem. The alkalinity of pool 1 water reached 65.96 mg/L, while pool 2 had a lower value, which was 58.2 mg/L. Both pools showed the same level of suspended solids (TSS), which was 5 mg/L, but there was a significant difference in the dissolved residue value (TDS), where pool 2 had a value of 127.6 mg/L while pool 1 had a value of 119 mg/L. The turbidity of pool 1 water reached 65.7 NTU, showed a high level of turbidity, while pool 2 had a much lower turbidity, which was 15.4 NTU. The iron content in pond water 1 and 2 is relatively low with values of 0.361 and 0.371 mg/L, respectively. The pH parameters in both pools were within a reasonable value range, with pool 1 of 7.85 and pool 2 of 8.3. Although both pools have relatively stable concentrations of nitrite and nitrate, the difference is seen in the ammonia content, where pool 2 shows a value of 0.25 mg/L while pool 1 has a value of 0 mg/L. The level of dissolved oxygen (DO) in pool 1 reaches 3.5 mg/L, while pool 2 has a higher value, which is 4.2 mg/L. This result indicates that there is a significant variation in water quality between the two pools, requires special attention, especially related to turbidity, TDS content, and dissolved oxygen levels to maintain the balance of the aquatic ecosystem.

Tablr 5. Water quality parameter suitability class in Kaden Farm Pond, Babakan Panjang Village, Nagrak District

Location	Value Total (Score x Weght)	Conformity Index (%)	Conformity Class
Pool 1	46	66,67	A little fits
Pool 2	49	71,01	A little fits

Based on the analysis of the suitability class of water quality parameters in the Kaden Farm Pond in Babakan Panjang Village, Nagrak District, there are two ponds that are evaluated. Pool 1 has a total value (the result of multiplication of weights and water quality parameter scores) of 46, with a conformity index of 66.67%, so it is included in the "Slightly Conforming" conformity class. Meanwhile, Pool 2 has a total score of 49 and a conformity index of 71.01%, also included in the "Slightly Conform" conformity class, but with a slightly higher level of conformity than Pool 1, as shown in Table 5.

Fish rearing

Success in fish management provides a solid basis for decision-making related to further maintenance strategies, so that this is one of the references in determining the feasibility of a cultivation site. The final results related to the maintenance variables are shown in Table 6.

Table 6. Fish growth in Kaden Farm Pond, Babakan Panjang Village, Nagrak District

Description	Value	Unit
Number of Stockings	10.000	ekor/kolam
Survival	70	%
Number of Harvests	7000	ekor
Daily weight growth rate	0,017	g/hari
Absolute weight growth rate	0,35	g
Absolute long growth rate	1,4	cm

The results of the analysis of fish rearing data show the success in the cultivation process, with the number of stocked as many as 10,000 fish and the survival rate reaching 70%, resulting in a harvest of 7,000 fish. The relative growth rate of 0.017 g/day and the specific growth rate of 14.62% indicate positive fish growth. The absolute length growth rate and absolute weight of 1.4 cm and 0.35 g, as well as the average length and weight of the fish increasing from week to week, indicate good health and development during the rearing period.

DISCUSSION

According to the Central Statistics Agency of Sukabumi City (2022), Babakan Panjang Village has an area of 470,635 hectares and is located in Nagrak District, Sukabumi Regency, West Java. This village has the potential to support fisheries, especially tilapia farming. The potential found in Babakan Panjang Village is that it has a lot of water resources because it is seen from the location of the village which is not far from the mountain water source. The condition and water system for irrigation are quite good because in terms of soil in the village it has conditions that are in accordance with the soil in general. Good soil and water conditions have great potential for tilapia growth. The number of residents of Babakan Panjang Village until 2022 is 4,635 people and 1,472 families. Most of the people in the village work as farmers with a monthly income of around Rp1,200,000 to Rp1,600,000 and the average number of unemployed in the village is seven to nine people per RT out of 37 RTs.

There are major challenges related to accessibility in this village. Difficulties in access mainly include obstacles in obtaining infrastructure facilities and a considerable distance to the

market. This obstacle has the potential to limit the availability and affordability of people's daily needs, as well as hinder effective access to markets for village economic activities. The development of road infrastructure and public transportation facilities can be a solution to improve village accessibility. In addition, focusing on improving the skills and entrepreneurship of the local community will have a positive impact in utilizing the potential of water resources in these ponds. Through this combination of efforts, it is hoped that the village can increase the use of its water resources and make a positive contribution to improving the welfare of the community.

The results of soil texture analysis in two locations showed the same criteria, namely dusty clay texture. Dusty clay felt has a smooth texture, is somewhat slippery, somewhat sticky, can be formed into a firm ball, and the surface of the roll is shiny (Mahardika, 2020). This can be seen from the higher proportion of clay and dust texture than sand and dust in each location. The proportion of sand ranges from 17–18%, dust between 42–43%, and clay between 40–42%. The discovery of Zainab et al., (2019) also revealed that the clay group contains at least 40% clay. The characteristics of clay are that it has a heavy texture, forms a perfect ball, is hard, sticks when dry, and has slow permeability. (Mulyono et al., 2019). Clay also has high water resistance and a good soil texture for traditional ponds is sandy clay clay (Nurchayati *et al.*, 2021). Based on these characteristics, the construction of the pond is recommended to use a concrete pond or tarpaulin pond because clay is able to store water and has high absorbency. In addition, clay soils tend to expand and are plastic in wet or humid conditions, so it is better to avoid the construction of earthen ponds. Recommendations that can be given include soil management actions to improve the structure, such as the addition of organic matter, as well as the selection of plants that are in accordance with the characteristics of soil texture. Periodic monitoring of changes in soil texture also needs to be carried out for more optimal planning and management. Good soil texture is soil that can maintain water quality for aquatic organisms and does not contain toxic substances (Afriana, 2016).

Based on the data of the class of suitability of water quality parameters in the Kaden Farm Pond in Babakan Panjang Village, Nagrak District, it can be concluded that the water quality of the two ponds is included in the category of "Slightly Appropriate." This is stated with a conformity index of 66.67% for Pool 1 and 71.01% for Pool 2. The total value, which is the result of multiplying the weight and the water quality parameter score, reaches 46 for Pool 1 and 49 for Pool 2. Although both pools can still be categorized as "Slightly Compliant," the difference in the conformance index indicates that Pool 2 has a slightly better fit compared to Pool 1. Further evaluation and corrective action may be needed for water quality scores that do not meet the score 3.

The value of water quality parameters that have not met the score of 3 is in the form of alkalinity, TDS, iron, nitrite, and nitrate values. The alkalinity value of the two ponds was still below (58.2-65.96 mg/L) the optimum value (120-160 mg/L). According to Ekasari & Amin (2018), the application of lime at a dose of 25 g/m2 can increase the alkalinity of tilapia pond water from 60 mg/L to 100 mg/L within 7 days. Then, the TDS value has a score of 2 with a value of >100 mg/L. Various efforts can be made to optimize TDS parameters, such as the use of biofilters, RAS systems, feed management, planting aquatic plants, and water replacement. According to (Sutrisno et al., 2023), the use of biofilters with zeolite stone media can reduce the TDS of tilapia pond water from 500 mg/L to 200 mg/L and TSS from 40 mg/L to 15 mg/L within 7 days.

Fe parameter scoring is also less than optimal. Fe metal is an essential metal that is needed by living organisms in certain amounts, but in excess it can cause toxic effects. Fe metal is an important element for tilapia, but its levels must be kept within the optimal range. Optimization of Fe parameters can be done by adjusting the pH of water also has an important role in optimizing fe levels, because Fe is more easily soluble in water with low pH. Keeping

the pH of the water in the range of 7–8.5 can help maintain optimal Fe levels (Supriyantini, 2015).

Ammonia, nitrites, and nitrates are organic materials that can be used to detect the presence of water pollution (Effendi, 2003). This ingredient is included in the macronutrient category (Mustofa, 2015). This element is utilized by aquatic organisms, one of which is used by phytoplankton. In the table, it can be seen that the nitrate and nitrite values in both ponds are very high and get a score of 1. The increase in nitrite, nitrate, ammonium and phosphate elements in waters is caused by the input of terrestrial elements such as household waste, aquaculture and agriculture that enter through river mouths (Mustofa, 2015).

The survival rate is the number of biota alive at the end of a given time expressed in percentages (Tarigan, 2014). At the end of the maintenance, 3,000 dead fish were obtained with a final survival result of 70%. This result is quite different from the research conducted (Salsabila et al., 2013), which stated that the survival rate of tilapia raised in the minapadi system reached 94.94% and the research conducted by Panggabean (2016) by obtaining the results of tilapia survival percentage ranged from 75-85%. According to (BSNI, 2009) the survival for tilapia production in calm water ponds is ≥75%, this indicates that the final result of maintenance does not meet the standards. Cases of death in fish are usually suspected to be due to stress on changes in the environment in which they live. There are 2 factors that affect survival in fish, the first is biotic factors such as competitors, parasites, predation, population density, adaptability of fish and handling carried out by humans. The second is abiotic factors such as physical properties and chemical properties of an aquatic environment (Effendi, 2003). In this case, the management of both factors needs to be considered which will later affect the survival rate in tilapia.

The daily weight growth rate was 0.017 g/day, the result was below the daily weight growth rate value of 0.9 g/day from Iskandar et al., (2021). The growth rate is a change in size, both the length and weight of the fish at a certain time (Wahyuningsih & Barus, 2006). Tilapia in this maintenance has good growth in length and weight and continues to increase every week. This is because there is excess energy from the feed provided. This is similar to the discovery of Gusrina, (2008) that growth occurs when there is excess energy, after which energy is used for standard metabolism, energy for the digestive process and energy for activity.

The absolute length growth at the end of maintenance of 1.4 cm shows that the stability of the cultivation environment conditions greatly affects the growth. This is evidenced by the research of Dahril et al., (2017) which found that the highest absolute length growth in red tilapia reached 2.68 cm which was raised at a salinity of 17 ppt. According to Zulkhasyni et al., (2017) the best absolute length growth was found in the application of pellets with a feed dose of 6%, which was 4.068 cm. Some of the factors that affect fish growth are the number of fish, available food sources, and water quality (Effendi, 1979). Maximum feeding can increase fish growth (Handajani & Widodo, 2010). The pellet feed provided also contributes quite high because it contains nutrients needed by fish (Firdaus *et al.*, 2018).

CONCLUSION

The feasibility of the location and tilapia cultivation in Kaden Farm is reviewed from the aspect of pond media in the form of soil that is suitable for cultivation, while in the aspect of water quality it is slightly in accordance with the expected quality standards. In terms of tilapia production at Kaden Farm, it is quite feasible which is reviewed based on survival and absolute length growth value, but it is not suitable from the daily weight growth rate.

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