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# Growth and Survival of Kissing Gourami (*Helostoma temminckii*) in Maintenance Media from Liquid Biological Fertilizer

## *Pertumbuhan dan Kelulushidupan Ikan Tambakan (Helostoma temminckii) pada Media Pemeliharaan dari Pupuk Organik Cair*

Siti Aisyah[1*], Rusliadi[1], Niken Ayu Pamukas[1]
[1]Department of Aquaculture, Faculty of Fisheries and Marine,
Universitas Riau, Pekanbaru 28293 Indonesia
**email:* siti.aisyah@student.unri.ac.id

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**Abstract**

This study aims to determine the growth and survival of kissing gourami (*Helostoma temminckii)* on a rearing medium given liquid biological fertilizer. This research was conducted from 01 April to 21 May 2022 at the Hatchery, Faculty of Fisheries and Marine, Universitas Riau. The container used was a bucket with a volume of 100 L. This study used a one-factor, Completely Randomized Design (CRD) method with five treatments and three replications. The level of treatment applied in this study was $P_0$ = No treatment, $P_1$ = treatment of 0.01 mL/L water, $P_2$ = treatment of 0.03 mL/L water, $P_3$ = treatment of 0.05 mL/L water and $P_4$ = treatment of 0.07 mL/L. The results showed that applying liquid biological fertilizer with different doses significantly affected fish growth performance ($P<0.05$). The best treatment was found at a dose of 0.03 mL/L, which produced a range of ammonia (0.0043-0.0163 mg/L), nitrate (0.049-0.189 mg/L) phosphate (0.036-0.072 mg/L), absolute weight growth (10.07 g), absolute length growth (11.31 cm), specific growth rate (1.94%), feed conversion (1.08%) and survival (85, 00%).

**Keywords:** Liquid Biological Fertilizer, Kissing gourami, Growth.

**Abstrak**

Penelitian ini bertujuan untuk mengetahui pertumbuhan dan kelulushiudpan ikan gurami (*Helostoma temminckii*) pada media pemeliharaan yang diberi pupuk hayati cair. Penelitian ini dilaksanakan pada tanggal 01 April - 21 Mei 2022 di Hatchery Fakultas Perikanan dan Kelautan Universitas Riau. Wadah yang digunakan adalah ember dengan volume 100 L. Penelitian ini menggunakan metode Rancangan Acak Lengkap (RAL) satu faktor, lima perlakuan dan tiga kali ulangan. Taraf perlakuan yang diterapkan pada penelitian ini adalah P0 = kontrol, P1 = 0,01 mL/L air, P2 = 0,03 mL/L air, P3 = 0,05 mL/L air, dan P4 = 0,07 mL/L. Hasil penelitian menunjukkan bahwa pemberian pupuk organik cair dengan dosis yang berbeda berpengaruh nyata ($p<0,05$) terhadap performa pertumbuhan ikan. Perlakuan terbaik terdapat pada dosis 0,03 mL/L, yang menghasilkan kisaran amonia (0,0043-0,0163 mg/L), nitrat (0,049-0,189 mg/L) fosfat (0,036-0,072 mg/L), pertumbuhan berat mutlak (10,07 g), pertumbuhan panjang mutlak (11,31 cm), laju pertumbuhan spesifik (1,94%), konversi pakan (1,08%) dan sintasan (85,00%).

**Kata kunci:** Pupuk Organik Cair, Ikan Tambakan, Pertumbuhan

# 1. Introduction

Kissing gourami (*Helostoma temminckii)* is a freshwater fish in the tropics. This fish has high economic value and prospects for developing aquaculture with great opportunities, and the selling price is relatively high; the price per kilo on the market is around IDR 65,000. Pond fish is an important commodity in the freshwater fish business (Augusta, 2016). The community loves this fish, widely used as a processed material and a consumption fish. Kissing gourami are categorized as very fast-growing and very easy to breed.

The decline in pond fish populations cannot be separated from fishing by fishermen. The catch is important for fishermen; it is not uncommon for fish ripe for the gonads to be caught, so the fish cannot spawn. This is what is meant by uncontrolled fishing, which causes the population of a type of fish to decrease. So, the number of pond fish in nature is decreasing. It needs to be preserved by carrying out cultivation activities to prevent extinction. In cultivation activities, one factor that needs to be considered is the medium in which the organism lives.

The obstacle faced in aquaculture development by pond fish farming is the price of commercial feed, which costs 60-70% of the aquaculture business to purchase feed. Then, the availability of natural feed can reduce the feed needed for maintenance. Raw food (plankton) is one of the determining factors for growth and success in aquaculture because it can reduce feed costs. Plankton are creatures (animals or plants) whose lives are floating or floating in the water and whose swimming ability is limited, so currents easily carry them away. The presence of plankton indicates the fertility of the waters. Efforts are being made to grow natural feed on cultivation media by applying fertilizers that utilize microorganisms and can break down organic matter. One technique that uses microbes to create a better environment by breaking down organic matter is liquid biofertilizer (Anggika, 2010).

The liquid biological fertilizer used is Plant Growth Promoting Rhizobacteria (PGPR), which contains *Pseudomonas flourencens* and *Bacillus polymixa*, which play an active role in fermentation. Bacteria *P. fluorenscens and B. polymymixa* can secrete enzymes and hormones to stimulate growth (Wulandari, 2006). Plant Growth Promoting Rhizobacteria (PGPR) biological fertilizers can also stimulate growth, increase the availability of natural food (plankton) for fish, and increase the stimulation of eating fish. The macronutrients contained in the Plant Growth Promoting Rhizobacteria liquid biofertilizer (PGPR) are N: 0.30%, P: 0.002%, K: 0.93, and C-organic 1.52%.

This study aims to obtain the best dose of liquid biofertilizer in rearing media to increase the growth and survival of kissing gourami fish.

# 2. Material and Method

*2.1. Time and Place*

This research was conducted from April 1, 2022, to May 21, 2022, for 50 days at the Hatchery of the Faculty of Fisheries and Marine, Universitas Riau, Pekanbaru.

*2.2. Methods*

Methods The method used in this study was an experimental method using a completely randomized design (CRD) with five treatment levels and three replications so that 15 experimental units were obtained. The placement of each treatment in the experimental unit was carried out randomly. The treatment applied at this stage of the study was the administration of Plant Growth Promoting Rhizobacteria Liquid Fertilizer (PGPR) with a dose referring to Panggabean et al. (2016), i.e., administration of a dose of 0.03 mL/L liquid biofertilizer was the best treatment for tilapia. Hence, the treatment level Liquid Biofertilizer used in this study were:

$P_0$: Not given liquid biological fertilizer
$P_1$: Application of liquid biological fertilizer 0.01 mL/L of water
$P_2$: Application of liquid biological fertilizer of 0.03 mL/L of water
$P_3$: Application of liquid biological fertilizer 0.05 mL/L of water
$P_4$: Application of liquid biological fertilizer of 0.07 mL/L of water

*2.3. Procedure*

*2.2.1. Preparation of Containers*

Kissing gourami seeds used in this study were seeds measuring 5.8-7 cm. The seeds have been selected with the criteria of uniform size, active movement, and no defects or injuries. The seeds were sown in the afternoon because there were no fluctuations in water temperature. Seed stocking is carried out by acclimatization so that the fish can adapt to the new environment slowly or so that the new environment does not stress the fish. Length and body weight measurements are carried out once every ten days to determine the growth of kissing gourami.

*2.2.2. Preparation and Maintenance of Test Fish*

The stocking density of the fry maintained was 1 fish/4 L of water. The container used was filled with 80 L of settled water, and the test fish was stocked after adding liquid biological fertilizer (PGPR) according to the treatment. The number of fish in each bucket was 20, and the total pond fish seeds used were 300 for 15 research container units. The pond fish seeds were reared for 50 days in a controlled container. During the fish rearing, they were fed Pellet PF-500 with a protein content of 39-41% made by a factory with a frequency of 3 times a day. Feeding was carried out at 08.00, 12.00, and 16.00 WIT. The feed dose given was 5%/day of body weight (Affandi *et al*., 2009).

*2.4. Parameter Measured*

*2.4.1. Water Quality Water*

Quality parameters measured during the study, such as temperature, pH, and DO, were measured once every ten days. At the same time, ammonia, phosphorus, and nitrate measurements were made at the end of the study.

*2.4.2. Absolute Weight Growth*

The weight growth formula used during this study was calculated as suggested by Effendie (2002) as follows:

$$W = W_t - W_0$$

Description:

$W$ = Growth in absolute weight of test fish (g)

$W_t$ = Average weight of average test fish at the end of the study (g)

$W_0$ = Average weight of test fish at the beginning of the study (g)

*2.4.3. Absolute Length Growth*

The growth formula used during this study was calculated as suggested by Zonneveld et al. (1991), namely:

$$L = L_0 - L_t$$

Description:

$L$ = Absolute length growth (cm)

$L_0$ = Average length -mean test fish at the start of the study (cm)

$L_t$ = Average length of the test fish at the end of the study (cm)

*2.4.4. Specific Growth Rate*

The specific growth rate formula used during this study was calculated as suggested by Zonneveld et al. (1991), as follows:

$$SGR = \frac{LnWt - LnWo}{t} \times 100\%$$

Description:

SGR = Specific daily growth rate (%/day)

LnWt = Average fish weight at the end of the study (g)

LnWo = Average fish weight at the start of the study ( g)

t = Length of rearing (days)

*2.4.5. Feed Conversion Ratio*

Calculation of the feed conversion ratio (FCR) is carried out using the formula from Effendie (2002), namely:

$$FCR = \frac{F}{(Wt+D)-Wo}$$

Description:

FCR = Feed conversion ratio

Wo = The weight of the tested fish biomass at the beginning of the research (g)

Wt = Biomass, weight of test fish at the end of the study (g)

D = Total weight of dead fish (g)

F = Weight of feed given (g)

*2.4.6. Survival*

Calculation of the survival rate is carried out using the formula proposed by Effendie (2002), namely:

$$SR = \frac{Nt}{No} \times 100\%$$

Description:

SR = Survival rate (%)

No = Number of test fish at the beginning of the study (fish)

Nt = Number of test fish at the end of the study (fish)

*2.5. Data Analysis*

Data that were obtained were tabulated and analyzed using the SPSS application, which included Analysis of Variance (ANOVA), used to determine whether the treatment had a significant effect on the growth of seed absolute weight (g), growth of the absolute length (cm), the specific growth rate (%/day), conversion feed (FCR), and survival (%). If statistical tests show significant differences between treatments, further tests are carried out in the Newman Keuls Study. Water quality data is displayed in tabular form and analyzed descriptively.

# 3. Result and Discussion

*3.1. Growth Performance*

The study's results showed that the average absolute weight, absolute length, specific growth rate, feed conversion ratio, and survival rate in each treatment could influence between treatments ($p<0, 05$).

Table 1. Results of measurements of absolute weight growth, absolute length, specific growth rate, FCR, and survival rate of kissing gourami

| Parameter | Perlakuan | | | | |
|---|---|---|---|---|---|
| | P0 | P1 | P2 | P3 | P4 |
| Wm | 5,13±0,03$^{a}$ | 5,25±0,09$^{a}$ | 6,26±0,07$^{d}$ | 5,96±0,03$^{c}$ | 5,73±0,02$^{b}$ |
| Lm | 4,25±0,09$^{a}$ | 4,26±0,01$^{a}$ | 4,82±0,03$^{d}$ | 4,62±0,02$^{c}$ | 4,43±0,05$^{b}$ |
| LPS | 1,70±0,015$^{a}$ | 1,73±0,03$^{a}$ | 1,94±0,03$^{d}$ | 1,88±0,00$^{c}$ | 1,83±0,09$^{b}$ |
| FCR | 1,18±0,03$^{b}$ | 1,06±5,0,09$^{ab}$ | 1,08±0,03$^{ab}$ | 1,03±0,05$^{a}$ | 1,06±0,03$^{ab}$ |
| SR | 83,3±2,87$^{a}$ | 80±5,00$^{a}$ | 85,0±2,87$^{a}$ | 76,7±2,87$^{a}$ | 77±2,87$^{a}$ |

Note: Wm= Absolute Weight, Lm= Absolute Length, LPS = Specific Growth Rate, FCR = Feed Conversion Ratio and SR = Survival

According to Table 1, There were differences in the absolute weight gain of kissing gourami from several treatments. The high growth in average weight of kissing gourami at $P_2$ is due to the administration of liquid biofertilizer with the correct maintenance dosage to maximize digestion and optimal utilization of feed nutrients. Giving liquid biological fertilizer at this dose in the rearing medium contains plankton, which is helpful as additional feed for kissing gourami and increases growth. Alfionita et al. (2019) state that phytoplankton and zooplankton are vital food sources for other organisms that live at higher trophic levels in waters.

The absolute length growth of pond fish, given the addition of liquid biofertilizer in the rearing medium, was faster than that of those without liquid biofertilizer. This is because applying liquid biological fertilizers can trigger the growth of natural feed (plankton) in kissing gourami seed-rearing media. Hence, the availability of raw feed affects the development of kissing gourami seeds. Therefore, the energy needed for growth is more optimal. Growth occurs when there is a balance between protein and power in the feed, so feed availability must be optimal. The energy sources are carbohydrates, fats, and proteins (Wijayanti, 2010). The liquid bio-fertilizer given to the rearing media has an excellent nutritional content, which plays a vital role in the survival of plankton in the waters.

The highest specific growth rate for kissing gourami was at $P_2$ 1.94%. This is presumably because the given dose causes sufficient plankton, making growth optimal. Tampubolon et al. (2016) stated that natural feed has a reasonably good nutritional content compared to commercial feed. In addition, raw food is small in size and fits the mouth opening of the fish fry. Meanwhile, good water quality causes an increased appetite. The addition of liquid biological fertilizer every ten days is based on each treatment to provide nutrients to the plankton content in the rearing medium and the availability of sustainable feed. In the opinion of Hermawan et al. (2014), a smaller FCR value indicates that the feed consumed by fish is more efficiently used for growth. Conversely, the greater the FCR value, the less efficient the feed consumed is (low growth utilization).

Fish survival is not directly affected by feed. Food availability in this study is considered sufficient to meet fish needs. According to Suprayudi et al. (2012), feed is not a factor that affects survival because survival itself is influenced by the initial handling of fish and the quality of the media used. High survival indicates the quality and quantity of feed given is sufficient to meet the needs principal can even increase growth.

*3.2. Water Quality*

Water qualities, namely temperature, pH, DO, Ammonia, Nitrate, and Phosphate, were measured during the study. Data on the results of measuring water quality for each treatment during the study can be seen in Table 2.

Table 2 shows the temperature range, pH, DO, ammonia, phosphate, and nitrate, which are still within the standard tolerance of pond fish seeds where the water quality is still in good condition in the maintenance of pond fish seeds. The temperature during the study ranged from 26.2 to 27.3 $^{o}$C. Santi et al. (2021) stated that the optimal temperature for the growth of pond fish was in the temperature range of 20-30 $^{o}$C. Putra et al. (2013) added that the temperature difference, which does not exceed 10$^{\circ}$C, is still good, and the temperature range is suitable for organisms in the tropics, namely 25-32$^{\circ}$C.

Table 2. Measurement of water quality during the research

| Treatment | Parameters | | | | | |
|---|---|---|---|---|---|---|
| | Temperature ($^0$C) | pH | DO (mg/L) | Ammonia (mg/L) | Phosphate (mg/L) | Nitrate (mg/L) |
| P0 | 26.4-27.1 | 6.6-7.2 | 5.5-6.5 | 0.0038-0.0132 | 0.032-0.065 | 0.047-0.189 |
| P1 | 26.4-27.1 | 6, 4-7.2 | 5.5-6.4 | 0.0039-0.0112 | 0.038-0.062 | 0.052-0.187 |
| P2 | 26.4-27.1 | 6.5-7.2 | 5.4-6.3 | 0.0043 -0.0069 | 0.036-0.072 | 0.049-0.178 |
| P3 | 26.4-27.3 | 6.4-7.2 | 5.5-6.3 | 0.0042-0.0123 | 0.037-0.074 | 0.047-0.167 |
| P4 | 26.2- 27.1 | 6.4-7.2 | 5.7-6.4 | 0.0045-0.0134 | 0.036-0.078 | 0.049-0192 |

The pH parameter is hydrogen ions in waters, which can affect the life of aquatic organisms because it is an indicator of the sustainability of the decomposition process by microorganisms. in deep waters (Pagoray et al., 2021). So, the good or lousy pH of water quality will support the success of fish farming. According to Putra et al. (2013), most fish can adapt well to aquatic environments with a pH ranging from 5 to 9. During the research, the pH ranged from 6.4 to 7.2, so it is still classified as a good water quality standard for the survival of pond fish.

The increase in DO in each treatment on kissing gourami rearing media is in line with the increasing abundance of phytoplankton in the rearing media to produce oxygen through photosynthesis. Besides that, aerators are used in containers. Dissolved oxygen content during this study ranged from 5.4-6.5 mg/L. Arifin et al. (2017) stated that pond fish can survive and perform everyday activities at a dissolved oxygen content of >3 mg/L.

Ammonia concentrations during the study ranged from 0.0038-0.0069 mg/L. This range still meets pond fish tolerance standards for life. Arifin et al. (2017) stated that pond fish can survive and perform everyday activities at an ammonia content of less than 1 mg/L. Then, according to Jangkaru (2004), free ammonia levels exceeding 0.2 mg/L are toxic to several types of fish, and ammonia levels safe for fish and aquatic organisms are less than 1 mg/L. Ammonia levels can increase due to leftover feed and feces that settle and dead fish carcasses in the rearing medium.

The high and low levels of nitrate and phosphate are caused by the presence of *Bacillus* sp and *Pseudomonas* sp bacteria in liquid biofertilizers, which can degrade organic matter from feces and leftover feed and convert them into phosphate and nitrate forms. Bacillus bacteria can produce protease, amylase, and lipase enzymes that can encourage the degradation of organic matter in water. Marista et al. (2013) stated that *Pseudomonas* and *Bacillus* bacteria are phosphate-solubilizing bacteria that have the most significant ability to biofiltilize by dissolving phosphate elements bound to other elements (Fe, Al, Ca, and Mg).

# 4. Conclusions

Based on research results regarding the application of PGPR liquid biofertilizer with different doses in rearing media for the growth and survival of kissing gourami had a significant effect ($P<0.05$). The best treatment was found in the administration of Liquid Biological Fertilizer at a dose of 0.03 mL/L ($P_2$) with an absolute weight growth of pond fish of 18.78 g, absolute length growth of 14.47 cm, specific growth rate of 1.94%, FCR 1.08, and survival rate of 85.0%. Ammonia range 0.0043-0.0163 mg/L, nitrate 0.049-0.189 mg/L, Phosphate 0.036-0.072 mg/L, temperature 26.4-27.1$^{\circ}$C, pH 6.5-7.2, dissolved oxygen (DO) 5.4-6.3 mg/L.

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