JMAI Jurnal Media Akuakultur INDONESIA
https://journal.unram.ac.id/index.php/jmai/index. E-ISSN : 2798-0553
Volume 4, Number 3, Agutstus 2024

PENGGUNAAN ULTRAVIOLET PADA PRODUKSI PENDEDERAN IKAN NILA *Oreochromis niloticus* DENGAN SYSTEM RESIRKULASI

The Use Of Ultraviolet In The Production Of Nursing Tilapia Fish Oreochromis niloticus Using A Recirculation System

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ABSTRAK

Kebutuhan pasokan ikan nila untuk pasar dunia belum sepenuhnya tercukupi, sehingga penerapan budidaya secara intensif diharapkan mampu meningkatkan hasil produksi budidaya. Sistem Resirkulasi menjadi pilihan dalam mengendalikana kualitas air budidaya, serta penambahan lampu UV di harapkan mampu membunuh bakteri yang terdapat dalam perairan budidaya. Penelitian ini bertujuan untuk mengavaluasi penggunaan lampu UV pada pendederan ikan serta menganalisa penggunaan lampu UV terbaik pada pendederan ikan nila. Penelitian ini dilaksanakan selama 45 hari, di Laboratorium Produksi Dan Reproduksi Ikan Universitas Mataram menggunakan metode eksperimental dengan rancangan acak lengkap (RAL) yang terdiri dari 4 perlakuan dan 3 kali ulangan, yaitu P1: tanpa lampu UV, P2: 5 Watt, P3:10 Watt, dan P4: 15 Watt. Parameter uji meliputi laju pertumbuhan panjang mutlak, panjang spesifik, berat mutlak, berat spesifik, *Feed Convertion Ratio* (FCR), *Survival Rate* (SR), kualitas air dan kelimpahan bakteri. Data dianalisa menggunakan *Analysis of Variance* (ANOVA) dan dilanjutkan dengan uji Duncan. Hasil penelitian menunjukkan bahwa parameter laju pertumbuhan, *Feed Convertion Ratio* (FCR), *Survival Rate* (SR) dan kelimpahan bakteri terbaik terdapat pada P4 dengan laju pertumbuhan panjang mutlak sebesar 6.4cm, panjang spesifik sebesar 0.05%/hari, pertumbuhan berat mutlak sebesar 9.7gr, berat spesifik sebesar 0.06%/hari, nilai *Feed Convertion Ratio* (FCR) sebesar 0.7, *Survival Rate* (SR) sebesar 94% dan kelimpahan bakteri sebesar 5.7 x 10^5 CFU/ml.

ABSTRACT

The need for tilapia fish supplies for the world market is not yet fully met, so the implementation of intensive cultivation is expected to increase aquaculture production results. Recirculation systems are an option for controlling the quality of cultivation water, and the addition of UV lights is expected to be able to kill bacteria found in cultivation waters. This research aims to evaluate the use of UV lamps in fish nurseries and analyze the best use of UV lamps in tilapia nurseries. This research was carried out for 45 days, at the Fish Production and Reproduction Laboratory, Mataram University using an experimental method with a completely randomized design (RAL) consisting of 4 treatments and 3 replications, namely P1: without UV lamp, P2: 5 Watt, P3: 10 Watts, and P4: 15 Watts. Test parameters include absolute length growth rate, specific length, absolute weight, specific weight, *Feed Conversion Ratio* (FCR), *Survival Rate* (SR), water quality and bacterial abundance. Data were analyzed using *Analysis of Variance* (ANOVA) and continued with the Duncan test. The results showed that the best growth rate parameters, *Feed Conversion Ratio* (FCR), *Survival Rate* (SR) and bacterial abundance were found in P4 with an absolute length growth rate of 6.4cm, specific length of 0.05%/day, absolute weight growth of 9.7gr, specific weight of 0.06%/day, *Feed Conversion Ratio* (FCR) value of 0.7, *Survival Rate* (SR) of 94% and bacterial abundance of 5.7 x 105 CFU/ml.

Kata Kunci	*Lampu UV, Ikan Nila, Resirkulasi, Parameter Pertumbuhan, Kelimpahan Bakteri*
Keywords	*UV Lamp, Tilapia, Recirculation, Growth Parameters, Abundance Of Bacteria*
Tracebility	Submission: 22/1/2024. Published : 4/7/2024
Panduan Kutipan (APPA 7th)	Antika, R., Cokrowati, N., & Scabra, A, R. (2024). The Use Of Ultraviolet In The Production Of Nursing Tilapia Fish Oreochromis niloticus Using A Recirculation System. *Indonesian Journal of Aquaculture Medium*, 4(3), 90-105. http://doi.org/10.29303/mediaakuakultur.v4i3.3834

INTRODUCTION

Tilapia is a freshwater fish species that has a fairly high selling price and has a large portion of the total national fisheries production (Husni, 2019). According to the Marine and Fisheries Ministry (2018), fish production in NTB in 2013 was 16,631.68 tons, in 2014 it was 17,858.27 tons, in 2015 it was 17,016.59 tons, in 2016 it was 18,114.43 tons and in 2017 it more than doubled. to 44,017.31 tons. Meanwhile, world production in 2018 reached 6.3 million tons (Suryanto, 2021).

The need for tilapia fish supply for the world market is not yet fully met. Based on the FAO (Food and Agriculture Organizaton) the need for the availability of tilapia on an international scale in 2010 is experiencing a stock shortage of 2,000,000 tonnes per year, therefore to meet high market demand one way to do this is by implementing a cultivation system intensive. The implementation of intensive cultivation is expected to increase cultivation production results (Hapsari *et al*., 2020).

Intensive cultivation systems are synonymous with high stocking densities so that high stocking densities cause high excretion results and even leftover feed also becomes high in a body of water until it eventually becomes waste. Recirculation systems are an option for controlling the quality of cultivation water, and the addition of UV lights is expected to be able to kill bacteria found in cultivation waters. The recirculation system is one application of sustainable aquaculture that can control waste discharge into the environment (Isroni *et al*., 2019). UV lamps are lamps that produce ultraviolet light which is useful for killing bacteria in water. The function of ultraviolet light is very effective in deactivating microorganisms, for example viruses, protozoa and bacteria (Rinaldi *et al*., 2021). The application of ultraviolet light in a recirculation system is expected to provide effective results to increase tilapia production so that it can meet increasing market demand.

METHODS

Time and Place of Research

The research was carried out for 45 days, at the Fish Production and Reproduction Laboratory, Aquaculture Study Program, Faculty of Agriculture, Mataram University.

Meanwhile, bacterial abundance was tested at the West Lombok Sekotong BPBL Testing Laboratory, West Lombok NTB.

Research Design

This research was carried out using an experimental method using a Completely Randomized Design (CRD) consisting of 4 treatments and 3 replications, resulting in a total of 12 experimental units. Each treatment uses the same filter, namely cotton, pumice, zeolite, bioball and UV lamp in each treatment with different power. The research design is as follows;
P1: Without UV lamp
P2: UV lamp 5 Watt/40 l
P3: UV lamp 10 Watt/40 l
P4: UV lamp 15 Watt/40 l

Research Procedure
Research Preparation
Media Preparation

The media used are 24 containers with a volume of 45 l, 12 units as maintenance containers and 12 units as water storage containers. Containers are cleaned using liquid soap and dried before use. Next, filter cross-sections are installed on each container which is a water storage container. Each section contains the same filter consisting of cotton, zeolite and pumice. Then, each container is filled with 40 l of water and given a filter in the form of a bioball and a UV lamp with different powers. The water used in this research is fresh water obtained from water sources in the Aquaculture Study Program. After the water storage container is filled, each storage container is given a bioball and a UV lamp. The first water storage container/container is without UV, the second container is 5 Watts, the third container is 10 Watts and the last one is 15 Watts. Lastly, a submersible pump is provided in each water storage container which will pump water to rise from the storage container to each maintenance container. Furthermore, when the water has reached a volume of 30 l, the water from the maintenance container will come out through the hole that has been made, then the water will flow back into the bottom container which is a water storage container, but before that the water will be filtered first by a filter device on top of the container. the water reservoir.

Fingerling Preparation

The fish fingerling used in this research were 1st nursery tilapia with a size of 4-6 cm, not affected by disease, complete body parts, and agile fish movements. Tilapia fish fingerling were obtained from fish farmers in Central Lombok, precisely in Teratak village, NTB.

Research Design

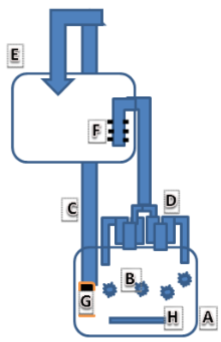


Figure 1. Research Desaign

Information :
A: Water storage container with a volume of 30 l
B : Bioball
C : Pipe
D : Cross-section of the filter
E: 30 l water volume maintenance container
F: Perforated pipe
G : Submersible pump
H: UV lamp

Research Implementation
Fish Acclimatization

Acclimatization aims to adapt new environmental conditions to the previous environment. Acclimatization is carried out by placing a plastic bag containing fingerling into a container or rearing unit and leaving it for a few minutes until the water temperature in the plastic bag is the same as the water temperature in the container or rearing unit.

Fish Measurements (length and weight)

Fish length and weight measurements were carried out three times during the rearing period, where these measurements were carried out on day 0, day 22 and day 45.

Fingerling Distribution

Fish fingerling are stocked in containers with a stocking density of 30 fish/container in accordance with SNI (Indonesian National Standards). The density of tilapia fingerling in nursery I (size 4-6 cm) is 1 fish/liter, the time for stocking fingerling is in the morning at 08.00- 09.00 or in the afternoon at 15.30-16.30 to avoid temperatures that are too hot due to sunlight.

Feeding

During the rearing period, fingerling are fed with a frequency of feeding three times a day, namely in the morning at 08.00, in the afternoon at 12.00 and in the afternoon at 17.00 WIB at satiation with a feeding dose of 6% of the fish biomass. 6% can increase the growth of absolute weight and absolute length of tilapia (Zulkhasyni, 2017).

Water Quality Measurement

Water quality measured during the research included temperature, dissolved oxygen (DO), acidity (pH) and ammonia (NH_3). Water quality measurements were carried out three times, namely on day 0, day 22 and day 45 where measurements were carried out in the morning or around 06.00 in the afternoon at 12.00 and in the afternoon at 18.00 WITA.

Research Parameters

The parameters tested in this study include absolute weight (Mulqan *et al*., 2017), specific weight (Sitio *et al*., 2017), absolute length (Mulqan *et al*., 2017), specific length (Sitto *et al*., 2017), survival (Endraswati *et al*., 2021), feed conversion ratio (Suryanto *et al*., 2021) water quality parameters (temperature, pH, DO, and Ammonia) and bacterial abundance.

Absolute Length Growth Rate

Absolute length increase is the difference between the length of the fish from the head to the tail end of the body at the end of the study and the body length at the beginning of the study (Mulqan *et al*., 2017). The formula for calculating it is as follows:

$$AL = Lt - Lo$$

Information:
AL = Absolute increase in length (cm)
Lt = Final average length (cm)
Lo = Initial average length (cm)

Absolute Weight Growth Rate

Absolute weight growth is a process where the weight of fish increases from the start of the study to the end of the study (Mulqan *et al*., 2017). The formula used is:

$$AW = Wt - Wo$$

Information :
AW = Weight gain (g)
Wt = Final weight of fish fry (g)
Wo = Initial weight of fingerling (g)

Specific Length Growth Rate

Based on Sitio *et al*., (2017) Specific length growth is calculated using the following formula:

$$SLGR = \frac{lnLt - lnLo}{t} \times 100\ \%$$

Information:
SLGR = Specific length growth rate (%)
LnLt = Average length of fish at the end of the study (gr)
LnLo = Average length of fish at the start of the study (gr)
t = Maintenance period (days)

Specific Weight Growth Rate

Sitio *et al*., (2017) stated that calculating specific weight growth can be done using the following formula:

$$SWGR = \frac{(lnWt - lnWo)}{t} \times 100\%$$

Information :
SWGR = Specific weight growth rate (%)
lnWt = Average weight at the end of the study (cm)
lnWo = Average weight at the start of the study (cm)
t = Maintenance period (days)

Survival Rate (SR)

Survival rate (SR) is the comparison level of the number of fish that survived from the beginning to the end of the study (Endraswati *et al*., 2021). The formula used is:

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

Information:
SR = Survival Rate (%)
Nt = Number of fish at the end of rearing (tails)
No = Number of fish at the start of rearing (tails)

Feed Conversion Ratio (FCR)

Feed Conversion Ratio (FCR) is a comparison between the amount of feed given and the weight of the fish produced. Feed conversion is calculated using the formula (Suryanto *et al*., 2021) as follows:

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

Information:
FCR = Feed Conversion Ratio
Wo = Test animal weight at the start of rearing
Wt = Weight of test animals at the end of rearing
D = Number of dead fish
F = Amount of feed consumed

Bacterial Abundance

Bacterial abundance was calculated at the beginning of the study, middle and end of the study using the TPC (Total plate count) method, as well as the formula used according to (Laili *et al*., 2022) as follows:

$$\text{Number of colonies per plate x} \frac{1}{dilution\ factors}$$

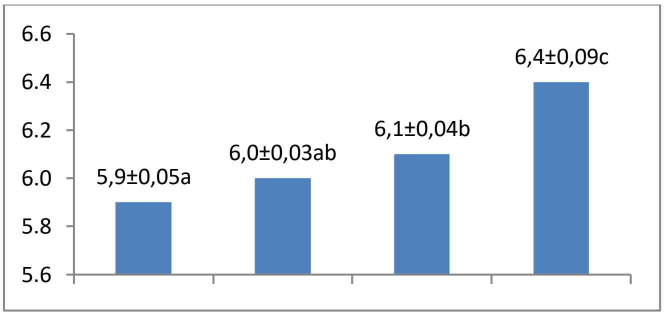
Data Analysis

In this research, several parameters were measured, including: growth parameters (absolute weight growth, absolute length, specific weight, specific length), Survival Rate (SR), Feed Conversion Ratio (FCR), water quality parameters (temperature, pH, dissolved oxygen, and ammonia), and bacterial abundance (TPC) using Analysis of Variance (ANOVA) at the 95% confidence level. The results of statistical analysis that were significantly different were carried out by Duncan's advanced test, while the abundance of bacteria and water quality parameters were analyzed descriptively.

RESULT AND DISCUSSION

Absolute Length Growth

The average growth in absolute length of tilapia during 45 days of rearing using a recirculation system with the addition of UV lamps with different powers ranged from 5.9 cm to 6.4 cm.



Description: P1: Without UV, P2 :5 Watt, P3 :10 Watt, P4 :15 Watt

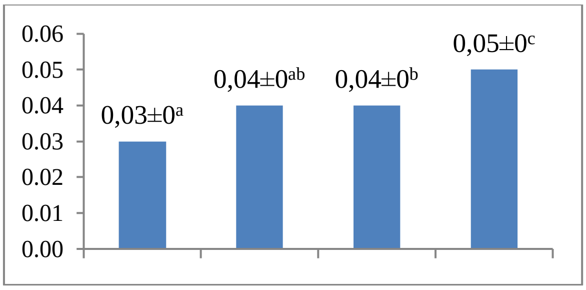
Figure 3. Absolute Length of Tilapia Fish

Absolute length growth is a parameter that describes the length growth of fish from tail to head at the start of the study until the end of the study (Mulqan *et al*., 2017). Based on the research results, it was found that the absolute length growth rate ranged between 5.9-6.4 cm, where the highest average value was in P4 with an average value of 6.4 cm and the lowest value was in P1, namely 5.9 cm. This high value is thought to be because the UV lamp given to P4 has greater power compared to other treatments so that the bacteria contained in the maintenance media are lower than in other treatments. This is in accordance with the opinion of Gusmawati *et al*., (2018), who stated that ultraviolet irradiation has long been an option for sterilizing supply water and is integrated in recirculation systems in aquaculture. Ultraviolet irradiation has been proven effective in inactivating various microorganisms without leaving toxic residues. Based on research from an expert named Kimura, (1976) in Gusmawati *et al*., (2018) stated that almost 100% of gram negative and gram positive bacterial cells will die by UV irradiation at doses of 4.0 x 103 and 2.0 x 104 µW.sec/cm2.

The lowest absolute length growth value was found in P1 with an average value of 5.9 cm. This low value is thought to be because UV lights were not provided in this treatment so the abundance of bacteria in the maintenance media was very high. Maintenance media that contain a lot of bacteria are not good for fish growth and can even have fatal consequences, namely death in pet fish. Soemardjati *et al*., (2013) stated that water containing a lot of bacteria can cause fish to suffer from disease, thus disrupting the fish's health, which is characterized by the fish becoming weak, having no appetite and even dying. Lack of appetite can impact the fish's growth because it does not receive food that provides energy for movement and growth.

Specific Length Growth

The average specific length growth of tilapia during 45 days of rearing using a recirculation system with the addition of UV lamps with different powers ranged from 0.03%/day to 0.05%/day.



Description: P1 : without UV, P2 :5 Watt, P3 :10 Watt, P4 :15 Watt

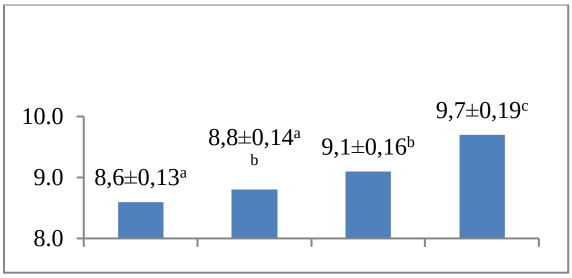
Figure 4. Specific length of Tilapia

Specific length growth is a parameter that describes the daily percentage of the absolute length of the fish divided by the length of rearing (Mulqan et al., 2017). Based on research that has been carried out, it was found that the specific length growth was in the range of 0.03-0.05%/day, where the highest specific length growth rate was found in P4, namely 0.05%/day. The high specific length value was thought to be due to the UV lamp. given to P4 has greater power compared to other treatments so that it provides different daily growth results. Apart from that, good water quality and optimal feeding are factors that influence it. This is supported by Prasetyo's statement (2018), which states that if the water conditions in the recirculation system are maintained well, the fish will not experience stress and the fish's appetite will increase with optimal use of feed to support their growth. Darmayanti *et al*., (2018)stated that the water quality of a body of water can also determine the quality of the fish that inhabit that environment.

The lowest specific length growth value was found in P1, namely 0.03%/day. This low value is thought to be because P1 does not use UV lamps which are useful for killing bacteria, so the abundance of bacteria in P1 is very high. Ambat *et al*., (2020) stated that bacteria are a source of disease which can cause death to cultivated organisms if they exceed normal limits. Bacteria as a source of disease will attack fish that are weak and not supported by good environmental conditions.

Absolute Weight Growth

The average absolute weight growth of tilapia during 45 days of rearing using a recirculation system with the addition of UV lamps with different powers ranged from 8.6 gr to 9.7 gr.



Description: P1: without UV, P2: 5 Watts, P3: 10 Watts, P4: 15 Watts

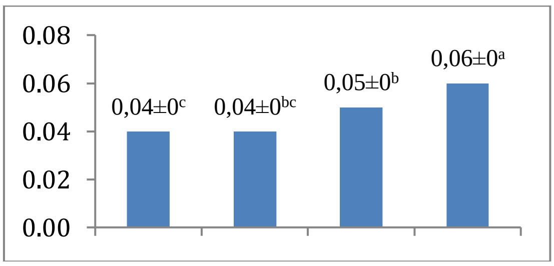
Figure 5. Absolute weight of Tilapia

Absolute weight growth is a parameter that describes the difference in body weight of fish from the start of rearing to the end of rearing (Resiani *et al*., 2022). Based on the research that has been carried out, it was found that the absolute weight growth was in the range of 8.9-9.7 grams, where the highest absolute weight growth rate was in P4, namely 9.7 grams. The high absolute weight value in P4 is thought to be due to the low abundance of bacteria. The low abundance of bacteria is thought to be due to the provision of lamps with higher power compared to other treatments. This is in accordance with the opinion of Chyntia *et al*., (2015), where the greater the lamp power, the total microbes decrease and the longer the irradiation, the total microbes also decreasing. In general, light has the property of damaging microorganism cells. Damage caused by ultraviolet light can damage cells and inhibit the growth of microorganisms (Risky *et al*., 2021). According to Kencana (2004) *in* Risky *et al*., (2021) states that after being given radiation, the Staphylococcus aerus bacteria will break and the shape of the cells will shrink or become smaller in an irregular arrangement.

The lowest absolute weight growth value was found in P1 with an average value of 8.9 gr. The low absolute weight value in P1 is thought to be due to the high abundance of bacteria and suboptimal feed utilization, considering that the size of the fish stocked in this study was not uniform, resulting in competition between fish. Nugroho *et al*., (2012)stated that the use of food which is supposed to provide growth for fish is used as defense to protect themselves from other fish. Food that enters the fish's body will first be used for survival and then used for growth.

Specific Weight Growth

The average growth in specific weight of tilapia during 45 days of rearing using a recirculation system with the addition of UV lamps with different powers ranged from 0.04%/day to 0.06%/day.



Description: P1: without UV, P2: 5 Watts, P3: 10 Watts, P4: 15 Watts

Figure 6. Specific weight of Tilapia

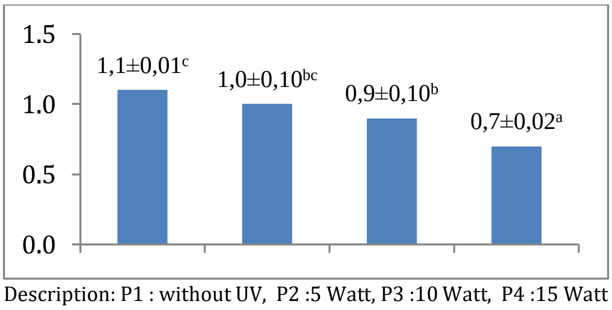
Specific weight growth is a parameter that describes the percentage of days of the absolute weight of the fish divided by the length of rearing carried out during the research (Resiani *et al*., 2022). The specific weight growth rate obtained during the research period was in the range of 0.04-0.06%/day, where the highest specific weight growth rate was found in P4 with a value of 0.06%/day. This high value is thought to be due to the low abundance of bacteria, food factors and the existence of a recirculation system so that water quality is maintained. Where the RAS system is the reuse of water that has been used, by continuously circulating the water repeatedly through a filter (Fauzia *et al.*, 2020). The use of RAS technology increases the carrying capacity of cultivation media, because the water used can be controlled well, is effective in water utilization and is more environmentally friendly for the life and growth of fish (Lembang *et al.*, 2021).

The lowest specific weight growth value was found in P1 with an average value of 0.048%/day. The low absolute weight value in P1 is thought to be due to the high abundance of bacteria and the large amount of feces remaining in the water. The high abundance of bacteria in P1 is thought to be due to the absence of additional UV lamps which are believed to be able to kill bacteria, while the large amount of fecal residue in P1 is thought to be due to the large amount of leftover food that the fish have not completely consumed. An abundance of bacteria that is too high in a body of water can cause the fish's health to be disturbed so that the fish's appetite decreases. This is in accordance with the statement of Soemardjati *et al.*, (2013), that high levels of bacteria will attack the biota being cultivated so that they become weak and their appetite decreases, often causing death in the biota being cultivated.

The ability of the filter to filter remaining feces will decrease if the amount is too large so that unfiltered feces will become organic material in the water which can cause water quality to decrease which results in decreased fish growth. Leftover food or feces that are not filtered will be toxic to fish and cause high levels of ammonia in the water. One of the filter capabilities used is a zeolite filter which can work chemically in the ammonia absorption process, experiencing a saturation point in carrying out the absorption process. One indication of the saturation point is a blockage in the filter area due to the large amount of accumulated fish waste (Syuhriatin *et al.*, 2020).

Feed Conversion Ratio (FCR)

The average value of the feed conversion ratio for tilapia during the 45 day rearing period using a recirculation system with the addition of UV lamps with different powers ranges from 0.7-1.1%.



Description: P1 : without UV, P2 :5 Watt, P3 :10 Watt, P4 :15 Watt

Figure 7. FCR of Tilapia

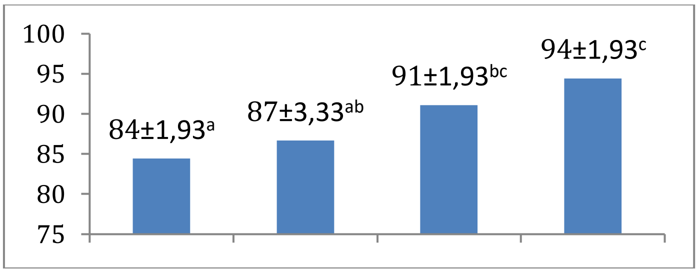
Feed Conversion Ratio (FCR) is a comparison between the weight of feed given to the weight of fish produced (Christin, 2021). Based on the research results, it was found that the FCR value obtained ranged from 0.7-1.1%. The feed conversion value obtained during the maintenance period is still in the good category because according to Sukardi *et al.*, (2018), which states that the FCR value is still considered efficient if it is less than 3%. The highest value is in P1 with a value of 1.1% and the lowest value is in P4 with a value of 0.7%. The high FCR value indicates that the effectiveness of the feed is low or its use for growth is less efficient. The FCR value at P4 is the best FCR value. This is in accordance with the opinion of Sukardi *et al.*, (2018), which states that the smaller the

FCR value means the feed is of higher quality, this shows that the amount of feed consumed is greater than the amount of feed consumed. remaining.

A similar thing was also conveyed by Tanjung *et al*., (2019) in Hapsari *et al*., (2020), who stated that the lower the feed conversion value, the better the level of efficiency of utilization of feed used for growth, conversely if the feed conversion is large, then the level of feed utilization efficiency is not good. According to Darmayanti *et al*., (2018), food factors play an important role in individual growth. To stimulate optimal growth, the quantity and quality of food that is available in sufficient conditions is required and is appropriate to the water conditions. The main function of food is for survival and growth. The food consumed by fish is first used for survival and then used for growth.

Survival Rate (SR)

The average Survival Rate (SR) value of tilapia for 45 days of rearing using a recirculation system with the addition of UV lamps with different powers ranges from 84-94%.



Description: P1 : without UV, P2 :5 Watt, P3 :10 Watt, P4 :15 Watt

Figure 8. *Survival Rate* (SR) of Tilapia

Survival rate (SR) or what is usually called survival is the percentage of test fish that are alive at the end of rearing from the number of fish stocked at the time of rearing (Dewi *et al*., 2022). Based on the results of research conducted for 45 days, it shows that the survival rate of tilapia in all treatments is classified as good because it is still above 80%. This is in accordance with the opinion of Dewi *et al*., (2022), namely that a survival rate of ≥50% is classified as good, survival rate of 30-50% is classified as moderate and less than 30% is classified as not good. The highest survival rate was found in P4 with an average of 94%. The high survival rate of tilapia fish is thought to be due to the provision of UV lights, which according to Risky *et al*., (2021), states that UV lights have the ability to kill bacteria in the water so that the fish are healthy and protected from disease. Husni, (2018), stated that the survival of tilapia fish is largely determined by the food and environmental conditions around it. Providing food with sufficient quality and quantity and good environmental conditions can support survival.

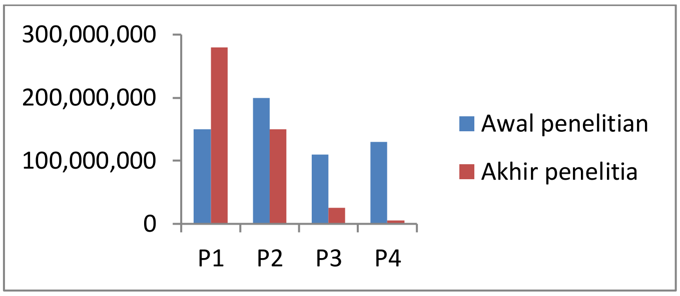
Fish survival is also influenced by internal and external factors, internal factors consist of the age and ability of the fish to adapt to the environment while external factors are competition between species, population increase in the same space, lack of food and others (Pardiansyah *et al.*, 2018). What is meant by environmental factors are, for example, fish handling and water quality. Incorrect handling can cause fish stress, so that the fish's health condition decreases and can cause death (Suryanto *et al.*, 2021). Meanwhile, water quality in this study was maintained by providing treatment with the addition of UV lamps and maintenance water which was channeled through a recirculation system so that the water quality was good.

Bacterial Abundance

Bacterial abundance measurement data during the study is presented in tables and graphs. The data displayed is the lowest data to the highest data for all treatments during the 45 day maintenance period.

Table 5. Bacterial Abundance

Parameter	Treatments	Results	Reference
Abundance of bacteria (CFU/ml)	P1	$1{,}5 \times 10^7$-$2{,}8 \times 10^7$	10^6 CFU/ml (Taslihan, 2004 *dalam* Ambat, 2022)
	P2	2×10^7-$1{,}5 \times 10^7$	
	P3	$1{,}1 \times 10^7$-$2{,}5 X 10^6$	
	P4	$1{,}3 \times 10^7$-$5{,}7 \times 10^5$	



Grafic 1. Abundance of bacteria

Bacterial abundance is the number of bacteria found in water that can support the water so that the water can be used as a cultivation medium (Asikin, 2020).. The abundance of bacteria in the research that has been carried out shows that the value of bacterial abundance ranges from 5.7 x 105 to 2.8 x 107 CFU/ml. The abundance of bacteria in this study can be said to be quite good because it is not too far from the maximum threshold for bacteria, in accordance with (Taslihah's, 200). opinion in Ambat *et al.*, (2021), which states that the maximum threshold for common bacteria in waters is 106 CFU/ml. In the research that was conducted, the highest bacterial abundance was in treatment P1, namely 2.8 x 107 CFU/mL and the lowest abundance was in P4, namely 5.7 x 105 CFU/ml. The high abundance of bacteria in P1 is thought to be due to differences in the power of the UV lamps used so that in treatments with high UV lamp power the abundance of bacteria is low, while in treatments where UV lamps are not given the abundance of bacteria is high. This is in accordance with the opinion of (Chyntia, 2015), where the greater the lamp power, the total microbes decrease and the longer the irradiation, the total microbes also decrease.

One way to kill bacteria is by using ultraviolet light. Apart from coming from sunlight, ultraviolet light also comes from lamps that have low wavelengths and contain mercury at low pressure (Risky *et al.*, 2021). Many people use disinfectants to kill bacteria, but using a UV system is the best choice to kill bacteria without causing a bad impact on the environment. UV light is effective in killing pathogenic microorganisms such as viruses and protozoa, and even several types of bacteria in the air can be killed in 10 minutes by ultraviolet light (LeChevallier, 2004 in Risky *et al.*, 2021). The greater the intensity given, the higher the bacterial death rate, and vice versa, the lower the intensity received, the lower the death rate of ETEC bacteria. The effectiveness of ultraviolet light in killing bacteria is influenced by several factors, including the area of the room, wavelength, lamp life, lamp length, exposure time, distance of the light source to the bacteria, and also the type of bacteria itself. Ultraviolet radiation can kill all types of microbes with sufficient intensity and time (Navratinova *et al.*, 2021).

Water quality

Water quality measurement data during the study is presented in table 6. The data displayed is the lowest data to the highest data for all treatments during the 45 day maintenance period.

Table 6. Water Quality Parameters

Parameter	Treatments	Results	Reference
Temperature (°C)	P1	27,7-30,0	25-32 °C (SNI 7550:2009)
	P2	27,1-28,7	
	P3	27,3-29,2	
	P4	27,2-28,6	
pH	P1	7,3-7,9	6,5-8,5 (SNI 7550:2009)
	P2	7,4-7,9	
	P3	7,4-7,9	
	P4	7,3-7,7	
Dissolved oxigen (mg/l)	P1	5,3-6,2	>3 mg/l (SNI 7550:2009)
	P2	5,2-6,2	
	P3	5,0-6,4	
	P4	5,0- 6,0	
Ammonia (mg/l)	P1	0,01-0,78	< 0,1 mg/L (SNI 7550:2009)
	P2	0,02-0,92	
	P3	0,01-0,83	
	P4	0,01-0,54	

Temperature

The water temperature obtained during the tilapia rearing period ranges from 27.1-30oC. The temperature range obtained is still within the optimal water temperature for the life and growth of tilapia. This is in accordance with SNI 7550:2009 where fish will grow optimally at water temperatures ranging between 25-32oC, whereas according to Gupta and Acosta (2004) in Azhari et al., (2018), the temperature range is good for cultivating tilapia (*O. niloticus*) is 25-30oC. Temperature is one of the factors that influences the growth of tilapia fish. High temperatures will cause the fish to experience stress and become susceptible to disease, while temperatures that are too low will reduce the fish's metabolic rate, thereby reducing the fish's appetite. This is in accordance with Hapsari *et al.*, (2020) where water temperature influences the appetite and metabolic processes of fish.

Degree of Acidity (pH)

During the period of raising tilapia, the degree of acidity (pH) obtained ranges from 7.3-7.9 ppm. The pH value obtained is still within the normal range, this is in accordance with the opinion of Rukmana (2007) in Afandi *et al.*, (2023), which states that water pH conditions between 5-11 ppm can be tolerated by tilapia while the pH is optimal for breeding and Tilapia growth is 7-8 ppm. The pH value is an indicator of the acidity of water. A pH value that is too low or too high can disrupt fish life. According to Hapsari *et al.*, (2020), stated that pH acidity that is not optimal can cause fish to be stressed, susceptible to disease, as well as low productivity and growth.

Dissolved Oxygen (DO)

The dissolved oxygen (DO) content obtained during the tilapia rearing period ranges from 5-6.4 mg/L. The dissolved oxygen (DO) value obtained is still within the normal range, this is in accordance with SNI 7550:2009 which states that the optimal dissolved oxygen level for the growth of tilapia is more than 3 mg/L. (Marsono, 2023) basically a dissolved oxygen concentration of 5 mg/L is the recommended oxygen content for cultivators. If the oxygen content is too low, ranging from 3-4 mg/L, the fish will experience stress and will die. The oxygen content in water is considered optimal for cultivating aquatic biota is 4-10 mg/L, a DO content of less than 1 mg/L can cause lethality or death within a few hours.

If the dissolved oxygen content is not balanced, this will cause fish growth to experience problems in accordance with Siegers *et al.*, (2019), which states that a lack of oxygen will cause fish to experience stress because the brain does not get enough oxygen. The worst situation is causing death due to the lack of oxygen for the breathing process. Dissolved oxygen (DO) has an important role in fish growth because dissolved oxygen (DO) is needed by fish for breathing, for metabolic processes or exchange of substances which then produce energy, this energy is used for fish growth and reproduction (Supii *et al.*, (2020).

Ammonia

Ammonia is the end result of fish metabolic processes. Ammonia can also come from uneaten food residue and dissolves in water. Non-ionized ammonia is toxic to fish and its drastic fluctuations can damage fish gill tissue (Fauzia *et al.*, (2020) . The ammonia content during the rearing period ranged from 0.01-0.92 mg/L. The ammonia value obtained was still within the normal range for both growth and survival of tilapia. This is in accordance with the opinion of Wahyuningsih *et al.*, (2020), that ammonia is toxic to commercially farmed fish at concentrations above 1.5 mg/l, in some cases the acceptable concentration is only 0.025 mg/l, whereas according to Yanuar (2017), states that the concentration limit that can kill tilapia is 0.1-0.3 mg/l. At high concentrations, ammonia is toxic, causing a large decrease in oxygen supply and undesirable changes in the ecosystem Wahyuningsih *et al.*, (2020). The toxic level of ammonia (NH3) in pond water can kill fish at a limit of 0.1-0.3 mg/l, while at a concentration level of ammonia (NH3) between 0.6-2.0 mg/L it can only poison fish if brief contact occurs Marsono *et al.*, (2013).

CONCLUSSION AND SUGGESTION

Conclussion

The use of ultraviolet lamps in tilapia nurseries has a significant effect on the growth rate of tilapia such as absolute length growth rate, specific length growth rate, absolute weight growth rate, specific weight growth rate, Feed Conversion Ratio (FCR), Survival Rate (SR) and abundance. bacteria, while the best use of UV lamps for tilapia nursery is P4. The highest average absolute length growth of tilapia was at P4, namely 6.4 cm and the lowest value at P1 was 5.9 cm. The highest specific length growth was at P4 at 0.05%/day and the lowest value at P1 was 0.03%/day. days, the highest absolute weight growth was at P4 at 9.7 gr and the lowest value at P1 was 8.6 gr, the highest specific weight growth was at P4 at 0.06%/day and the lowest value at P1 was 0.04%/day, FCR value The best value is in treatment P4 with a value of 0.7, while P1 is 1.1, while the best SR value is found in P4 at 94% and the lowest value is in P1 at 84%. Meanwhile, the best bacterial abundance was in P4 with an abundance of 5.7x105 CFU/ml and the worst was in P1 with an abundance of 2.8x107 CFU/ml.

Suggestion

Based on the research that has been carried out, the author hopes to carry out further research with different types of fish and more appropriate UV light power for the growth and survival of tilapia.

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