Journal of Fish Health
Volume 4, Issue 1, February 2024
https://doi.org/10.29303/jfh.v4i1.4416

Evaluation of Common Carp (*Cyprinus carpio*) Cultivation Techniques at Balai Benih Ikan (BBI) Lingsar, West Nusa Tenggara

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Received : 01-24-2024
Accepted : 02-24-2024

Keywords:
Cyprinus carpio, Common Carp, Cultivation Techniques, Fish Farming

ABSTRACT

This research aims to evaluate the cultivation techniques of common carp (*Cyprinus carpio*) at the Balai Benih Ikan Lingsar Installation, West Nusa Tenggara. The research method involved observation, interviews, and common carp cultivation activities. Data collected included pond preparation, seed selection and stocking, feed management, carp seed growth, evaluation of survival rate (SR), feed conversion ratio (FCR), and water quality measurement. The research results showed significant growth in common carp seeds, with average weight and length increasing from the beginning to the end of the rearing period. The survival rate (SR) reached 97%, while the feed conversion ratio (FCR) reached 0.77, indicating good feed efficiency. Water quality during the common carp cultivation period was within the optimal range, with pH, dissolved oxygen (DO), and temperature values suitable for fish growth. This research demonstrates that the common carp cultivation techniques applied at the Balai Benih Ikan Lingsar Installation are effective in supporting the growth and survival of common carp.

INTRODUCTION

Indonesia is a country with a continuously increasing population. According to the Central Bureau of Statistics (BPS), the Indonesian population reached 275.77 million in 2022. The high demand for animal protein, particularly sourced from fish, has reached 57% (Djunaidah, 2017). Fish farming is a promising sector for both large and small-scale operations, with common carp (*Cyprinus* sp.) being one of the promising species due to its delicious flesh taste and high protein content, leading to an increasing interest in carp in the market (Jatnika *et al*., 2014). This prospect is evident from the continuous increase in total carp production, which reached 8.92% from 2015 to 2019, thus enhancing the production opportunities and income for farmers, aiming to fulfill the nutritional needs of the community (Mustamin *et al*., 2018).

Common carp (*Cyprinus carpio*) is widely cultivated due to several advantages, including its adaptability to environmental changes, ease of natural spawning, good disease resistance, omnivorous feeding habit, and fast growth rate. These factors present significant

opportunities for further development and enhancement through effective breeding and rearing activities (Mustofa *et al*., 2018).

Carp rearing (*Cyprinus* sp.) is a stage in carp aquaculture. The rearing stage involves a series of activities starting from the selection of the size and type of fish to be stocked in the cultivation container. The initial rearing stages include preparation of cultivation containers, selection of fish seeds, feeding, fish maintenance activities, water quality management, pest and pathogen control, and ultimately, harvesting. According to Pratama *et al*. (2018), the growth of cultured fish is influenced by two aspects: internal and external. Internal aspects are directly related to the fish, such as age, inherent natural characteristics like genetics, ability to maximize feed, and resistance to disease. External aspects relate to the fish's living environment, such as physical and chemical water quality, movement, and food supply in terms of quality and capacity. One of the external aspects that can support fish growth is the cultivation pond or tank.

Carp rearing activities using cement pond tanks are located at the Balai Benih Ikan Lingsar Installation, West Lombok Regency. This area is in Lingsar Village, Lingsar District, West Lombok Regency. The location is adjacent to springs, which can assist in fish farming activities with conventional systems. Therefore, it is important to implement this field work program so that students can learn and understand the proper techniques for carp rearing at the Balai Benih Ikan (BBI) Lingsar Installation, West Lombok. The purpose of this field work program is to broaden students' insights and experiences in carp rearing techniques. This program benefits students by enhancing their knowledge and skills and enabling them to directly apply carp rearing techniques.

METHODS

This study was conducted in June-July 2023 at the Balai Benih Ikan Lingsar, West Nusa Tenggara. Data collection was carried out through observation and interviews, as well as engaging in common carp rearing activities. The methodology followed the approach outlined by Lailiyah *et al*. (2018), employing a descriptive method that involved observing all production activities at the research site. The methodology comprised several stages, including pond preparation, seed selection and stocking, feeding management, common carp (*Cyprinus carpio*) seed rearing, growth measurements, evaluation of survival rate (SR), feed conversion ratio (FCR), and water quality measurements. The details of each methodological stage are as follows: Pond Preparation, Seed Selection and Stocking, Feeding Management, Common Carp Seed Rearing, Evaluation of Survival Rate (SR), Evaluation of Feed Conversion Ratio (FCR), and Water Quality Measurements. By employing this methodology, the study aimed to observe the growth and survival of common carp and evaluate the environmental quality during their rearing process. Additionally, this method allowed for the identification of factors influencing the success of common carp cultivation.

RESULTS

Pond Preparation for Common Carp Cultivation

Pond preparation is an essential initial activity in aquaculture. It is crucial because the pond serves as a vital aspect that can influence fish growth. The ponds used at BBI Lingsar are concrete ponds measuring 3 x 2 m^2 with a depth of 75 centimeters. Activities involved in pond

preparation include drying and cleaning the pond, fertilizing, installing outlet pipes, and filling the pond with water.

Drying the Pond

Drying the pond is the first step in preparing the cultivation pond. This process involves draining the pond by opening the drainage outlet at the end of the pond once the fish have been completely harvested (total harvest). After the water has drained, the pond is cleaned using clean water to remove any remaining debris.

Fertilizing the Pond

Fertilizing the pond is carried out after it has been dried and cleaned of debris and organic matter. Pond fertilization involves using compost or chicken manure mixed with soil at a dosage of 300 grams.

Installation of Outlet Pipes

Outlet pipes are installed at the corners of the pond using 5-inch pipes, extending 7.5 centimeters from the height of the pond. This is done to prevent the water level from exceeding the maximum height of the pond during filling, ensuring that the water flow does not carry the cultured fish away.

Water Filling

Water used in fish farming processes is sourced from Aik Mual spring, Lingsar Village, which flows continuously throughout the year. Therefore, the ponds at BBI Lingsar implement a calm water pond system. The water flow into the pond area goes through several stages, including passing through main pipes, then through filter tanks, and finally distributed through pipes in each pond, including the ponds used for rearing common carp.

Seed Selection and Stocking

Common carp seeds used in this practical work were obtained directly from the Balai Benih Ikan Lingsar. The carp seeds are collected in a holding tank using a net for initial sorting or seed selection.

Feeding Management

Feeding management is crucial for supporting successful aquaculture. Controlled feeding aims to ensure that the feed provided is utilized efficiently by the fish, optimizing their growth.

Feeding Period and Frequency

Feeding is done three times a day at 08:00, 12:00, and 17:00 WITA (Western Indonesian Time). The amount of feed given is regulated according to the fish biomass, with 5% of the fish biomass taken, ensuring it contains the appropriate protein content.

Common Carp Seed Rearing (*Cyprinus carpio*)

Common carp seed rearing is conducted in permanent rectangular ponds measuring 2 x 3 meters with a height of 79 centimeters, with a stocking density of 100 carp seeds. The average length of the carp seeds stocked is 7.7 centimeters, with an average weight of 4.8 grams, and they are reared for 3 weeks. During the rearing period, an increase in carp growth is observed over time. This phenomenon is influenced by various factors, including environmental conditions and the quality of the feed consumed by the fish. The initial average weight of the carp seeds is approximately 4.8 grams. After 21 days of rearing, the recorded final average weight is around 14.6 grams. Similarly, the initial average length of the carp seeds is 7.7 centimeters, but after 21 days of rearing, the measured final average length is approximately 10.6 centimeters. The growth data of the common carp can be seen in Table 1 below.

Table 1. Common Carp Growth Data

Initial Biomass Weight (g)	Final Biomass Weight (g)	Initial Average Length (cm)	Final Average Length (cm)	Absolute Weight (g)	Absolute Length (cm)
488	1.424	7,7	10,6	9,8	2,9

Based on the obtained common carp growth graph, it is evident that the cultivated common carp exhibit good growth rates. The data collected from the beginning to the end of the rearing period indicates a significant increase, with an absolute weight of 9.8 grams and an absolute length of 2.9 centimeters.

The specific growth rate (SGR), or the percentage increase in fish weight per day, can be observed from the research data, where the SGR result is 0.34% per day.

Survival Rate (SR)

The survival rate (SR) of fish is the total percentage of live fish at a specific time compared to the total number of fish stocked at the beginning of the rearing period. The fish cultured at Balai Benih Ikan Lingsar achieved an SR value of 97%, obtained from the initial stocking of 100 fish and the final count of 97 fish at the end of the rearing period.

Feed Conversion Ratio (FCR)

The Feed Conversion Ratio (FCR) is the ratio between the weight of feed given to the weight of fish produced. The common carp cultivation conducted at Balai Benih Ikan Lingsar obtained an FCR value of 0.77. This value is calculated by dividing the total feed consumed by the fish biomass cultivated. The obtained FCR value is relatively low, indicating good feed efficiency.

Water Quality

Water quality is a crucial factor determining the success of fish farming. It can influence the growth and survival of common carp, with good water quality resulting in optimal fish growth. Water quality parameters measured during common carp cultivation include pH, dissolved oxygen (DO), and temperature, with measurements conducted once a week. The water quality results during the rearing period are presented in Table 2 below.

Table 2. Water Quality Data

Parameter	Cultivation Pond Water Quality	Optimal Water Quality According to National Standards
DO	9,2 – 9,6 mg/l	> 5 mg/l (Sabrina, 2016)
pH	7 – 8,7	6,6 – 8,7 (Nursandi, 2018)
Temperature	26 – 28^{o}C	25 – 32^{o}C (Sabrina, 2016)

The table above shows that the water quality during common carp rearing is within normal conditions. The pH values obtained during the research period were 7.0 in the first week, 8.7 in the second week, and 8.6 in the third week. The dissolved oxygen (DO) values obtained were 9.2 mg/l in the first week, 9.4 mg/l in the second week, and 9.6 mg/l in the third week. Water temperature is a critical factor to consider as it can affect the metabolic system of fish. Temperature measurements were taken three times during the common carp rearing period.

Harvesting

Harvesting activities in this study were conducted when the common carp were 3-4 months old. Grading activities were performed if there were buyers. Harvesting was done in

the morning by opening the L pipe at the outlet and placing a sorting tank on the outlet channel, followed by lining the tank with a net. After the water has drained, the common carp in the pond are collected using a net and transferred to a bucket containing water, then moved to temporary holding tanks. After all the common carp have been transferred, a complete count of the surviving common carp is conducted.

DISCUSSION

In the process of drying, the pond is drained and exposed to sunlight for one to two days until it is completely dry with the aim of improving the pond, removing toxic substances from the decomposition of organic matter. This is in line with Hasibuan *et al*. (2021), who argue that pond cleaning is done until the pond is completely dry to eliminate most pathogenic microorganisms, remove toxic substances or gases at the bottom of the pond, and break the life cycle of fish pests and pathogens during previous cultivation.

The next activity is pond fertilization, aimed at increasing the fertility of the pond water and accelerating the growth of bottom algae as natural fish feed. This is consistent with Mustajib *et al*. (2018), who state that fertilization aims to produce the nutrients needed for natural feed to make the pond area fertile.

In the installation of water outlet pipes, they should not exceed the maximum height of the predetermined pond to ensure that the fish remain in a safe condition and are not carried away by the water current. According to the Ministry of Education and Culture (2013), the water outlet functions to remove water from the pond when necessary.

The filling of carp (*Cyprinus carpio*) maintenance ponds is carried out for one day from the process of water sedimentation. This is in accordance with Roziq *et al*. (2016), who argue that filling the pond with clean water and allowing it to settle for approximately 24 hours allows excessive materials in the water to settle. Subsequently, water sourced from the filter tank is continuously distributed to the fish maintenance pond (flow-through water system).

Carp seedlings to be used must be in healthy condition and free from pathogens, as good seed quality will determine the quality of the fish obtained at harvest. This is consistent with Ambarwati *et al*. (2021), who suggest that seed selection be done evenly in terms of shape, color, and health level of the fish to select healthy fish before stocking to improve the resulting cultivation quality. The average size of carp seedlings used is 7.7 cm in length and 4.8 grams in weight. The seedlings are placed in a tank containing water, then spread by partially submerging the tank and allowing the seedlings to swim out on their own. The stocking density for one pond is 100 fish, with a pond area of 2 x 3 m. Density is an aspect that can affect fish growth. This is in line with Herliwati (2016), who argues that if the fish stocking density is too high, it will cause food competition and oxygen uptake, as well as restrict fish movement.

The amount of protein in feed aims to increase the growth of carp seedlings. This is consistent with Putranti (2015), who suggests that carp seedling growth will increase if fed with protein content of more than 29.46%. Feed frequency is increased along with fish growth, where feed given for maintenance from days 1-7 is 24.4 g/day, from days 8-14 is 38.9 g/day, and from days 15-21 is 49.8 g/day. The feed provided is in the form of floating pellets derived from various raw materials and has a nutritional content suitable for fish requirements. In its composition, the nature and size of the fish are also considered to obtain optimal fish growth with low FCR (Putri *et al*., 2022).

Feed is a major component in fisheries cultivation that can affect fish growth. Feed that can be used is floating pellets with a protein content of 36% and a pellet size of 0.3 mm adjusted to the mouth opening of the fish being cultivated.

Carp in this study are fed at a dose of 5%. This is in line with Serlina *et al*. (2022), who argue that the growth of carp seedlings can continue to increase if fed with a 5% feed dose, as this dose is in accordance with the amount of feed needed by carp for growth, as seen from the increasing length and weight of the fish along with the frequency of feed given as growth increases.

The growth data obtained during the maintenance period show significant significance. This phenomenon is supported by environmental conditions and regular feeding, which contribute to optimal growth in carp. This finding is in line with the opinion expressed by Cahyaningrum *et al*. (2015), who state that the growth rate of fish can be influenced by various types and qualities of feed given. High-quality feed has the potential to significantly increase fish growth while promoting higher feed efficiency. External factors such as fish response to the feed given and environmental conditions can also affect the overall growth rate of fish.

The growth of carp is supported by the provision of quality feed and good aquaculture water conditions, as well as low fish stocking density, allowing fish to grow well without competition for food. This finding is in line with the opinion of Afandi (2023), who states that fish growth rates are influenced by factors such as competition for space, water quality, and the amount of feed given. When carp are ready for harvest, their length tends to decrease because the nutritional resources consumed by the fish are used for weight gain, causing the fish body to widen rather than elongate. This is also consistent with Afandi (2023) view that fish growth can be influenced by internal factors such as the fish's ability to utilize feed.

Based on the results obtained, it can be said that the SGR of the fish is quite good. This is consistent with Mulqan *et al*. (2017), who argue that the average specific growth rate obtained is 0.40% per day, where the energy in the feed consumed by the fish exceeds the energy needs of the fish for growth and other activities, so half of this energy is used to support its growth.

The obtained SR value is relatively high, supported by good water quality monitoring with optimal water quality, even distribution of feed according to fish needs, and low fish stocking density, resulting in no competition for food. This is consistent with Tampubolon (2021), who argues that the average survival rate in freshwater fish farming is 84%, while the optimal survival rate ranges from 63.5% to 86.0%, influenced by stocking density, feeding, disease, and water quality factors including temperature, dissolved oxygen, and water pH.

The FCR value obtained in this study is 0.77. The low value is likely due to the fish being raised in open ponds, where there is a chance for phytoplankton to thrive and be consumed by the fish. Furthermore, the low FCR value is estimated due to the excellent utilization of feed for growth, as the fish's voracious appetite ensures that the feed requirement during the growth period is met. This is consistent with Sitio *et al*. (2017), who suggest that a good Feed Conversion Ratio (FCR) value for fish generally ranges from 1.5 to 2.5; the lower the value, the more efficient the feed is utilized by the fish for growth.

The obtained pH value indicates an optimum value for the survival of carp during the rearing activity; if the pH value is not suitable, it can disrupt the fish's survival. This is consistent with Mas'ud (2011), who argues that pH conditions that can disrupt fish life are either very acidic or very alkaline. Poor pH conditions can have adverse effects on fish, such as stress, susceptibility to disease, decreased productivity, and low growth.

From these measurement figures, it can also be seen that the obtained DO has a value suitable for carp rearing. This is consistent with Sabrina (2016), who argues that dissolved oxygen (DO) is the most important aspect for aquatic ecosystems, especially for the respiratory process of aquatic animals; generally, the concentration of dissolved oxygen in water should be >5 mg/l, which is recommended for the optimal health of fish.

In the first week, the temperature obtained is 28°C, in the second week it is 26°C, and in the third week it is 26°C, where the water temperature at BBI Lingsar is suitable for carp growth. This is consistent with Sabrina (2016), who argues that temperature is an external aspect that directly affects fish, such as reducing respiratory activity, growth, reproduction, and appetite; the optimal temperature for fish survival is between 25°C and 32°C. During harvesting activities, total harvesting is usually performed by emptying most of the water from the pond to facilitate capture using a seine or net (Wicaksana *et al*., 2015).

CONCLUSION

This research shows that the carp (*Cyprinus carpio*) rearing technique conducted at the Balai Benih Lingsar, West Nusa Tenggara, produces significant growth in carp seedlings with a high survival rate. Evaluation of water quality also indicates optimal conditions for fish growth. Furthermore, good feed efficiency, reflected in the low feed conversion ratio (FCR), indicates that feed is given correctly. Therefore, it can be concluded that the carp rearing technique applied at the research site is effective in supporting carp growth and survival. This research provides valuable insights for fish cultivation practitioners and can be used as a guide to improve the efficiency and productivity of carp cultivation in the future.

ACKNOWLEDGEMENT

We would like to thank the Lingsar Fish Seed Center for providing facilities and infrastructure for Nurul Aeni's research.

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