Breeding Technique And Business Feasibility Analysis of Pandu Nile Tilapia *(Oreochromis niloticus)* at Working Unit of Freshwater Fish Hatchery and Aquaculture (LOKA PBIAT) of Janti, Klaten, Central Java

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Abstract

Pandu nile tilapia (Oreochromis niloticus) is one of the essential commodities for freshwater aquaculture that can be cultivated for breeding and growing out. This commodity has a huge business prospect with relatively high price in the market. Nile Tilapia Pandu is a crossbreed fish with fast growth and high economic value because of the ease of cultivation method, popular taste, and wide environmental tolerance. Therefore, the purpose of this article was to investigate breeding techniques, facilities, infrastructure, and challenges of O. niloticus breeding conducted at Loka PBIAT Janti. In addition, this article also provided business feasibility analysis to find out the business prospect of O. niloticus breeding. This article described the Pandu Nile Tilapia breeding techniques include pond preparation, broodstock preparation, spawning, egg hatching, larva rearing, nursery, harvesting, pest and disease control, and water quality control. The results of observations in O. niloticus breeding are the fecundity of 958 eggs, the fertilization rate (FR) of 95.29%, the hatching rate (HR) of 96.62%, and the survival rate (SR) of 91.47%, the water quality showed a suitable and optimal results for O. niloticus breeding. The results of business feasibility analysis revealed that total revenue gained was Rp. 18.400.000., with BEP unit was 24,35 Kg and BEP price was Rp. 1.351.584,-.

Keywords: Pandu Nile Tilapia, Breeding Technique, Business Feasibility Analysis

Introduction

Nile tilapia *(O. niloticus)* is a main export commodity for aquaculture development in Indonesia. Nile tilapia is targeted to encourage the achievement of the fisheries industrialization program. The need for Nile tilapia in the form of fillet in the American market is quite significant, and other potential markets for Nile tilapia are the European Union, Iran, and Russia (Fitzsimmons, 2012; FAO, 2017).

Pandu nile tilapia is a type of tilapia with a male parent generation of the Singapore strain of red tilapia (SS). Tilapia has high economic value because of its easy cultivation method, popular taste, relatively affordable price, and wide environmental tolerance (PBIAT Janti, 2012). Pandu nile tilapia is similarly with other tilapia fish. However, Pandu nile tilapia has unique characteristics which make it popular among farmers. Tilapia resulted from crosses tend to grow faster. Therefore, the results of duration production during one cycle will be more effective (Putri et al., 2013).

According to Malide et al., (2018), cultivation development efforts cannot be separated from the breeding or seeding stage of superior types of organisms. Pandu tilapia is also a strain that should be developed at this time so that marketing could be better known to the broader community at the international level. The demand for good quality fish will remain the same in the market. This is because huge number of customers prefer tilapia for the consumption. Based on this, the Pandu tilapia has good prospects for development. Related to the potential above, this article aims to determine the hatching technique for Pandu nile tilapia as well as to investigate its business feasibility study.

Materials and Methods

The investigation was conducted from January - February 2023, at Loka Janti, Klaten, Central Java. The article

implemented data collection techniques, consists of primary data collection by observation, interviews, and active participation to obtain accurate data. Secondary data was obtained from various literature (journals/textbooks), previous research results, and other scientific sources. Data analysis observed in this research includes fecundity, fertilization rate (FR), hatching rate (HR), survival rate (SR), and growth rate. While, the parameter of business feasibility analysis consists of total cost (TC), total revenue (TR), R/C ratio, and break-even point (BEP).

Results and Discussion

Media preparation

Preparing containers in earthen ponds for spawning and hatching eggs at Loka PBIAT Janti by managing the land before filling the water. Preparation of the spawning pond included drying the pond, checking the pond's condition, and repairing the pond construction. Drying was carried out for three days until the pond soil cracks by checking the pond's condition so that no damage occurs during seeding activities. The aim of this activity is supported by Mustajib et al., 2018 with the statement pond production aims to improve the pond and remove toxic compounds from the decomposition of organic materials. Concrete and fiber ponds were prepared by cleaning the ponds with sanitation and cleaning the containers, then drying the ponds for 1-2 days to obtained sterile ponds.

Broodstock preparation

The broodstock rearing was carried out separately by males and females in concrete ponds. The separation aims to avoid mass spawning and select and mature the gonads. Hence, the fish are ready to be spawned and are expected to produce the desired offspring. This is also supported by the opinion of Haris and Supramono (2016) that separate rearing of broodstock aims to breed broodstock so that the broodstock could take a break from spawning, hence the broodstock produced may be of superior quality. Besides, broodstock maintenance was given an increased feeding frequency with high nutritional content. This is to support the growth of the parent tilapia fish.

Broodstock selection

During spawning, broodstock selection was carried out to select excellent and healthy prospective broodstock and to observe the level of gonad maturity in the broodstock. The pandu nile tilapia in Loka Janti could be declared to have passed the selection in terms of age. The age of the pandu tilapia with mature gonads was 5-6 months. The level of gonad maturity suitable to use as a parent is TKG IV-V, which could be identify based on the color of the genitals, with the difference being that male tilapia fish have round marks on the tip and are whitish. In contrast, females have stripes on the tip of the genitals and are reddish. Based on the opinion of Widodo and Rawas (2021), this is appropriate because, in TKG IV-V, the fish have been the adults and spawning with these characteristics, which means that the fish are ready to become spawning broodstocks.

Spawning

Pandu nile tilapia spawning implemented natural methods with a male-to-female parent ratio of 1:3 in a pond. The spawning process involved male and female fish chasing each other, indicating that the fish were spawning. When the female fish had released its eggs, the male fish would fertilize them by releasing sperm after the egg had been exposed to the male parent's sperm. After the eggs hatch, the female broodstock would immediately carry the eggs back to incubate them in the mouth and remove them from the broodstock's mouth. So tilapia were categorized as spawning as mouth breeders (Tahapari et al., 2019).

The rearing period was the next stage after spawning: the pressure and seed-weaning systems. The seed-weaning system was a system that spawns and allows the broodstock to incubate the eggs until they emerge as larvae. Meanwhile, the pressure system took the eggs being incubated by the parent directly and newly hatched larvae during the spawning process for 14-16 days to hatch them for 3-7 days.

The fecundity, FR, and HR obtained during the spawning were 958 eggs with a parent weight of 208g, FR of 95.29%, and HR of 96.62%. These results showed that the fish produced in Loka Janti had a high fertilization value and hatching rate. According to SNI (2009) and Rizkiawan (2012), the fecundity value for parent tilapia weighing 500g per spawning cycle is ≥ 1000 eggs or 200 eggs/100 grams. The fecundity results obtained from spawning Pandu tilapia are reasonable because they comply with the SNI for tilapia hatcheries. The high fertilization value was because the sperm released corresponds to the eggs released by the female. Therefore, during spawning, paying attention to the ratio between the male and female that you want to spawn is necessary.

The high hatching rate (HR) results were due to the appropriate water quality conditions at the egg hatching time. Because tilapia eggs float and do not stick, the hatching container resembles the conditions in which the eggs are in the mother's mouth. The egg-hatching container should have suitable water circulation; therefore, the eggs do not settle and rot. Apart from that, the container was given a heater to ensure the eggs can hatch properly because the temperature in the pond is significantly warm. According to Hasan et al., (2020), the parent tilapia fish has the characteristic of incubating its eggs in the mouth to provide warm temperatures during egg hatching. A suitable temperature for hatching tilapia eggs is around 29°C, as temperature plays a critical role in the egg-hatching process.

Feeding

Feeding of Nile Pandu tilapia at Loka Janti started from the broodstock until the fingerlings produced had been fed with different type of feeding. Table 1 shows feeding for each size and age.

Table 1. Feeding Management

No	Types	Age	Feed	Freq	Method
1.	Brood stock	4-6 months	Pellet 3 mm	Once	Ad satiation
2.	Larvae	Day 0– 7	-	-	-
3.	Fingerlings 1	Day 7–27	Powder pellet	Once	Ad satiation
4.	Fingerlings 2	Day 28–58	Pellet 3 mm	Once	Ad satiation

Newly hatched larvae aged 0-7 days were not provided the food since the larvae still had egg yolk as food. After the 7th day, the larvae were moved to the nursery pond. The larvae was feed with the form of fine pellets. This was due to adjusting the mouth opening according to the age. At the second nursery stage, the fingerlings were feed a granular pellets, even though the fish have not large mouth size as like as adult fish. However, the fingerlings may consume the pellets by nibling the pellets.

The method of feeding in ponds was generally ad satiation, namely by feeding until the fish were completely full and feeding may be stopped. An indication that the fish were full was no longer chasing pellets or appear to have scattered to the bottom of the pond. This observee the opinion of Mulyani and Fitriani (2014), the behavior of fish fed ad satiation, namely that the fish will gather to chase pellets when starving and leaving when the fish are being full.

Water Quality Management

Water quality for cultivating freshwater fish should meet several requirements because poor water quality will lead to the outbreak diseases. Water quality management could be implemented by cleaning the waste from the inlet channel. Then, by maintaining the flow or quantity of water entering the inlet, aims to ensure that the incoming water is not too strong or too small, which can affect the quality of dissolved oxygen and water quality control was carried out once a week so that the water quality condition remains stable. Water quality conditions and standards by Standar Nasional Indonesia (SNI) for Nile Tilapia Breeding (2009) and Panggabean (2016) as presented in Table 2.

Table 2. Water quality requirements

No	Parameter	Unit	Value
1.	Temperature	℃	25-30
2.	pH	-	6,5-8,5
3.	Dissolved Oxygen (DO)	mg/l	>3
4.	Brightness	cm	30-50

Pest and Disease Control

One of the ectoparasitic diseases which was mainly found in Loka Janti was Trichodina sp. Trichodina ectoparasite was often found in the seed-to-brood stage. According to Susila (2016), this is appropriate because these ectoparasites can cause stress and can cause damage to fish morphology. Saprolegniasis was also a disease often found in larvae and broodstock of Nile Pandu tilapia in Loka Janti. The initial symptoms of an attack were characterized by fine, cotton-like threads sticking to the body of the injured fish. According to Supiana (2017), these threads can also attack weakfish, the head area. Gill covers fins and other body parts. Pests and diseases could also be avoided or managed appropriately.

There were several methods used at Loka Janti to prevent pest attacks and diseases of tilapia, including maintaining the quality of the pond water, cleaning the bottom of the pond, installing filters or screens at the water intake inlet to prevent some pests and disease-carrying vectors from entering the pond, meet the nutritional needs of fish and avoid stress on fish.

Meanwhile, fish that have been infected with the disease were taken from the pond and placed in a quarantine pond to be given potassium permanganate by soaking in a solution at a dose of 4 mg/liter for 12 hours, repeated every two days for fish treatment until the fish do not contract the disease. According to Zalukhu et al., (2016), potassium permanganate (KMnO4) is a strong oxidizer often used to treat fish diseases caused by ectoparasites and bacterial infestations, especially in fish in ponds.

Harvesting

Harvesting was done for fingerlings after nursery 1 with a day of culture period of 20 days and nursery 2 with a day of culture period of 30 days. The DOC was adjusted to consumer needs in selling fingerlings. Harvesting could be start in the morning at 07.00, and the sun's height is more than 45°, making harvesting more accessible and reducing stress levels on the fingerlings. The harvesting procedure could be started by reducing the pond water by opening the outlet channel and closing the inlet channel. After the water volume decreases, the fingerlings were harvested by catching them manually with waring/seser, then storing them in drums filled with water.

The fingerlings were transported and stored in a holding pond as a hapa, a temporary fish-holding area, before being packaged. Fingerlings harvesting was carried out in nursery ponds with the size of fingerlings ready for harvest in nursery 1, namely 2-3 cm and nursery 2, namely 3-5 cm. Fingerlings packaging could be carried out in closed packaging using plastic containers measuring 80 cm x 50 cm with a density of 200-300 fingerlings/plastic and a water and oxygen ratio of 1:2. Supported by the opinion of Iskandar et al., (2021) who stated that the density of fingerlings with a ratio of water and oxygen must be appropriate based on the size of the fingerlings so that when shipping the fish do not run out of oxygen because they are too dense.

The survival rate (SR) obtained during rearing was 91.47%, with a weight growth of 20.19g and a fish length growth of 6.31 cm. This could be interpreted as that the kept fish have a high survival value caused by high body resistance, optimal growth, and resistance to good environmental conditions. This cause was due to feed factors, which will influence the growth of the fish, which will later lead to the fish's metabolism to survive. According to Imani (2018), this is appropriate because fish need energy to stay alive, obtained from protein from feed.

Growth with increasing weight and length of fish shows that weight and length are relevant to the suitability of the feed given. This is also expressed in the opinion of Setijaningsih and Umar (2015), who state that intensive feeding and

maintenance can increase the growth in weight and length of fish because metabolism can run optimally. Therefore, good fish metabolism will be used as growth energy for the fish. However, if fish metabolism decreases, fish growth will also decrease.

Business Feasibility Analysis

The revenue from Nile Pandu tilapia production in one production period was Rp. 18,400,000.00. This was because the selling price of tilapia was influenced by the way farmers market the tilapia. Meanwhile, the income from the Nile Pandu tilapia cultivation business in one production period was IDR 11,473,650.00. The income from cultivation businesses at Loka Janti was relatively stable since the buyers come from various parts of the wider community. This follows the opinion of Pantow et al., (2017), which states that the results of revenue, income and profits are influenced by consumers and the market at that time because fisheries production is not always uncertain, where demand can increase or even decrease.

The R/C ratio shows the number 2.36, which means that Rp. 1 spent may generate a profit of Rp. 2.36 was very good to work towards. This is under the statement of Hidayati et al., (2020) that if the R/C ratio is <1, then the cultivation business can be said to be unfitted to continue because the value of production costs is more significant than profits and will cause losses.

Table 3. Business Feasibility Analysis

No	Description	Total
1.	Fixed cost	Rp. 851.498,-
2.	Variable cost	Rp. 6.926.350,-
3.	Total revenue	Rp. 18.400.000,-
4.	Total cost	Rp. 7.777.848,-
5.	Break Even Point (BEP) □ BEP unit □ BEP price	 24,35 Kg Rp. 1.351.584,-
6.	Income	Rp. 11.473.650,-
7.	Profit	Rp. 10.622.152,-
8.	R/C ratio	2,36

Conclusion

Based on the results of this activity, it can be concluded that from the results of spawning of broodfish broodstock, an average egg fecundity of 958 eggs per broodstock was obtained, with an FR of 95.29%, an HR of 96.62%, and a larval survival rate obtained amounted to 91.47% with growth in weight of 20.19 gr and length of 6.31 cm. The results of the business analysis calculations showed a profit of IDR 10,622,152.00/year, an R/C Ratio of 2.36, a Break Event Point (BEP) price of IDR 1,351,584 and a unit BEP of 24.35 Kg/Production.

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