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Red Tilapia (*Oreochromis* sp.) Rearing Productivity in Running Water of Banjaran Irrigation Area, Purwokerto, Central Java, Indonesia

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ABSTRACT: This research studied Red Tilapia (*Oreochromis sp.*) rearing productivity level in running water of Banjaran Irrigation Area, Purwokerto. Experimental research was designed with 3 treatments on density, 100, 150 and 200 fish/m^3. Common ponds was reconstructed permanently into 3 running water sized 2x6x1 $m^3$with water inlet and outlet in the base of the ponds. Each pond was separated into three parts by using polyethylene net. Volume of water in each pond was 15-17 l/s and the depth was 70 cm. Red tilapias weighed ±44 gwere fed with at satiation method three times in a day. Growth parameters (growth rate, survival rate, feed conversion ratio and feed efficiency) were analyzed by ANOVA test and followed with Tukey's test. Optimal water quality parameters were with temperatures at 24.5-27.5 ^{0}C, dissolved oxygen at 4.5-5.7 mg/l, and pH 7-7.5. Fish density level was in line productivity level, but long period of time was needed to achieve the weight of consumption fish. Red tilapia rearing in running water of Banjaran Irrigation Area, Purwokerto could be conducted with fish density at 200 fish/m^3, harvest target over 45 kg/m^3, and rearing period over above 60 days.

Key words: *Oreochromis* sp., Running Water, Density, Productivity

INTRODUCTION

Production and demand on tilapia fish keep rising and should be followed with technology culture innovation [1]. An effort to increase production and productivity is by applying running water technology [2]. This technology could be conducted with high fish density at 200 fish/m^3 and harvest target at 70-200 kg/m^3[3]. This technology requires great volume of water source and continuous water flow throughout the year [2].

One of potential area is Banjaran Irrigation Area. Irrigation technique with Banjaran River as water source, continues to flow throughout the year with water volume at 2-14 m^3/s [4] where most of the area is at ±500 m above the sea. Temperature ranges from 24.4^{0}C – 30.9^{0}C with an average at 26.3^{0}C [5]. Data and information of level productivity for aplay technology rearing red tilapia in running water in Banjaran irigation area, purwokerto

MATERIAL AND METHODS

Three running waterwere constructed with size 2x6x1 m^3. Each pond was separated into three parts sized 2x2x1 m^3 with polyethylene net. Sample fish tested were red tilapias with 44±13.56 gram in size. They were fed with commercial feed for tilapias. Feeding was done using at satiation method three times in a day at 08:00, 12:00, and 16:00 local time [2]. Observation was conducted daily to record consumed feed, the quantity and weight of dead fish. Sampling on fish growth was conducted every 14 days and water quality was observed in the beginning and the end of 60 days rearing period.

The research was designed using random complete design with three treatments and 3 repetitions. Fish density at 100 fish/m^3 (A), 150 fish/m^3 (B) and 200 fish/m^3 (C). Growth parameters (growth rate, survival rate, feed conversion ratio, and feed efficiency) were analyzed with ANOVA test and followed with Tukey's test using SPSS program version 16.0.

RESULTS

Design and construction of running water built in Banjaran Irrigation area, Purwokerto showed in Figure 1.Figure 1 showed design and construction changes of the running water where water inlet and outlet were made

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at the base of the ponds to improve their support capability. Ponds averagely flowed with water at ±15-17 l/s with 70 cm water depth. Optimal water quality parameters were with temperature at 24.5-27.5⁰C, dissolved oxygen at 4.5-5.7 mg/l, pH 7-7.5 and water transparency ±70 cm [6-8]. Tilapias growth can be seen in Figure 2.

Previous graphic showed improving growth, but the higher density, the lower the growth. Yet, the higher density, the higher productivity, A (22kg/m^3), B (29kg/m^3), C (36kg/m^3). Fish rearing for 60 days showed average weight gain A (119 g), B (108 g), and C (99 g). The effect of density on fish growth can be seen in Table 1.

Figure 1. The pond before (left) and after turned into running water (right)

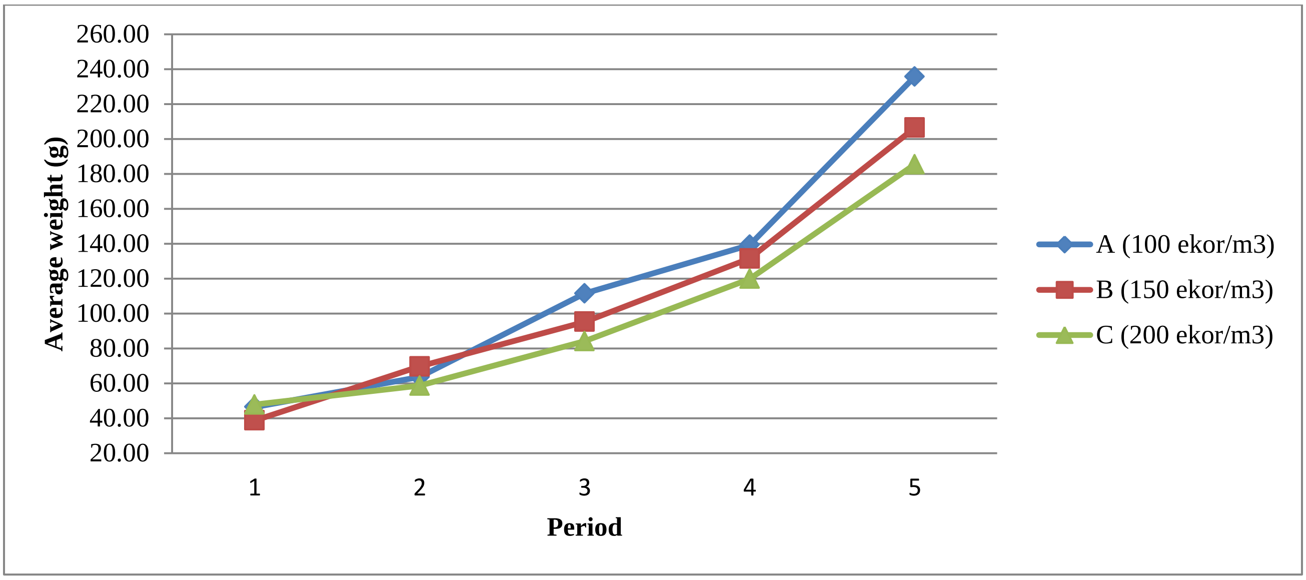

Figure 2. Fish growth (measured every 14 days)

Table 1. The effect of density on fish growth parameters

Parameters	Fish density (fish/m^3)		
	A (100)	B (150)	C (200)
Growth rate	2.73 ± 0.11	2.81 ± 0.13	2.31 ± 0.23
survival rate *	93.57 ± 1.43[a]	93.41 ± 2.26[a]	97.74 ± 0.98[b]
Feed efficiency	68.99 ± 0.07	69.04 ± 0.04	68.97 ± 0.08
Feed conversion ratio	1.449 ± 0.001	1.448 ± 0.001	1.450 ± 0.002

* = significantly different

DISCUSSION

Water quality parameters fluctuated dynamically, but fresh water flowed in each pond could maintain optimal water quality. Strong current pattern at the base of the ponds fastened organic material outage from the ponds [9]. This condition could improve their support capability for the fish's life and growth [2].

Growth as a succeeding factor of culture was showed by size enlargement and weight gain each period of time [7]. Fish growth cycle showed improving growth each week where the higher the density, average of weigh will low but the other hand the pond's productivity got higher. As a result, red tilapia rearing with jetted pond technology in Banjaran Irrigation Area showed that fish density was in line with productivity level, but long period of time was needed to achieve the size and weight of consumption fish. This condition happened because fish density affects the space and food competition [10].

Each pond's productivity ranged 17-45 kg/m^3, at 29 kg/m^3 average. This was because running water technology could be done at high density with harvest target at 70-200 kg/m^3 [3], in 4-5 months [2]. Daily growth rate measurement showed that density A (2.73 %) and B (2.81 %) were higher than density C (2.31 %). If the density fish high, will make low the level of growth. Even though the result of ANOVA test was not significantly different, it is presumed due to the environment support capability which was still able to sustain the growth. So, fish density at 200 fish/m^3 could be applied in jetted ponds of Banjaran Irrigation area, Purwokerto.

The survival rate at density A (93.57 %) and B (93.41 %) were lower than density C (97.74 %). It showed that the higher the density, the lower the mortality. One factor which could affect fish survival rate is the environment. Space competition in high density pond could improve fish behavior as a form of adaptation [10]. Feed efficiency illustrates feed utilization to improve fish culture weight [11]. The higher the efficiency caused to the better the fish growth [12]. High fish activity in running waterfish culture still gave efficiency ranged at A (68.99 %), B (69.04 %) and C (68.97%). Feed conversion ratio also shown at 1.45 from all fish densities. It indicated quality and quantity of the feed along with its environment support capability were still able to sustain life and growth of the fish [13]. Fish density affected the efficiency and conversion ratio of the feed. Feed quality with protein 31-33%, fat 3-5%, fiber 4-6%, water 10-13% and ash value 11-13%, could fulfill for maintenance and growth.

ANOVA test result showed that all density treatments and growth parameters of red tilapia in running water were not significantly different except for its survival rate. It was understandable because fish growth could be affected by internal and external factors. Internal factors include genethical and physiological condition of the fish while the external factors are related to the environment, feed and diseases [14]. Technology input through the application of running water construction, water volume, fish types, feed and same management in Banjaran Irrigation Area could support fish growth from all densities.

Some researchers showed that fish density affected growth, survival rate, feed efficiency and it conversion ratio [11, 15]. But this research showed different result. It was presumably caused by the volume, size and density of the fish were able to be sustained by the environment support capability and the available feed[15]. As the result, red tilapia rearing in running water in Banjaran Irrigation Area could be done with density at over 200 fish/m^3, harvest target above 45 kg/m^3, and rearing period more than 60 days.

CONCLUSION

Fish density level was as same as productivity level, but longer time needed to achieve the size and weight of consumption fish. Red tilapia rearing in running water in Banjaran Irrigation Area, Purwokerto could be done with density at over 200 fish/m^3, harvest target above 45 kg/m^3, and rearing period more than 60 days.

Recommendation

Production and pond's productivity could be improved with the application of running water technology. Further research could be done regarding the social economy.

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