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Performance evaluation of Vietnam koi (*Anabas cobojius*) in biofloc culture system: A case study

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ABSTRACT

The study investigated the growth and economic performance of Vietnam koi (*Anabas cobojius*) using biofloc culture technique in farmers' field. The experiment was carried out in two number of tarpaulin (650 GSM) biofloc tanks of with 4 meter diameter, 1.3 meter height. The stocking density of each tank was @5000 numbers per 8000 liters with initial average weight of each as 5.1 g with the depth of water between 90-100 cm. For better growth performance and to avoid the growth disparity the fishes were separated based on size and kept in separate tanks as bigger and smaller between the tanks every month. The feeding rate was gradually reduced from 2% to 0.05% of body weight from June 2019 to November 2019 and the feed conversion ratio (FCR) was found to be 0.59. The specific growth rate (SGR;%) was achieved the highest in the month June (3.27) and the lowest in the month of November (0.44). Based on the performance evaluation a total yield of 872 kg (Tank-1@460 kg per 8000 liter and Tank-2 @412 kg per 8000 liter) of Vietnam Koi (*A. cobojius*) was harvested from both the cultured biofloc tanks within a period of six months. The net profit was of Rs. 21,020.00 (including infrastructure cost and of Rs. 63,020.00 (excluding infrastructure cost) with B:C ratio of 1.16 and 1.70 respectively.

Key words: *Anabas cobojius*, biofloc technology, performance, SWOT

INTRODUCTION

Vietnam koi (*Anabas cobojius*), a variety of exotic koi, native to Vietnam is getting tremendous popularity in different parts of India which is generally called as Gangetic koi. Now it is found in lakes, ponds, ditches or paddy fields and able to live out of water for protracted period. Its external physical appearance is similar to native climbing perch as of India, but two black spots found, one in operculum and another is in caudal peduncle which is not found in native climbing perch *Anabas testudineus* (Hasan et al., 2010; Datta and Ghosh, 2015; Kohinoor et al., 2016). Biofloc fish farming has become very popular all around as an alternative to open pond fish farming. In aquaculture, the major prominent factors are the feed cost (accounting to 60-70% of the total production cost) and the most limiting factor in the water and or land availability. The main principle of this technique is the in situ production of large range of microorganisms and accelerating the nitrogen cycle by maintaining higher C: N ratio through stimulating heterotrophic microbial growth, which assimilates the nitrogenous waste that can be exploited by the cultured species as a feed (Daniel and Nageswari, 2017). By addition of carbohydrates the desired C: N is generally maintained through the source (molasses) and the water quality is improved through the production of high quality single cell microbial protein (De Schryver et al., 2008). This technology is based also on the principle of flocculation within the system. With this condition, dense microorganisms develop and mainly function both as bioreactor controlling water quality and protein food source. In biofloc environment the control of toxic nitrogen species occurs more quickly because of the growth

rate and microbial production per unit substrate of heterotrophs are ten-times greater than that of the autotrophic nitrifying bacteria (Ray, 2012; Avnimelech, 2015). In this study, the performance and economic viability of Vietnam koi using biofloc technology was evaluated in the farmer's field.

MATERIALS AND METHODS

Study site

The map of the study site (with latitude 21.72° N and longitude 86.86° E) is presented below (Fig.1).

Fig. 1. The study site of Village Nadpur, Block Betonati, Dist Mayurbhanj, Odisha.

Experimental design

The total land area for fish farming was about 400 m^2 (20 m × 20 m) including tank area, solar panel and go down area. Two circle tanks made up of tarpaulin (650 GSM) used for the grow-out of Vietnam koi with the diameter of 4 m, 1.3 m height and 0.9-1.0 m water depth. The slope maintained for the drainage pipe sloping around 1.5 ft from the center for better outlet of water. A protective sheet outside of the tank was used to protect the tarpaulin from external damages. The experiment was carried out for six months, i.e. from June 2019 to November 2019. The Vietnam koi fishes were stocked in the two biofloc tanks (BFT) @5000 numbers per 8000 liters having capacity of each tank 10000 liters with initial average weight of each as 5.1±0.13 g. The fishes were treated in the hospital tank with potassium permanganate ($KMnO_4$) @ 2 mg l-1 as disinfectant before stocking in the biofloc tank. The fishes were fed with the floating feed three times per day with respect to the percentage (%) of body weight of the fishes. First two months (June and July) the fishes were fed with 2% of body weight followed by 1% in the month of August and September and 0.5% in the month of October and November. The heterotrophic organisms by using the organic matter and the available ammonia in the biofloc tank accelerated in the decomposition of the organic matter to generate large amounts of bacterial biomass to accelerate the nitrogen cycle. The C: N ratio was maintained as 15: 1 throughout the culture period.

RESULTS AND DISCUSSION

Water quality parameters

The water parameters were analyzed by kit method Dissolved oxygen (CIFEDO, ICAR, CIFE), pH (CIFE pH test Kit, ICAR, CIFE), Ammonia (Ammonia test kit, API), but the TDS and Temp (TDS-3) with digital meter. The water analysis of both the tanks was done on weekly basis and the average of different parameters calculated. The average values of the water quality parameters of the biofloc tanks are shown in Table 1 and Fig. 2. Sarma et al. (2010) observed role of water quality parameters on dissolved oxygen concentration in water, temperature and oxygen consumption by fishes. Emerenciano et al. (2017) stated that biofloc technology helps to maintain water quality parameters at the optimal level for fish cultivation.

Growth parameters

The growth parameters like average body weight, average daily weight gain, specific growth rate (SGR; %), mortality in numbers and survival rate (%) of both the tanks were calculated month wise shown in Table 2. The maximum mortality was found in the month June (230 nos) and there were nil mortality from the month of September. SGR was the highest in June (3.27) and the lowest in the month of November (0.44). The feed conversion ratio (FCR) and the total fish production were 0.59 and 872 kg, respectively. The detail results of the growth parameter were shown in Table 3 and Fig. 3.

Table 1. Average values of the observed water parameters during culture period (June to November 2019)

Sl. No	Parameter	June	July	August	September	October	November
1	Temperature (°C)	28	26.5	25.57	22.29	21	20
2	Dissolved oxygen (mg L^{-1})	6	5	6	5	5	5
3	pH	7.5	8.25	7.1	7.75	7.25	8
4	Total dissolved solids	88.5	128.1	220.6	260.5	318.4	350.5
5	NH_3	0.1	0.25	0.5	0.5	0.25	0.5

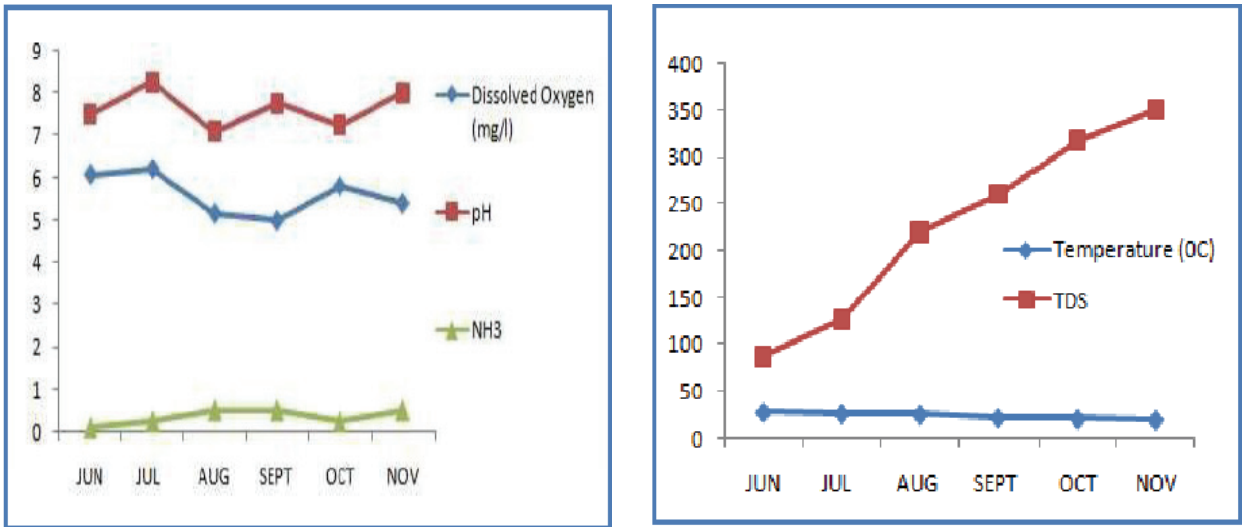

Fig. 2. Average values of the observed water parameters during culture period (June to November 2019)

Economic performance

The economic performance Vietnam Koi (*Anabas cobojius*) in biofloc farming system of both the two biofloc tanks during culture period (June-19 to Nov-19) was calculated and found that a net profit of ₹ 21,020.00 (including infrastructure cost) and profit of ₹ 63,020.00 (excluding infrastructure cost) with B:C ratio of 1.16 and 1.70 respectively (Table 5). The details of the economic performance was mentioned in Table 4 and Table 5.

Table 2. Observed average weight (g m^{-1}), mortality and feeding schedule during culture period (June to November 2019)

Month	Stock status (Nos)	Month wise Morality (Nos)	Average weight (g)	Type and size of feed in millimeters	Feeding rate (% of body weight)	Month wise feed used (kg)
June	9770	230	5.1	Floating feed (1 mm)	2	29.90
July	9630	140	13.6	Floating feed (1 mm)	2	81.20
August	9530	100	24.4	Floating feed (1 mm)	1	72.08
September	9530	0	45.7	Floating feed (2 mm)	1	130.66
October	9530	0	64.8	Floating feed (2 mm)	0.05	95.72
November	9530	0	79.2	Floating feed (2 mm)	0.05	113.22

Table 3. Growth parameters of Vietnam koi during culture period (June to November 2019)

Parameters	Months					
	June	July	August	September	October	November
Average weight (g)	5.1	13.6	24.4	45.7	64.8	79.2
Weight gain	8.5	10.8	21.3	19.1	14.4	11.1
Average daily weight gain (g) per day	0.28	0.35	0.69	0.64	0.46	0.28
Specific growth rate (%)	3.27	1.89	2.02	1.16	0.67	0.44
Mortality (pieces)	230	140	100	0	0	0
Survival rate (%)	97.7	98.56	98.96	100	100	100
Feed Conversion Ratio	0.59					
Total production in both the tanks (BFT-1+BFT-2)= 872 kg within six months (June to November 2019)						

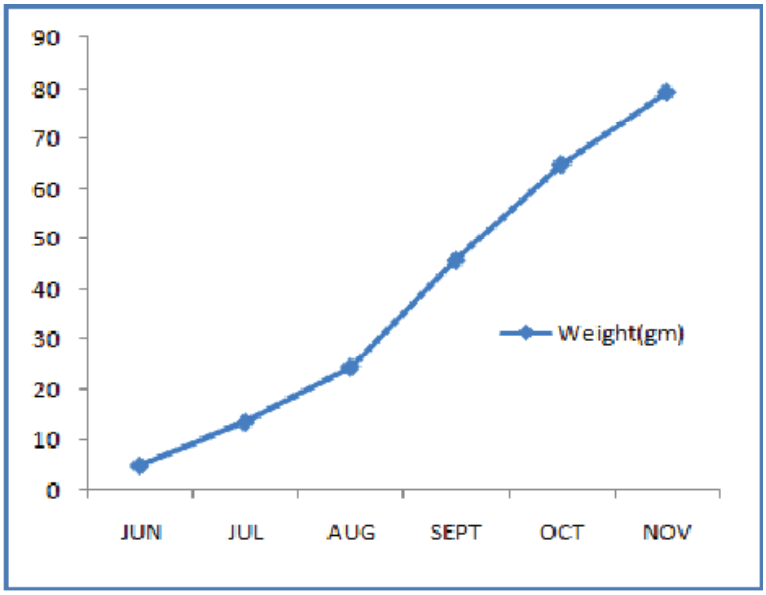

Fig. 3. Observed average weight (g per month) during culture period (June to November 2019)

Table 4. Cost involvement during the study

Components	Amount (₹)
Construction of biofloc tank (2 nos) (4 m diameter × 1.5 m height, Water holding capacity 10000 L) with accessories	42,000.00
Labor cost (provides protection, feed supply)	30,000.00
Seed 10000 nos @ ₹ 2 per piece	20,000.00
Feed (Floating feed , 522 kg)	24,300.00
Probiotics, medicine and test kit	10,800.00
Electricity	4,000.00
Total expenses	1,31,100.00

Table 5. Revenue generation after completion of the culture period

Type	Production	Unit price (₹ per kg)	Revenue (₹)	Total income (₹)	Total expenditure (₹)	Net profit (₹)	B:C	
							II	EI
Revenue from the fish cultured from six months	Local sell: 252 kg	210	52920	1,52120	1,31,100	Profit including infrastructure (II) as 21,020.00 and excluding infrastructure (EI) 63,020.00	1.16	1.70
	Mass sell: 620 kg	160	99200					

CONCLUSION

Biofloc is an alternative technology to open pond fish farming. It provides a boost to doubling fish production and encourages small landholders and entrepreneurs to take up fish farming. In the present study the biofloc technique was used for Vietnam Koi (*A. cobojius*) fish production in a small scale. The growth and benefit cost ratio was encouraging. Their consumer demand is very high due to the high nutritional and medicinal value. and farmers can get good price by selling the fishes in live conditions. This technique is also best suitable for the areas where the land and water availability is the major constrain. There is a need of more research on water quality, microorganism profile and growth related parameters due to consumption of floc and conversion of ammonia to protein with reference to Vietnam Koi culture with higher stocking density .

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