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Growth performance of Vietnamese koi (*Anabas testudineus*) in a commercial farm

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Abstract

An experiment was carried out to study the growth performance of Vietnamese koi (*Anabas testudineus*) in a commercial farm. From 01 September, 2013 to 02 April, 2014 at Rahmatpur, in Sadar Upazilla in the district of Mymensingh, Bangladesh, having three treatments designed as treatments T1, T2 and T3, respectively, with stocking densities of 976, 1000 and 1055 fry/dec were conducted. Same size of fry was stocked (length 1.50 cm and weight 1.01g) and fry were fed with commercial pelleted feed. At the very beginning 20% feed were provided for 1st month and then it was adjusted to 10% for the next two weeks and finally to 1%. During the experimental period, water quality parameters were assessed fortnightly. The average temperature was found 22.53±0.60, 21.24±.1.20 and 22.62±0.45°C in treatment T1, T2 and T3, respectively. The mean values of pH content of the water in T1, T2 and T3 were 7.45±0.36, 7.60±0.26 and 7.62±0.23, respectively. The mean values of dissolved oxygen content of the water in treatment T1, T2 and T3 were 4.77±0.18, 4.77±0.18 and 4.79±0.14 mg/l, respectively. The growth performance was determined at the end of the experiment in respect of measuring length (cm) and weight (g). The treatment T1 showed the best growth performance followed by T2 and T3, respectively. This might be due to stocking density and management issues. The final average length (cm) gain of Vietnamese koi was found to be 13.70±0.03, 13.64±0.02 and 13.58±0.01 cm in treatments T1, T2, and T3, respectively. Average weight gain (g) was found to be 90.00±2.000, 88.00± 1.000 and 86.02±1.020 g for T1, T2 and T3, respectively. The production was found to be 83.57 kg/dec in T1, followed by T2 (83.60 kg/dec) and T3 (84.01 kg /dec), respectively. Finally, it could be concluded that the growth performance of Vietnamese koi is higher in low stocking density but production was maximum in high stocking density. In future more research should be done to know the growth performance of Vietnamese koi.

Keywords: growth performance, treatments, stocking density, vietnamese koi

Introduction

Bangladesh is blessed with numerous natural water bodies. These water bodies are scattered all over the country in the form of small ponds, beels, canals, lakes, small and large rivers. The total area of inland water bodies is 46,99,345 ha of which open waters comprise 39,25,290 ha and closed waters 7,74,055 ha (DoF, 2013). In fact, fish and fisheries are extremely important for Bangladesh and these have been an integral part of nutrition, economy, culture and tradition of the people of Bangladesh from time immemorial. Presently fish and fisheries sector contribute 60% of total protein intake, 4.39% to GDP, 22.76% to agricultural production and 2.46% to foreign export earning of the nation (DoF, 2013). Once upon a time we were depended for fish consumption only from the natural open water resources but this dependency is out of thought due to gradual degradation of open water bodies as well as

increasing our population density. Since the augmentation of fish production from our beels, canals, lakes, river and estuaries are generally to be complicated; we need to depend on aquaculture especially on pond aquaculture for increasing of our population demand, employment generation and poverty alleviation of Bangladesh. Though the population of Bangladesh is increasing geometrically but our resources are not increasing in the same way. Our per capita annual fish intake is 18.94 kg where demand is 20.44 kg; this gap should be fulfilled from our culture fisheries (DoF, 2013). Therefore, a significant effort to increase fish production should be concentrated on aquaculture. The total fish production of the country during the year 2011-2012 was about 32, 61,782 mt of which 26,83,162 mt was produced from inland waters (DoF, 2013). Akhterruzzman (1988) conducted an experiment on the monoculture of, Anabas testudineus (Bloch) under semi-intensive culture system. Fingerlings (average wt. 8 to 9 g) were stocked at a density of 160200/ha in three 0.028 ha size ponds. They were fed daily with a mixture of rice bran mustard oil cake and fishmeal 4 at ratio of 3:1:1. Feed was given daily at the rate of 5-6% of the estimated body weight of the stocked fish. After 5 months rearing, the average yield was 450 kg/ha and average survival rate was 78%. BFRI (Research Progress 1998) undertook studies on culture of Koi (Anabas testudineus) at a stocking density of 20000/ha to assess the production potential of koi in earthen ponds. In treatment-1, the gross production was 425 kg/ha where rice bran 50%, mustard oil cake 30% and fish meal 20% were used as a supplementary feed. On the other hand, gross production of 286 kg/ha was obtained where rice bran 50% and mustard oil cake 50% were used as a supplementary (feed treatment-2). From the study it was revealed that the gross production of koi was significantly higher (p) in treatment-1 that of treatment-2.

Chanchal et al. (1978) carried out an experiment on some aspect of biology of Anabas testudineus. They reported that male and female attain sexual maturity when they grow to weight 11.3 g and 12.2 g, respectively. The sex ratio of this fish recorded by them was 3 females: 2 males. The estimated fecundity of this species was found to range from 3481-42564. Islam (2007) conducted study on physico-chemical condition and occurrence of some zooplankton in a pond of Rajshahi University, found that water temperature and dissolved oxygen changed diurnally. In our country sustainable development of aquaculture is essential in order to increase the production. In this case, Vietnamese Koi can play an important role to have more production considering with low capital investment but higher financial returns. Koi is a small indigenous native species of our country. Koi looks like greenish in color. This species was available in our natural water body in the past time. But this species has been decreasing day by day due to reduce natural water body of our country. On the other hand, its growth rate in the culture pond is not expectable as per demand. To meet the demand, few years ago Thai koi had been introduced to our country. But it has lost its higher growth rate capability criteria for the unconscious inbreeding during fry production. To retrieve from this problem Sharnalata Agro Fisheries Limited has introduced Vietnamese Koi (Anabas testudineus) in 2010 which is very fast growth rate than Thai Koi. Vietnamese Koi (Anabas testudineus) is whitish in color. This koi can be cultivable in pond as Thai Koi. This koi takes artificial feed as Thai Koi. Since Vietnamese Koi (Anabas testudineus) is a newly introduced species in aquaculture of Bangladesh, no report yet been available to us about its culture technique, stocking density, food and feeding habit, breeding and disease incidence.

Materials and Methods

Description of the study area

The experiment was conducted in a private fish farm named “Reliance Aqua Farm” which is owned jointly by Ritesh Pandit and Mohammad Sharif Ahmed at Rahmatpur, in Sadar Upazilla in the district of Mymensingh, Bangladesh. The total area of farm is 10 acres and located beside the Mymensingh-Tangail highway, about 17 kilometers away from the Bangladesh Agricultural University.

Time span for the study

The study was conducted from 01 September, 2013 to 02 April, 2014.

Description of experimental ponds

The experiment was carried out in three commercial ponds. The area of the pond was 42, 50 and 43 dec in each. The shape of each pond was rectangular. Ponds were equal in depth, basin configuration, bottom types and contour. The ponds were well exposed to sunlight, not interconnected by inlet and outlet and the main sources of water were rainfall and water supplied from a pump using a flexible plastic pipe whenever needed. The embankments were well protected and covered with grass. The water depth was maintained at least

1m. For the experimental purpose, the ponds were numbered as pond 1, 2 and 3. Water source of the ponds were shallow tube-well. Water quality was maintained properly through routine exchange of water during experimental period.

Experimental protocol

The experiment was carried out commencing from 01 September, 2013 to 02 April, 2014. The study was conducted with the fry of Vietnamese koi (Anabas testudineus). The weight of each fry was 1.01 g. The same size fry was stocked for the experimental purpose.

Experimental design

The experiment was undertaken with three treatments (T_1, T_2, and T_3) and had no replications. Pond 1 was treated as T_1, pond 2 and 3 were treated as T_2, and T_3, respectively. Stocking densities were maintained at 976, 1000 and 1055 fry/dec respectively.

Pond preparation

Pond preparation is a pre-requisite for successful fish culture.To achieve the goal of culture in the pond, the experimental ponds were prepared precisely.

Growth performance of Vietnamese koi

Data collected during growth trials and subsequent analysis of data was used to determine the growth trials in different treatments were calculated by using following parameters.

Weight gain (g)

Weight gain (g) = Mean final fish weight (g) — Mean initial fish weight (g)

Percent weight gain

$$\% \text{ weight gain} = \frac{\text{Mean final weight (g) - Mean initial weight (g)}}{\text{Mean initial weight (g)}} 100$$

Length gain (cm)

Length gain (cm) =Average final length- Average initial length

Specific growth rate (SGR %/day)

Specific growth rate (SGR) is the instantaneous change in weight of fish calculated as the percent of increase body weight per day over the experimental period. SGR was calculated by using following formula:

$$\text{SGR (\% per day)} = \frac{\log_e W_2 - \log_e W_1}{T_2 - T_1} x100$$

Food conversion ratio (FCR)

The food conversion ratio is expressed by the amount of food consumed to the weight gain was determined for each of the three treatments. It was calculated as:

$$\text{FCR} = \frac{\text{Feed fed (dry weight)}}{\text{Live weight gain}}$$

Survivability (%)

$$\text{Survivability (\%)} = \frac{\text{No. of fish harvested}}{\text{No. of fish stocked}} x\ 100$$

Production (kg/dec/7 months)

At the end of the experiments, most of the fishes were caught by net and the rest by draining out the ponds. It was calculated as:

Production = No. of fish harvested × Average final weight of fish (g)

Statistical analysis

All data that are collected during the study period converted to arcsine and then applied for analysis. This was followed by Duncan's New Multiple Range Test (DMRT), to identify the level of significance of variance among the treatments. Computer analysis of data was done by using the software SPSS program and MS excel program (Gomez and Gomez, 1984).

Results

The results of the experiment have been described under the following ways-

Table**:** Growth parameters of Vietnamese koi observed during the study period under three treatments

Parameters	T_1	T_2	T_3	LSD	Level of sig.
Mean initial weight	1.01	1.01	1.01	-	ND
Mean final weight	90.00	88.00	86.02	1.64	*
Weight gain (g)	88.99	86.99	85.01	1.64	*
% Weight gain	8810.89	8612.87	8416.83	162.06	**
SGR (%/day)	2.14	2.13	2.12	0.012	**
SGR (%)	448.97	446.73	444.46	1.841	*
Average gain	0.42	0.41	0.40	0.012	*
FCR	1.88	1.91	1.94	0.01	*
Survival %	95.12	95.00	92.50	0.96	**
Fish production kg/decimal	83.57	83.60	84.01	0.15	**
SE	**T_1**	**T_2**	**T_3**		
mean initial weight	0.000	0.000	0.000		
mean final weight	2.000	1.000	1.020		
Weight gain (g)	2.000	1.000	1.020		
% Weight gain	198.020	99.010	100.990		
SGR (%/day)	0.011	0.005	0.006		
SGR (%)	2.223	1.136	1.186		
Average gain	0.010	0.005	0.005		
FCR	0.020	0.100	0.040		
Survival %	1.120	2.000	2.200		
Fish production kg/decimal	2.100	1.100	2.010		

* = Significant at 5% level of probability
**= Significant at 1% level of probability
LSD = Least Significant Difference
ND = Not Defined

Production (kg/dec/ 7 months)

At the end of experiment, the net yields of Vietnamese koi were 83.57±2.100, 83.60±1.100and 84.01±2.010 kg/dec/7 months in T_1, T_2 and T_3, respectively. The significant (≤0.01) highest fish production was obtained in T_3.

Benefit-cost ratio (BCR)

BCR was calculated as the ratio of gross income to gross cost. The BCR was found in the three treatments T_1, T_2 and T_3 were 1.26, 1.24 and 1.22, respectively.

Table: Cost-benefit analysis of Vietnamese koi in a commercial farm at the end of experiment

Item	T_1	T_2	T_3
Expenditure (tk.)			
Pond preparation	250.00	250.00	250.00
Liming	25.00	25.00	25.00
Price of fry	976.00	1000.00	1055.00
Feed	7698.60	7824.12	7985.99
Man power	311.11	311.11	311.11
Leasing price of land	1166.67	1166.67	1166.67
Others	200.00	200.00	200.00
Gross cost/decimal (tk.)	10627.38	10776.9	10993.77
Income (tk.)			
Gross income/decimal	13371.43	13376.00	13443.13
Net profit	2744.05	2599.12	2449.36
BCR	1.26	1.24	1.22

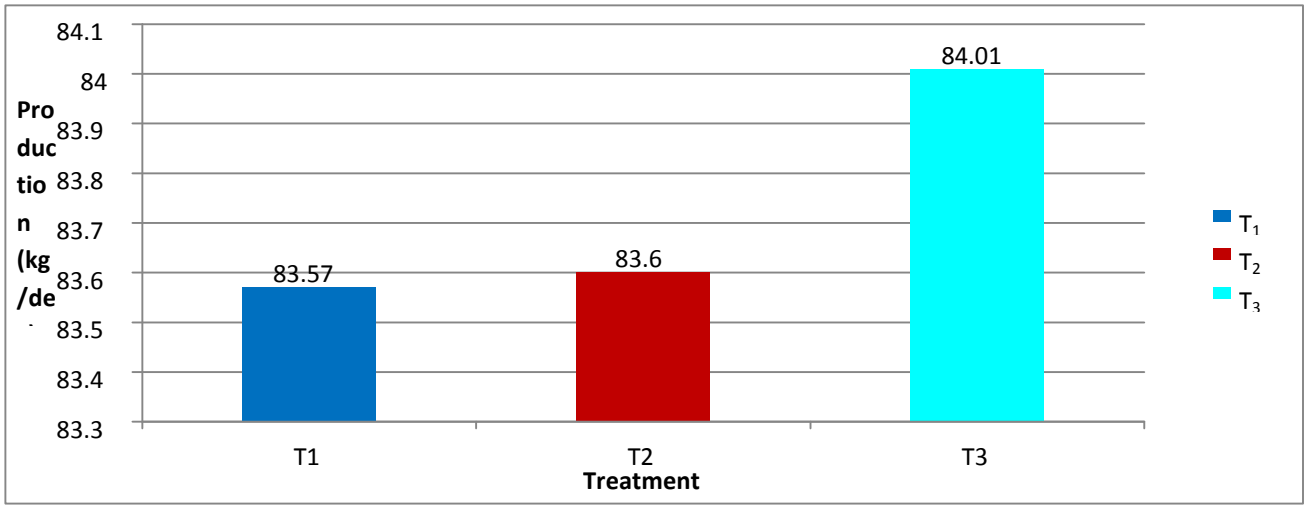

Figure1: Production of Vietnamese koi in kg/dec under three treatments

Discussion

Water quality parameters play a significant role the culture of fish and other aquatic organisms. Good water quality is undoubtedly a prerequisite for fish growth and their survival. Temperature plays a vital role in respect of fish production. In the present study the average temperature was recorded were 22.53±0.60, 21.24±.1.20 and 22.62±0.45 °C in T_1, T_2 and T_3, respectively. The maximum temperature 30.90°C was recorded in T_1 on 16 October due to high intensity of sunlight and absent of cloud in the sky. The lowest water temperature was recorded (15.10°C) in T_2 on November 31, due to low intensity of sunlight and some rains. Dewan et al, (1991), Nirod (1997), Rahman (2000), Kohinoor (2000), Sarker (2000), Hasan(2007), and Maghna (2012) who measured water temperature in ponds of BAU Campus, Mymensingh and found the range between 29 to 32˚C, 21.8 to31.10˚C, 29.7 to 29.9˚C, 18.5 to 32.9˚C, 19.8 to 22.8˚C, 21 to 32.8˚C and 32 to 34.3˚C, respectively. From an experiment, the water temperature ranged from 28 to 35°C is suitable for fish culture. So, in the present study, water temperature was within the suitable range. Karim (2006) conducted an experiment at Boilor near about Mymensingh. He found that the variation of temperature was 27.50ºC to 29.90ºC, pH 7.8 to 8.7and dissolved oxygen 5.1 to 6.2.

P^H in the water body absolutely is an important factor for successful fish culture. Abrupt change of pH in the culture system may hamper the production alarmingly. In the present study, the mean values of pH content of the water in T_1, T_2 and T_3 were 7.45±0.36, 7.60±0.26 and 7.62±0.23, respectively. Dewan et al, (1991), Nirod(1997), Rahman (2000), Kohinoor (2000), Sarker (2000), Hasan (2007) and Maghna (2012) who measured pH in ponds of BAU Campus, Mymensingh and found to vary between 6.6 to 8.8, 6.5 to 8.5, 4.9 to 5.2, 6.5 to 8.0, 6.8 to 8.3, 6.5 to 7.9 and 7.6 to 8.3, respectively. Begum (1998) recorded pH 7.05 to 8.02 in the research ponds of BAU campus, Mymensingh. The pH values were within the suitable range. Growth and production of Vietnamese koi in the three ponds under three treatments were recorded at an interval of 15 days.

The growth of koi was measured by weighing their lengths (cm) and weights (g). The average length gain was recorded as 13.70±0.03 cm, 13.58±0.01 cm and 13.64±0.02 cm in treatments T_1, T_2 and T_3, respectively. The highest length gained in T_1 where stocking density was 976 fry/dec. The lowest length gained in T_3 where stocking density was 1055 fry/dec. A little variation was found in T_1 than the other two treatments. The average weight gain of Vietnamese koi at the harvesting time was 88.99±2.000, 86.99±1.000 and 85.01±1.020 g for T_1, T_2 and T_3, respectively. The highest weight gained in T_1 was 88.99±2.000 g and the lowest weight gained in T_3 was 85.01±1.020 g. Weight gain was significantly varied among the three treatments. In the present study survival of Vietnamese koi was high because they can survive under adverse condition like; low oxygen, high temperature and high pH value. The survival rate of Vietnamese koi was recorded 95.12±1.120, 95.00±2.000 and 92.50±2.200 (%), in the T_1, T_2 and T_3, respectively at the harvesting time. In the treatment T_1 the higher survival rate was found due to low density and might be for management issues than the other two treatments. The survival rate was significantly ($\leq$0.01) varied than the other two treatments. The production of Vietnamese koi was calculated by using its correspondent formula. In the T_3 more production was gained then followed by T_2 and T_1. Net income was estimated by deducting gross cost from gross income. The net profit was 2744.05 Tk./per decimal in T_1, followed by T_2 and T_3. The present study showed that the highest growth rate was found in T_1 in which production was less, although there stocking density was also less than T_2 and T_3. But experiment emphasized that using high stoking density lead to maximize output. For considering that view in mind, Vietnamese koi which can tolerate crowding condition can be cultured intensively in the farmer's pond to raise the production higher. For doing this job successfully farmer have to keep deep concentration on the management issues.

Conclusion

The yield was achieved at the harvesting as 83.57 kg, 83.60 kg and 84.01 kg /dec in T_1, T_2 and T_3, respectively. The highest production was found from T_3 for the variation of stocking densities and might be for management issues. The highest net income obtained from T_1 where growth rate was higher and production cost was less and then followed by T_2 and T_3. The best benefit was gained from T_1 where BCR was 1.26 and the other two treatments BCR were 1.24 in T_2 and 1.22 in T_3.So, from the above experiment, it could be concluded that the growth performance of Vietnamese koi is higher in low stocking density but production was maximum in high stocking density. The most valuable thing is that one must keep appropriate management tactics to have the better growth performance of Vietnamese koi. In future more research should be done on the above discussion.

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