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Effect of Feed and Fertilizer on Production of Monosex Tilapia (*O. niloticus*) Farming in Pond

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Abstract

Effect of feed and fertilizer on the growth of monosex tilapia in pond was assayed from August to November 2013. The experiment trail was done with 4 treatments (T_0 control and T_1 only fertilizer, T_2 feed + fertilizer, T_3 feed) having 3 replications each. Lime was administrated at 617.5 kg/ha. The stocking density was 49400 (0.3 g each)/ha/ponds. In T_3, two times feeding was done at 50% to 5% of their body weight Cow dung, urea and TSP were applied at 1482 kg/ha, 49.4 kg/ha and 49.4 kg/ha initially and 370.5 kg/ha, 9.88 kg/ha and 9.88 kg/ha weekly basis in T_1 and T_2 respectively. Samplings were done fortnightly and the significance level was assessed through one way ANOVA. Significant difference ($P \geq 0.05$) was observed for growth indices such as final body weight, FCR, SGR and yield (kg/ha) among different treatments except T_2 and T_3 in case of SGR and survival rate. The highest survival rate (90%), gross yield (6.06±1.20 ton/ha), SGR (6.78±.015% per day) and BCR (2.01) were in T_3 with a minimum in T_0. Highest and lowest FCR value was 0.90±.06 and 0.79±.01 in T_2 and T_3 respectively. The result reveals that T_3 is the best monosex tilapia culture method in pond.

Keywords

Feed, Fertilizer, Production, Aquaculture, Tilapia

1. Introduction

Bangladesh combats for elevation of poverty, meeting current and future increasing demands for food and nutrition, and ensuring employment opportunities for its rapidly increasing population [1]. Fisheries sector which provides 60% (3.87 million MT in the year of 2015-2016) of animal protein plays an important role in the economy of Bangladesh [2]. Aquaculture sector of Bangladesh is expanded rapidly with respect to both the quantity and variety of species [3]. Fish and fisheries have significance in national economy, nutrition, employment generation, income of Bangladesh and also help a lot of foreign exchange earnings. But most of the poor people have been suffering from malnutrition due to lack of proper animal protein. Modern and scientific aquaculture practice can solve this problem by increasing the fish production.

Both the public and private sector has been strongly promoted the development of aquaculture in an attempt to meet the need of fish for food for the country's population [4]. Inland pond culture reflects the mainstay of aquaculture in Bangladesh, accounting more than 80% of the total aquaculture production, and is dominated by carps (indigenous and exotic), Mekong pangas and tilapia [5]. Tilapia is one of the most important species for the 21st

century aquaculture and is produced in more than 100 countries [6]. In the year of 2014-2015, production of tilapia was second (18.36 ton) among the fish species production in pond aquaculture of Bangladesh [7]. The vast water resources as prevalent in Bangladesh could be appropriately utilized by economically tilapia culture through proper planning and scientific management.

Tilapia culture in tropical and subtropical countries is practiced at either extensive, semi- intensive or intensive levels. Nile tilapia *Oreochromis niloticus* is cultured worldwide mostly in semi-intensive culture systems using fertilization. Fish yields from such techniques have been found to be higher than those from natural unfertilized systems [8]. Addition of artificial feeds plays an important role as they rich in protein, carbohydrate, fat, vitamins, minerals and growth-promoter [9, 10, 11, 12], especially under conditions of heavy stocking, when natural feed supply has declined or completely disappeared.

However, costs of fish farming have increased significantly because of increasing the price of artificial feeds dramatically in recent years. As, feed cost is one of the largest operational costs in aquaculture [13]. The main problem for farmers is the shortage of operating capital, sore concerned about high feed cost, citing feed cost as the major constraint of fish farming expansion [14]. So fish farmers should give the best nutrient management technique that will give low cost with high profit.

There is some study result of more fish production with fertilizer and supplementary feed than with fertilizer or without fertilizer application in the fish pond. But no combined study has been found on the effect of these nutrient management techniques as well as the effect of only feed on growth particularly in Sylhet region. With a view to fill up the above gap, the present study was undertaken to assess economics and effect of fertilization and feed on tilapia production.

2. Materials and Methods

2.1. Location of the Experiment

The experiment was conducted in twelve rain-fed rectangular ponds (each 0.004 ha and depth 1m) located in the pond complex of Sylhet Agricultural University campus for a period of 3 months from 15th August to 15th November, 2013.

2.2. Preparation of the Experimental Pond

Pond dykes were repaired. Aquatic weeds were removed manually and undesirable species was eradicated by using phostoxin tablet (500 tablets/ha). After one week, liming was done at 617.5 Kg/hectare. Ponds were divided into four treatments Viz. T_0 (Only Liming), T_1 (Liming + Fertilization), T_2 (Liming + Fertilization + Supplementary feeding) and T_3 (Liming + Complete feeding), each having three replications (R_1, R_2 and R_3). Seven days after liming, the ponds under T_1 and T_2 were fertilized with cow dung 1482 Kg/ha, urea 49.4 Kg/ha and triple super phosphate (TSP) 49.4 Kg/ha respectively.

2.3. Stocking, Feeding and Fertilization

The monosex tilapia fry were stocked at 49400fry/ha for each treatment. Fry were initially fed at 50% of their body weight and was gradually reduced up to 5% of body weight in case of treatment T_3 and T_2. Fertilization was done at cow dung 370.5 Kg/ha, urea 9.88 Kg/ha and triple super phosphate (TSP) 9.88 Kg/ha respectively in treatment T_1 and T_2. Sampling was done fortnightly and final harvesting was done by seine net. Length and weight of fish were taken by common length measuring scale and a portable digital electronic balance (model: AFD Ek-300i, Max-300g, D-0.001g, E-0.1g) respectively. The growth parameters were monitored fortnightly and determined using the following standard formula:

1 Percent weight gain$=\frac{\text{Mean final body weight} - \text{Mean initial body weight}}{\text{Mean initial body weight}} \times 100$

2 Specific growth rate (SGR% per day) $= \frac{\text{Loge W2} - \text{Loge W1}}{\text{T2} - \text{T1}} \times 100$

Where,

W_1 = The initial live body weight (g) at time T_1 (day)

W_2 = The final live body weight (g) at time T_2 (day)

T_1=Time at the commencement of experiment

T_2=Timeat the end of the experiment

1 Food conversion ratio (FCR) $=\frac{\text{Food fed (dry weight)}}{\text{Live weight gain}}$

2 Survival rate (%) $= \frac{\text{No.of fish caught}}{\text{No.of fish released}} \times 100$

3 Yield of fish (kg) = No. of fish caught × Average final weight

The benefit cost ratio (BCR) were calculated in different treatments by using following formula-

Benefit Cost Ratio (BCR) = (Total Returns)/(Total Costs)

2.4. Analysis of the Result

At the end of the experiment all data were analyzed statistically using one way analysis of variance (ANOVA). The mean values were compared to Duncan's Multiple Range Test. SPSS statistical software (11.5 versions) was used for all the analysis. Standard deviation (SD) of treatment means were calculated from the residual mean square in the analysis of variance. Probabilities of $P<0.05$ were considered to test significance level.

3. Result and Discussion

3.1. Growth Performances

During the study growth performances of monosex tilapia was assessed. The final weight gain, percent weight gain, specific growth, survival rate, FCR, yield were determined for the purpose of proper growth performance of monosex tilapia fry in different treatments during the experimental period.

3.1.1. Final Weight Gain

Final weight gain was ranged from 15.55±0.18g to 134.63±1.99g (Table 1). The highest value was recorded in T_3 (134.63±1.99g) followed by T_2 (95.35±7.07g) and T_1 (72.07±9.67g). The lowest value was in T_0 (15.55±0.18g). Significant differences (P<0.05) were found among the treatments.

Supplemental feeding in fertilized ponds resulted a significantly higher growth than fertilization alone was recommended previously which supports to the present study [8, 15]. The significantly (P<0.01) weight gain (244.72 g) was found in fish having feeding frequency two times [16].

Table 1. *Comparative growth in weight.*

Sampling No.	Treatment-0 Weight (g)	Treatment-I Weight (g)	Treatment-II Weight (g)	Treatment- III Weight (g)
01	4.73±0.943	8.9±3.65	13.4±6.13	17.0±5.3
02	4.63±1.06	18.25±7.89	22.25±11.67	26.87±15.08
03	5.12±1.06	32.95±8.13	51.43±22.04	55.73±9.31
04	8.75±3.418	44.02±20.86	53.25±7.07	64.4±17.68
05	13.57±4.71	52.12±14.61	72.25±10.01	93.87±21.92
06	$15.55±0.18^{d}$	$72.07±9.67^{c}$	$95.35±7.07^{b}$	$134.63±1.99^{a}$

3.1.2. Percent Weight Gain

Percent weight gain of the present study ranged from 5000 to 44776.67. The highest value was recorded in T_3 (44776.67) followed by T_2 (23923.33) and T_1 (31683.33). The lowest value was in T_0 (5000). Significant differences (P<0.05) were found among the treatments (Table 2). Supplemental feeding in fertilized ponds resulting significant higher growth rates than fertilization alone which supports the present study [15]. Karim *et al.* (2017) concluded that percent weight gain was 4293.7 of fish fed two times in a day.

3.1.3. Survival Rate

In this experiment the survival rates were found to be very good in all of the treatments. The survival rates of tilapia were 50%, 75%, 85% and 90% in T_0, T_1, T_2 and T_3 respectively (Figure 1). Significant differences (P<0.05) were found among the treatments. There was significant difference (P<0.05) in case of survival among the treatments (Table 2).

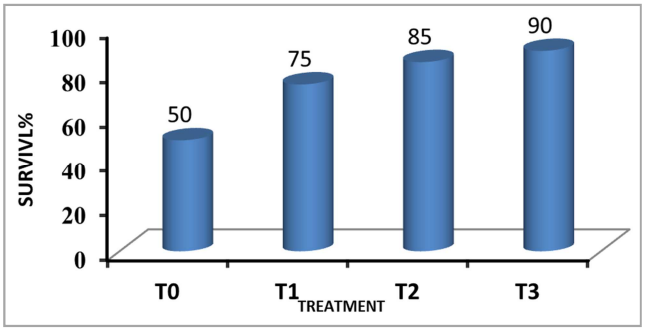

Figure 1. *Graphical view of treatment wise survival rate of tilapia fry.*

Tilapia survival percentage differed significantly among treatments (P> 0.05). The first treatment (control) had the lowest survival percentage 50% and the highest survival percentage, 90% was for the treatment-3 followed by 85% for T_2. This survival rate is considerably higher than those (57 and 65%) of sex-reversed Nile tilapia genetically improved farmed tilapia (GIFT) strain fed at 100 and 67% of satiation (28.6% protein) in fertilized ponds [17] and those 81.65 and 82.07% of mixed-sex tilapia fed on experimental diets in organic fertilized ponds [18].

3.1.4. FCR

The feed conversion ratio (FCR) is the amount of feed required to produce 1 kg of fish. The FCR value was below 1 in all treatments, 0.90±.06 and 0.79±.01 in T_2 and T_3 respectively (Table 2). Significantly higher (P<0.05) FCR value was observed in T_2 over T_3. It was observed that in T_3 the FCR was lowest than in T_2. Lower FCR value was found in the T_3 where only feed given.

FCR value 2.4 for GIFT tilapiaPond-1 (given organic manure and artificial feed) which were significantly higher than Pond-2 (given only feed) accounting 2.1 which is similar to the previous study [19]. FCR was decreased from 1.79 to 1.37 when ponds were fertilized recorded [20].

3.1.5. Specific Growth Rate

The specific growth rates of the present study were ranged from 4.38±0.02% per day to 6.78±.015% per day. The highest SGR% per day 6.78±.015 was recorded in T_3 followed by T_2 (6.40±.08) and T_1 (6.08±.15) and the lowest SGR 4.38±.02 was recorded in T_0 (Table 2). There was significant difference (P<0.05) among the treatments except T_1 and T_2.

SGR value for Pond-1 (given organic manure and artificial feed) were significantly higher than Pond-2 (given only feed) in a previous study which not supports to the present study because this study was carried out in rain-fed ponds which are containing rain water [19]. As a result pond water becomes turbid which is major cause for feed loss.

Specific growth rate and condition factor significantly higher (p<0.05) for Catla fish in manure and artificial feed treated pond than cow dung and poultry manure treated, and control ponds was recorded [21].

3.1.6. YIELD

In this research, yield of tilapia under the four treatments were estimated on the basis of survival rate and average final weight gained by the tilapia at the end of the study period, and the results so far obtained have been shown in tabulated form (Table 2). The gross yield of tilapia recorded in T_0, T_1, T_2 and T_3 were 0.39±0.14 ton/ha, 2.91±2.61 ton/ha, 4.06±1.83 ton/ha, and 6.06±1.20 ton/ha respectively. Significantly higher yields were observed in T_3 followed by

T_2 and T_1 (Table 2).

The production of tilapia of 3,554 kg/ha/6 months was obtained in treatment receiving supplementary feed consisting of rice bran and mustard oil cake another study reported [22]. But in fertilized pond, it was only 1,510 kg/ha/6 months, while it was 2,738 kg/ha/6 months in ponds fed with rice bran only without fertilizers which indicate tilapia show better growth performance in pond which only contain artificial feed rich with protein and fat which supports the present study. Earlier results also showing that supplemental feed is required to increase fish yield in fertilized ponds [23].

Table 2. *Growth and production performances of tilapia fry in different treatments.*

Variables	Treatment-0	Treatment-I	Treatment-II	Treatment-III
Average initial weight (g)	0.3	0.3	0.3	0.3
Average final weight (g)	15.55 ± 0.18^{d}	72.07 ± 9.67^{c}	95.35 ± 7.07^{b}	134.63 ± 1.99^{a}
Percent weight gain (%)	5000^{d}	23923.33^{c}	31683.33^{b}	44776.67^{a}
Survival (%)	50.00 ± 4.36^{c}	75.00 ± 4.36^{b}	85.00 ± 4.44^{a}	90.00 ± 3.12^{a}
SGR (%body weight day^{-1})	4.38 ± 0.02^{c}	6.08 ± 0.15^{b}	6.40 ± 0.08^{a}	6.78 ± 0.02^{a}
Yield (ton/ha)	0.39 ± 0.14^{d}	2.91 ± 2.61^{c}	4.06 ± 1.83^{b}	6.06 ± 1.20^{a}
FCR	-	-	0.90±.06	0.79±.01

Mean values with different superscript letters in the same row indicate a significant difference ($P<0.05$) based on one way ANOVA.

3.2. Benefit- Cost Ratios (BCR)

The cost and benefit calculated in different treatments on per ha area basis have been presented in Table 3. The BCR obtained 0.20, 1.56, 1.13 and 2.01 in T_0, T_1, T_2 and T_3 respectively.

Table 3. *Comparisons of economics among different treatments on 1 ha area.*

Items	Treatment-0	Treatment-I	Treatment-II	Treatment- III
Tilapia fry (Tk. 1.20 per fry)	59280	59280	59280	59280
Feed (Tk. 45 per kg)	-	-	191761.5	238750.2
Cost of Fertilization (Tk)	-	32949.8	32949.8	-
Total costs (Tk)	59280	92229.8	283990.7	298030.2
Total returns (Tk)	11559.6	118930.5	394804.8	598728
Net benefit (Tk)	-47720.4	51400.7	36714.08	300697.8
Benefit cost ratio (BCR)	0.20:1	1.28:1	1.39:1	2.01:1

4. Conclusion

The present study was performed to assess the combine effect of liming with fertilizer, complete feeding and supplementary feeding in the growth of commonly cultured Tilapia. And the study revealed that the liming with complete feeding has given best result with economic benefit.

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