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Economics of Tilapia Culture in Watershed Pond in Bangladesh

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Abstract

With a view to assess the suitability of mono-sex Tilapia (*Oreochromis niloticus*) culture using downstream flow from hills by observing their growth, survival and production in watershed pond, an experiment was carried out in a commercial aquaculture farm Mrittika Fisheries, Odolia, Hathazary, Chittagong. The duration of {each} culture period was 4 months. Stocking densities of the three culture ponds were same as, 10 individuals/m^2. All the fish were of same age group having mean body weight about 1.2 gm. A commercial pellet feeds were used at the rate of 20% of body weight during first 15 days and then the feeding rate was reduced to 18%, 15%, 12%, 10%, 8%, 6%, and 5%, receptively with 15 days interval and the measured survival rate of fish was 84.33%, 77%, 72.33%, 69%, 66.33%, 65%, 63.67%, and 62.67% receptively in 15 days interval. From the economic analysis it was found that the net profit accrued out of the three ponds (1.20 hector) was (BDR=Bangladeshi Taka, 1 US$=81 BDT) BDT 547177.77, whilst the operational cost was BDT 700544.23, the rate of profit ratio obtained is 78.11% in comparison to the operational cost. The results of the specific study indicate that the culture of tilapia in the watershed ponds by using downstream water flow is exceedingly suitable even with the high stocking density. The resultant production was good with high profitability with less input of operational cost and reduced risk.

Keywords: *Oreochromis niloticus, Oreochromis mossambicus, Chara*

Introduction

Bangladesh is a densely populated country of 147570 km^2 with a population of 150 million people. The prime characteristic of this land is shaped by extensive water resource in the form of pond natural depressions (Haor, Baor and Beels) (Haor, Baor and Beels are local terms for natural depressions of flood plain. Haors are extensively large low lying areas seasonally inundated by monsoon rain and flesh floods, Baors are created by shifting of river courses creating a low lying plain and Beels are comparatively small areas which remain waterlogged throughout the year). Haors, Beels, lakes, canals, rivers estuaries all together covers an area of 4.56 million hectors [1]. Now a days the natural production of fish has been decreased alarmingly for various factors. To meet the enormous demand for protein source majority of the people depends largely on fishes which is cheap in comparison to other protein sources in the country. Artificial fish culture gained much popularity due to the abundance of low lying plains and water bodies. The practitioners implemented improved technology to increase fish production per unit area within minimum period of time. They also introduced various culture methods on the basis of varying characteristics of water bodies. Tilapia is one of the most important fish species and widely cultured in Bangladesh to meet the increased protein demand. Tilapia Mozambique (*Oreochromis mossambicus*) was the first imported Tilapia species in Bangladesh from Thailand. But this species was not commercially viable. Firstly in 1970 *Oriocromis niloticus* was imported from Thailand by UNISEF. Secondly Bangladesh Fisheries Research Institute imported *Oriocromis niloticus* at 1987 from Thailand. The Hybrid species of Red Tilapia was imported in 1988 from Asian Institute of Technology (AIT) Bangkok, Thailand. In 1994 Bangladesh Fisheries Research Institute (BFRI) imported Gift Tilapia for research of genetic improvement by a project of World Fish Center. In June, 2005 another species of Red Tilapia is imported to BFRI [2]. Now a days culture of Tilapia in water shed area is a popular practice in Bangladesh. Watershed area is (1) an area that, because of topographic slop, contributes water to a specified surface water drainage system, such as stream or river. (2) The natural or disturbed unit of land (Catchment) on which all of the water that falls (or emanates from springs or melts from snow packs), collects by gravity, and fails to evaporate, runs off via a common outlet. (3) All lands enclosed by a continuous hydrologic drainage divided and lied upslope from a specified point on a stream; a region or area bounded peripherally by a water parting and draining ultimately to a particular water course or body of water. (4) A ridge of relatively high land dividing two areas that are drained by different river system. Present study was carried out to analysis the economics of tilapia culture in watershed pond with water and soil parameter analysis.

Materials and Methods

The research study was conducted at Mrittika fisheries (Figure 1), situated at Odolia, under Hathazary Upazila of Chittagong District. The study area is situated about 20 km North from Hathazary Upazila Sadar. The geographical location of study area (Hathazary Upazila) is 91°41" E to 91°54" E and 22°39" N to 22°23" N. This experiment was conducted in three practical fish culture pond having size 80 meter×50 meter each. Spring water (local name is "*Chara*") was used to fill the ponds. Water depth was strictly maintained 1.4 meters. All of the selected ponds were same in construction, size and shape. It is notable that all of the studied ponds and whole culture unit were newly developed by conversion of rice field. It is also mentionable that the ponds were situated contiguously that ensured similar characteristics of soil of each pond. Three ponds were studied at a time. Study was continued up to 120 days (a typical culture cycle) from 1st January 2012

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Figure 1: Geographical location of study area.

to 30th April 2012. Except this pond construction and preparation of the virgin ponds were performed carefully with scientific measures. At first the ponds were drained out. Then the ponds bottoms were fully dried up and subsequently crashed lime stones were spread on the bottom surface at the rate of 100 kg/hector. After 3 days of liming, ponds were filled with downstream water flow to the desired level and after that cow-dung was applied at the rate of 400-500 kg/hector to produce natural food. The pond depth was maintained at 1.4 meters throughout the experiment. The fries of mono-sex (*Oreochromis niloticus*) tilapia were collected from a local Hatchery. Collected fries were transported using oxygenated polythene bag to the pond site at the early morning and after acclimatization with pond water temperature the fries were released in the culture ponds at the density of 11 individuals/m^2. At the beginning of the experiment feed (Formulated feed that is collected from M.M. Aga Feed company was supplied at the rate of 20% of the body weight of reared mono-sex tilapia and gradually it was readjusted to 18%, 15%, 12%, 10%, 8%, 6% and 5% respectively in each 15 days interval (Starter, Grower). The mono-sex tilapias were fed four times a day up to 30 days, then three times daily up to 70 days and then two times (morning and evening) till the ending of the experiment. The sampling was performed according to schedule during the period of investigation notwithstanding the fact considering most of the major nutrients and parameters were measured. Water samples were taken from the surface portion of three studied ponds (during collection of sample in all ponds - same depth were maintained) for determination of different physico-chemical parameters and bottom Soil samples of the study area for the analysis of different soil parameters. Data on fish stocking density, stocking size etc. were kept during stocking. Fish growth rate in each pond were obtained by random sampling with a cast net. Fish biomass yield was calculated *in situ* after complete harvest.

Results

Water quality parameters

The water quality parameters such as temperature, pH, DO (Dissolved Oxygen), transparency etc. of all treatments were mentioned at 10 days interval during experimental period except temperature. During the study period the water temperature varied from 22°C to 28°C in different treatments. The mean values of temperature in three treatments were 24.67°C, 25.67°C and 25°C. Lowest of water temperature 22°C was found in First sampling at January in pond 1 and high temperature 28°C was found in final sampling at April in pond 2 and pond 3. Average water temperature are mentioned above though temperature was measured daily during the whole experiment.

Water pH of the ponds was more or less similar in different treatments in different ponds. The ponds were almost neutral with pH values ranging from 7.1 to 7.4 in different treatments. The mean values of water pH in three treatments were 7.26, 7.27 and 7.30. High value of water pH 7.1 was found in first sampling at September, 20 in pond 3 and high water pH 7.4 was found in first sampling, second sampling and third sampling in pond 2. Dissolved Oxygen concentration in different treatments was found to be more or similar and very close in all treatments. During period, the DO contents of the water found throughout varies from 6.1 milliliter per liter (ml/l) to 6.7 ml/l. The mean values of DO content obtained with different treatments are 6.57 ml/l, 6.31 ml/l and 6.16 ml/l. Water NO_2-N concentrations in different treatments was also found to be more or similar and very close in all treatments. During period, the NO_2-N contents of the water were found throughout varies from 0.17 to 0.24 parts per million (ppm). The mean values of NO_2-N content obtained with different treatments are 0.21 ppm, .021 ppm and 0.22 ppm. Water PO^4-P a concentration in different treatments was also found to be more or similar and very close in all treatments. During period, the PO^4-P contents of the water were found throughout varies from 0.21 ppm to 0.32 ppm. The mean values of PO^4-P content obtained with different treatments are 0.23 ppm, 0.29 ppm and 0.30 ppm. The observed secchi disk value ranges from 35 centimeters (cm) to 42 cms in different treatments. The mean values of transparency were 41.33 cm, 38.66 cm and 36.67 cm in different treatments. The maximum value of transparency 42 cms was recorded at second sampling of pond 3 and the minimum value of transparency 35cms was recorded at third sampling of pond 2. The observed Total Suspended solid (TSS) value ranges from 019 milligram per liter (mg/l) to 0.28 mg/l in different treatments. The mean values of transparency were 0.23 mg/l, 0.21 mg/l, and 0.27 mg/l in different treatments. The maximum value of TSS 0.28 mg/l was recorded at third sampling of pond 3 and the minimum value of TSS 0.19 mg/l was recorded at second sampling of pond 1. The observed Total Dissolved solid (TDS) value ranges from 0.046 mg/l to 0.081 mg/l in different treatments. The mean values of transparency were 0.054 mg/l, 0.056 mg/l, and 0.074 mg/l in different treatments. The maximum value of TDS 0.081 mg/l was recorded at third sampling of pond 2 and the minimum value of TDS 0.19 mg/l was recorded at first sampling of pond 1. There was a continuous water flow through the experimented ponds supplied from down stream flow of hilly creeks. There was an outlet drain to release over flow of water. The range of series water flow was 156 l/min to 114 l/min. The mean values were 156 l/min, 140 l/min, and 114 l/min in different treatments.

Soil parameters

The range of selected soil parameters of experimental watershed ponds was analyzed. The soil parameters such as, soil pH, Organic Matter (OM), Organic Carbon (OC) of all treatments were mentioned at 30 days interval during experimental period.

The soil of ponds was slightly acidic with pH values ranging from 6.2 to 6.7 in different treatments. The mean values of soil pH in three treatments were 6.73, 6.3 and 6.33. The maximum value of soil pH (6.8) was found at first sampling in pond 1 and minimum value of soil pH (6.2) was found in second sampling and third sampling of pond 2 and pond 3 respectively. The range of soil Organic Matter (OM) was varied

Monitoring time	Days intervals	Weight (gm)			Avg. wt. gain. (gm)	**Individual survive**	Feed given of body weight	Feed Given in a day	Total Feed Given in K.G
		Pond 1	Pond 2	Pond 3					
Stocking	0	1.2	1.2	1.2	1.2	120000	20%	4	0.0
1st time	15	7.2	9.6	8	8.3	101200	20%	4	669.3
2nd time	15	19.8	22	18.7	20.2	92400	18%	4	1341.6
3rd time	15	34.5	37.1	36.2	35.9	86800	15%	4	1871.4
4th time	15	56.2	58	54.8	56.3	82800	12%	3	1679.2
5th time	15	78.4	81	77.5	79.0	79600	10%	3	1885.7
6th time	15	102.8	106.4	105.4	104.9	78000	8%	3	1963.1
7th time	15	132.5	135	131.7	133.1	76400	6%	2	1220.0
8th time	15	156.9	161.5	178.6	165.7	75200	5%	2	1245.8
									11876.1

Table 1: Periodic Growth Monitoring.

Ponds	**Area (m^2)**		**SD/m^2**	**Total Area (m^2)**	**Total No of stock**	**Culture period (Month)**	**No. of fish harvest**	**Survival rate (%)**	**Average survival rate (%)**	**Final average wt.gm/ind**	**production Per pond (kg)**	**Production. Per m^2 (kg)**	**Average production per m^2**
	Length	**Width**											
Pond 1	80	50	10	4000	40000	4	24400	61		156.90	3828	0.9571	
Pond 2	80	50	10	4000	40000		24800	62	62.67	161.5	4005	1.0013	1.040
Pond 3	80	50	10	4000	40000		26000	65		178.6	4644	1.1609	
TOTAL				12000	120000		75200				12477		

Table 2: Survival Rate.

Monitoring Time	**Days intervals**	**Survival Rate (%)**			**Survive**	**Average Survival Rate (%)**	**Average Mortality rate (%)**
		Pond 1	**Pond 2**	**Pond 3**			
Stocking	0	40000	40000	40000			0
1st time	15	84%	86%	83%	101200	84.33	15.67
2nd time	15	77%	79%	75%	92400	77.00	7.33
3rd time	15	72%	74%	71%	86800	72.33	4.67
4th time	15	68%	70%	69%	82800	69.00	3.33
5th time	15	65%	66%	68%	79600	66.33	2.67
6th time	15	63%	65%	67%	78000	65.00	1.33
7th time	15	62%	63%	66%	76400	63.67	1.33
8th time	15	61%	62%	65%	75200	62.67	1.00

Table 3: Periodic Survival Rate.

from 5.0% to 5.6% in different treatments. The mean values of OM in three treatments were 5.03%, 5.32% and 5.4%. The maximum value of OM 5.6% was found at first sampling in pond 2 and minimum value of OM 5.0% was found in second and last sampling of pond 3 and pond 1 respectively. The range of soil Organic Carbon was varied from 2.61% to 3.26% in different treatments. The mean values of OC in three treatments were 2.92%, 3.09% and 3.14%. The maximum value of OC 3.26% was found at first sampling in pond 2 and minimum value of OC 2.61% was found in first sampling pond 1.

Production and erowth observation

In this experiment, the Growth, periodic growth rate, specific growth rate, survival rate and production of mono-sex tilapia (*Oreochromis niloticus*) in the selected watershed ponds was observed in 15 days interval. At the beginning of the experiment feed was supplied at the rate of 20% of the body weight of reared mono-sex tilapia and gradually it was readjust to 18%, 15%, 12%, 10%, 8%, 6% and 5% respectively (Table 1). The mono-sex tilapias were fed four times up to 45 days, then three times daily up to 90 days and then two times up to ending the experiment. There was more or less similar in initial weight of fish under treatments. At the end of study period the maximum average weight of fish was 178.6 gm, and the minimum individual weight of fish was 156.9 gm. The grand average weight gain by fish in the culture period was 165.7 gm (Table 1). The maximum weight 178.6 gm was gained at pond 3. Average weight gain of tilapia was recorded at each 15 days interval. The average weight gain at each 15 days was increased with time up to 120 days. The maximum weight gain of tilapia was (32.6 gm/15 days) at 105 to 120 days period and the minimum weight gain of tilapia was 7.1 mg/15 days at first 15 days.

The range survival rate (%) of fish was 61% to 65% (Table 2). The survival rate of each pond was 61%, 62% and 65%. The final mean survival rate was 62.67%. In intervallic consideration the maximum mortality rate was (15.67%) at first 15 days and minimum mortality was (1%) at final 15 days. Total production of fish was 12932 kg (Table 2) and total amount of feed given was 11876.1 kg. The final FCR was 1:1.05. The stocking density of the watershed pond culture system was 10 individuals/m^2. Average weight of tilapia during stock was 1.2 gm/individual. Duration if culture was 4 months. Total number of harvested fish was 75200 and average weight of harvested fish was 165.7 g. Total production of fish was 12477 kg. Average production of the farm was 1.04 kg/m2.

Cost benefit analysis

The cost is shown in table 4 and cost benefit analysis of is shown in

Sl. No.	Expenses	Unit price (BDT.)	Quantity	Total price BDT.
1	Price of fry	1	120000	120000
2	Price of feed	40	11876.11	475044.23
3	Medicine	-	-	2000
4	Fertilizer:			0
	Urea	40	150	6000
	TSP (Triple Super Phospate)	60	150	9000
5	Cow dung and lime	1200	2.5	3000
6	Electricity bill	8	1000	8000
7	Repairing of pond	2000	3	6000
8	Instruments	-	-	5000
9	Transportation	-	-	5000
10	Stationery	-	-	2000
11	Salaries(2 person)	10000	4	40000
12	Daily wages	250	30	7500
13	Fish capture expenses	2000	5	10000
14	Miscellaneous expenses	-	-	2000
Total operational cost				700544.235

Table 4: Cost Analysis

Fish production	12477.16
Average price of fish	100
Selling price of fish	1247716
Total operational cost	700544.23
Profit or loss	547171.77
Rate of profit %	78.11

Table 5: The cost benefit analysis of the 1.165 hectors farm is accounted below.

table 5. The reappearing cost of pond of the existing ponds also included in this account. The stocking density of the watershed pond culture system was 10 individuals/m2. Average weight of tilapia during stock was 1.2 gm/individual. Duration of culture was 4 months. Total number of harvested fish was 75200 (Table 1) and average weight of harvested fish was 165.7 gm. Total production of fish was 12,477 kg. Price of one kg fish was BDT 115, total price of fish was BDT 14,34873.40 (Table 4).

The stocking density of the culture pond was 10 individuals/m^2. Total area of three ponds was 12000 m^2, so total number of fry stocking in 3 experiment ponds was 120000, price of each fry was BDT 0.80. Total price of fry was BDT 96000. The feed used was 11876.1 kg and the price of feed was BDT 35/kg (Table 2), so total cost of feed was BDT 415663.71 (Table 4). Since the farm was established long time ago, any construction cost or development cost are not shown in this account. No depreciation costs are there, because properties do not have any depreciation. Only operation cost is shown there.

The cost of fingerlings can be estimated by multiplying four times (for three culture periods) in a year with the number of fingerlings required each period. In fact this value may also fluctuate following the fluctuation of fingerling price. The cost of feed in intensive fish culture method constitutes the highest item of the annual production cost. However, feed cost should be based on food conversion obtainable for a particular type of feed. Better food conversion or those that are usually less than 3:1 will decrease feed cost. Poor food conversion for a given feed usually results in larger amounts of pellets needed so that feed cost also increases. Labor cost is higher in running water pond method than other methods. However, labor cost would vary under each particular case and location. For purposes of computation of labor cost in this paper it is assumed to be uniform. Miscellaneous costs are available in one year production. It may cover cost of depreciation, sundries or any item which do not contribute a large percentage to the overall cost.

Discussion

Water temperature is one of the most important factors for aquatic organisms which influence other physical, chemical, and biological conditions of a water body. Temperature regulates the growth, reproduction, metabolism and other biological activities as well as feeding intensity of fish. Therefore temperature has a marked effect on overall production of fish. For 1°C rise of temperature, metabolic rate of fish increases 10%. During the present study, the high temperature recorded was 28°C in the month of April and lowest temperature was 22°C in the month of January. The mean values of temperature in three treatments were 24.67°C, 25.67°C and 25°C. The water temperature ranging from 25°C to 35°C is suitable for culture of fish [3]. The suitable temperature ranges for production of plankton in tropical ponds were between 18.3°C and 37.8°C [4]. The found water temperature of ponds 20.5°C to 36.5°C was favorable for fish culture. In present study water temperature was within suitable range. pH values recorded in the study area were more or less constant and it was almost neutral. This may be due to the high fresh water discharge through down stream flow into the watershed ponds. An acidic pH of water reduces the growth, metabolism and other physiological activities of fishes [5]. The observed value of pH (7.1 to 7.4) recorded in present study indicate that pH in all treatments were within the range and suitable for fish culture who reported that pH 6.5 to 9.0 is suitable for pond fish culture [5]. Dissolved Oxygen is most important parameter of culture pond, because, higher concentration of DO ensure the higher growth of aquatic animals. Founded DO in the experimented pond was rich in concentration. The concentration of Dissolved Oxygen (DO) in the present experiment found throughout varies from 6.1 ml/l to 6.7 ml/l. The DO ranging from 5 to 7 ml/l was good for fish culture. Dissolved oxygen content of a productive pond should be 5 ml/l or more. Present experiment agreed with these recommended level [6]. Water transparency is generally expressed as the level of productivity of water body and also indicates the concentration of plankton in the water body. The observed Secchi disk value ranges from 35 cm to 42 cm in different treatments. The mean values of transparency were 41.33 cm, 38.66 cm and 36.67 cm in different treatments. The transparency of productive water bodies should be 40 cm or less. In the present experiment the water transparency values were within productive ranges [6]. The concentration of Nitrite-Nitrogen was comparatively low in the present investigated pond. Nitrite can only be utilized by phytoplankton in presence of light [7]. The range of concentration ware 0.069 to 1.23 micro gram per liter (µg/l), having similarity with those [8]. During period, the NO_2-N contents of the water found throughout vary from 0.17 to 0.24 ppm. In the present study it is shown that the average concentration of PO_4-P in control tank is 0.662 µg/l and average concentration of PO4-P in treatment tank is 1.003 µg/l. The very high level of orthophosphate utilization is effected only by bacteria and not by phytoplankton [9,10]. It was experimentally proved that bacteria was responsible for the entire uptake of inorganic phosphate present in freshwater ecosystems [11]. By considering this it may say that founded PO^4-P level is more suitable.

The observed Total suspended solid (TSS) value ranges from 019 mg/l to 0.28 mg/l in different treatments. The mean values of transparency were 0.23 mg/l, 0.21 mg/l, and 0.27 mg/l in different treatments. It is found that the minimum was 0.18 mg/l in July and maximum was 0.43 mg/l [12]. The observed Total dissolved solid (TDS) value ranges from 0.046 mg/l to 0.081 mg/l in different treatments. The mean values of transparency were 0.054 mg/l, 0.056 mg/l, and 0.074 mg/l in different treatments. It was found that the minimum was 0.14 mg/l and maximum was 0.34 mg/l which were higher than in present

study [12]. In present study the TDS range was very low. Continuous water release is useful for minimizing dissolved mater in water body [2]. There was a continuous water flow through the experimented ponds supplied from down stream flow of hilly creeks. There was a outlet drain to release over flow of water. The ranges of series water flow were 156 l/min to 114 l/min. The mean values were 156 l/min, 140 l/min, and 114 l/min in different treatments. Since water flow continued through the culture period no water quality degradation or phytoplankton bloom was founded, because flow of water carryout the nutritional load, dissolved and suspended matter from pond water, which is the main important advantage of water based pond [2]. Flow of water makes a fluctuation upon the pond surface which helps to increase DO level in pond water. And this is why, total culture period was completed without any vulnerability of culture system.

The higher the clay and organic matter contents, the more lime is required for a given change in the sediment pH [13]. During the rainy season minimum soil pH was recorded 5 and maximum was recorded 6.40, and in January minimum soil pH was recorded 6 and maximum was recorded 7 where, in the present study, the soil pH values ranged from 6.2 to 6.7 in different treatments. The mean values of soil pH in three treatments were 6.73, 6.3 and 6.33. That is in the range of recommended level. The inorganic portion of sediment is quite variable in size and composition. It is composed of small rock fragments and minerals of various kinds. The rock fragments are of aggregates of minerals and are remnants of massive rock from which the regality and, in turn, the sediment have been formed by weathering. They are usually quite coarse. The inorganic fraction of the sediment is the original source of most of the minerals elements that lie big and other scientists have found to be essential for plant growth [14]. The minimum organic matter was 2.66% and maximum was 7.49 where, in the present study the ranges of soil Organic Matter were varied from 5.0% to 5.6% in different treatments [13]. The mean values of OM in three treatments were 5.03%, 5.32% and 5.4%. Present experiment agreed with these recommended levels. Organic Carbon is the part of Organic Matter. OC in soil is constantly related to OM. OC is 1.72 times of OM. The range of soil Organic Carbon was varied from 2.61% to 3.26% in different treatments. The mean values of OM in three treatments were 2.92%, 3.09% and 3.14%. The recorded range of organic carbon was 1.22% to 3.94% in July and 1.12% to 3.68% in December [13]. Present experiment agreed with these recommended levels. The source of water in the experimented watershed pond was hilly downstream flow. Water supply was continuing through the culture period. The supplied water was flowed through a series of pond and finally released through overflow outlet drainage system with maintaining constant water depth of the ponds. Suitable pond depth for tilapia semi-intensive culture is 0.8 to 1.25 m [2]. Since water flow was continuous through the culture period, no change of constant depth and no crises of water were faced through the culture period. That hill source water prevents the cost of irrigation in dry seasons. There were no sources of pollution in way of water flow, so no treatment cost was there. Those were the great advantages for the watershed pond in the hilly area. No water quality degradation or phytoplankton bloom was observed, because flow of water carryout the nutritional load, dissolved and suspended matter from pond water, which is the main important advantage of water based pond [2]. Flow of water makes a fluctuation upon the pond surface which helps to increase DO level in pond water. And this is why total culture period was completed without any vulnerability of culture system.

Growth of mono-sex tilapia in the watershed pond of the hilly area was investigated in this experiment. There was more or less same in initial weight (1.2 gm) of fish under treatments. At the end of study period the maximum average weight of fish was 178.6 gm, and the minimum individual weight of fish was 156.9 gm. The grand average weight gain by fish in the culture period was 165.6 gm. The maximum weight of 178.6 gm was gained. The range of rate of fish was 61% to 65%. The final mean survival rate was 62.67%. The survival rate recorded in the present study is lower than the range of that the survival rate recorded earlier. The mean value of survival rate of each pond was 61%, 62% and 65% [15] (Table 3). The higher mortality was recorded at first 15 days (15.67%), because the released fry was very small in size about 1.2 gm. In this culture system tilapia can be cultured in more density. Released water from this culture system can be used in the agricultural land, and it is also good source of fertilizer [16]. The stocking density of the watershed pond culture system was 10 individuals/m^2. Average weight of tilapia during stock was 1.2 gm/individual. Duration of culture was 4.5 months. Total number of harvested fish was 81210 and average weight of harvested fish was 165.6 gm. Total production of fish was 12477.1 kg. Average production of the farm was 1.04 kg/m^2. Total number of harvested fish was 75200 which provided 12477.1 kg of biomass. Total income from selling fish was BDT 1247716 and operational expenses was BDT 700544.2 so, the profit was BDT 547171.77. The rate of profit was 78.11% on the basis of operation cost (Table 3).

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